SAVONA, 7-9 SEPTEMBER 2011

EGU TOPICAL CONFERENCE SERIES

13TH PLINIUS CONFERENCE ON MEDITERRANEAN STORMS

EUROPEAN GEOSCIENCES UNION
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Provincia di Savona

13th PLINIUS CONFERENCE on MEDITERRANEAN STORMS
DISASTERS AND CLIMATE CHANGE: KNOW TO ADAPT

SAVONA 7-9 SEPTEMBER 2011

Dear participants in the thirteenth edition of the Plinius Conference on Mediterranean Storms,

with great pleasure I welcome you in the city of Savona, who will host this year's conference.

The objective of the 2011 edition of the Conference is to provide an interdisciplinary forum for presentations and discussions of our current state of knowledge, as well as motivating new research and applications within the variety of disciplines related to Mediterranean storms and their impacts on people.

This year the Plinius Steering and Scientific Committees decided to emphasize the role of climate change on the causes of the origin, frequency and intensity of Mediterranean storms and analyze the possible strategies to address the need for adaptation. This choice is summarized in the subtitle of the conference “Disasters and climate change: know to adapt”.

This subtitle also implies another important concept: the advances in knowledge produced thanks to our work, is fruitless without an efficient transfer chain ending to end users and “potential victims” of the Mediterranean Storms that we study, allowing them to raise awareness on risk exposure and exerting informed influence on policy choices and planning. For this reason, the scientific program of the conference includes a session dedicated to the social impacts of Mediterranean storms and communication.

But the choice that I think the most innovative in the history of this conference, which has generated the enthusiasm of local authorities, is the conference opening to the public through a series of artistic events focused on the theme of natural disasters in the Mediterranean. The art was considered the most direct way to communicate important concepts and to raise public awareness on the work of the conference that this group of scientists is conducting. This is why we chose this historic venue, the XVI century Priamar fortress, built by the Genoese to control the rebel area now converted into a symbol of cultural renaissance of the city, to host the conference.

For the duration of the conference the Priamar fortress will host works of internationally renowned video-artists, already presented in international contexts (including the Venice Biennale) dedicated to the themes of the conference. In the arcades of the “Palazzo della Loggia” four young artists of the Academies of Fine Arts of the countries of the Mediterranean realize, in public, a series of large compositions on a theme. The work of young artists will be retaken and projected on the evening of the outer wall's height.

The award of the participating artists and the first national screening of the film by Eugenio Manghi “Boiling Mediterranean” will close the conference. We hope you enjoy this offer and that and wish to actively participate in the artistic event.

The scientific program of the conference consists of 6 thematic sessions, dedicated to different types of storms in the Mediterranean, from hydrometeorology (topics 3 and 4) to hydrogeology and marine storms (topics 5 and 6) connected by two cross-cutting sections on the impact on the population (topic 1) and observation of Mediterranean storms (topic 2).

The poster presentations will be in an area adjoining the conference hall to allow you all to be able to view and discuss with the authors during the conference breaks.

As you can see from the programme, there are no parallel sessions. This was a sensible choice, as the Plinius Conference, as the NH division that promotes it, has a multidisciplinary nature, and so we wanted to allow participants to attend all the presentations of the six sessions. I would like to thank the conveners of the six sessions: thanks to their work we will attend very interesting talks.

Along with the conference, three meetings of international projects (HyMeX, DHRIM, OPERA) focused on topics related to the objectives of the conference will be organized, in order to give opportunity for wider audience to get in touch with the scientific communities that manage these projects. All interested participants are welcome to attend these meetings.

I must thank Ms. Elisa Poggi, who led the organizing secretary, together with the entire administration of CIMA Foundation, Dr. Luciano Pasquale, president of the local organizing committee, for his interest and support and the mayor of Savona, dr. Federico Berruti, which has offered the space for the conference, dr. Roberto Rudari and dr. Antonio Parodi, CIMA Foundation, for supporting me in the definition of the scientific programme.

Last but not least the sponsors: Fondazione De Mari, the Chamber of Commerce of Savona, the City of Savona, Fondazione CIMA, Consortium Cos (OT), Acrotec s.r.l., Italian Space Agency, CNR-ISAC, Fondazione AMGA, Paredes Italia.

I hope you will enjoy the conference as well as your stay in Savona.

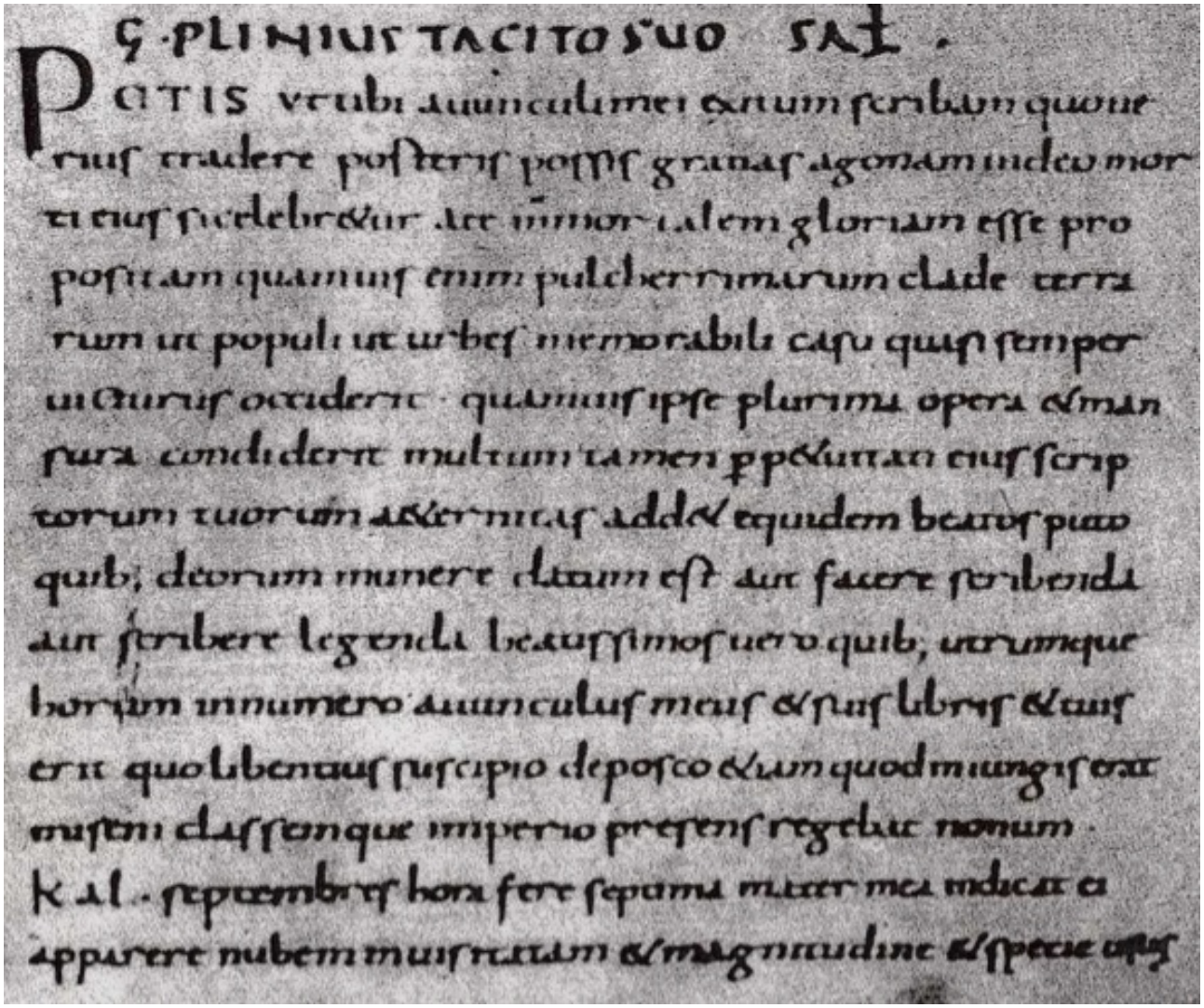
Sincerely,

Giorgio Boni
Organizing Committee Chairman

Pliny the Younger, Letters, VI, 16\h

The eruption of Mount Vesuvius in 79 A.D.

(Codex Laurentianus Mediceus 47.36, 9th century C.E.)



Original text

C. Plinius Tacito suo s.

Petis, ut tibi avunculi mei exitum scribam, quo verius tradere posteris possis. gratias ago; nam video mortis eius, si celebretur a te, immortalem gloriam esse propositam, quamvis enim pulcherrimarum clade terrarum, ut populi, ut urbes, memorabili casu quasi semper victurus occiderit, quamvis ipse plurima opera et mansura condiderit, multum tamen perpetuitati eius scriptorum tuorum aeternitas addet. equidem beatos puto, quibus deorum munere datum est aut facere scribenda aut scribere legenda, beatissimos vero, quibus utrumque. horum in numero avunculus meus et suis libris et tuis erit. quo libentius suscipio, deposco etiam, quod iniungis.

Bullard, F. M., 1968. Volcanoes. Austin. University of Texas Press, 441 pp.

Dear Tacitus,

Your request that I would send you an account of my uncle's death, in order to transmit a more exact relation of it to posterity, deserves my acknowledgement; for, if this accident shall be celebrated by your pen, the glory of it, I am well assured, will be rendered forever illustrious. And not with standing he perished by a misfortune, which, as it involved at the same time a more beautiful country in ruins, and destroyed so many populous cities, seems to promise him an everlasting remembrance; notwithstanding he has himself composed many and lasting works; yet I am persuaded, the mentioning of him in your immortal writings will greatly contribute to render

Erat Miseni classemque imperio praesens regebat. nonum Kal. Septembres hora fere septima mater mea indicat ei apparere nubem inusitata et magnitudine et specie. usus ille sole, mox frigida, gustaverat iacens studebatque; poscit soleas, ascendit locum, ex quo maxime miraculum illud conspici poterat. Nubes, incertum procul intuentibus, ex quo monte (Vesuvium fuisse postea cognitum est), oriebatur, cuius similitudinem et formam non alia magis arbor quam pinus expresserit. nam longissimo velut trunco elata in altum quibusdam ramis diffundebatur, credo, quia recenti spiritu evecta, dein senescente eo destituta aut etiam pondere suo victa in latitudinem vanescebat, candida interdum, interdum sordida et maculosa, prout terram cineremve sustulerat.

Magnum propiusque noscendum, ut eruditissimo viro, visum. iubet liburnicam aptari: mihi, si venire una vellem, facit copiam; respondi studere me malle, et forte ipse, quod scriberem, dederat. egrediebatur domo: accipit codicillos Rectinae Casci imminenti periculo exterritae (nam villa eius subiacebat, nec ulla nisi navibus fuga); ut se tanto discrimini eriperet, orabat.
Vertit ille consilium et, quod studioso animo incohaverat, obit maximo. deducit quadriremes, ascendit ipse non Rectinae modo, sed multis (erat enim frequens amoenitas orae) laturus auxilium. properat illuc, unde alii fugiunt, rectumque cursum, recta gubernacula in periculum tenet adeo solutus metu, ut omnis illius mali motus, omnis figuras, ut deprenderat oculis, dictaret enotaretque
Iam navibus cinis incidebat, quo propius accederent, calidior et densior, iam pumices etiam nigrique et ambusti et fracti igne lapides, iam vadum subitum ruinaque montis litora obstantia. cunctatus paulum, an retro flecteret, mox gubernatori, ut ita faceret, monenti 'fortes', inquit, 'fortuna iuvat, Ponponianum pete!' Stabiis erat, diremptus sinu medio (nam sensim circumactis curvatisque litoribus mare infunditur); ibi, quamquam nondum periculo appropinquante, conspicuo tamen et, cum cresceret, proximo, sarcinas contulerat in naves certus fugae, si contrarius ventus resedisset. quo tune avunculus meus secundissimo invectus; complectitur trepidantem, consolatur, hortatur, utque timorem eius sua securitate leniret, deferri in balineum iubet: lotus accubat, cenat aut hilaris aut, quod aeque magnum, similis hilari.

Interim e Vesuvio monte pluribus locis latissimae flammae altaque incendia relucebant, quorum fulgor et claritas tenebris noctis excitabatur. ille agrestium trepidatione ignes relictos desertasque villas per solitudinem ardere in remedium formidinis dictitabat. tum se quieti dedit et quievit verissimo quidem somno. nam meatus animae, qui illi propter amplitudinem corporis gravior et sonantior erat, ab iis, qui limini obversabantur, audiebatur. sed area, ex qua diaeta adibatur, ita iam cinere mixtisque pumicibus oppleta surrexerat, ut, si longior in cubiculo mora, exitus negaretur. excitatus procedit

his name immortal.....It is with extreme willingness, therefore, that I execute your commands; and should indeed have claimed the task if you had not enjoined it.

He was at that time with the fleet under his command at Misenum. On the 24th of August, about one in the afternoon, my mother desired him to observe a cloud which had appeared of a very unusual size and shape. He had just taken a turn in the sun, and after bathing himself _in cold water, and making a light luncheon, gone back to his books; he immediately arose and went out upon a rising ground from whence he might get a better sight of this very uncommon appearance. A cloud, from which mountain was uncertain at this distance, was ascending, the form of which I cannot give you a more exact description of than by likening it to that of a pine tree, for it shot up to a great height in the form of a very tall trunk, which spread itself out at the top into a sort of branches; occasioned, I imagine, either by a sudden gust of air that impelled it, the force of which decreased as it advanced upwards, or the cloud itself being pressed back again by its own weight, expanded in the manner I have mentioned; it appeared sometimes bright and sometimes dark and spotted, according as it was either more or less impregnated with earth and cinders. This phenomenon seemed to a man of such learning and research as my uncle extraordinary, and worth further looking into."

He ordered a light vessel to be got ready, and gave me leave, if I liked, to accompany him. I said I would rather go on with my work; and it so happened he had himself given me something to write out. As he was coming out of the house, he received a note from Rectina, the wife of Bassus, who was in the utmost alarm at the imminent danger which threatened her; for [from] her villa lying at the foot of Mount Vesuvius, there was no way of escape except by sea; she earnestly entreated him therefore to come to her assistance. He accordingly changed his first intention, and what he had begun from a philosophical, he now carried out in a noble and generous spirit. He ordered the galleys to put to sea, and went himself on board with an intention of assisting not only Rectina, but the several other towns which lay thickly strewn along the beautiful coast. Hastening then to the place from whence others fled with the utmost terror, he steered his course direct to the point of danger, and with so much calmness and presence of mind as to be able to make and dictate his observations upon the motion and all the phenomena of that dreadful scene.

He was now so close to the mountain that the cinders, which grew thicker and hotter the nearer he approached, fell into the ships, together with pumice stones, and black pieces of burning rock; they were in danger too not only of being aground

seque Pomponiano ceterisque, qui pervigilaverant, reddit. in commune consultant, intra tecta subsistant an in aperto vagentur. nam crebis vastisque tremoribus tecta nutabant et quasi emota sedibus suis nunc huc, nunc illuc abire aut referri videbantur. subdio rursus quamquam levium exesorumque pumicum casus metuebatur; quod tamen periculorum collatio elegit. et apud illum quidem ratio rationem, apud alios timorem timor vicit. cervicalia capitibus imposita linteis constringunt; id monimentum adversus incidentia fuit. Iam dies alibi, illic nox omnibus noctibus nigrior densiorque, quam tamen faces multae variaque lumina solabantur. placuit egredi in litus et ex proximo adspicere, ecquid iam mare admitteret, quod adhuc vastum et adversum permanebat. ibi super abiectum linteum recubans semel atque iterum frigidam poposcit hausitque. deinde flammae flammarumque praenuntius odor sulpuris alios in fugam vertunt, excitant Illum. innitens servolis duobus adsurrexit et statim concidit, ut ego colligo, crassiore caligine spiritu obstructo clausoque stomacho, qui illi natura invalidus et angustus et frequenter interaestuans erat. ubi dies redditus (is ab eo, quem novissime viderat, tertius), corpus inventum integrum, inlaesum opertumque, ut fuerat indutus: habitus corporis quiescenti quam defuncto similior. Interim Miseni ego et mater - sed nihil ad historiam, nec tu aliud quam de exitu eius scire voluisti. finem ergo faciam. unum adiciam: omnia me, quibus interfueram, quaeque statim, cum maxime vera memorantur, audieram, persecutum. tu potissima, excerpes: aliud est enim epistulam, aliud historian, aliud amico, aliud omnibus scribere. vale.

by the sudden retreat of the sea, but also from the vast fragments which rolled down from the mountain, and obstructed all the shore. Here he stopped to consider whether he should turn back again; to which the pilot advising him, 'Fortune'" he said, 'favors the brave; steer to where Pomponianus is'." "Pomponianus was then at Stabiae (now Castellammare), separated by a bay, which the sea, after several insensible windings, forms with the shore. He had already sent his baggage on board; for though at that time he was not in actual danger, yet being within sight of it, and indeed extremely near, if it should in the least increase, he as determined to put to sea as soon as the wind, which was blowing dead in-shore, should go down. It was favorable, however, for carrying my uncle to Pomponianus, whom he found in the greatest consternation; he embraced him tenderly, encouraging and urging him to keep up his spirits, and, the more effectually to sooth his fears by seeming unconcerned himself, ordered a bath to be got ready, and then, after having bathed, sat down to supper with great cheerfulness, or at least (which is just as heroic) with every appearance of it.

Meanwhile broad flames shone out in several places from Mount Vesuvius, which the darkness of the night contributed to render still brighter and clearer. But my uncle, in order to soothe the apprehensions of his friend, assured him it was only the burning of the villages, which the country people had abandoned to the flames: after this he retired to rest, and it is most certain he was so little disquieted as to fall into a sound sleep: for his breathing which, on acount of his corpulence, was rather heavy and sonorous, was heard by attendants outside. The court which led to his apartment being now almost filled with ashes and stones, if he had continued there any time longer, it would have been impossible for him to have made his way out. So he was awoke and got up, and went to Pomponianus and the rest of his company, who were feeling too anxious to think of going to bed. They consulted together whether it would be most prudent to trust to the houses, which now rocked from side to side with frequent and violent concussions as though shaken from their very foundations; or fly to the open fields, where the calcined stones and cinders, though light indeed, yet fell in large showers and threatened destruction. In this choice of dangers they resolved for the fields: a resolution which, while the rest of the company were hurried into by their fears, my uncle embraced upon cool and deliberate consideration. They went out then, having pillows tied upon their heads with napkins; and this was their whole defense against the storm of stones that fell round them.

It was now day everywhere else, but there a deeper darkness prevailed than in the thickest night; which however was in some degree

Ancient Vesuvius – Death of Pliny. Pierre-Henri de Valenciennes, Musée des Augustins, 1813, Toulouse

alleviated by torches and other lights of various kinds. They thought proper to go farther down upon the shore to see if they might safely put out to sea, but found the waves still running extremely high, and boisterous. There my uncle, laying himself down upon a sail cloth, which was spread for him, called twice for some cold water, which he drank, when immediately the flames, preceded by a strong whiff of sulphur, dispersed the rest of the party, and obliged him to rise. He raised himself up with the assistance of two of his servants, and instantly fell down dead; suffocated, as I conjecture, by some gross and noxious vapor, having always had a weak throat, which was often inflamed. As soon as it was light again, which was not till the third day after this melancholy accident, his body was found entire, and without any marks of violence upon it, in the dress in which he fell, and looking more like a man asleep than dead. During all this time my mother and I, who were at Misenum -- but this has no connection with your history, and you do not desire any particulars besides those of my uncle's death; so I will end here, only adding that I have faithfully related to you what I saw as an eye-witness myself or received immediately after the accident happened, and before there was time to vary the truth. You will pick out of this narrative, whatever is most important; for a letter is one thing, a history another; it is one thing writing to a friend, another thing writing to the public. Farewell.

Location and Conference Address

The 13th Plinius Conference on Mediterranean Storms is organized by Dr. Giorgio Boni (CIMA Research Foundation) with support from the European Geosciences Union (EGU). The Conference is held at the the historical Priamar Fortress, Savona, Italy, from 07 – 09 September 2011.

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Topics and Conveners

Topic 1: Societal impacts of Mediterranean Storms
Conveners: M.C. Llasat , L. Ferraris , N. Lomarda , D. Miozzo

Topic 2: Monitoring of Mediterranean Storms
Conveners: E.A. Smith , D. Cripe , A. Mugnai

Topic 3: Diagnosis and Forecasting of Mediterranean Storms
Conveners: E. Foufoula , S. Davolio , K. Lagouvardos

Topic 4: Hydrometeorology and hydrology of Mediterranean Storms
Conveners: F. Castelli , L. Garrote

Topic 5: Landslides, coastal erosion and tsunamis in the Mediterranean
Conveners: F. Ardizzone , S. Lorito

Topic 6: Wind, waves and other Mediterranean storms of oceanic origin
Conveners: L. Bertotti , J. Salat

Invited Speakers

Venkatachalam Chandrasekaran
Colorado State University, United States)

Peter Janssen
ECMWF, United Kingdom

Shaun Lovejoy
McGill University, Canada

Agostino Miozzo
EEAS - European Union, Belgium

Helena Molin Valdes
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Registration & Information Desk

The registration & information desk will be open from Wednesday, 7 September to Friday, 9 September during the sessions.

Special Events

Full Participant to the 13th Plinius Conference with excursion and field trip fee includes:

- Coffee Breaks (All days)
- Wednesday: ice-breaking
- Thursday: visit: Walking around the old city of Genoa
- Thursday: Gala Dinner
- Friday: light dinner
- Saturday: Whale Watching (weather permitting, from 12:00 to 19:00)

The Med-Storm Prize for Young Researchers

In the framework of the Plinius Conference, an International Committee headed by the President of CIMA Foundation will award with the "Med-Storm Prize for young researchers" the best oral and poster presentations of young researchers participating to the 13th "Plinius Conference on Mediterranean Storms".

The prize has been established in 2005, to promote the excellence of young researchers (Ph.D. students and Post-Docs) in the field of risk related to Mediterranean Storms.

A candidate should satisfy all the following criteria:

- be in age 35 or younger (by 1 January of the year when the award is presented);
- to be the first author;
- to be the person who presented the paper (oral or poster);
- to attend the Gala Dinner;
- do not have co-authors being members of the International Committee awarding the prize.

Applications will be collected at the registration & information desk.

Conference Proceedings

Authors whose papers have been accepted for presentation at the 13th Plinius Conference on Mediterranean Storms, are invited after the conference to prepare a short but self-contained manuscript (4–6 pages) for publication in the Conference Proceedings a special issue of ADGEO (*Advances in Geosciences*)
www.advances-in-geosciences.net/

Selected contributions (both poster and oral ones) are invited for submission as regular length articles to a special issue of NHESS (*Natural Hazards and Earth System Sciences*)
www.natural-hazards-and-earth-system-sciences.net/

Wednesday 7th

	Sibilla room		Atrium	Cel 01	OPERA room
08.00 - 08.45	Registration				
08.45 - 09.15	Opening and Welcome Local Autority				
09.15 - 09.40	Invited PL 1	Siccardi			
09.40 - 10.05	Invited PL 1	MolinValdes			
10.05 - 10.30	Invited PL 1	Miozzo			
10.30 - 11.00	Coffee Break				
11.00 - 11.15	PL 1		Poster PL 1 PL 3		
11.15 - 11.30	PL 1				
11.30 - 11.45	PL 1				
11.45 - 12.00	PL 1				
12.00 - 12.15	PL 1				
12.15 - 12.30	PL 3				
12.30 - 12.45	PL 3				
12.45 - 13.00	PL 3				
13.00 - 14.30	Lunch				
14.30 - 14.45	PL 3		Poster PL 1 PL 3		OPERA Meeting
14.45 - 15,00	PL 3				
15.00 - 15.15	PL 3				
15.15 - 15.30	PL 3				
15.30 - 15.45	PL 3				
15.45 - 16.00	PL 3				
16.00 - 16.15	PL 3				
16.15 - 16.30	PL 3				
16.30 - 16.45	PL 3				
16.45 - 17.15	Coffee Break				
17.15 - 17.30	PL 3		Poster PL 1 PL 3		OPERA Meeting
17.30 - 17.45	PL 3				
17.45 - 18.00	PL 3				
18.00 - 18.15	PL 3				
18.15 - 18.30	PL 6				
18.30 - 18.45	PL 6				
18.45 - 19.00	PL 6				
19.00 - 19.15	PL 6				
19.15 - 19.30	PL 6				
19.30 - 21.30	Ice Breaker				

Thursday 8th

	Sibilla room		Atrium	Cel 01
08.45 - 09.10	Invited PL 6	Jansen	Poster PL 4 PL 6	
09.10 - 09.35	Invited PL 3	Provenzale		
09.35 - 10.00	Invited PL 3	Richard		
10.00 - 10.25	Invited PL 3	Rotach		
10.25 - 10.50	Invited PL 3	Lovejoy		
10.50 - 11.15	Coffee Break			
11.15 - 11,30	PL 2		Poster PL 4 PL 6	
11.30 - 11.45	PL 2			
11.45 - 12.00	PL 2			
12.00 - 12.15	PL 2			
12.15 - 12.30	PL 2			
12.30 - 12.45	PL 2			
12.45 - 13.00	PL 2			
13.00 - 13.15	PL 2			
13.15 - 14.30	Lunch			
14.30 - 14.45	PL 4		Poster PL 4 PL 6	HyMex Meeting
14.45 - 15,00	PL 4			
15.00 - 15.15	PL 4			
15.15 - 15.30	PL 4			
15.30 - 15.45	PL 4			
15.45 - 16.00	PL 4			
16.00 - 16.15	PL 4			
16.15 - 17.45	Transfer to Genova			
17.45 - 20.00	Visit to Genova old Town			
20.00 - 20.30	Appetizer @ Acquarium Entrance Hall			
20.30 - 21.15	Visit to Genoa Aquarium			
21.15 - 23.30	Gala Dinner @ Aquarium Sharks Hall			

Friday 9th

	Sibilla room		Atrium	Cel 01
09.00 - 09.25	Invited PL 5	Papadopoulos	Poster PL 2 PL 5	
09.25 - 09.50	Invited PL 5	Tinti		
09.50 - 10.15	Invited PL 4	Nativi		
10.15 - 10.40	Invited PL 2	Chandra		
10.40 - 11.00	Coffee Break			
11.00 - 11.15	PL4		Poster PL 2 PL 5	DRIHM Meeting
11.15 - 11,30	PL4			
11.30 - 11.45	PL4			
11.45 - 12.00	PL4			
12.00 - 12.15	PL4			
12.15 - 12.30	PL4			
12.30 - 12.45	PL4			
12.45 - 13.00	PL4			
13.00 - 14.30	Lunch			
14.30 - 14.45	PL 2		Poster PL 2 PL 5	DRIHM Meeting
14.45 - 15,00	PL 2			
15.00 - 15.15	PL 2			
15.15 - 15.30	PL 2			
15.30 - 15.45	PL 2			
15.45 - 16.00	PL 2			
16.00 - 16.15	PL 2			
16.15 - 16.30	PL 2			
16.30 - 16.45	PL 2			
16.45 - 17.15	Coffee Break			
17.15 - 17.30	PL 5		Poster PL 2 PL 5	DRIHM Meeting
17.30 - 17.45	PL 5			
17.45 - 18.00	PL 5			
18.00 - 18.15	PL 5			
18.15 - 18.30	PL 5			
18.30 - 18.45	PL 5			
18.45 - 19.00	PL 5			
19.00 - 19.15	PL 5			
19.15 - 20.30	Light Dinner			
20.30 - 21.00	Awards Ceremony (young scientists, students, young artists)			
21.00 - 21.15	Book Presentation			
21.15 - 21.30	Presentation of the Documentary			
21.30 - 23.00	Documentary: "Boiling Mediterranean" by E. Manghi			

Saturday 10th

12.00 - 19.00	Whale-watching

Wednesday, 07 September 2011

08:00–08:45: Registration

08:45–09:15 Opening & Welcome Local Autority

Topic 1
Societal impacts of Mediterranean Storms

Conveners: M.C. Llasat; L. Ferraris; N. Lomarda; D. Miozzo
Lecture Room: Sibilla

09:15–10:30

09:15–09:40: Plinius13-123
From Mediocristan to Extremistan Building up a civil protection knowledge (solicited)
Siccardi F.

09:40–10:05: Plinius13-135
Disaster Risk Reduction: Form global strategies to local implementation (solicited)
Molin Valdes H.

10:05–10:30: Plinius13-118
The European Dimension of Civil Protection (solicited)
Miozzo A.

10:30 Coffee Break

11:00–11:15: Plinius13-120
Nine questions to understand Civil Protections problems around the globe
Miozzo D., Ferraris L., Musso L., **Altamura M.**

11:15–11:30: Plinius13-64
Towards a database on societal impact of Mediterranean floods in the framework of the HYMEX project
Llasat M.C., Llasat-Botija M., Petrucci O., Pasqua A.A., Rosselló J., Vinet F., Gajic-Capka M.

11:30–11:45: Plinius13-41
Toward a sustainable education program - Water and Society: A space-time framework for integrated studies.
Lutoff C, Anquetin S., Borga M., Creutin J.D., Créton-Cazanave L., de Gouville M., Ruin I.

11:45–12:00: Plinius13-19
Citizen-scientists on the hydro-meteorological scene: mashup technology for research on Mediterranean Storms.
Bedrina T., Quarati A., Clematis A., Parodi A., Rudari R.

12:00–12:15: Plinius13-87
Are bluefin tuna fishes in the Mediterranean waiting for a sign from skies to start their migrations?
Salat J., Tudela S., Sainz-Trapaga S., Cermeño P., Quilez G.

Topic 3
Diagnosis and Forecasting of Mediterranean Storms

Conveners: E. Foufoula; S. Davolio; K. Lagouvardos
Lecture Room: Sibilla

12:15–13:00

12:15–12:30: Plinius13-34
Towards a long-term climatology of Medicanes
Cavicchia L., von Storch H.

12:30–12:45: Plinius13-3
Intense small cyclonic vortices in the Mediterranean
Jansa A., Campins J., Picornell M.A., Guijarro J.A.

12:45–13:00: Plinius13-36
Assessing medicane risk using synthetic event sets
Tous M., Emanuel K., Romero R.

13:00 Lunch Break

14:30–14:45: Plinius13-40
Saturation fraction and gross moist stability in an evolving Mediterranean environment
Comellas A., Fuchs Z., Molini L., Parodi A.

14:45–15:00: Plinius13-42
Multi-scale evaluation of Mediterranean storm numerical Ensemble forecasting
Anquetin S., Molinié G., Creutin J.D., Ceresetti D., Sivia S.

15:00–15:15: Plinius13-69
Connections between Mediterranean Storms and Tropical Convective Activity
Tripoli G.J., Smith E.A., Mugnai A.

15:15–15:30: Plinius13-88
The Mediterranean coastal orographic heavy precipitation field campaign within HyMeX
Ducrocq V. and the HyMex Executive Committee for SOP1 Team

15:30–15:45: Plinius13-37
The 6-8 September 2010 flood over Southern France: observational and modeling analysis in the frame of HYMEX project
Lagouvardos K., Kotroni V., Defer E., Bennett A., Betz H., Bousquet O.

15:45–16:00: Plinius13-29
Precipitation downscaling and multi-sensor fusion based on sparse representation and non-Gaussian statistics
Foufoula-Georgiou E., Ebtehaj M.

16:00–16:15: Plinius13-18
Small-scale variability of the raindrop size distribution and predictability properties of Mediterranean Storms
Checa R., Durán L., Molini L., Parodi A., Tapiador F.J.

16:15–16:30: Plinius13-105
Variational assimilation of InSAR-derived integrated water vapour in mesoscale models: improving initial conditions at high spatial resolution
Pichelli E., Ferretti R., Panegrossi G., Cimini D., Perissin D., Pierdicca N., Rocca F., Rommen B.

16:30–16:45: Plinius13-6
Examining correlation between lightning activity, rainfall and flash flooding. A case study in the island of Crete.
Koutroulis A.G., Grillakis M.G., **Tsanis I.K.**, Kotroni V., Lagouvardos K.

16:45 Coffee Break

17:15–17:30: Plinius13-31
Statistical evaluation of real-time WRF predictions across the Mediterranean region
Katsafados P., Papadopoulos A., Mavromatidis E.

17:30–17:45: Plinius13-110
Hydrological analysis of the extreme precipitation event of June 2011 in the Parma basin, Italy
Alberoni P.P., Amorati R., Pecora S., Ricciardi G., Tonelli F., Zenoni E.

17:45–18:00: Plinius13-4
Mediterranean Winter Cyclones as Projected by Climate Models
Ziv B., Kushnir Y., Nakamura J., Naik N., Harpaz T.

18:00–18:15: Plinius13-59
Analyses of possible changes in the mean and extreme precipitation regimes over Spain under climate change scenarios
Turco M., Llasat M.C., Quintana Seguí P.

Topic 6
Wind, waves and other Mediterranean storms of oceanic origin

Conveners: L. Bertotti; J. Salat
Lecture Room: Sibilla

18:15–19:30

Chairperson(s): L. Bertotti & J. Salat

18:15–18:30: Plinius13-46
Operational Wave Forecast in Mediterranean Coastal Areas
Catini F., **Inghilesi R.**, Lionello P., Orasi A., Morucci S.

18:30–18:45: Plinius13-80
Wave extremes in the climate change perspective: the Adriatic Sea case study
Carniel S., Fedele F., Benetazzo A., Sclavo M., Ricchi A., Bucchignani E.

18:45–19:00: Plinius13-1
Modelling of an exceptional storm
Bertotti L.

19:00–19:15: Plinius13-86
A modification for sea evaporation estimates based on changes in stratification in the contact layer
Salat J., Umbert M., Ballabrera J.

19:15–19:30: Plinius13-83
The significance of Dense Shelf Water Cascading in the Mediterranean Sea and future projections at the light of climate change scenarios
Canals M., Somot S., Sanchez-Vidal A., Herrmann M., Calafat A.M., Company J.B., Durrieu de Madron X., Heussner S., Medina R., Losada I., Palanques A., Puig P., Sarda F.J.

19:30 Ice Breaker

20:30 Plinio Reading

Thursday, 08 September 2011

Topic 6
Wind, waves and other Mediterranean storms of oceanic origin

Conveners: L. Bertotti; J. Salat
Lecture Room: Sibilla

08:45–09:10

Chairperson: L. Bertotti

08:45–09:10: Plinius13-132
Survey of the Physics of Ocean waves from global to regionalscales. (solicited)
Janssen P.A.E.M.

Topic 3
Diagnosis and Forecasting of Mediterranean Storms

Conveners: E. Foufoula; S. Davolio; K. Lagouvardos
Co-Conveners:
Lecture Room: Sibilla

09:10–10:50

09:10–09:35: Plinius13-8
Precipitation, weather, low frequency weather and the emergence of the climate (solicited)
Lovejoy S., Schertzer D.

09:35–10:00: Plinius13-33
From Mediterranean storms to Karakoram waters (solicited)
Provenzale A., von Hardenberg J., Palazzi E., Vuillermoz E., Verza G.P., Bonasoni P., Cristofanelli P.

10:00–10:25: Plinius13-129
Uncertaintypropagation for floodforecasting in the Alps: Differentviews and impacts from MAP D-PHASE (solicited)
Rotach M., Arpagaus M., Dorninger M., Hegg C., Montani A., Ranzi R.

10:25–10:50: Plinius13-90
Towards a mesoscale Ensemble Hydro-Meteorological Prediction System for the northwestern Mediterranean (solicited)
Richard E., Hally A., Fresnay S., Lambert D., Vié B., Nuissier O., Ducrocq V., Vincendon B.

10:50 Coffee Break

Topic 2
Monitoring of Mediterranean Storms

Conveners: E.A. Smith; D. Cripe; A. Mugnai
Lecture Room: Sibilla

11:15–13:15

Chairperson: Eric A. Smith

11:15–11:30: Plinius13-11
Cb-TRAM: Tracking and monitoring severe convection over the Mediterranean from onset over rapid developm ent to mature phase using multi-channel Meteosat SEVIRI data
Tafferner A., Forster C., Mannstein H., Zinner T.

11:30–11:45: Plinius13-51
Monitoring Mediterranean floods using COSMO-SkyMed: experiences gained in the OPERA project
Pulvirenti L., Pierdicca N., Chini M., Guerriero L.

11:45–12:00: Plinius13-44
Do Vestige Atlantic Hurricanes Trigger Cyclonic Storms Over Mediterranean Basin?
Smith E.A., Mehta A.V., Mugnai A., Tripoli G.J

12:00–12:15: Plinius13-35
A high-resolution satellite-based climatology of heavy precipitating events over the Mediterranean region
Alhammoud B., Claud C., Funatsu B. M., Beranger K., Chaboureau J-P.

12:15–12:30: Plinius13-43
Precipitation Products from the Hydrology SAF
Mugnai A., Dietrich S., Levizzani V., Casella D., Cattani E., Di Paola F., Formenton M., Laviola S., Sanò P., De Leonibus L., Zauli F., Biron D., Melfi D., Porcù F., Puca S.

12:30–12:45: Plinius13-67
High-resolution rainfall sampling: the scales of interest
Molinié G., Boudevillain B., Berne A., Biron R., Coquillat S., Jaffrin J., Gérard S., Martin J.M., Studzinski A., Anquetin S., Creutin J.D., Delrieu G.

12:45–13:00: Plinius13-50
Post-event field investigations: A Socio-Hydro-Meteorological analysis of the 15-16 June 2010 disastrous flash flood event in the Var (France)
Ruin I., Boudevillain B., **Anquetin S.**, Creton-Cazanave L., Creutin J.-D., Delrieu G., Lutoff C., Vannier O.

13:00–13:15: Plinius13-25
Monitoring extratropical cyclone activity through the observation of stratospheric gravity waves using highly resolved radio sounding data
Kramer R., Wüst S., Bittner M.

13:15 Lunch Break

Topic 4
Hydrometeorology and hydrology of Mediterranean Storms

Conveners: F. Castelli; L. Garrote
Lecture Room: Sibilla

14:30–16:15

14:30–14:45: Plinius13-45
Precipitation in a boiling soup: is microphysics driving the statistical properties of intense turbulent convection?
Parodi A., von Hardenberg J., Provenzale A.

14:45–15:00: Plinius13-55
Advancing Hydrometeorological use of Multi-Instruments for Experimental Investigation of Precipitation Structure, Dynamics and Microphysics in Eastern Mediterranean: HYDREX
Anagnostou M. N., Kalogiros J., Baelen J. V., Marzano F. S., Chronis T. G., Nystuen J. A., Montopoli M., Anagnostou E. N., Picciotti E.

15:00–15:15: Plinius13-98
Microphysical characterization of severe rainfall events occurred on North-Western Italy using a C-band radar classification algorithm for hydrometeors.
Molini L., Montopoli M., Parodi A., Marzano F.S.

15:15–15:30: Plinius13-100
Comparison of multi-source rainfall field spatial mapping for operational flood alert using a distributed model
Tomassetti B., Montopoli M., Marzano F.S., Picciotti E., Verdecchia M.

15:30–15:45: Plinius13-82
Satellite and ground data assimilation in a surface hydrology model with snow dynamics
Martina F., Boni G., Caparrini F., Castelli F., Gabellani S, Rudari R.

15:45–16:00: Plinius13-54
Combining data assimilation and a genetic algorithm for real-time flood forecasting with a distributed hydrologic model
Mediero L., Garrote L., Chávez A.

16:00–16:15: Plinius13-119
Climate change and extreme surface flooding: a case study based on the 26th September 2007 Venezia flood
Buonomo E., Buontempo C., Huddleston M., Banovsky I., Ford C., Toothill J., Stowasser M., Tschudi S., Duveau T.

16:15 Transfer to Genova

17:45 Visit to Genova old Town

20:00 Appetizer at Acquarium Entrance Hall

20:30 Visit to Genova Aquarium

21:30 Gala Dinner at Aquarium Sharks Hall

Friday, 09 September 2011

Topic 5
Landslides, coastal erosion and tsunamis in the Mediterranean

Conveners: F. Ardizzone; S. Lorito
Lecture Room: Sibilla

09:00–09:50

Chairperson(s): F. Ardizzone, S. Lorito

09:00–09:25: Plinius13-28
Tsunami in the Mediterranean: assessment of impact and strategies for mitigation (solicited)
Tinti S., Armigliato A., Pagnoni G., Zaniboni F.

09:25–09:50: Plinius13-131
Tsunami Warning Systems in the Mediterranean and the NE Atlantic (solicited)
Papadopoulos G.A.

Topic 4
Hydrometeorology and hydrology of Mediterranean Storms

Conveners: F. Castelli; L. Garrote
Lecture Room: Sibilla

09:50–10:15

09:50–10:15: Plinius13-89
Cyber(e)-infrastructures for Hydrometeorology (solicited)
Nativi S.

Topic 2
Monitoring of Mediterranean Storms

Conveners: E.A. Smith; D. Cripe; A. Mugnai
Lecture Room: Sibilla

10:15–10:40

10:15–10:40: Plinius13-124
Radar network for urban and complex terrain flood monitoring (solicited)
Chandrasekar V., Lim S.

10:40 Coffee Break

Topic 4
Hydrometeorology and hydrology of Mediterranean Storms

Conveners: F. Castelli; L. Garrote
Lecture Room: Sibilla

11:00–13:00

11:00–11:15: Plinius13-107
A methodology for identify impact zones of potential hydrocarbons spills during floods
Deda M., Fiorini M., Massabò M., Rudari R.

11:15–11:30: Plinius13-78
Hydrological impact of forest fires and climate change in a Mediterranean basin
Versini P.-A., Sempere-Torres D.

11:30–11:45: Plinius13-99
Analysis of long flow discharge time series to assess possible changes in hydrological cycle over the Abruzzo Region in Central Italy
Lombardi A., Tomassetti B., Verdecchia M.

11:45–12:00: Plinius13-111
Seasonal to daily drought prediction in the Po catchment, Italy
Agnetti A., Del Longo M. Pavan V., Pecora S., Zenoni , E., De Michele C., Vezzoli R.

12:00–12:15: Plinius13-32
A Fully Distributed Model for Water Management and Flood Forecasting
Silvestro F., Gabellani S., Delogu F., Rudari R., Boni G.

12:15–12:30: Plinius13-79
How grid computing helps flood prediction, ground water management and hydrological survey
Petitdidier M., Lecca G., Hluchy L., Ivanovic M., Kussul N., Ray N., Thieron V.

12:30–12:45: Plinius13-14
A standards-based services-oriented architecture for sharing hydrometeorologic data
Hooper R., Zaslavsky I., Tarboton D., Maidment D.

12:45–13:00: Plinius13-72
Does seasonality impact the distribution of rainfall extremes?
Allamano P., Laio F., Claps P.

13:00 Lunch Break

Topic 2
Monitoring of Mediterranean Storms

Conveners: E.A. Smith; D. Cripe; A. Mugnai
Lecture Room: Sibilla

14:30–16:45

Chairperson(s): Douglas Cripe & Alberto Mugnai

14:30–14:45: Plinius13-125
Coupling X-band dual-polarized mini-radar and hydro-meteorological forecast models: the HydroRad project
Marzano F.S., Picciotti E., Cinque G., Montopoli M., Bernardini L., De Sanctis K., Anagnostou E., Anagnostou M., Fessas Y., Volpi A., Telleschi A., Kalogiros J., Cazac V., Pace R.

14:45–15:00: Plinius13-66
Semi objective definition of Mediterranean sub regions using full temporal and spatial resolution IR geostationary observations
Liberti G.L., Formenton M., Mugnai A., Kotroni V., Lagouvardos K.

15:00–15:15: Plinius13-65
Validation of the Cloud Dynamics and Radiation Database (CDRD) precipitation retrieval algorithm using Tropical Rainfall Measuring Mission (TRMM) radar-radiometer observations over the Mediterranean area
Casella D., Dietrich S., Di Paola F., Formenton M., Mugnai A., Sanò P., Smith E.A., Tripoli G.J.

15:15–15:30: Plinius13-39
High resolution modeling of deep moist convective processes: turbulence, microphysics and grid-spacing are the key ingredients?
Fiori E., Tanelli S., Parodi A.

15:30–15:45: Plinius13-93
Lightning detection and prediction from multi-sensor remote observations
Montopoli M., Picciotti E., Cimini D., Di Fabio S., Scipioni M., Marzano F. S.

15:45–16:00: Plinius13-94
Tracking and validation of surface rain rate from Mediterranean storms using microwave satellite and surface weather radar network observations.
Cimini D., Romano F., Ricciardelli E., Marzano F.S., Picciotti E., Vulpiani G.

16:00–16:15: Plinius13-117
Determining criteria for monitoring torrential rains
Stefanovic M., Gavrilovic Z., Milovanovic I., Zlatanovic N., Milojevic M.

16:15–16:30: Plinius13-60
Analysis of changes in heavy precipitation in Italy and connection to atmospheric circulation
Baldi M., Dalu J.D., Dalu G.A.

16:30–16:45: Plinius13-95
Flooded-Area Mapping and Change Detection from Multitemporal COSMO-SkyMed Images
De Martino M., Moser G., Angiati E., Dellepiane S., Serpico S.B.

16:45 Coffee Break

Topic 5
Landslides, coastal erosion and tsunamis in the Mediterranean

Conveners: F. Ardizzone; S. Lorito
Lecture Room: Sibilla

17:15–19:15

Chairperson(s): F. Ardizzone, S. Lorito

17:15–17:30: Plinius13-48
Remote sensing precipitation data to determine rainfall thresholds for the possible occurrence of landslides in central Italy
Luciani S., Brunetti M. T., Peruccacci S., Valigi D., Rossi M., Kirschbaum D.B., Guzzetti F.

17:30–17:45: Plinius13-9
Heavy rainfall triggering flash floods and shallow landslides: the case study of a Ligurian event (4th October 2010)
Sacchini A., Faccini F., Firpo M., Bozzano S., Francioli G., Robbiano A.

17:45–18:00: Plinius13-113
Spatiotemporal modeling of some case histories of shallow landslides in the area of Oltrepo Pavese, Northern Italy
Montrasio L., **Valentino R.**, Losi G.L., Meisina C., Rossi L., Rudari R.

18:00–18:15: Plinius13-61
Modelling of a 11,500 cal yr BP old tsunami generated by a submarine landslide in the Western Mediterranean Sea
Iglesias O., Canals M., Lastras G., Olabarrieta M., González M., Aniel-Quiroga I., Otero L.

18:15–18:30: Plinius13-121
Modelling tsunamis generated by submarine landslides. Application to real cases in the Mediterranean
González-Vida J. M., de la Asunción M, Castro M.J., Fernández-Nieto E.D., Macías J., Parés C.

18:30–18:45: Plinius13-77
Slip Distribution of the Giant 2011 Tohoku-oki Earthquake from Joint Inversion of Tsunami Waveforms and GPS Data
Romano F., Piatanesi A., Lorito S., D'Agostino N., Hirata K., Atzori S., Cocco M.

18:45–19:00: Plinius13-81
Integrating fault data into tsunami hazard studies
Kastelic V., Tiberti M.M., **Basili R.**, Romano F., Lorito S., Piatanesi A., Selva J., Valensise G.

19:00–19:15: Plinius13-38
Tsunamis versus extreme wave events: a geomorphological approach for discriminating boulder deposition processes in two Mediterranean areas.
Vacchi M., **Rovere A.**, Zouros N., Firpo M.

19:15 Light Linner

20:30
Awards Ceremony (young scientists, students, young artists)

21:00
Book Presentation

21:15
Presentation of the Documentary

21:30
Documentary: "Boiling Mediterranean" by E. Manghi

Saturday, 10 September 2011

12:00 Whale-watching

Wednesday, 07 September 2011

Topic 1
Societal impacts of Mediterranean Storms

Conveners: M.C. Llasat; L. Ferraris; N. Lomarda; D. Miozzo
Poster Area: Atrium
Attendance Time: during the breaks

P1: Plinius13-128
Enhancing Resilience to Reduce Vulnerability in the Caribbean Project
Farrell D., Ferraris L., King I., **Parodi A.**, Robertson A., Rossi L., Rossi L., Siccardi F.

P2: Plinius13-57
Social impact analysis of two heavy rain events in Catalonia: 14th and 15th July 2001 and 3rd April 2002
Barberia L., Amaro J., Aran M., **Llasat M.C.**

P3: Plinius13-122
Long term monitoring of reforestation activities in Liguria: social and environmental impacts
Greco S., Miozzo D., Biondi G., D'andrea M., Franciosi C., Fiorucci P.

P4: Plinius13-26
Climatic characteristics of summer human thermal discomfort in Athens and its connection to atmospheric circulation
Bartzokas A., Lolis C.J., Kassomenos P.A., McGregor G.R.

P5: Plinius13-21
DRIHMS (Distributed Research Infrastructure for Hydro-Meteorology Study) project
Parodi A., Kranzlmueller D., Schiffers M., Clematis A., Rebora N., Craig G., Tafferner A., Morando M., Trasforini E., Molini L., D'Agostino D., Galizia A., Quarati A., Siccardi F.

P6: Plinius13-130
The digitalization of civil protection knowledge in forecasting and monitoring activities: the DEWETRA platform
Boni G., Botto A., Burastero A., Campanella P., Corina A.C., Ferraris L., Miozzo D., Molini L., Pagliara P., Rossello L., Traverso S., Versace C.

P7: Plinius13-56
Communication and perception of hydrometeorological risks in Catalonia
Llasat M.C., Llasat-Botija M., Guamis J.

Topic 3
Diagnosis and Forecasting of Mediterranean Storms

Conveners: E. Foufoula; S. Davolio; K. Lagouvardos
Poster Area: Atrium
Attendance Time: during the breaks

P8: Plinius13-2
Numerical simulation of thermodynamic and microphysical features of heavy snowfall caused by Mediterranean cyclones over Ukraine
Pirnach A., Romash T.

P9: Plinius13-15
Trends in rainfall regime over Israel, 1975-2010, and its relation with the variations in the synoptic systems and large-scale oscillations
Saaroni H., Ziv B., Pargament R., Alpert P.

P10: Plinius13-16
Sensitivity experiments for the simulations of a heavy rainfall event in Epirus, NW Greece
Sindosi O.A., Bartzokas A., Kotroni V., Lagouvardos K.

P11: Plinius13-68
The utility of SAFRAN as analysis of near-surface atmospheric variables: the case of the snowstorm in Catalonia on 8th March 2010
Turco M., Quintana-Seguí P., Llasat M.C.

P12: Plinius13-70
Atmospheric circulation characteristics favouring the development of desert dust storms in the Mediterranean
Gkikas A., Houssos E.E., **Lolis C.J.**, Bartzokas A., Mihalopoulos N., Hatzianastassiou N.

P13: Plinius13-84
A study of the urban Heat Island effect in Cyprus using Artificial Neural Networks
Michaelides S., Tymvios F., Retalis A., Paronis D., Hadjimitsis D.G., Agapiou A.

P14: Plinius13-92
Mediterranean Atmospheric Fronts: Analysis and Forecast of the Three-Dimensional Geometry
Gordin V., Bykov Ph.

P15: Plinius13-7
The summer North Atlantic Oscillation influence on the Eastern Mediterranean.
Chronis T., Raitsos D., Kassis D., Sarantopoulos A.

P16: Plinius13-12
The storms of the 18 September 2009: The dynamic processess and an analysis of some thermodynamic indices
Nicolaides K., Charalambous D.

P17: Plinius13-102
Multi-approach analysis of a Mediterranean storm in complex orography: case study on 19-21 September, 2009
Gentile S., Pichelli E., Maiello I., Ferretti R., Montopoli M., Picciotti E., Di Fabio S., Tomassetti B., Verdecchia M., Cimini D., Marzano F.S.

P18: Plinius13-101
Sensitivity of precipitation mesoscale numerical forecast to different initial conditions and weather radar data assimilation strategy
Maiello I., Gentile S., Montopoli M., Picciotti E., Ferretti R., Marzano F. S.

P19: Plinius13-103
Investigating the impact of high resolution surface humidity on WRF PBL and microphysics fields
Panegrossi G., Pichelli E., Gentile S., Ferretti R., Cimini D., Pulvirenti L., Pierdicca N.

P20: Plinius13-104
Investigation of urban boundary layer by high resolution models and ground based observations in Rome area: understanding parameterizations potentialities
Pichelli E., Ferretti R., Cacciani M., Siani A.M., Ciardini V., Di Iorio T.

P21: Plinius13-85
Recent advances and challenges in storm surge and flood forecasting: Examples from Delft-FEWS
Weerts A.H., Verlaan M, Gijsbers P, Jagers B

P22: Plinius13-134
Severe events determined by the Mediterranean lows over eastern Romania
Andrei S., Stefan S., Georgescu F.

Thursday, 08 September 2011

Topic 4
Hydrometeorology and hydrology of Mediterranean Storms

Conveners: F. Castelli; L. Garrote
Poster Area: Atrium
Attendance Time: during the breaks

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Conveners: F. Ardizzone; S. Lorito
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Plinius13-1
Modelling of an exceptional storm

L. Bertotti

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An explosive cyclogenesys storm, named "Klaus", hit the coasts of southern France and northern Spain in late January 2009, causing fatalities and serious damages in both countries. After crossing the Pirenees range, entered the western part of the Mediterranean Sea with still unabated violence. The ensuing waves were estimated as possibly the highest ones in the last 10 ~ 20 years.Given the exceptional character of the storm, it was of interest to analyse the evolution of both the wind and wave fields. In particular we were interested in how well the various operational models could forecast the storm.A number of meteo-oceanographic centres produce daily forecast in the Mediterranean Sea. We collected the data from seven different model systems with the aim of a) intercomparing their wind and wave fields, in so doing deriving an estimate of their reliability in such extreme conditions, b) comparing their results with available measured data, including satellite and buoys. The overall results make evident how the performance of the different model systems can change dramatically when dealing with a storm of exceptional character. In particular the strong gradients, in space and time, of the driving wind field stress the need for a relatively high frequency rate of the flow of information from the meteorological model to the wave one.

Plinius13-3
Intense small cyclonic vortices in the Mediterranean

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The Mediterranean area is known to be one of the most cyclogenetic regions in the world. Some of the cyclones formed in the Mediterranean are the so-called medicanes or tropical-like Mediterranean cyclones. The medicanes are intense small scale cyclonic vortices, characterised by symmetry, warm core and convective origin. But there are some other intense small cyclonic vortices in the Mediterranean that can also produce high impact weather (strong winds and/or heavy rain), but that are probably not classifiable as medicanes. On 29 October 2008, one of these vortices produced very strong winds, with damages, in the SW of the Island of Mallorca. Later, during 2010, up to 5 cases have been identified near the Balearics, some of them with strong winds, other with heavy rain, or both. Their small size makes difficult to obtain a good description of these disturbances. In the present contribution a general description of these disturbances is exposed. Besides, a semi-qualitative attempt of classification of these disturbances, based on the cyclone-phase space of Hart (2003), is explored.

Plinius13-4
Mediterranean Winter Cyclones as Projected by Climate Models

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The output of simulations of 9 models that participated in the CMIP-3 Project is compared to the NCEP-NCAR reanalyzed data for 1961-1990. The aim is to evaluate their performance in reconstructing the temporal and spatial characteristics of the winter Mediterranean cyclones. The properties examined are the spatial distribution of cyclone occurrence, long-term trend in their occurrence and the location of the Mediterranean upper-level trough.
The models reconstructed realistically the maxima of cyclone density within the Mediterranean and the inter-annual variability in their occurrence. However, they underestimated the level of cyclone occurrences, especially in the western part, where the simulated winter average cyclone counts was 60% of that observed. Accordingly, the models underestimate the intensity of the 500 hPa Mediterranean trough and shift it eastward.
A possible reason for that is the models' tendency to overestimate both the subtropical high-pressure belt and the low pressure over the higher latitudes. This is expressed in the doubling of the south to north pressure gradient between western North Africa and the eastern North Atlantic. This gradient was found correlated, with marginal significance, with the density of the Mediterranean cyclones. The models skill in reproducing the cyclone density distribution was found also to be correlated also with their spatial resolution, 0.8 for the number of vertical levels and 0.56 for the horizontal grid spacing. The improvement expected in the models' spatial resolution suggests that their ability to reproduce the Mediterranean cyclones would be improved as well.

Plinius13-6
Examining correlation between lightning activity, rainfall and flash flooding. A case study in the island of Crete

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Flash floods can seldom be predicted and therefore any new evidence regarding the occurrence of events can be useful for their mitigation. The present study reports the possible relationships between lighting activity and high precipitation related to flash flood events. In this study an attempt was made to correlate the lightning number and location, recorded by the ZEUS lightning detection system with the rainfall characteristics for sixteen rain events (4 flood and 12 non-flood events) in the island

ofCrete, during the period 2008-2009. Spatiotemporal analysis of rain and rain rate with flash count was performed with respect to distance (radius) of flashes from raingauge location at various temporal scales, in order to examine the correlation of accumulated rainfall and lightning activity. Results show increased lightning activity occurring during flood triggering storms. Furthermore, there is evidence that the number of flashes that occur during a precipitation event is related to precipitation depthwhen the latter is adequate to produce a flood event. Differences between flood and non-flood producing storms need to be further assessed by analyzing more independent parameters, including the synoptic conditions and dominant flash flood hydrological generating processes.

Plinius13-8
Precipitation, weather, low frequency weather and the emergence of the climate

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A basic feature of fluid systems is that the larger the structure (L) , the longer the lifetime (τ) . Over "weather" time scales, we show starting from the solar forcing and backed by extensive empirical evidence - that this is controlled by the energy flux ε so that from dimensional analysis, $\tau \approx \varepsilon^{-1/3} L^{2/3}$. The observed tropospheric mean $\varepsilon \approx 10^{-3}\ m^2/s^3$ implies that planetary structures ($L \approx 20000$ *km*) live for $\tau_w \approx$ 10 days at which scale, the temporal scaling undergoes a drastic "dimensional transition". In the strongly variable high frequency "weather" regime, fluctuations in a field f vary as $\Delta f \approx \tau^H$ where H a scaling exponent generally >0 so that fluctuations generally grow with scale. However, for "low frequency weather" $\tau > \tau_w$, we find (theoretically, empirically), that $H < 0$ so that fluctuations no longer grow but diminish with scale. In spectral terms (and ignoring the intermittency corrections) this implies $E(\omega) \approx \omega^{-\beta}$ with β =1+2 H so that at high frequencies $\omega > \omega_w = \tau_w^{-1}$, $\beta > 1$ whereas at low frequencies $\omega < \omega_w = \tau_w^{-1}$, $\beta < 1$ so that the spectra are much flatter: the resulting "low frequency weather" regimes have been called "spectral plateaus". For the oceans, the turbulent dynamics are very similar but the mean surface $\varepsilon \approx 10^{-8}\ m^2/s^3$ so that the critical time scale is $\tau_o \approx$ 1 *yr*.

In spite of their differences, the low and high frequency regimes can be considered "weather" since both have statistical scaling properties that are well modeled by conventional atmospheric (weather and climate) models as well by stochastic cascade models. However at a new scale τ_c – if only because of the large glacial to interglacial fluctuation in temperature, precipitation and other fields – low frequency weather must eventually give way to the emergence of a qualitatively new "climate" regime in which once again fluctuations grow with scale ($H > 0$). We present evidence that while this scale varies somewhat from region to region that although globally, $\tau_c \approx 10$ *yrs* that in the Mediterranean region it is somewhat larger ($\tau_c \approx 100$ *yrs*) and we discuss the consequences. We show how this scaling picture can unify our understanding of precipitation, weather and climate – including the extremes - and we discuss the ability of current GCM's to model the very low frequency climate regimes at scales $\tau > \tau_c$.

Plinius13-9
Heavy rainfall triggering flash floods and shallow landslides: the case study of a Ligurian event (4th October 2010)

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According to many authors climate variations are leading to an increasing number of flash floods at medium latitudes. In Liguria heavy rainfalls and floods occurred several times in the second half of the past century, triggering many landslides and causing damages and victims. Only in the last decade we can remember such events in Ceriana (2000), Chiavari and Fontanabuona Valley (2002), Recco (2007) and Magra Valley (2010). The last event occurred at Varazze and Genoa-Sestri Ponente on October, 4th, 2010. Anyhow heavy rainfalls with precipitation more than 100 mm / h occur in Liguria every years. Liguria is characterized by steep Alpine and Apennine southward slopes with the watershed at distance of 5-30 km from the sea. Brief streams characterized by very short runoff times, wind across urban areas in their lower part. In addition geological complexity and a particular atmospheric circulation determine a high flood hazard, above all between September and November when the Ligurian Sea is hotter. In october 4th 2010, at 00:00 a disturbance associated with a deep through centered near the Biscaglia Gulf approached the Western Mediterranean. An anticyclonic block in the Middle Mediterranean, leading African air with 15 $^\circ$ C at 850 hPa between Corsicaand Sardinia, stopped this barocline system on the Ligurian Sea. Together with warm temperature of the sea, these are the typical meteorological conditions triggering heavy rainfalls in Liguria. The intensive wet and hot southern air flux in the warm sector of the disturbance develops strong stationary thunderstorm activity around the sea-land border accentuated by the orographic effect of the Alpine and Apennine chain. Around 6:00 a.m. a supercell system developed on Varazze and determined rainfall of almost 100 mm in an hour and about 220 mm in 3 hours. Between 09:00 and 12:00 a.m. the same regenerated system hit Sestri Ponente, about 20 km westward Varazze, with a rainfall peak of 125 mm in 1 hour and 385 mm in 5 hours. All streams of the above locations flooded urban areas and a lot of shallow landslides triggered causing heavy damages, while a man died in a quarry near Sestri Ponente. Analysing the Basin Master Plans of the most hit catchments we observed that flooded areas had been well individuated by this planning tool. On the contrary, most of the

instability phenomena occurred in areas that had been designated high, medium or low-risk areas during land planning (never very high) and in sectors that were defined as stable because they lacked accepted indicators of potential landslide hazard. The above considerations highlight some problems in Master Plans as a tool to prevent geological risks in such meteorological situations that are more and more recurrent. Therefore, to update this land planning tool, it is necessary to extensively investigate local geomorphological features and to study a different method for assigning weights to the geohazard map.

Plinius13-11
Cb-TRAM: Tracking and monitoring severe convection over the Mediterranean from onset over rapid developm ent to mature phase using multi-channel Meteosat SEVIRI data

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Cb-TRAM is a fully automated tracking and nowcasting algorithm. Intense convective cells are detected, tracked and discriminated with respect to onset, rapid development, and mature phase. In addition, short range forecasts are provided. The detection is based on Meteosat SEVIRI (Spinning Enhanced Visible and Infra-Red Imager) data from the broad band high resolution visible (HRV), infra-red 6.2 µm (water vapour), and the infra-red 10.8 and 12.0 µm channels. Areas of convection initiation, of rapid vertical development,and mature thunderstorm cells (cumulonimbus Cb) are identified. The tracking is based on geographical overlap between current detections and first guess patterns of cells detected in preceding time steps. The first guess patterns are obtained with the aid of an image matching algorithm providing complete fields of approximate differential cloud motion. Based on this so-called pyramid matcher also nowcasts of motion and development of detected areas are provided.
Cb-TRAM is operated in real time and output is provided in the form of thunderstorm objects formatted in XML. The objects contain thunderstorm location (polygons), nowcast contours and some additioanl parameters as e.g. cell centre, cloud top temperature and trend. Examples of application are presented for thunderstorm detection and tracking over the Mediterranean. These include the Mallorca storm of 4 October 2007 and the aircraft incident with hail encounter on the approach to Palermo on 1 October 2009.

Reference: Zinner, T., Mannstein, H., Tafferner, A. 2008: Cb-TRAM: Tracking and monitoring severe convection from onset over rapid development to mature phase using multi-channel Meteosat-8 SEVIRI data. Meteorol. Atmos. Phys. 101, 191210

Plinius13-14
A standards-based services-oriented architecture for sharing hydrometeorologic data

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Developing comprehensive hydrologic and hydrometeorologic models of the Mediterranean Basin requires sharing data among multiple countries, across multiple levels of government, and between universities and government agencies. The Consortium of Universities for the Advancement of Hydrologic Science, Inc. (CUAHSI) has developed a services-oriented architecture for data publication, discovery, and transmission called the CUAHSI Hydrologic Information System (HIS). The use of standards by CUAHSI HIS, such as the WaterML 2.0 schema for transmitting time-series data, enables it to be easily adopted by multiple organizations. Further standardization using existing Open Geospatial Consortium (OGC) standards will further lower barriers to adoption. A large-scaleprototype system has been developed in the North America with more than 70 different services registered including universities, government agencies (such as USGS and US EPA), and local authorities (such as Niagara Peninsula Conservation Authority, Ontario). This prototype illustrates the potential of such a system to advance collaborative research, resource assessment, and predictive modeling using data from multiple administrative units.

Plinius13-18
Small-scale variability of the raindrop size distribution and predictability properties of Mediterranean Storms

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A deeper understanding of the spatial and temporal variability of the raindrop size distribution (RDSD) is of great relevance for various hydro-meteorological applications like cloud/precipitation microphysical processes, numerical weather modeling, estimation of rainfall using remote sensing techniques, and predictability studies of severe rainfall processes. Along complementing lines, some recent research results support the idea that the notion of convection in equilibrium or non-equilibrium may shed some light on the predictability properties of Mediterranean Storms. Validating this hypothesis requires of tailored measurements. A growing amount of dense networks of disdrometers is now available for different hydrometeorological areas of the Earth andprovide an estimate of the variability range at spatial scales relevant for spatial radars such as TRMM-PR and GPM-DPR. In

this study we report some preliminary findings aiming to quantify the relationship between the fine-scale properties of RDSD and the predictability features of the corresponding storms. The empirical data of the study consists in eight dual instruments (16 Parsivel disdrometers) that were used to record the RDSD from October 2009 to January 2010 in Central Spain.

Plinius13-19
Citizen-scientists on the hydro-meteorological scene: mashup technology for research on Mediterranean Storms.

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In this study, some preliminary results about the application of mashup technology for the study of Mediterranean storms are presented: emphasis is devoted to the importance of those technologies to support a range of hydro-meteorological activities of interest for researchers, hydro-meteo professionals (e.g. Civil Protection agencies, Meteorological Services etc), and finally the population at large.
A better exploitation of data archives according to a multidisciplinary perspective is a critical issues in HMR (Hydro-Meteorology Research).
The main challenges stem from the large quantity, complexity and heterogeneity of the tools and datasets originated by various sources: remote sensory observations, satellites, ground-based radars and ensemble forecasting methods.
The use of Web technologies on the collection and accumulation of the geoscientific data is now well-established. There are significant increase in the availability of free sensor data over the Internet (Weather Underground, WeatherBug, etc).
It is therefore essential to develop IT initiatives and tools enabling rapid data discovery from different web sources, their aggregation and development of functionality to homogenize, compare and interpolate these datasets.
The concept of "mash up", which has recently become very popular in many fields, could be useful and productive in case of information integration from a number of web sources. Mashup technology stands for a methodology that permits to combine data from two or more external online sources into an integrated experience. In other words a mashup application grabs data from one place on the Web, mix it up with relevant information from another place on the Web and presents it in a single application.
Individual citizen-scientists, often meteorology enthusiasts, are providing over the weather web services with affordable weather monitoring stations a growing amount of real-time data such as temperature, precipitation and wind-speed. On different onlinesources the weather data is registered in various formats and schemas. The aggregation methodology will permit to implement the transformation into one format (WaterML OGS format) and representation the data in homogenized form.

Plinius13-25
Monitoring extratropical cyclone activity through the observation of stratospheric gravity waves using highly resolved radio sounding data

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Strong cyclones can be hazardous atmospheric systems. Their enormous energy content and the resulting precipitation are parameters which have to be observed and analysed in detail. Consequently, improved understanding of the life-cycle of strong cyclones and their physics is important.
Atmospheric waves, especially gravity waves, which are radiated from a storm system, are investigated to serve as a proxy for the energy content of the storm itself: in several case studies higher gravity wave activity in the lower and middle stratosphererelated to the passage of fronts, which are part of extratropical cyclones, are analyzed. All analyses are based on high resolution radio sounding data of several European stations, whereas the longest time series lasts from 1997 to 2009. Thereby, wave signatures in temperature between 15km and 30km height are focussed on and compared to strong winds in the troposphere due to densely spaced isobars.
A measuring campaign in autumn/winter 2011 on Mallorca will extend the data base. The concept will be presented.

Plinius13-28
Tsunami in the Mediterranean: assessment of impact and strategies for mitigation

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The Mediterranean basin is theatre of tsunamis, which is not surprising since all the tectonic processes for tsunami generation are active in the region: coastal and submarine seismogenic zones, coastal and island volcanoes, unstable submarine margins. Most tsunami activity is concentrated in southern Italy and along the Hellenic Arc subduction zones, which means that the Mediterranean countries most affected by tsunamis are Italy, Greece and Turkey. Tsunami research has progressed very much in recent years, also as a consequence of the increased attention raised by the large tsunami of the 2004 in the Indian Ocean which attracted interest and funds. What is clear is that importance of studying tsunamis in the Mediterranean was overlooked for a long time,which lead to an underestimation of the related hazard and risk.
Gathering of historical information lead to the compilation of tsunami catalogues that extend back for several centuries and also include events of Greek and Roman civilisation, and that, complemented by the outcome of paleotsunami studies, provide a goodand sometime a sound basis for tsunami hazard evaluations. However, the assessment of tsunami impact, on the coast, that is the estimate of the damage that a single big tsunami can provoke (deterministic problem), and further, the estimate of the damage that tsunamis are expected to produce in a given period of time (probabilistic problem) are still

unsolved issues. They have not been conducted systematically for the whole coasts of the Mediterranean, but only for some limited spots in the frame of specific projects and with a variety of methods. The same considerations hold also for the elaboration and implementation of strategies for the mitigation of the tsunami effects.
This paper will highlight the results of the most recent studies on the impact of tsunamis of different origins in the Mediterranean region, and will further analyse the main factors that have limited so far the extensive application of such research to all the coasts of the basin that are expected to be under severe tsunami threat.
One of the most promising approaches in terms of possible scientific, technical and social synergies is the view that sees coastal inundation studies, including assessment and mitigation, as complementary contributions within a multidisciplinary research (or even within a unique discipline) that focus on the problems of the coastal zone, irrespective on the strict cause of the inundation (tsunami, storm surge or waves, coastal subsidence, climate change). Advantages and disadvantages of such approach in view of the implementation of natural risk protection strategies will be discussed.

Plinius13-29
Precipitation downscaling and multi-sensor fusion based on sparse representation and non-Gaussian statistics

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Precipitation fields often contain sparsely populated coherent high intense rain-cells embedded within lower intensity areas. A statistical manifestation of these isolated extremes is the remarkably non-Gaussian statistics with symmetrically extended heavy tails in the wavelet domain. A probability model is found which explains well this observed heavy tail structure via mixtures of Gaussian densities in the wavelet domain. Exploiting this probability model, a new framework is presented which permits multiscale adaptive fusion of multi-sensor precipitation data while preserving precipitation local extremes by taking into account the intrinsic non-Gaussian structure of rainfall in the estimation process.
A direct consequence of this observation is that these fields exhibit a nearly sparse representation when projected onto an appropriately chosen basis. This sparsity opens up the opportunity to explore a new paradigm for high-resolution recovery of precipitation data from low-resolution noisy observations via dictionary learning and l1-norm minimization. We demonstrate both the downscaling and fusion methodologies and demonstrate their advantages using a dataset of coincidental observations of precipitation events by the space-born precipitation radar abroad the Tropical Rainfall Measurement Mission (TRMM) satellite and ground-based weather surveillance Doppler radars.

Plinius13-31
Statistical evaluation of real-time WRF predictions across the Mediterranean region

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The non-hydrostatic limited area model WRF with the NMM dynamical core has been installed and appropriately configured in the parallel computing infrastructure of the Department of Geography at Harokopio University of Athens since late 2008. A part of conventional weather predictions, the model forecasts support many other operational and research activities such as driving local hydrological models for flash floods predictions, especially over small catchments, producing fire weather indexes and fire risk assessments during summer and providing estimations of the maximum wind power for areas with dense wind farms installations.
In the present study the performance of WRF predictions has been assessed using as reference the surface measurements available from the World Meteorological Organization (WMO) network. The comparison of the WRF weather forecasts against observations was made across the Mediterranean basin and the Black Sea. Surface observations from more than 900 conventional stations were used to verify and compare categorical model forecasts for two consecutive years (2009 and 2010). The statistics are based on the point-to-point comparison between the model generated variables and the relevant surface observations unevenly distributed over the domain of integration. Therefore, a verification procedure has been developed based on the estimation of traditional objectiveverification techniques such as bias, RMSE and threat scores for both continuous and discrete predictants. Moreover, quality control has been applied to remove erroneous measurements, based on checking the physical range of each parameter being verified,the allowable rate of change in time and the stationarity. Despite the known issues associated with comparing point measurements with area-averaged estimates, the measurements from WMO network are valuable for the study due to their coverage and the continuous recording. Preliminary results indicated that the model errors are highly dependent on the diurnal cycle, the seasonality, the forecast time and the station location especially over areas with complex physiographic characteristics.

Plinius13-32
A Fully Distributed Model for Water Management and Flood Forecasting

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Complete and distribute models, based on physical equations, can be very useful in hydrology as they can be applied in different contexts and for a wide range of purposes: flood forecast, water management, drought forecast, prediction of impact on the hydrologic cycle due to natural and human changes of the territory. Since they must mimic a variety of processes they can end up to be

very complex and with a high degree of parameterization. Furthermore these kind of models can be designed in order to assimilate data of different nature detected by ground stations and remote sensors.

In this work a model that balance the need of reproducing the physic of the processes and the practical goal of avoiding over-parameterization is presented. The model is developed to be easily applied in different contests contexts even in data scarce environments. All main hydrological phenomena are modeled in a fully distributed way: overland flow, infiltration, sub-surface flow, vegetation, deep flow, water table evolution and evapotranspiration. Complete mass balance and energy balance are introducedwith the capability of soil surface temperature estimation.

Particular attention is set on the both comparison between simulated soil temperature and data from remote sensors and to the feedbacks that satellite data have in the developing of hydrological models.

Plinius13-33
From Mediterranean storms to Karakoram waters

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Mediterranean storms may have effects that go far beyond the Mediterranean basin. In the Karakoram mountain range and the upper Indus basin in Pakistan, precipitation takes place mainly in winter and it is associated with the arrival of "western weather patterns" originating from the Mediterranean and the Middle East. Owing to this circulation, Karakoram glaciers receive their water input in winter and melt in summer, similarly to what happens in the Alps and quite differently from the monsoon-controlled dynamics in the eastern stretches of the Himalayas.

In the Karakoram, glaciers and snow melt contribute a large fraction of Indus waters. To assess the availability of water resources in this area, it is thus necessary to monitor and understand the relationships between precipitation, snowmelt, glacier response and runoff. This is especially important in view of the ongoing climate and land use changes and of the possible variations in the interaction between monsoons and western weather patterns. Modifications in the hydrological regimes in this region, both in terms of floods and droughts, can be rather dangerous owing to the presence of an extended artificial irrigation systems which depends on Indus water.

The French-Italian project PAPRIKA is devoted to addressing some of these topics, with a specific focus on the effects of atmospheric aerosols (black carbon in particular), on cryospheric responses and on water availability in the upper Indus basin. In this talk, some of the results obtained so far on atmospheric aerosols and on precipitation properties in the Karakoram area are reviewed, considering satellite data, meteorological reanalyses and in-situ measurements provided by two Automatic Weather Stations placed at high elevation near the Baltoro glacier. The discussion will then widen to include some general issues related to the hydrological cycle in the Hindu Kush – Karakoram – Himalaya range, its monitoring and numerical modelling.

Plinius13-34
Towards a long-term climatology of Medicanes

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Medicanes, strong mesoscale cyclones with tropical-like features (axis-symmetry, a warm core, a cloud-free eye surrounded by a cloud cover with spiral shape, winds up to the hurricane speed), are known to develop occasionally over the Mediterranean Sea.

Due to the scarcity of observations over sea and the coarse resolution of the long-term reanalysis datasets, it is difficult to study systematically the statistical and dynamical properties of Medicanes.

Our goal is to assess the Medicanes long-term variability and trends, performing the dynamical downscaling of the NCEP/NCAR reanalysis data for the 1960-2010 period in order to obtain a long-term climatology, and then replying the same procedure on GCM projections for future climate scenarios.

In order to prove the robustness of the method outlined above and to investigate the value added by the use of regional climate models to the study of Medicanes, we performed several climate mode simulations in a high resolution RCM (CCLM) for a number oftest cases studied in the literature, and we tested on a five-years model run different algorithms tailored to optimize automatic Medicanes detection in long-term simulations.
We present results on the model ability to reproduce Medicanes test cases and to catch their dynamical characterization, and we then discuss the performance of tracking and detection algorithms.

Plinius13-35
A high-resolution satellite-based climatology of heavy precipitating events over the Mediterranean region

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High impact weather phenomena are rather frequent in the Mediterranean region. Its geographical location, with latitudinal range from the subtropics to midlatitudes, the complex orography surrounding the Mediterranean sea, and the large supply of water vapor at low levels, are all factors that contribute to severe weather conditions. The large population density in the Mediterranean makes this

region particularly vulnerable to such events which cause severe social and economical distress. In addition, theMediterranean has been identified as one of the most responsive to global climatic change. For all these reasons, it is important to understand the climatological picture of these severe weather conditions. Severe weather encompasses conditions such as heavy precipitation and floods, strong winds and droughts. In our case we concentrate on the climatological study of heavy precipitation. Due to the scarcity of conventional observations, use is made of NOAA/METOP satellite observations, for which advantage can be taken of the time coverage differences between the platforms. A combination of AMSU-B (Advanced Microwave Sounding Unit-B)/MHS (Microwave Humidity Sounder) observations permit to investigate precipitating events while coincident AMSU-A (Advanced Microwave Sounding Unit-A) observations give insights into the larger synoptic-scale environment in which they occur.
The temporal and spatial distribution of moderate and heavy precipitation patterns over the Euro-Mediterranean region for the last decade will first be discussed. We find that the rain occurrence is widespread over the Mediterranean in wintertime while reduced in the eastern part of the basin in summer. The heavy precipitation is essentially located over land during wintertime and shifts to mostly over the sea during summer and autumn. Then, inter-comparisons with existing climatologies, like HOAPS (Hamburg Ocean Atmosphere Parameters and Fluxes from Satellite Data), will be presented. There is generally a rather fair agreement between these climatologies for describing the large-scale patterns such as the strong latitudinal gradient of precipitation. However, the higher spatio-temporal resolution of AMSU measurements gives access to mesoscale details over some key areas like coastal regions. We will finally show how this climatology can be used to validate numerical simulations.

Plinius13-36
Assessing medicane risk using synthetic event sets

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Tropical-like cyclones developed over the Mediterranean Sea, also called medicanes, are infrequent warm-core small scale cyclones that pose in risk islands and coastal regions. Although tropical cyclones and medicanes differ in their dimensions and other meteorological parameters such as maximum wind velocity, their energetics, based on the thermodynamic disequilibrium between the sea and the atmosphere, appear to be similar.

The low frequency of medicanes and the difficulty of detecting them, complicate their study. Our aim is to find characteristic patterns in medicane development that distinguish them from other types of Mediterranean cyclones, but the absence of a large historical database is problematic for our research.

A recent technique used in the study of tropical cyclones has been adapted to create a considerable collection of synthetic medicane events in the present climate. These events are consistent with the Mediterranean climatological variables and permit us to develop a database of events, circumventing the problem of the low number of real detected events. Furthermore, these synthetic cyclones are independent of historical medicane data: The inputs come directly from gridded climate variables (in this case from reanalysis data but it can be from GCMs, too), which affords a high potential utility in the study of how medicanes will respond to climate change.

As a first step, we will compare the genesis probability distribution of synthetic medicanes to observations. Spatial density and track maps created using our technique identify the Central and Western Mediterranean regions as the most likely areas of cyclone formation. Other parameters, like the annual and monthly frequency of the events, central surface pressure, radius of maximum circular wind and wind speed values are examined in this work, too. Although these results are not entirely satisfactory, they are good enough to be considered a useful tool to complement risk assessment based on the limited number of observed events.

Plinius13-37
The 6-8 September 2010 flood over Southern France: observational and modeling analysis in the frame of HYMEX project

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This presentation is devoted in the observational and modeling analysis of the most severe precipitation event that occurred over southeastern France in 2010. Indeed, during the period 6-8 September, important convective activity, accompanied by a large number of lightning and heavy precipitation occurred over the southeastern part of France. Raingauges in the area recorded more than 320 mm of accumulated rain within 48 hours.
In the frame of this presentation the event is analysed by using:
(a) all the available observations, namely rain gauge accumulations and operational radar reflectivity fields, space-based infrared/visible and microwave observations together with lightning measurements provided by three networks: ATDnet, LINET and ZEUS. These observations permitted to follow the evolution, both in space and time, of the convective activity over the study area..
(b) high resolution model simulations of the event, using MM5 model at 2-km resolution over southern France. The model results permitted to set the synoptic and mesoscale environment in which the convective activity was sustained. An attempt to assimilate lightning information during the first 12-15 hours of the model execution is also evaluated, through comparison against the control simulation and the available observations.

Plinius13-38
Tsunamis versus extreme wave events: a geomorphological approach for discriminating boulder deposition processes in two Mediterranean areas.

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Tsunamis and extreme waves are one of the largest threats for coastal areas, especially in territories where modern social development has led to an increase of coastal population.
On one hand, tsunami warning or extreme wave prediction systems have been put in place since the early 20's as networks for detection and communication to issue timely alarms to allow evacuation of coastal areas. On the other hand, the definition of coastal tracts subject to different degrees of hazard is left to historic datasets. These can be quantitative (i.e. measured data for the last century) or qualitative (i.e. data inferred indirectly for the last few thousands years).
In this perspective, geological markers of tsunamis or exceptional storm waves along coastal tracts give a substantial contribution to the definition of long-termed datasets related to the occurrence of past catastrophic events. A large range of literature deals with the mechanisms triggering tsunamis, mainly addressing their geographical origin, wave propagation and deformation. Although easier in the Mediterranean, distinguishing between tsunamis and extreme storms from geological markers remains a difficult task, although this topic has been addressed by different authors.
In this study, field surveys were aimed to identify and assess the main characteristics (dimensions, weight, position along the coast) of boulder deposits found along two Mediterranean shorelines. One is located in the Aegean Sea (Lesvos Island, Greece), the other in the Ligurian Sea (Savona Province, Italy). These localities are different from hydrodynamic, geological, geomorphologic and socio-economic point of view. Data were processed using two recently published hydrodynamic approaches in order to quantify the waves necessary to displace the boulders in the two areas. On the basis of the pre-transport settings identified, values of Storm wave height (Hs) and Tsunami wave height (Ht) theoretically required for the boulder displacement were calculated in the two areas. Where present, marine biological remains were sampled and dated with radiocarbon to identify the age of the event, and historical photographs analyzed to gather details of coastal changes.
The results support the hypothesis that the boulders in Lesvos (Greece) where settled on the coast by a tsunami triggered by the Chios-Karaburum earthquake of 1949. Some of them where after re-oriented by exceptional storms occurred after their emplacement. The results obtained for boulders near Savona (Italy) provide suggestive evidence that they were settled during a severe storm occurred in the last 10 years. Nevertheless, geological and morphological data suggest that the continental shelves and slopes of this area can be subjected to sediment mass failure, potentially leading to tsunami events.

Plinius13-39
High resolution modeling of deep moist convective processes: turbulence, microphysics and grid-spacing are the key ingredients?

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Actual petascale and next-generation exascale modeling platforms are making possible the numerical simulation of severe weather events at unprecedented fine mesh-scale. This strong progress has the potential for enabling a deeper insight into spatio-temporal properties of deep moist convective processes, but also requires a better understanding of the uncertainties associated with the adoption of the different physical parameterizations, such as turbulence and microphysics closures.
In this paper, deep moist convective processes in idealized and real atmospheric scenarios are studied by means of high resolution numerical simulations.
The focus of the work is to establish if and at which extent the convection-resolving solutions, in the range of grid-spacing between 1 km and 100 m, statistically converge from a turbulence perspective with respect to flow field structure, transport properties and precipitation forecast. Different turbulence closures, microphysics settings and grid-spacings are combined and their joint impact on the spatial-temporal properties of storm processes is assessed and discussed.

Plinius13-40
Saturation fraction and gross moist stability in an evolving Mediterranean environment

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Deep moist convection is a threatening phenomenon that recurrently hits both the Mediterranean and tropical seas. For this reason, many attempts have been made to try to characterize and predict it, and with this objective several physical indices have been proposed in literature during the last decade. Among these and for tropical environments, saturation fraction and gross moist stability, which are a measure of the atmospheric columnar saturation and an estimation of the convective behavior through therelation of the convective forcing and the convection response, respectively, have been proposed.
For the midlatitude, Mediterranean convection, the convective adjustment time-scale τ_c has been introduced, which is an estimation of the convective equilibrium of the environment through the use of CAPE and its rate of change by convective heating. This paper hypothesizes with the idea of a potential suitability of the tropical indices in a continuously-warming Mediterranean atmosphere, by testing them for the set of severe rainfall events over Italy during January 2007-February 2009. In another study, they had already been successfully classified into two categories of events showing non-equilibrium or rather equilibrium conditions, by using the convective adjustment time-scale τ_c. Our results indicate that such classification based on the equilibrium

criterion as function of the episodes' duration does not show consistency for the saturation fraction, while the events' mean normalized gross moist stability is widely negative, the meaning of which for the midlatitude environment is not clear yet and remains an open debate within the scientific community.

Plinius13-41
Toward a sustainable education program - Water and Society : A space-time framework for integrated studies.

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In the context of climate change, the European Union and its southern partners are particularly concerned with water resources issues, including droughts, dry-spells, water quality, excess of runoff and extended floods.
The coupling of natural and social processes requires a deep understanding of the scaling problems involved in each domain and a clear idea of the spatio-temporal dynamics of interactions between each domain. This challenge calls for interdisciplinary collaborations in the early stage of the design of long-term observation strategies of natural and social processes that integrates spatio-temporal scales.

In May 2011, the International Summer School "Water and Society : A space-time framework for integrated studies" was organized to strengthen interdisciplinary around water issues and in particular, Mediterranean flash-flood.
It brought together hydrologists, meteorologists, climatologists, geographers, sociologists, and politics from academic and operational fields; half of the participants came from Social Sciences. It gathered 10 different countries (Morocco, Hungary, Italia, China, India, USA, UK, Spain, Burkina Faso).
Based on the concepts developed by Holling (2001) and illustrated by Ruin et al. (2008) and Creutin et al. (2009) for Mediterranean flash-flood issues, the school proposed to explore how time and space frameworks can be developed and applied in interdisciplinary research and education that aims to investigate water and society studies.
Based on lectures focusing on central concepts and theories, the participants worked in small interdisciplinary groups. In each groups, the exercise aimed first at listening and understanding each other's expertise in order to build a common virtual research question weaving water and society's problems. Then, the groups were asked to approach their research question through the lens of the space-time conceptual framework in order to better apprehend the concept and to test its limits and strengths. Several challenges had to be handled, mainly because of disciplines and language barriers.
This presentation will give an overview of 1/ how the program was built to reach the objectives and 2/ the main issues of the projects proposed to the students. It will be open to new perspectives dealing with how and why to maintain and strengthen interdisciplinary networks for integrated studies, in particular, dealing with water issues in Mediterranean.

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Plinius13-42
Multi-scale evaluation of Mediterranean storm numerical Ensemble forecasting.

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During a heavy precipitation event, the distribution of rainfall intensities usually includes common and extreme values. To forecast river flow, hydrologists are mainly interested on average rainfall values over a catchment basin while hazard rainfall events are often due to extreme rainfall values. However, Ramos et al. (2005) have shown that the point rainfall intensity is not a robust indicator of the storm danger, the impacted surface and the rainfall duration must be taken into account.
In this presentation, we propose to assess the uncertainties of heavy precipitation ensemble forecasts in characterizing on one hand the overall rainfall and on the other hand the extreme one.
For overall rainfall, we use the scale dependent quality index defined and fully characterized in Yates et al. (2007). This index is defined as the correlation coefficient, between a reference and a simulated field, computed for different spatial resolutions, i.e. the surface of rainfall aggregation.
The extreme rainfall-forecast quality is assessed on the basis of severity diagrams (Ramos et al., 2005). These 3-dimensional diagrams display the rainfall return periods against the impacted surface area at different duration. For the application in a complex-relief region, a generalization of severity diagrams has been implemented in order to incorporate the regional behaviour of heavy rainfall events (Ceresetti et al., 2011).

Severity diagrams and scale dependant quality index are applied to simulated and observed rainfall fields for three major storms that occurred in the last decade over a Mountainous Mediterranean region of Southern France. It is shown that first severity diagrams allow to detect the critical space-time scales of rainfall events. Second, that severity diagrams provide a synthetic diagnostic of simulated fields. Both indexes demonstrate good capacities to highlight the differences in between

members of ensemble simulations of the studied events.

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Plinius13-43
Precipitation Products from the Hydrology SAF

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The EUMETSAT *Satellite Application Facility on support to Operational Hydrology and Water Management* (H-SAF) was established by the EUMETSAT Council on July 3, 2005 and started activity at the official date of September 1, 2005. The development programme duration was 5 years, ending on August 31, 2010. Soon after, the first phase of a follow-on *Continuous Operations-Development Programme* (CDOP-1) started with a 18-month period of duration. A following second phase (CDOP-2) should then provide long-term perspective (five years) to the initiative. The Italian Meteorological Service serves as *Host Institute* on behalf of 12 European countries.
H-SAF products concern precipitation, soil moisture and snow parameters. Some products are based only on satellite observations (OBS), while other products are based on the assimilation of satellite measurements/products into numerical models (ASS). In addition to products development and generation, H-SAF includes a products validation programme and a hydrological validation programme. The Italian Civil Protection Department (DPC) coordinates the validation programme. The following table presents the list of the precipitation products being generated within the CDOP-1 phase.
Here, we will focus on the OBS precipitation products that are based on algorithms developed by CNR-ISAC in collaboration with the international community. All these products were first generated during the H-SAF development programme and are now under continuous development in order to improve their performance. They are generated routinely at the Italian *Centro Nazionale di Meteorologia e Climatologia Aeronautica* (CNMCA), which is responsible of operational product generation and dissemination; in addition, they are generated in a pre-operational fashion, with a delay of few minutes to few hours from observation, depending on product and satellite data access.
Specifically, we will present and discuss the algorithms on which these precipitation products are based. We will also discuss the activities that are presently performed during CDOP-1 or are planned to be performed during CDOP-2, in order to enhance and improve algorithms and processing schemes and extend them to satellites that will be operational in the 2011-2017 timeframe – with special emphasis on the GEO *Meteosat Third Generation* (MTG) satellite which is scheduled to be launched by EUMETSAT in 2016, and on the LEO Core Observatory of the *Global Precipitation Measurement* (GPM) mission which will launched by NASA and JAXA in 2013.

Plinius13-44
Do Vestige Atlantic Hurricanes Trigger Cyclonic Storms Over Mediterranean Basin ?

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One of the more interesting tropical - mid-latitude dynamics interactions is one that has important effects on precipitation within the Mediterranean basin. This interaction consists of an Atlantic tropical cyclone or cyclone vestige whose original disturbance travels eastward and northward across the Atlantic basin, eventually intermingling with a mid-latitude cyclone entering southern Europe and/or the western Mediterranean basin. The period for these interactions is from mid-September through the month of November. If the tropical cyclone and/or its vestige is able to make the eastward Atlantic transit within the low to mid-levels, or if an upper level potential vorticity perturbation (jet streak) emitted by a Hurricane in its latter stages within the central Atlantic is able to propagate into and along the longwave flow affecting the western Mediterranean basin, then there is the prospect for a tropical cyclone remnant to produce a modification of a mid-latitude storm system affecting the Mediterranean basin. For such an occurrence to take place, it is necessary for an amplifying baroclinic perturbation to be already situated to the rear of a longwave trough, or to be excited by the emitted jet streak to the rear of a longwave trough – in either case, preparing to affect the western Mediterranean. In the first part of this presentation, we present the past history and qualitative evidence for these interactions. Then in a second part, we explore through numerical modeling the quantitative process of how such an interaction might takes place. The Algiers City flood of 9-10 November 2001, which killed some 700 people, was produced by a Mediterranean cyclone that most likely was influenced by the cumulative influence of Atlantic tropical storm Lorenzo and two vestige Atlantic hurricanes, Michelle and Noel. A published modeling study involving various of this study's authors, has already described the dynamical development of the Algiers storm as it amplified from a developing baroclinic disturbance within a Rossby wave

train, into a northern Africa hazardous flood system – then lingered in the western Mediterranean basin as a semi-intense warm core cyclone. In retrospective modeling experiments, we investigate how the Atlantic tropical cyclone– Mediterranean storm interaction may have occurred, and the eventual impact on how the interaction influences precipitation in the Mediterranean basin.

Plinius13-45
Precipitation in a boiling soup: is microphysics driving the statistical properties of intense turbulent convection?

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Intense precipitation events are often associated with strong convective phenomena in the atmosphere.
A deeper understanding of how microphysics affects the spatial and temporal variability of convective processes is relevant for many hydro-meteorological applications, such as the estimation of rainfall using remote sensing techniques and the ability to predict severe precipitation processes.
In this paper, high-resolution simulations (0.1-1 km) of an atmosphere in radiative-convective equilibrium are performed using the Weather Research and Forecasting (WRF) model by prescribing different microphysical parameterizations: from single-moment to triple-moment closures.
The dependence of fine-scale spatio-temporal properties of convective structures on microphysical details are investigated and the simulation results are compared with the known properties of radar maps of precipitation fields. We analyze and discuss similarities and differences and, based also on previous results on the dependence of precipitation statistics on the raindrop terminal velocity, try to draw some general inferences.

Plinius13-46
Operational Wave Forecast in Mediterranean Coastal Areas

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The Mediterranean Coastal WAve Forecast system (MCWAF), which will be operational from january 2012, has been implemented and tested extensively in the past two years on more than 40 key studies. The operational version of the system will soon replace the old SIMM-Poseidon forecast system, in use since 2000 at ISPRA. The aim of the project is to provide reliable forecasts on several selected coastal areas in the Mediterranean Sea using a combination of different third generation spectral wave models. The basin-scale implementation of the WAM model covers the whole Mediterranean Sea and includes the assimilation of satellite data and the coupling with currents. In order to have realistic simulations in coastal areas, not only it is necessary to run the models on parallel machines, but also to undergo two different levels of nesting. The basin-scale implementation produces high resolution boundary conditions for the regional implementations which simulate the wave evolution and propagation on intermediate resolution regional-scale zones. The SWAN model is nested on the high-resolution regional WAM grids and simulates the physical processes typical of the propagation in shallow waters. On the whole, the system is organized in a modular way, such that it is rather easy to add or modify grids at the regional or local level of nesting. The wind used is generated at ISPRA by an updated, high resolution version of the BOLAM regional meteorological model. A special effort is made to have an optimal bathymetry representation on the coastal, very high resolution, grids. Currents are provided by the Mediterranean Forecasting System in the framework of the MyOcean project. In this study we discuss the implementation of the operational version of MCWAF and present some results of the simulation of recent storms in the Ligurian and Northern Tyrrhenian Sea, showing the comparison with available observations.

Plinius13-48
Remote sensing precipitation data to determine rainfall thresholds for the possible occurrence of landslides in central Italy

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We defined rainfall thresholds for possible landslide occurrence in central Italy using remote sensing precipitation data. For the purpose, we used 3-hour cumulated rainfall on a 0.25 × 0.25 grid provided by NASA. We compared the thresholds with thresholds defined for the same area using rainfall measurements obtained from a network of 154 rain gauges in central Italy. For each rainfall event that has resulted in one or more landslides in the period 2002-2010, we calculated the cumulated rainfall E (mm) and the duration D (h) of the rainfall event. We compiled two data sets of empirical rainfall conditions (D, E) obtained from the rain gauge measurements and the remote sensing precipitation data. Using this information, we defined two different *ED* thresholds, for rain gauge measurements and for the remote sensing estimates. To define the thresholds, we adopted a Frequentist probabilistic method that assumes that the threshold curve is a power law $E = \alpha \cdot D^{\gamma}$, where E is the cumulated rainfall (mm), D is the duration of the rainfall event (h), α is a scaling constant (the intercept), and γ is the slope of the power law curve. We defined rainfall thresholds corresponding to an exceedance probability of 5% for the remote sensing data T_{5S}, and for the rain gauge measurements T_{5R}. Inspection of the two thresholds shows that the threshold curves have a similar scaling exponent γ, with T_{5S} exhibiting a lower intercept α. We conclude that, in the study area, the cumulated rainfall required to initiate landslides estimated using the

remote sensing precipitation data is persistently lower than the cumulated rainfall measured by the rain gauges. The result is significant. The two thresholds have a similar slope and this suggests that remote sensing precipitation data can be used to obtain rainfall thresholds for the possible occurrence of landslides. This can be useful in areas where rain gauge measurements are insufficient, or inexistent.

Plinius13-50
Post-event field investigations: A Socio-Hydro-Meteorological analysis of the 15-16 June 2010 disastrous flash flood event in the Var (France)

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On 15-16 June 2010, the vicinity of the town of Draguignan, located in the Var area (France) was hit by torrential rainfall amounts up to 400 mm in 36 hours. The total accumulated rainfall reached 200 and 300 mm over, respectively, 2000 and 250 km2 and led to important flash flooding. Officially this event was responsible for the death of 25 persons and damages were evaluated at 1 billion euros. 2450 persons were rescued, including 1350 who were airlifted and 300 who escaped a certain death. Three municipalities concentrated the most part of the fatal accidents: Draguignan (10), Trans en Provence (5) and Roquebrune (5).

The success of the meteorological operational forecasting chain was poor due to the very small-scale of the storms, the complexity of the associated physical processes and the difficulty of data assimilation at short time scale. In addition, the rivers responsible for the inundation are monitored by a low-resolution gauge network and were not part of the operational river monitoring system managed by the national flood warning service (Service de Prévision des Crues: SPC). The warning system was only based on the meteorological forecast provided by Météo-France at the regional scale.

Learning from such extreme events is not easy as very few data are available to understand the local environmental conditions surrounding individuals' responses to the event. In fact, in such case peak discharge measurements are nearly inexistent and the estimation of direct economical and human losses is often the only "social" data collected. Nevertheless, the understanding of the hydro-meteorological conditions and social settings in which individuals managed to protect themselves or their relatives against such dangerous and fast changing situation is crucial for preventing future events to turn again into disasters. This type of physical and social information needs to be collected coherently to improve our capability to better forecast and warn for such event in the future.

This presentation will describe an original methodology to both collect the lacking physical (meteorological and hydrological) and behavioral data in the context of post-event field investigations. Based on collaborations between social and physical scientists, this field experience happens to be also an excellent opportunity and a powerful tool to truly integrate research questions across disciplines.

Plinius13-51
Monitoring Mediterranean floods using COSMO-SkyMed: experiences gained in the OPERA project

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The potentiality of spaceborne Synthetic Aperture Radar (SAR) systems for flood mapping was demonstrated by several past investigations. The synoptic view and the capability to operate in almost all-weather conditions and during both day and night are thekey features that make the SAR images useful for monitoring inundation events. In addition, the latest generation of very high resolution SAR satellites allows a fairly accurate delineation of the flood extent. In particular, the COSMO-SkyMed (COnstellation of small Satellites for Mediterranean basin Observation) mission offers a unique opportunity to obtain radar images characterized by a high spatial resolution and by a short revisit time, so that it is presently possible to produce near real-time accurate flood maps that enable emergency responders to react to and manage fast-moving events, and to direct the resources to the highest-priority areas.
Italian Space Agency (ASI) is presently funding some projects aiming at assessing the utility of Earth Observation techniques into an operational flood management system. In the framework of one of these projects, named OPERA, ASI made available some COSMO-SkyMed (CSK) images of recent flood events. A number of these events occurred in the Mediterranean area, in particular in Italy and in Albania. This study presents the major outcomes of the experiences we made, within the framework of the OPERA project,using the X band radar images provided by CSK for flood mapping.
Most of the literature algorithms for flood mapping from SAR data use a threshold applied on an image temporarily close to the event, to separate flooded and non-flooded regions. The threshold is determined either by performing a visual interpretation of the image or in an automatic way. Heuristic segmentation techniques are also employed. Our approach is based on the considerations of the physics of the radar return from flooded areas, since, an analysis accounting for the various electromagnetic mechanisms that determine the radar return in the presence of a water surface may improve the accuracy of flood mapping. Indeed, in the presence of an inundation, not only specular reflection, characteristic of flooded bare terrains, but also double bounce backscattering, typical of agricultural/forested areas, may take place. While a specular surface is characterized by low radar return, so that flooded bare terrains, as well as vegetated areas completely covered by water appear dark in a SAR image, the intensity of double bounce backscattering involving stems or trunks is generally increased by the underlying water.
To carry out an accurate inundation map, the variations of the radar return caused by the presence of water

surfaces have to be identified. For this purpose, it is useful to analyze not only a SAR observation of the event, but also an image of the monitored area under dry conditions, i.e. preceding the flood, or following it with a sufficiently large temporal interval.
The results obtained through our approach, particularly when dealing with agricultural and forested flooded areas will be stresses in our presentation. The importance of having available also ancillary data such as a digital elevation model and a land cover map will be also underlined. Finally, the possibility to monitor also the temporal evolution of a flood, thanks to the short revisit time of CSK data, will be presented making reference to one case study we analyzed throughout our activity.
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Plinius13-54
Combining data assimilation and a genetic algorithm for real-time flood forecasting with a distributed hydrologic model

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Real-time flood forecasts can be improved using an adaptive model that takes into account the errors between predictions and observations. Data assimilation procedures update the estimation of the initial state of the system and correct the model from the new observations. But there are many sources of uncertainty in the forecast process and the model parameters can change in each time step. A genetic algorithm has been developed to implement a looped process. The best parameter combinations are selected in each time step by means of an objective function and mutations are performed over the selected parameters with random disturbances.
The forecast model uses the deterministic and distributed RIBS (Real-time Interactive Basin Simulator) model. The RIBS model was calibrated by a probabilistic multi-objective global optimization methodology that identifies a probability distribution, instead of a unique value, to represent each model parameter. The forecast starts with a random sample of basin states represented by parameter values generated from the probability distributions given as calibration result. After measured rainfall and discharge data are received, the ensemble of basin states is propagated in time, and then reduced selecting those states which better represent the observed discharges. Mutations are performed over these selected basin states and a new operational loop is started. This methodology was applied to a hydrological basin located in Spain, comparing the results for different rainfall events. The process is computationally intensive, because it is required to simulate many replicas of the ensemble using a distributed rainfall-runoff model, and it is therefore well suited to test the applicability of the potential of the Grid technology to hydrometeorological research.

Plinius13-55
Advancing Hydrometeorological use of Multi-Instruments for Experimental Investigation of Precipitation Structure, Dynamics and Microphysics in Eastern Mediterranean: HYDREX

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The inherent spatial and temporal variability of precipitation makes rainfall one of the most difficult geophysical variables to measure anywhere, and yet it is one of the most important in advancing hydrologic and weather forecast applications. In particular, improving local flood and flash flood forecasting requires accurate quantitative rainfall measurements at small temporal (minutes) and spatial (hundred of meters to few kilometers) scales. Arguably, weather radar's capability to monitor precipitation (in particular radars with dual-polarization capability) at high spatial and temporal scales has stimulated great interest and support within the hydro-meteorological community. Furthermore, precipitation over oceans plays a significant role on the hydrological cycle and the ocean circulation. The comprehensive measurement of precipitation is valuable for understanding the water and energy cycle and predicting weather and climate. Climate change has raised the need for accurate spatial and temporal measurement of ocean and land surface precipitation. Furthermore, measuring precipitation enhances overall weather-forecasting capabilities and can determine the location, structure and strength of storms at sea, contributing valuable information for ship routing so that vessels can avoid heavy storms. Satellite instruments present complex trade-offs among their characteristics; for example among spatial resolution, spatial coverage and revisit time, or between sensitivity and spectral resolution. However, the sound produced by rainfall underwater can be used to quantitatively measure rainfall at sea. Further research is needed to understand how to distinguish the acoustic signal of rainfall at sea to identify it and quantify it at the sea surface as well as data from dual-polarization weather radar to predict precipitation dynamics, vertical structure and microphysical properties of storms. HYDREX (Hydrometeorological Experiment) is an experimental set up in the coastal area southeast of Athens targeting measurements of coastal rainfall and urban hydrologic processes from multiple sensors and at various spatio-temporal scales. Experimental data from HYDREX will facilitate studies for (1) developing improved techniques for retrieving rainfall rate and drop size distribution parameters from high-frequency (X-band and C-band) dual-polarization radar observations, (2) the estimation of rainfall and drop size distribution by underwater sound measurements, and (3) investigating the connection of rainfall scaling, microphysical variability and vertical structure as a mean for improving assimilation of remote sensing data in numerical weather

prediction and quantitative precipitation estimation. The experimental set up includes the National Observatory of Athens X-band dual-polarization Doppler mobile weather radar (XPOL), the Hellenic National Meteorological Service's C-band dual-polarization and Doppler weather radar, in situ stations consisting of rain gauges and disdrometers (a 2DVD and a Parsivile), a vertically pointing radar (named MRR), and a passive acoustic sensor (PAL) deployed at sea. The experiment was initiated in November 2010 through May 2011. Several storm cases of varying structure, rainfall intensities, and microphysics have been observed and will be presented at the meeting.

Plinius13-59

Analyses of possible changes in the mean and extreme precipitation regimes over Spain under climate change scenarios

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Global climate models (GCM) are basic tools to study the climate. However due to their coarse resolution, generally few hundred kilometres (Solomon et al. 2007), they are not useful to study regional aspects of the climate of order of tens of kilometres (Cohen, 1990). This is especially true for Spain, which is geographically complex and heterogeneous and it is characterized by a great variability of precipitation (Serrano et al. 1999, Trigo and Palutikof, 2001). Consequently, developing regional climate scenarios is a key aspect for any impact and adaptation study to climate change in Spain.
In contrary to the traditional approach in which the statistical downscaling has been considered as an alternative to dynamical downscaling, we used the two kinds of downscaling approaches together in order to combine their advantages. This hybrid approach is becoming popular (Maraun et al. 2010, Piani et al. 2010, Quintana Segu\'{\i} et al 2010, Themeßl et al. 2010) thank to the better skill of RCMs (e.g. Herrera et al. 2010a) and the increase of availability of RCMs (e.g. due to projects like ENSEMBLES).
In this study, the fields of precipitation simulated by an ensemble of RCMs are statistically post-processed in order to downscale and to calibrate their precipitation fields using the analog method, (Lorenz, 1969), according to the approach of the Model Output Statistics (MOS, Wilks, 2006). The simulations used as predictors have been the RCMs provided by the EU-funded project ENSEMBLES. The Spain02 precipitation dataset (Herrera et al. 2010b) is used as predictand. The application of the MOS-analog method shows a big reduction of the systematic error of the RCMs in representing the spatial pattern of the climatology of several standard and extreme precipitation indices (Turco et al. 2011, accepted in JGR).
After an extensive validation of this method under optimal (using RCMs driven by ERA40) and sub-optimal conditions (using RCMs driven by GCM in current climate), we have also tested the validity of the statistical relationship in a surrogate climate as in (Frias et al. 2006). Finally, we present the application of this method to RCM scenario run.

Plinius13-60

Analysis of changes in heavy precipitation in Italy and connection to atmospheric circulation

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In this study we present results from a comprehensive analysis of the changes in precipitation extremes in Italy carried on using long term time series recorded at an high number of ground stations in the Country in the period 1971-2009. The precipitation time series has been checked for inhomogeneities and spatial and temporal pattern of changes in the extreme events of precipitation are evaluated considering the ETCCDMI -- Climate core precipitation indices. In addition, precipitation extreme events have been correlated with large scale circulation patterns leading to intense events over the region in order to better understand the mechanisms leading to intense daily precipitation. Although the complexity of the national territory acts directly on the precipitation regime and a coherent pattern of change all over the Country cannot be clearly detected, however, some trends in the temporal evolution of a number of indices has been detected as illustrated in this paper.
In order to increase the significance of the results and to explore more in detail the extreme precipitation trends, the national territory has been divided into climatically homogeneous regions and spatial and temporal patterns of changes for each region are presented.

Plinius13-61

Modelling of a 11,500 cal yr BP old tsunami generated by a submarine landslide in the Western Mediterranean Sea

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The BIG'95 submarine debris flow occurred on the Ebro margin of the gulf of Valencia, in the Western Mediterranean Sea, at prehistoric times (11,500 cal yr BP). Its resulting deposit covers an area of 2200 km2 of the slope and base of slope, at water depths ranging from 200 to 1800 m, with an estimated volume of 26 km3. The numerical model COMCOT (COrnell Multigrid COupled Tsunami Model) has been used to reveal the size and spreading pattern of the tsunami that such a landslide could have generated though assuming current sea-level conditions. The reconstruction of the pre-failure bathymetry and the shape change of the seafloor during landslide occurrence, both required by the model, have been developed based on multibeam bathymetry and high-resolution seismic reflection profiles of the deposit, and on the conceptual and numerical model of Lastras et al. (2005).
In terms of arrival time to nearby coastlines, the results show the relevance of the asymmetric shape of the basin floor. The model illustrates that the first shoreline impacted by the tsunami would be that of Eivissa Island instead of the closer to the source Iberian coast. Eivissa

would be first hit by the out-going wave 18 min after the failure initial triggering and the island of Mallorca 9 min later. The back-going wave would hit the Iberian Peninsula 54 min after the failure. This marked difference is due to the strong shoaling effect produced by the much wider continental shelf of the Ebro margin if compared to the Balearic Islands one.
Serial times and spectral analyses show that the periods of tsunamis generated by seismic sources in the Algerian coast (Alvarez et al., 2010) are larger than those generated by a submarine landslide such as the BIG'95. This implies that resonance effects, that usually account for major damage onshore, would occur in smaller bays, such as Santa Pon\c{c}a Bay, where the model predicts strong amplification, with waves up to 9 m high, which is 6 m in excess than in Palma Bay, and a peak of energy around 10-15 min. Other peaks in the modelled spectral analyses are found, at larger periods, in the synthetic station in the Iberian coast, which could be explained by resonant excitation of trapped edge waves on the Ebro continental shelf. Both tsunami source mechanism and bottom and shoreline morphology are crucial to assess tsunami impact in a given region, accounting for significant changes in arrival times, wave height and subsequent coastal flooding.

Plinius13-64
Towards a database on societal impact of Mediterranean floods in the framework of the HYMEX project

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The Working Group 5 is a transversal group of HYMEX that deals with all the aspects related with societal and ecological impacts of hydrometeorological extremes, as well as their perception and communication processes. It includes heavy rainfalls, droughts and water scarcity, and the impact of climatic change on these risks and on water resources. Environmental services and water resources are also considered, as is show in the Science Plan (SP) and Implementation Plan (IP). One of the main points of the IP is the creation of a common database on floods and their societal impact, for the Mediterranean region, as well as its analysis. In spite of that it is usual to have a similar objective in the main part of projects dealing with floods, it is not usually achieved. The main problem is usually the heterogeneity of available data and information, as well as the different criteria of insurance companies on sharing their information. Although some databases already exist and are frequently consulted, they are mainly focused on major catastrophic events. This is the case of the Emergency Events Database (EM-DAT) from the Centre for Research on the Epidemiology of Disasters of the Universit\'{e} Catholique de Louvain, and the Natural Hazards Assessment Network (NATHAN) of the reinsurance firm Munich Re. However, both databases only consider those events that fulfill several criteria to be considered major disasters. But the Mediterranean experiences every year a high number of minor flash-floods that usually give place to moderate damages and a short number of casualties (or anyone), but that considered in their totality produce important losses and disruption of the everyday life. This communication presents a preliminary database covering the period 1981-2010. Starting form the FLASH database (Llasat et al, 2010) it is focused on the Northeast of Spain (Catalonia and Balearic Islands), Southeast of France, Southeast of Italia and Croatia.

Plinius13-65
Validation of the Cloud Dynamics and Radiation Database (CDRD) precipitation retrieval algorithm using Tropical Rainfall Measuring Mission (TRMM) radar-radiometer observations over the Mediterranean area

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Physically-based approaches for precipitation retrieval from space-borne passive microwave (MW) radiometers are based on the use of Cloud Radiation Databases (CRD's) within a Bayesian inversion scheme. Within EUMETSAT's *Satellite Application Facility on support to Operational Hydrology and Water Management* (H-SAF), we have developed a large CRD database optimized for the European area. This consists of the outputs of the numerical simulations of 60 precipitating events that have been performed by means of the University of Wisconsin -- Nonhydrostatic Modeling System (UW-NMS), and of the associated upwelling brightness temperatures (TB's) that would be measured by satellite-borne microwave radiometers, which have been simulated by means of an appropriate radiative transfer scheme.

In order to reduce the retrieval uncertainty and improve the retrieval performance, we have expanded the CRD approach by generating a so-called Cloud Dynamics and Radiation Database (CDRD) approach that incorporates dynamical/thermodynamical/environmental information (including lightning) in addition to the upwelling TB's.
In this paper, we describe the CDRD algorithm and the results of a validation experiment over the Mediterranean area (25N-36N; 25W-40E). To this end, we apply the CDRD algorithm to a large number of MW observations taken by the TRMM Microwave Imager (TMI) onboard the Tropical Rainfall Measuring Mission (TRMM) space observatory, and compare the retrievals with concurrent measurements by the TRMM Precipitation Radar (PR). Then, in order to quantify the impact of the additional information on the retrievals, we compare the error statistics of our CRD and CDRD algorithms.

Plinius13-66
Semi objective definition of Mediterranean sub regions using full temporal and spatial resolution IR geostationary observations

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A semi objective technique to define sub regions, within the Mediterranean Area, homogeneous in terms of cloud activity is presented. Sub regions defined from this technique should allow an Eulerian approach for data analysis based on a more physically meaningful definition of area over which different cloud related variables are expected to behave consistently. The technique is based on the analyses of the spatial correlation of high frequency variability in the IR geostationary full spatial and temporal resolution observations. The set of parameters (e.g. variable, starting point, criteria to stop etc.) needed to set up the automatic procedure is discussed and examples of applications are reported.
A set of cases studies is individuated to compare the cycle of cloud cover and brightness temperatures anomalies produced by the technique within the sub-regions with lightning activity measured by ZEUS ground network. We focus our attention to daytime storms that occur over continental Europe during the warm season.

Plinius13-67
High-resolution rainfall sampling: the scales of interest

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Uncertainties in rainfall sampling affect number of applications in hydrology and meteorology. Whatever the measuring process, sampling uncertainties are strongly linked to the space and time scales of measurements relatively to the rainfall variability. Many studies dealt with rainfall variability and showed that it is strongly dependent on environmental parameters. Our goal is to characterize rainfall parameters in between the foothill and the mountain ridge of a Mediterranean region. Thus, since October 2010, a dense network of rain instruments (HPicoNet) has been deployed in a subregion of the HyMEx target area in southern France, the Cévennes target area. It includes 8 measurement stations in a 25km2 area. Each measurement station is equipped with power supply, data storage and backup facilities over the web. Among the recorded parameters are the rainfall intensity (tipping-bucket raingauges), the DSD, and the electrical charge of raindrops.

DSD measurements are provided thanks to the network of disdrometers from EPFL. It consists in 8 optical disdrometers (Parsivel) that have been set up at 7 stations, with 2 collocated disdrometers at one place to get information about the sampling uncertainty in the disdrometer measurements. These 8 disdrometers are divided in 2 groups of 4, each composed of 1 master station and 3 associated slave stations. The master station queries data (every 30 s) from each slave and then sends the data in real-time using GPRS (mobile phone service) to a web server for storage and back up.

Analyses of the data collected during these first 9 months of operations show the reliability of the network.
The rainfall variability is studied in terms of DSD, intermittency and intrinsic intensity. For specific rainfall events ground-based measurements are compared to radar data. The rain-measurement network usefulness is assessed for different types of applications and perspectives are given concerning its future extensions.

Plinius13-69
Connections between Mediterranean Storms and Tropical Convective Activity

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The current understanding of the energy-water cycle of the tropical atmosphere has been summed up by Professor William Gray of CSU as "up moist-down-dry", in reference to convective plumes transferring latent heat into the atmosphere in compensation for large scale subsidence which is in turn driven by radiative cooling to space. However, a seminal paper by Johnson (1989) used FIGGE data to demonstrate that the tropical energy – water cycle viewed on isentropic surfaces looks much different revealing a necessary interaction with extra-tropical overturning in order to resolve large accumulations of energy at high altitudes associated with tropical convection. Recent investigations by Tripoli (2011, Cyclone Workshop) have presented empirical evidence supported by modeling studies that reveal a process of internal energetic conversions within tropical cyclones that result in high altitude energy accumulations similar to those discussed by Johnson. Further investigation of the downstream impacts of this process by Tripoli, revealed that in the case of some tropical cyclones (in the Pacific and Caribbean) this accumulation of energy was resolved within days or weeks by the direct interaction of the tropical outflow with extra-tropical overturning, fueled by this energy. These interactions took different extra-tropical forms, but consistently involved the formation of a very deep subtropical tropopause fold that became associated with a "super jet stream". This jet-stream-fold would then drive an anomalously strong quasi-geostrophic response.
A recent study by Tripoli et al. (2005) showed that the 2000 Algerian flood was linked to a strong PV anomaly that moved into Northern Africa and the Southern Mediterranean from the Atlantic. An independent investigation of another anomalously strong storm striking Iceland two days prior (Shapiro, personal communication) was also associated with a strong "Rossby wave train", but one that Shapiro felt seemed to have an origin related to a tropical cyclone several days prior. In light of the

recent energetics investigations of Tripoli, we propose a new hypothesis: Both of these extratropical storms, were fueled off of a single plume of energy released by an Atlantic tropical cyclone several days earlier, through a process analogous to the recent investigations of Tripoli in the Pacific basin.
For the oral presentation, new modeling investigations similar to the studies performed recently by Tripoli will be presented that investigate this hypothesis. In a separate Plinius 13 paper, presented by Smith et al., evidence will be presented that many, perhaps a majority of the strong Fall season Mediterranean storms can be linked to tropical cyclones in the Atlantic several days or weeks earlier. Implications of these results will be discussed.

Plinius13-72
Does seasonality impact the distribution of rainfall extremes?

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Rainfall often exhibits marked periodic variability on annual time scales. As a consequence, also the corresponding extreme values will likely be dependent on the non-homogeneity of their occurrences. Accounting for the seasonal character of hydroclimaticextremes in determining their design values is a somewhat obscure problem for engineers. We devise a simple stochastic model in which rainfall extremes are produced by a non-homogeneous extreme value generation process; the design values are estimated (in closed analytical form) both in a peak over threshold framework and by using the standard annual maxima approach. In this completely controlled world of seasonal hydrological extremes, a statistical measure of the error associated to the adoption of a homogeneous model is introduced. The sensitivity of this measure to the typology and strength of seasonality is investigated. We find that seasonality induces a downward bias in design value estimators. The magnitude of the bias may be large when the peak over threshold approach is adopted, while the return period distortion is limited when the annual maxima are considered. An application to daily rainfall data from a 30000 Km^2 region in North-Western Italy is presented.

Plinius13-77
Slip Distribution of the Giant 2011 Tohoku-oki Earthquake from Joint Inversion of Tsunami Waveforms and GPS Data

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On 11 March 2011 a giant earthquake (Mw 9.0) occurred near the northeast coast of Tohoku, Japan (142.861 $^\circ$ E 38.1035 $^\circ$ N according to Japan Meteorological Agency). This earthquake ruptured the interface between the Pacific and North America plates, and generated a huge tsunami that devastated parts of the northeastern Honshu Island for up to 5 km inland. This is probably the best instrumentally recorded great earthquake ever. In fact, the extraordinarily dense and high-quality Japanese network provided a huge amount of seismological, geodetic, and tsunami recordings.
In particular, a network of bottom pressure recorders and GPS-buoys, specifically designed for measuring tsunami waves close to the Japanese coasts and in the open Pacific Ocean, together with the Japanese GPS network, allow an unprecedented resolution onthe slip distribution for this earthquake.
The results of the joint inversion (GPS and tsunami data) show an unexpected amount of slip concentrated in a very narrow region with the rupture probably reaching to the trench, consistently with analogous results obtained with seismic data.
On the wake of the devastating Japanese tsunami and with a view to a future Tsunami Early Warning System implementation, then we point out the necessity to install a real time monitoring network in the Mediterranean Sea (geodetic and sea level measurements) in order to better constrain real time tsunami forecasts and tsunami source estimation.

Plinius13-78
Hydrological impact of forest fires and climate change in a Mediterranean basin

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Mediterranean basins affected by flash floods usually respond rapidly to intense rainfall because of steep slopes, impermeable surfaces, and/or saturated soils. This fast response can be amplified by forest fires affecting the basin: during the years right after a fire, the effects induced by a forest fire in the hydrological response may be similar to those produced by the growth of impervious areas. Moreover, climate change and global warming in Mediterranean areas can imply consequences on both flash flood and fire hazards, by amplifying these phenomena.

Based on post-fire experience, the consequences on the hydrological behaviour for a burnt basin have been established: (i) a 70% increase of the runoff ratio, (ii) a 60% decrease of characteristic time of the hydrograph, (iii) a 100% increase of the peak discharge. Interpreted in terms of rainfall-runoff model parameters, the impacts of forest fire have been studied in order to assess their consequences on flood occurrence. In a second time, the combined effect of forest fire and climate change has been analysed by using future climate scenarios.

This study has been conducted in the Llobregat river basin (Spain), a catchment of about 5000 km2 frequently affected by flash flood and forest fires. The results show that flood frequency can be significantly altered by forest fires. Also, it has been analysed how climate change may increase the occurrence of both hazards and make more frequent severe flash floods.

Plinius13-79
How grid computing helps flood prediction, ground water management and hydrological survey

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The Civil Society at large has addressed to the Earth Science community many strong requirements related in particular to climate changes, natural and industrial risks, and so forth. The main critical point is that on one hand the civil society and all public ask for certainties i.e. precise values with small error range as it concerns prediction at short, medium and long term in all domains; on the other hand Science can mainly answer only in terms of probability of occurrence. A large part of uncertainties have been related to error or lack of data, use of relatively simple models, more complex being the solution, or too few statistics. The use of DCI and new technologies will be a way to answer those challenges.
The paper illustrates six applications in various domains of hydrology; for them the use of Grid technology providing a substantial improvement. The first set of 3 applications concerns flood prediction. Intense and localized rain events are commonly observed in the Mediterranean area. Because of the short response time of the basins, these events lead to flash flood, likely to cause serious damages. Severe fluvial floods frequently occur and have also large impact on societies. That is why the need for systems, including complex models and real-time data, able to help authorities in related crisis management is increasing. The second set of 2 applications is related to water management, a critical point nowadays. Groundwater models are becoming increasingly important in the decision making process as they provide systematic and consistent information on water availability, impacts of climate and land use changes, and analyses of non-point source pollution. An environmental problem in the mediterranean area is the seawater intrusion in regional coastal aquifers, under explicit consideration of uncertainty. Business field of drinking water supply, management and planning need groundwater flow dynamic parameters. Those applications face complex modelling and large set of data. The last application,the EU FP7 EnviroGRIDS project, aims at building capacities in the Black Sea region on new international standards to gather, store, distribute, analyze, visualize and disseminate crucial information on past, present and future states of this region in order to assess its sustainability and vulnerability. E-collaboration, a pillar of Grid technology, plays an important role in this project.
The history and goals of each application are quite different. However their principal motivation is to use the Grid technology to significantly improve flood prediction, groundwater management and comprehensive hydrological survey, all grand challenges for the Civil Society at large.

Plinius13-80
Wave extremes in the climate change perspective: the Adriatic Sea case study

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We present a study on wave climate changes in the Adriatic Sea for the period 2070-2099 and their impact on wave extremes. To do so, the phase averaged spectral wave model SWAN (www.swan.tudelft.nl) is forced using results of the regional climate model CLM (the climate version of the COSMO model, maintained at CIRA) downscaled from a global climate model running under the IPCC A1B scenario. Namely, the wind fields adopted are resulting from the C14E5 dataset (spatial resolution 14 km, boundary conditions from CMCC-MED, atmospheric component ECHAM5 at 80 km resolution).
Firstly, a model validation is performed by comparing numerical predictions for the period 1965–1995 with available buoy data, in order to infer model's accuracy in predicting seasonal changes and extreme events.
A statistical analysis is then exploited to predict the climate changes on coastal and offshore waves and their extremes for the simulated scenario. In particular, a Generalized Extreme Value (GEV) theory is used to predict changes of extreme storms. In contrast to a GEV analysis that requires data fitting in describing extremes, we also adopt the Equivalent Power Storm (EPS) model (Fedele and Arena, 2010) to predict return periods of storms and their largest waves. Such model is based solely on probabilistic principles and it improves the stochastic representation of the significant wave height history locally at storm peaks by an equivalence to random storms of parabolic or cusp shape.
Finally, Adler's theory of Euler-Characteristics of random fields (Fedele et al., 2011) is applied to predict space-time extremes defined as maxima of the sea surface over a given area during time. Results confirm that in short-crested seas the occurrenceof wave extremes in space increases with respect to that expected at a given point in time.

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Plinius13-81
Integrating fault data into tsunami hazard studies

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Tsunamigenic earthquake faults are usually located offshore and are therefore hardly accessible. Mapping these faults require to look for appropriate data and to adopt different strategies from those adopted on land for carefully addressing geometric and behavioral characteristics and related uncertainties.
We present a methodological study of investigation and parameterization of potentially tsunamigenic earthquake faults to be used as basic input for tsunami-wave numerical modeling in probabilistic tsunami hazard assessment. For this scope, tsunamigenic earthquake sources are first subdivided into two categories according to the tectonic environment of origin: (1) "crustal sources" which include all faults in the upper crust, near the coast or offshore, and faults located in the upper plate of subduction systems; (2) "subduction sources" which include the shallower slab interface, splay faults, and intraslab faults. For all the necessary parameters of each of the studied tsunamigenic sources we defined a range of values to capture their variability. Each source is also assigned to a classification that reflects the level of confidence for its existence.
Considering that our target area is the coast of southern Italy and that tsunami waves can travel long distances preserving most of their harmful power, we investigated the above types of sources in the Central and Eastern Mediterranean. We will illustrate the results of our mapping and characterizing tsunamigenic earthquake faults and how these data interface with a logic-tree approach in tsunami hazard studies.

Plinius13-82
Satellite and ground data assimilation in a surface hydrology model with snow dynamics

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The estimation of the different components of the energy balance at the land surface is recognized to be a crucial research field in many hydrological and meteorological problems. And above all this aspect plays a crucial role in snow covered areas, wherewater dynamics are governed by melting processes in snowpack.
The present study has the aim to evaluate energy and mass balance in snow covered areas by using a variational method of assimilation. It consists in an objective function constrained by the equations of a mathematical model that explains physics of the processes through Lagrange multiplier.
Snow dynamics are described through a 4-layer model: the model considers two layers of snow, to discriminate between fresh and old snow behavior, and two layers of soil. Four state variables are related to energy balance: they are temperatures in each layer. Four state variables are related to water balance in snow: they are snow water equivalent and snow density for each layer of snow. These eight equations represent the constrains for the adjoined function, in which assimilated variables are surface temperature and snow height. Surface temperature is a variable observed from geostationary satellite MSG, and in the variational scheme iscompared with surface temperature obtained from the 4-layer model. Surface temperature is a good parameter to improve the estimate of energy budget because it gives implicit information on available energy. Spatial resolution of satellite data is around three kilometers, and time resolution is 15 minutes, but data are assimilated each hour, and it is considered the average value for the hour. To keep into account problems associated with application of satellite data in a mountain area, such as georeferencing, changing in viewing angle and shadowing, it was applied a geometric correction to satellite data in order to consider orography complexity. Correction was made using a digital elevation model at spatial resolution of 400 meters, which is the final resolution of the model. The other assimilated variable is snow height: it is obtained by the interpolation of nivometer observations available. In assimilation process this observation in used to improve the estimate of snowfall. As formulated the model is able to manage the change between snow and soil cover.
Considered study area is Valle d'Aosta region in which several stations are available for the observation of snow height, and in which meteorological data necessary for 4-layer model, such as air temperature, relative humidity, air pressure, wind speed and precipitation, are available.
Final objective of the work is to show that using results of the assimilation model in hydrological simulations can improve the estimate of river discharge in mountain environment.

Plinius13-83
The significance of Dense Shelf Water Cascading in the Mediterranean Sea and future projections at the light of climate change scenarios

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Increasing evidence has accumulated during the last few years showing the significance of Dense Shelf Water Cascading (DSWC) as a key driver of the deep Mediterranean Sea in many aspects. DSWC modifies the properties of intermediate and deep waters, carries massive amounts of organic matter to the basin thus fuelling the deep ecosystem, transports huge quantities of coarse and fine sedimentary particles that abrade canyon floors and rise the load of suspended particles, and also exports pollutants from the coastal area to

deeper compartment. DSWC occurs every year in late winter and spring at the northernmost extensions of the Mediterranean Sea, which are the Gulf of Lion and the north Catalan margin, the Adriatic Sea and the Aegean Sea. This is because these areas are the most directly influenced by strong, persistent, dry northern winds blowing during winter months that cause the surface waters to loss heat and become denser. Low precipitation winters also favour the formation of dense shelf waters, as otherwise significant river discharge would add floatability to the upper layers and make the densification process more difficult. Yearly dense waters overflow the continental shelf edge and sink over the bottom till they reach their equilibrium depth, usually a few hundred meters depth. Deep penetrating, intense DSWC (i.e. that driving dense shelf waters deeper than 1,000 m) is more unusual, as illustrated by the fact that it has occurred only three times in the last twenty years in the Gulf of Lion. These events usually last some weeks and consist of various pulses of variable intensity.

Intense DSWC can be viewed as a regenerating mechanism for the deep ecosystem as following the initial impact, when damaging effects occur because of high turbulence and abrasion, it likely stimulates the recruitment and growth of numerous species, including those with the highest market value, as illustrated by the rose shrimp Aristeus antennatus.

In addition to DSWC, short-lived (hours to few days) large costal storms driven by eastern wet winds can also efficiently trigger the transport of matter and energy from shallow to deep. Recent observations along the north Catalan shoreline and continental shelf have shown the power these storms have to erode the coastline, remobilise coarse sediment and extensively damage coastal benthic communities either by abrasion, pulling up or burial.

Future projections of DSWC occurrence, in particular in its most intense expression, and also of large coastal storms have to be viewed at the light of on-going modelling efforts under various climate change scenarios. While the tendency for the decades to come points to a decreasing frequency of intense DSWC, especially in the Gulf of Lion, which would add to a parallel reduction of offshore convection, trends for large coastal storms appear less consistent.

Plinius13-86

A modification for sea evaporation estimates based on changes in stratification in the contact layer

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Evaporation from sea surface plays a key role in the ocean-atmosphere energy exchanges, and is a primary source for moisture to the atmosphere. Both energy and moisture are drivers for storms and marine circulation. However, up to date direct measurementsof evaporation over the sea are extremely occasional, without much impact on weather or oceanographic analyses. Traditionally evaporation has been estimated by means of bulk aerodynamic formulas involving specific humidity, wind speed, and sea surface temperature (SST). All of these quantities are widely observed in most coastal stations, as well as in ships or buoys, and can also be derived from remote sensors in satellites. One of the basic assumptions of the bulk formulas is that air in contact with the sea surface will collect as much moisture as required to reach saturation at sea surface temperature. However, these formulas do not consider the renewal of the air after taking the moisture from the sea. That is, the ability of this air to move away – upwards - exporting the water out of the contact layer. Otherwise, a barrier over the sea surface will form, preventing moisture export.

In this communication we introduce a correction in the bulk formulas through a stability criterion that accounts for these alternative situations. The estimates of evaporation are thus lower when the contact layer is stratified. Therefore, overall estimates of evaporation are reduced as well as the latent heat extraction from the sea which would revert to higher SST.

The preliminary results in some scenarios, using semi hourly meteorological and SST data, show overall daily reductions (up to a 60%) of the evaporation estimates over the estimates using the typical bulk formulae. We also used this correction to estimate its impact on the SST upon a regional configuration of the NEMO-OPA oceanic model, implemented over the eastern North-Atlantic Ocean. The overall response of the SST to this correction is almost negligible but slightly more realistic in terms of RMS error. In particular, in the coastal upwelling areas new SST estimates do not reach values as low as those without correction. These results should raise awareness in the numerical modelling community that the cold SSTs simulated in the upwelling regions may not come only from the upwelling dynamics but from an unrealistic evaporation regime.

Plinius13-87

Are bluefin tuna fishes in the Mediterranean waiting for a sign from skies to start their migrations?

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In an effort to have a better understanding of the distribution patterns, reproduction and feeding habits during their Mediterranean stays, since summer 2008, some individuals of bluefin tuna have been tagged with pop-up satellite devices (PAT) in the NW Mediterranean. These tags are able to record the depth of the fishes as well as water temperature and light that is used to estimate their position. The number of individuals tagged from 2008 to 2010 was 4-6 per year, from which a total of 12 records lasted for more than 45 days. The first results of the records obtained show that fishes remained in a relatively confined area northern of the Balearic Islands during summer, with displacements shorter than 4-6 nautical miles per day. By the end of summer and during autumn, some of the tagged individuals, mostly the larger ones, started moving away at more than 8-10 miles per day (and occasionally 20-30). Starting dates of migrations - and restarting long displacements after some rest - appear to be in all cases related to stormy weather. For instance, in 2008, 4 individuals started on 20-25 September after a storm recorded in the whole Western Mediterranean area, and two of them resumed their travel around 30 October, coinciding with another storm. In 2009, after a short migration of one of the fishes on 12

September, coinciding with a general cooling, all of them started a longer migration on 7-9 October coinciding with another storm. Finally, two of the 3 individuals tagged in 2010 started moving on 11 September for a relatively short trip and the other one joined them when they resumed their migration on 9-10 October. Both dates were associated to stormy weather in the Western Mediterranean.
The answer to the heading question is still far from being confirmed, and the method does not allow for statistical confirmation. However, these preliminary data point to that storm events can act as a trigger for migrations. An indication of the autumn season, probably through the effect of vertical mixing caused in the upper ocean. In the next years, new information will shed more light on this curious impact of the storms.

Plinius13-88
The Mediterranean coastal orographic heavy precipitation field campaign within HyMeX

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HyMeX (HYdrological cycle in the Mediterranean Experiment, http://www.hymex.org/) is an international program aiming at a better quantification and understanding of the water cycle in Mediterranean - with emphases on intense events - by monitoring and modelling the Mediterranean coupled system (atmosphere-land-ocean), its variability (from the event scale, to the seasonal and interannual scales) and characteristics over one decade in the context of global change. In particular, HyMeX aims at addressingkey issues related to (1) the water budget of the Mediterranean basin, (2) the continental hydrological cycle and related water resources, (3) heavy precipitation and flash-flooding and (4) intense air-sea exchanges produced by severe regional winds and cyclogeneses. HyMeX aims also at monitoring vulnerability factors and adaptation strategies developed by different societies to accommodate the impacts of climate change and intense events.

The aim of the talk is to present an update of the program implementation regarding the observation and modelling strategy for heavy precipitation over the mountainous Mediterranean coastal regions. The general observation strategy is based on a three-level nested observation scheme: (1) a Long-term Observation Period (LOP, 2010-2020) to gather and provide observations on the whole coupled system in order to analyze the seasonal-to-interannual variability of the water cycle and to estimate the water budget, (2) Enhanced Observation Periods (EOP) for both budget and process studies lasting several years and (3) Special Observation Periods (SOP) lasting several months. The observation strategy of the EOP/SOP dedicated to heavy precipitation and flash-flooding will be presented as well as the associated modelling activities. HyMeX will constitute a unique test-bed for new-generation convection-permitting ensemble prediction and data assimilation systems in order to advance the predictability of these high-impact weather events.

Plinius13-89
Cyber(e)-infrastructures for Hydrometeorology

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This presentation will introduce and discuss cyber(e)-infrastructure design and development to facilitate and support the research and operation in the Hydrometeorology area. Main challenges, available technologies, and ongoing initiatives will be discussed.

Interoperability issues will be addressed with particular attention to cross-disciplinarity aspects. Relevant European and international initiatives, like INSPIRE and GEOSS, will be introduced.

Plinius13-90
Towards a mesoscale Ensemble Hydro-Meteorological Prediction System for the northwestern Mediterranean

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During the last 15 years, ensemble weather forecasting has made substantial progress and has proved its skill in forecasting the probabilities of relevant weather events. More recently, the development and growing use of high-resolution, convection-permitting models has significantly increased the potential of atmospheric modelling. However, this opens new questions regarding the representation of the initial state, boundary conditions, and model uncertainties. In particular, the relative weight of each contribution remains to be investigated.

The talk will report on a current French research effort aiming at developing an Ensemble Prediction System (EPS) suited for heavy precipitation events in the northwestern Mediterranean basin. The envisaged system is based upon the French operational model AROME. It accounts for local initial condition uncertainties (derived from an ensemble data assimilation technique), boundary condition uncertainties (obtained from a larger-scale ensemble forecast) and model physics uncertainties (considered by introducing random perturbations in the cloud physics and turbulence parameterizations).

Plinius13-93
Lightning detection and prediction from multi-sensor remote observations

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Lightining represents one of the most feared threat due to atmospheric phenomena. The detection and temporal

prediction of Lightining is of fundamental importance for the safety of the citizens and for preventing economic losses.
Nowadays ground networks of remote sensors, even portable, are the most used tool for detecting the lighting activity in real time. These sensors are basically low noise receivers tuned on Very Low Frequency / Low Frequency (VLF/LF) bands of the electromagnetic (EM) spectrum. They receive EM emission generated either by the current flow from the top of the cloud to the ground or within the cloud itself. The arrival time of this emission at the receivers, located at different sites, allows estimating the position of the lightining on the ground surface.
Alterative lighting detection approaches have been studied in literature. They are mainly based on the use of weather radar and satellite Meteosat Second Generation (MSG) observations. The physical principle used to infer the lighting occurrence from these sensors is based on the measure of the radar reflectivity and the brightness temperature, being both of them recognized to be good indexes for identifying the convection .
In this work we analyze the potential use of a synergic multisensor approach to detect and predict the lighting occurrence in central Italy. This work is motivated by needs expressed by the part of local companies which, due to lighting activity, experiment unexpected blackouts and their production interruption. To this aim, weather radar data and MSG satellite observations are used together with ground lighting sensors. Temporal trends of radar reflectivity, radar bin heights against chosen isotherms andMSG brightness temperature will be used as short term precursor of lightining. On the other hand, the regional instability index like the Lifted Index (LI), K-index, and Maximum Buoyancy (MB) index estimated from MSG satellite observations are used as longer term precursor. The results of lighting detection are validated against the ground sensor network measurements.

Plinius13-94
Tracking and validation of surface rain rate from Mediterranean storms using microwave satellite and surface weather radar network observations.

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Measurements of the rain amount released by a storm is fundamental for detecting and alerting the risk of severe weather, flash floods, and landslides. In an ideal case one observation system, such as a weather radar, is able to monitor a storm originating, developing, and fading off. However, storms may travel covering significant distances and it is likely that the life cycle cannot be monitored by a single weather radar. Nowadays, weather radar networks offer the opportunity to monitor rainfall over extended regions, though these networks are limited to land and coastal areas. On the other hand, satellite passive microwave observations offer a tool for monitoring rain rate at lower temporal/spatial resolutions – with enhanced accuracy over ocean whereother estimates usually do not exist. Therefore, satellite microwave observations and ground-based weather radar networks seem complementary for monitoring and tracking the rainfall from Mediterranean storms.

In this work we show results from the operational rain rate estimate developed at IMAA-CNR in collaboration with CETEMPS based on the satellite observations of the Advanced Microwave Sounding Unit B (AMSU-B) and Microwave Humidity Sounder (MHS) on board of the U.S. NOAA 16-18-19 as well as the European EUMETSAT MetOp A satellites.

The rain rate estimates from satellite are coupled with the composite of the Italian ground-based radar network with the addition of ancillary infrared observations from the Meteosat Second Generation (MSG) to characterize the rainfall temporal/spatial evolution of Mediterranean storms.
Moreover, where AMSU-B and ground-based weather radar network observations are nearly simultaneous and collocated, the measurements from the ground-based weather radars are used to validate the rain rate values obtained from satellite, providing quantitative evaluation of the consistence between these two source of rainfall information.

Plinius13-95
Flooded-Area Mapping and Change Detection from Multitemporal COSMO-SkyMed Images

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Flooded-area and ground-change detection are relevant tasks when monitoring natural hazards due to storms and heavy rain. In this framework, remote-sensing synthetic aperture radar (SAR) data play a decisive role, thanks to their all-weather and day-and-night acquisition capabilities. This potential is further enforced by the current availability of very high-resolution data (VHR; up to 1 m) with short revisit time (up to 12 hours) granted by the recently completed Italian COSMO/SkyMed constellation, which represents a formidable tool with respect to rapid response after a flood.
In this paper, the problems of generating (fast-ready and detailed) flooded-area maps and change maps from multitemporal COSMO/SkyMed images are addressed by adopting an image-processing and pattern-recognition perspective. Multitemporal image-analysis methods are applied to pairs of COSMO/SkyMed images acquired on the same area at different times. This work is framed in the "OPERA – Civil protection from floods" pilot project, funded by the Italian Space Agency (ASI) in cooperation with the Italian Department for Civil Protection.
Focusing first on fast-ready mapping of flooded areas, the input images are combined into a false-color composite image for better enhancing flood water as compared to other land-cover classes. An appropriate pre-processing is required to combine the multitemporal images because they can be acquired with different sensor parameters. To this end a cross-calibration/ normalization step is applied [1].
For detailed flooded-area maps, a multi-seed-growing segmentation approach is employed. It starts from a set of points in the pre-event image, corresponding to permanent water pixels. Seed-points can be manually selected by the user or automatically extracted by an appropriate algorithm. An anisotropic image-scanning mechanism is employed where the order of pixel analysis is dependent on the image content, so the growing sequence turns to be adaptive to the local and global

image context [1].
The problem of detecting the ground changes occurred between two observation dates (typically before and after the flood) is addressed by a contextual unsupervised multiscale approach, based on Markov random fields (MRFs) [2], wavelet transforms, and generalized Gaussian distributions [3]. Wavelets are used to extract multiscale features from the input multitemporal data set [3]. An MRF model is introduced to fuse both the extracted multiscale information and the spatial context associated to the VHR multitemporal data set [1]. The statistics of the multiscale features in changed and unchanged areas are modeled by resorting to generalized Gaussian distributions and to parametric estimation techniques based on higher-order moments.
Experiments are presented on several COSMO-SkyMed multitemporal data sets, related to recent floods in Italy and Albania and to the tsunami occurred in 2011 in Japan.

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Plinius13-98
Microphysical characterization of severe rainfall events occurred on North-Western Italy using a C-band radar classification algorithm for hydrometeors.

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Severe weather events affecting Mediterranean regions can be classified essentially through the different dynamical regimes distinguished by differing degrees of control of convective precipitation by the synoptic-scale flow. Molini et al. (2010), taking advantage from Done et al. (2006) work, showed that a different trigger often lead to two very different event types. The first one is dominated by short-lived (with a total duration minor than 12 hours) and small-scaled (covering areas minor than 50x50km2) rainfall events.
Moreover, the forecast skill of numerical weather prediction models turned out to be very sensitive to the weather type, since the larger was the time-space extent of a rainfall event the higher was their predictive ability.
For this reason, since the aforementioned study was carried out using mainly two-dimensional atmospheric variables like rainfall depths and CAPE, a fully three dimensional analysis of microphysical features of severe events is required as a necessary further step. To this end, we selected a set of heterogeneous events which include convective and stratiform rain regimes. C-band polarimetric weather radar of M.te Settepani, north-western Italy is used to characterize the selected events in terms of their microphysical signature.
The classification algorithm of hydrometeors based on a Bayesian approach named BRAHCC by Marzano et al. (2007) has been used for this purpose. It was initialized with ERA-Interim reanalyses temperatures and then applied to observational radar data. ine This study presents the results dealing with hydrometeors concentration vertical profiles for both iced and liquid particles, their trend in time and space and their frequency as they were utilized to characterize severe events even from a fully three-dimensional microphysical standpoint.

Plinius13-99
Analysis of long flow discharge time series to assess possible changes in hydrological cycle over the Abruzzo Region in Central Italy

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A long time series of average flow discharge observations has been analyzed to assess possible changes in hydrological cycle over the Abruzzo Regions in the Central Italy in the last seventy years. The region is characterized by about ten small streams, each draining a basin of few hundreds of Km2, while greatest basin cover an area of about 4000 Km2. The observations have been collected in different points of such drainage network with daily time resolution.
The preliminary results of time series analysis are discussed showing an overall decreasing of flow discharge especially in the years from 1930 to 1955; the quantitative decreasing of flow discharge also appear to be very similar for the whole year cycle suggesting the hypothesis that water deficit is more likely linked to anthropic activities respect to climatic changes.
The sparse observations of flow discharge have also been analyzed using a distributed hydrological model in order to investigate the major areas affected by the decrease of water resources; the spatial distribution of such deficit clearly shows that the major differences affect the areas characterized by a strong urbanization in the half of last centuries; the observed decrease of flow discharge also lead to cause dry periods for many streams especially during July and August.

Plinius13-100
Comparison of multi-source rainfall field spatial mapping for operational flood alert using a distributed model

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A peculiar feature of Cetemps Hydrological Model (CHyM) is the possibility to rebuild the precipitation field using different predictions and/or observations, more specifically the model is forced with radar and satellite precipitation estimates, rain gauge observation and meteorological model predictions. The ingestion of such different data set is carried out using a Cellular Automata (CA) based approach allowing to reduce computing time respect to other physical based techniques like the kriging algorithm. For few case studies, characterized by severe precipitation events, the model has been forced

with a single data source and the two dimensional precipitation fields rebuilt on the CHyM grid have been compared. Preliminary results will be discussed showing as the CA based technique allows to reduce the effect of uncertainties dealing with single observation technique and, as a consequence, the uncertainties of hydrological prediction.

Plinius13-105
Variational assimilation of InSAR-derived integrated water vapour in mesoscale models: improving initial conditions at high spatial resolution

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The high spatial resolution Numerical Weather Prediction (NWP) models are able to reproduce realistic atmospheric scenarios, but one of their most limiting factor is the poor resolution of the initial conditions (IC). In particular the lack of both precise and continuous water vapour data is one of the major sources of error in short-term forecast of precipitation. An improvement in monitoring the atmospheric water vapour and its assimilation in NWP models would lead to more accurate forecasts of precipitation and severe weather. In this context, benefits from InSAR high resolution phase wet delay can be employed by obtaining integrated water vapour (IWV) maps from InSAR data and assimilating them in NWP. In this study a preliminary experiment of variational assimilation of InSAR data has been performed to correct initial condition of the mesoscale model MM5. The basic procedure for GPS assimilation has been adapted to InSAR data, suitably converted in IWV information. Cases study of the 2008 campaign of ESA METAWAVE (Mitigation of Electromagnetic Transmission errors induced by Atmospheric Water Vapour Effects) project has been simulated . A sensitivity study is performed using different error matrix of the measured data; the impact on both IC and simulated results has been investigated. Variations on the initial horizontal and vertical distribution of water vapor will be discussed. Moreover a comparison of MM5 simulations with experimental data by radiosondes, surface stations and RADAR has been performed to the aim of establishing the impact of InSAR assimilation on model results. An impact on the rain distribution and amount is found: InSAR assimilation allows to correct MM5 overestimation of accumulated rain, although no impact is found on the timingof the rain cells evolution. These results are anyway promising and further experiments will be performed

Plinius13-107
A methodology for identify impact zones of potential hydrocarbons spills during floods

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The contamination from sparse sources in case of flood events is difficult to characterize and to analyze. Sources are difficult to be detected and impact area highly depends on both the water flow during inundation and on contaminant accumulation and spreading in different environmental phases such as water, sediment, soil, biota and atmosphere. The final distribution of contaminants is influenced by the whole dynamic of the floods, form the inundation to the drying phases of the territory. In this research, we propose a coupled dynamic model for water flood and for multiphase contaminant transport in order to assess the potential environmental implications of the floods.
Distribution of organic pollutant in the natural environment is here simulated by a two-dimensional fugacity based models; fugacity based models can simulate the distribution of contaminants in a multimedia environment. The 2D fugacity based model is a rapid method for predicting the environmental fate processes for specific chemical compounds. We have taken an hypothetical example for the release of fuel such as diesel and gasoline (cars, fuel storage, industrial machine ecc.) from urban area. Fuel products are composed by hundreds of different compounds with different chemical and physical properties influencing their environmental behavior. To overcome the difficult of simulating the spreading of hundreds compounds we used a methodology for grouping the chemicals in a limited number of homogenous classes in terms of chemical-physical properties.
In impact zones are finally identify by introducing an hazard index proportional to the concentration in an environmental phase and the toxicity of the contaminants in that phases. In the same time, the approach allows to identify the environmental phaseswhere accumulation can occurs, and hence drive the sampling design after emergency.
The methodology has been applied to the two-dimensional model in the Shkodra case study (Albania, January & December 2010).
Starting from analysis of hydrocarbons(TPH), the model can prevent the transport and the fate of TPH during the Shkodra flood. Using this results we can characterize the risk in terms of hazard index for the population and the environment.
The results obtained from the 2D fugacity based model added a very important value for the characterization of the human health and the environmental risk, especially for the civil protection management during the first support actions, and the assistancefor the population during and post flood events.

Plinius13-110
Hydrological analysis of the extreme precipitation event of June 2011 in the Parma basin, Italy

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On June 11th 2011, in the afternoon, Emilia Romagna Region has been interested by intense thunderstorms on different areas. In particular an extreme event occurred around 5 pm and located between Taro and Parma basins, causing hydrogeological dissest withlarge damages on two small water course, will be analysed and described. This event covered an area of about 10 km2 and had a duration of less than 2 hours. Statistical analysis of available raingauges data has been calculated for duration of 1, 3, 6, 12and 24 hours. In

particular, a comparison between annual and seasonal maximum analysis has been carried out. The maximum return period has been found for 1 hour cumulated rainfall at Medesano station, with an amount of 42.6 mm and a return period of 17 years. Visual inspection of radar rainfall images showed that the storm centre was located in an ungaged area between Taro and Parma basins. Preliminary numerical analysis of radar images was carried out leading to an estimated total amount of rainfall of about 100 mm for 3 hours duration, with a return period of more than 100 years in the storm centre.
Soil moisture content before and during the storm played a rule both in runoff generation and in solid matter dynamics linked with anthropic conditions and the special coupling of input precipitation characteristics and catchment response times. Estimation of soil moisture in the sub basins has been carried out through antecedent and actual precipitation. Precipitation during the storm has been evaluated using real time rain gauges data and radar maps.
The available meteorological forecasting model run (COSMO-LAMI) of day 11th June 2011 has been also analysed in terms of hourly mean rainfall on the flooding area. It is shown that the meteorological model was not able to predict the event due to its temporal and spatial scales and characteristics, typical of an extreme convective event.
Finally, hydrological-hydraulic real time forecasting results from a Flood Early Warning System are shown. This system is operative in real time for flood forecasting on the whole Po river catchment. Three hydrological-hydraulic chains are available (MikeNam-HD, Hec Hms-Ras and Topkapi-Sobek), giving new real time flood forecasting results every three hours on a number of sections of the main course of the Po river and on main tributaries as well. It is shown that, again due to temporal and spatial scales of the event, the actual forecasting system was unable to predict or even simulate the event occurred on June 11th 2011.
The development of further hydro-meteorological modelling applications, e.g. feeding the model with radar QPE, is introduced to cope these extreme events, improving the overall forecasting architecture in the next future.

Plinius13-111
Seasonal to daily drought prediction in the Po catchment, Italy

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In the last years, the Po river catchment has been increasingly affected by drought events, caused by a marked reduction in snow and rain precipitations in autumn and winter seasons.
The main stakeholders and administrations that are involved in the use of water decided to develop a model capable of generating forecast scenarios used in a system supporting decision-making and alerting processes necessary for a good water management.ewline The system is composed by a spatially distributed hydrological model combined with hydraulic model used with real-time data provided by telemetry network and forecast meteorological data provided by deterministic and probabilistic seasonal model. It also includes stochastic models capable to highlight meteorological and hydrological drought conditions evaluating return periods and drought indexes. The deterministic modelling chain covers a 15 days forecast, while the probabilistic one covers 3 months forecast.
Here it is presented a method to transfer information from hydrometeorological models to spatial and temporal scales useful for hydrological applications.
Drought event models require a large forecast lead time, so the use of seasonal forecasts became crucial. Unfortunately this kind of forecast model usually provides data at monthly or seasonal time scale, while management models require daily data. For this reason a rainfall generator, based on Neymann Scott rectangular pulse model, is used. In this way, daily time series of precipitation in selected reference sites are available. Similarly, the temperature forecast can be downscaled through AR, Richardson's or Kilsby's models.
This approach generates an ensemble output allowing the user to evaluate, not only the simulated scenarios, but also the uncertainty of the system towards the forecast, giving a higher degree of sensitivity of the results.
The system provides the standardized precipitation index (SPI) and ad hoc developed discharge index. Moreover hydrologic droughts are characterised applying the run-method in terms of severity and duration respect to a threshold discharge. A multivariate analysis of droughts severity and duration allows to estimate the return period of the event.

Plinius13-113
Spatiotemporal modeling of some case histories of shallow landslides in the area of Oltrepo Pavese, Northern Italy

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On the 27th and 28th of April 2009, the north-eastern sector of the area of Oltrepo Pavese has been affected by a heavy storm, which has caused the triggering of thousands of shallow landslides. On the 28th of April, Cigognola rain-gauge station recorded 150 mm of rain in 48 h (20% of the annual average amount) with a maximum rainfall intensity of 22 mmoh-1 at 9 p.m. on April 27th. Most of the landslides were concentrated on slopes with vineyards or woodlands of newly formed. The triggering of soil slips provoked one fatality and the damaging or the blocking of many roads. Arial photointerpretation, coupled with field surveys, revealed that the rainfall event of April 2009 triggered about 1,600 landslides in the north-eastern sector of Oltrepo Pavese. At least 115 landslides occurred in the municipal territory of Broni. Landslides appear on SW-NE oriented slopes and were observed in the slope range from 16° to 37°. The highest landslide frequency corresponds to slope angles between 25°-30°. Most of the landslides tended to be concentrated in areas where the slope angle

changed from a gentle slope to a steep slope or vice versa. The soils involved in the shallow landslides are represented by the colluvial deposits derived by the weathering of the bedrock (S.Agata Fossili Marls, M. Arzolo Sandstones, Rocca Ticozzi Conglomerates, and fluvial and alluvial deposits). Once acquired the input data about the topography, the geotechnical properties of soil, and the land use of the study area, it has been carried out a slope-stability analysis on regional scale, at first on an area of 2.4 km2, and then, on other two zones, respectively, of 17.5 km2, partially coinciding with the first area, and of 15.8 km2. The slope stabilityanalysis has been carried out using distributed model, named SLIP (Shallow Landslides Instability Prediction), which has been recently implemented in a platform, which allows to process the required territory information on regional scale. In particular,the territory is divided into a 10x10 m grid, where each cell is independently modeled considering its own soil features. The slope angle corresponding to each cell is derived from a Digital Terrain Model (DTM) with a resolution of 10 m, whereas geotechnical data have been assigned to each cell starting from the lithological and soil coverage maps previously produced for the area. The slope-stability analysis has been carried out for the municipal territory of Broni for the period between the 1st of May 2008 and the 30th of April 2010. Finally, the model predictions are compared, from a spatial point of view, with observed landslide localizations, through the ROC analysis (Receiver Operating Characteristic), and from a temporal point view, regard as the expecting date, evaluating for a two years the quantity of instable areas against the precipitations.

Plinius13-117
Determining criteria for monitoring torrential rains

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Torrential rains are an intense physical process of short duration, limited in time and space. They are formed from cumulonimbus cloud systems. The monitoring of these kinds of cloud formations is geared toward anti-hail protection and air traffic. After ice turns into water, little significance has been given to the rain itself and its characteristics, despite the fact that these rains cause torrential floods. Due to the large number of rapidly changing observed data, mathematical models are aimed at thespecific task of anti-hail protection. On the other hand, mathematical models of intense rains of short duration require more computer time than the phenomenon itself. This results in devastating flash floods being characterized as "unexpected" or "sudden".
Analysis of previously recorded flash floods and their causes has shown that every rain forming cloud formation has been completely recorded. The mathematical model for precipitation prediction lags beyond the time of need for these predictions. The delayin the notification of potential torrent floods is in part due to shortcomings of existing prediction models for integrating hydrological and meteorological processes. Specifically, these prediction models were designed for relatively large catchments where floods are caused by day-long rains and last several days.
Flash floods are caused by heavy rains that last from 1 to 5 hours and are characterized by torrential flow regime and great destructive power, endangering traffic corridors, infrastructure systems and urban areas. These are constructions of high value and high urban density. That is why damages are proportionally high, with the inevitable loss of life.
The construction of passive flash flood protection systems is expensive, slow and significantly lags behind the needs. This is why the protection from flash floods in urban environments and traffic corridors has become a major problem. Due to the nature of the causes and effects, the research is focused on monitoring and mathematical modelling of meteorological and hydrological processes, as is the case with large cloud systems and river basins. Unfortunately, the desired results have not been achieved.ewline
The search for the solution is directed towards defining the lower threshold of the phenomenon that triggers flash floods, i.e. the intensity and duration of heavy precipitation, because this is possible to identify and evaluate during the monitoring of the cloud system.
All observed occurrences of flash floods have been analyzed, as well as the characteristics of rains that caused them. Based on this analysis, sets of intensities and amounts of heavy precipitation have been defined, which are the criteria needed for the monitoring of cloud systems using remote sensing and radar observations.
These criteria are the basis of timely predictions and notifications of flash floods which can operate in real time, and is in operation in Serbia.

Plinius13-118
The European Dimension of Civil Protection

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Since the establishment of the European Community, much has been done in order to create a political union of States able to confront with the many problems afflicting its vast and heterogeneous territory. The European Civil Protection, however, is far from being fully functional. One of the main reasons can be ascribed to the emphasis posed by the Lisbon Treaty (2007) on Civil Protection as Member State competence. European States, in the preparatory works of the Treaty expressed a clear reluctance on loosing their exclusive sovereignty on such a delicate topic.
Seen from the European perspective, with particular attention to expatriate European citizens, it is possible to identify a multiplicity of recommendations issued by single States.
Most of the times, Member States approach emergency management activities disorderly, in a mixture of intentional excesses in alarmism or omission of interventions which are both dictated by national political dynamics.
In the specific aspect of the civil protection activities, the problem of creating a strong and unitary Civil Protection institution can be furthermore examined when developed countries, usually donor of aid, are hit by a major disaster. These difficulties, in the frame of international relationships, are hard to cope with at a European scale but become insurmountable molochs when experienced on a global dimension.
Three topical and recent cases can be used as examples, Hurricane Katrina (USA - 2005), L'Aquila earthquake

(Italy - 2006) and the Tohoku earthquake (Japan 2011).
These events posed worldwide the basis for a critical analysis of international crisis response in the contest of mega disasters.
The question that arises from these thoughts can be synthesised in the difficult process of integrating different social realities into homogeneous operative procedures. With this contribution, the European External Action Service would like to give a partial answer to such a problem.

Plinius13-119
Climate change and extreme surface flooding: a case study based on the 26th September 2007 Venezia flood

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Pluvial flooding is a challenging hazard as it can be triggered by intense localised downpour rather than by large scale precipitation. This events might change substantially in the future climate, since the increased global temperature is associated withan increase in atmospheric humidity which might increase the intensity of precipitation. Extreme rainfall events are common in the Mediterranean region, especially in late summer and in early winter. In this paper we present the result of an analysis of the flood which affected the area around Venezia in September 2007.The return period for the event has been estimated to exceed 100 years
By looking at the Regional Climate Model outputs provided by the UK project UKCIP09 we assess what can be said in terms of flood of this size becoming more frequency or more intense in the future.Regional model output has been downscaled and used to drivefor the JBA surface water model for events in the present and future climate.

The paper describe both the innovative methodology and the main
conclusion of the study.

Plinius13-120
Nine questions to understand Civil Protections problems around the globe

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CIMA Research Foundation has been studying, for the past years, a new branch of Italian criminal law; focus of the research is the effect that the Italian jurisprudential system has on Civil Protection (CP) activities. The Italian Constitution, in fact, according to article 112 obliges prosecutors to initiate criminal proceedings in the case of death or damage to properties. Our legal system (civil law) binds the magistrature to the sole interpretation of rules and laws. This legal constrain, which has tobe considered as a conquest of freedom and equality by our society, poses however several problems of systemic nature: CP operators, more often confronted with the risk of being personally accused of manslaughter, became more precautious. The problem is,de facto, very similar to the notorious issue of defensive medicine, caused by comparable legal measures. One very first effect that we have observed has been the rapid increase of alerts issued by our system in order to reduce the risk of being condemned for omissive crimes.
Moreover, the media played a very important role in depicting a fictitious perception of inefficiency towards the population. News pages are filled with incompliant CP operations, rarely intervening when they are carried on meticulously in extremely difficult situations. L'Aquila earthquake (Abruzzo region, 2009) is one example that must be strongly emphasized. The members of the Commissione Grandi Rischi, national scientific reference for the Department of Civil Protection, have been charged with the accusations of manslaughter for having communicated wrongly the risk of a possible earthquake in the region. No, or very little, attention has been paid on the fact that a modest earthquake, in terms of released energy, has crumbled an entire city known for its high risk of seismicity, including its newest infrastructures. No, or very little, attention has been paid on the fact that the response of the CP has been extraordinary rapid, greatly reducing a possibly catastrophic death tool.
The fact that the Italian society is starting to believe that one of the most functional system of CP in the world is inefficient, triggered the necessity to examine if the same interference between CP and the legal system have been problematic also abroad.
Thus, in order to stimulate a critical revision of normative systems and to enhance a mutual interest on the comprehensive understanding of CP practices across our Countries, a questionnaire has been distributed to scientists and jurists involved with CP activities. The necessity of interacting with different societal and jurisprudential models - common and civil law systems - stemmed from the different approaches that every state has towards the paradigm of tort compensation. The class action carried on in the United States after Hurricane Katrina can be regarded as a specular way of tackling tort compensation. In this case, for example, a civil, rather than criminal, proceeding has been carried on.
The ambition of this work is to create a think tank capable of providing a detailed comparison on how CPs, jurisprudential systems, the media and society interact in different countries. Its institution will facilitate the identification of normative bestpractices, while, at the same time, encourage a shared road map of common strategies for a sustainable Civil Protection.

Plinius13-121
Modelling tsunamis generated by submarine landslides. Application to real cases in the Mediterranean.

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We present some real applications of the two-layer Savage-Hutter type model developed by E. D.

Fernández-Nieto et al (JCP, 2008) to study submarine avalanches. In this model, a layer composed of fluidized granular material is assumed to flow within an upper layer composed of an inviscid fluid (e. g. water). The model is derived in a system of local coordinates following a non-erodible bottom and takes into account its curvature, and it is discretized using a two dimensional high-order finite volume scheme implemented on GPU cards for increasing the speed-up.
Simulation of a paleotsunami occurred in the Alboran Sea is presented focusing on its coastal impact: arrival times, inland advance, wave-height, etc.

Plinius13-123
From Mediocristan to Extremistan. Building up a civil protection knowledge

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It's likely that many of those who attend the conference remember that the second part of Taleb's recent book is titled We just can't predict (Taleb, N.,N., 2010, The Black Swan. The impact of highly improbable, Random House, N.Y.). Such a message sounds tragic for everybody has helped to build civil protection systems and for everybody daily works in them. It sounds tragic for everybody deals with "physical predictable events", like the meteorological and hydrological ones.It sounds tragic finally for the whole Hydro Meteoscientific community. They strive to advance knowledge to transform it into models available to forecasters. Attempting had been made to capture together the processes living in Mediocristan and the rare processes living in Extremistan.(see, for example: Rossi, F., Fiorentino, M., and Versace, P., 1984, Two-component extreme value distribution for flood frequency analysis. Water Resour. Res. 20 (7), 847-856.). However the world of civil protection is more complex and uncertain than thephysical processes only. It involves social random processes of risk exposure of a few or sometimes many people. It involves human behaviour of decision makers.

I will try to read some of Taleb's thesis using a historical example of the world of officers of civil protection. Such segment of civil servants gradually learns by reporting about past events, describing their physical features and social consequences. Collecting and analysing the "event reports" is their way to build up and transfer knowledge. Taleb addresses such a knowledge as poor under the scheme of "narrative fallacy". I will show that a much safer methodology is to report not only what just happened but also what might have happened. This way of reporting, hardly ever used by meteorologists and hydrologists, would largely improve the knowledge of the past and the ability to operate in the present: it will possibly change a narrative fallacy intoa new narrative knowledge.

Plinius13-124
Radar network for urban and complex terrain flood monitoring

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Quantitative precipitation estimation (QPE) is a very important application of weather radar systems, to monitor rainfall intensity and total rainfall amount and to further forecast flooding risk. Flooding is one of the most common natural hazards in the world and urban flooding is particularly a potential high-impact disaster. Recently a new quantitative precipitation estimation QPE product has been developed (Wang and Chandrasekar 2011), which is based on an adaptive differential phase (K_{dp}) estimation. This prototype QPE product has been evaluated extensively using gauge measurements from Oklahoma's MicroNet, including all rainfall events that occurred over the ground gauge network. The validation study is unique in that it demonstrates a radar network's high resolution capabilities for rainfall estimation, both in terms of rainfall rate and spatially distributed hourly accumulation. The cross-validation was conducted at individual rain gauge station for every storm event. The event-wise evaluations demonstrated reliable operation in different storm types. Over the 29 storm events observed from 2007 to 2009, the composite IP1 QPE product has a fairly small bias of 4.26% and a small NSE of 22% for this three year period. The excellent performance of the radar network QPE can be attributed collectively to several sensing factors: better K_{dp} estimates, measurements close to the ground, and high spatiotemporal resolution of the dataset enabled by the networked sensing operation. The quality of the IP1 experimental QPE product is shown in various aspects.

Plinius13-125
Coupling X-band dual-polarized mini-radar and hydro-meteorological forecast models: the HydroRad project

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HydroRad is the name of the project positively evaluated by European Commission under Seventh Framework Programme (FP7) and currently started. The main aim of the project is to develop an innovative dual-polarization

X-band mini-radar system and software-based business support tools for the use of weather, climate information in industrial sectors and government emergency management agencies. HydroRad project have seven partners located in Italy, Greece, Cyprus and Moldova.
It is worth mentioning that high-frequency - low-power polarization-diversity mini-radars can constitute a low-cost solution to the problem of hydrologic forecasting for urban and small-scale flood-prone basins and coastal areas and probably the only economically feasible solution for developing countries to provide nationwide weather radar coverage.
Since, they are low power systems, they have range limitations, another major limitation is that measurements at X-band undergo sever copolar and differential attenuation that can cause significant reduction of the horizontal reflectivity and differentialreflectivity signal, which must be corrected because it introduces errors in the rainfall estimation.
The capability to invert the polarimetric radar measurements into useful hydro-meteorological products is crucial for the exploitation of the new mini-radar system.
Specific project objectives include:
1. X-band polarimetric mini-radar system design, production and deployment optimizing characteristics in terms of the best trade-off between costs and performances for hydro-meteorological applications;
2. X-band radar algorithm development and system interface to implement, improve and validate X-band mini-radar network measurements. These algorithms are focused on path-attenuation correction, hydrometeor classification, vertical profile correction, nowcasting and rain-rate estimation
3. to set up an integrated tool for short-to-medium-range forecasting using coupled hydro-meteorological models and miniradar data assimilation schemes
4. test the overall system in the Moldova Operational Field (MOF) campaign where three miniradar system data and hydro-meteorological tool will be tested and comparing against a state-of-the-art radar (X-POL) and against in situ weather stations (raingauges, disdrometer and streamflow) measurements. The MOF campaign will last a minimum of one month and maximum up to two months during the wet season in Moldova territory.
5. Hydro-meteorological application and validation where the performance of the overall system during MOF campaign will be carried out through systematic analysis and validation of radar-network products.
Objectives and preliminary results of the HydroRad projects will be presented during the conference, focusing on both algorithmic, applicative and technological issues.

Plinius13-129
Uncertaintypropagation for floodforecasting in the Alps: Differentviews and impacts from MAP D-PHASE

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D-PHASE stands for Demonstration of Probabilistic Hydrological and Atmospheric Simulation of flooding Events in the alpine region and it is the Forecast Demonstration Project of the World Weather Research Programme (WWRP) that is related to the Mesoscale Alpine Programme (MAP). Its goal was to demonstrate the reliability and quality of operational forecasting of orographically influenced (determined) precipitation in the Alps and its consequences on the distribution of run-off characteristics. A special focus was, of course on heavy-precipitation events.
The D PHASE Operations Period (DOP) ran from June to November 2007, during which an end-to-end fore-casting system was operated covering many individual catchments in the Alps, with their water authorities, civil protection organizations or other end users. The forecasting system's core piece was a Visualization Platform where precipitation and flood warnings from some 30 atmospheric and 7 hydrological models (both deterministic and probabilistic) and corresponding model fields were displayed in uniform and comparable formats. Also, meteograms, nowcasting information and end user communication was made available to all the forecasters, users and end users. D-PHASE information was assessed and used by some 50 different groups ranging from atmospheric forecasters to civil protection authorities or water management bodies.
In the present contribution the various elements of D-PHASE will be presented, its outstanding scientific results and, in particular the lessons learned with respect to uncertainty propagation. A Focus thereby will be on the transfer ensemble prediction information in the hydrological community and its use with respect to other aspects of societal impact. Objective verification of forecast quality will be contrasted to subjective quality assessments during the project (end user workshops, questionnaires) and some general conclusions concerning forecast demonstration projects will be drawn.

Plinius13-131
Tsunami Warning Systems in the Mediterranean and the NE Atlantic

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The tragic experience from the devastating tsunamis of 2004 in the Indian Ocean and of 2011 in Japan showed that the forecasting of the tsunami wave arrivals is of crucial importance for the risk mitigation. In Japan, a Tsunami Warning System (TWS) was inplace since the 1950's but in ocean-wide scale until 2004 only the Pacific Ocean was covered by a TWS operating since the 60's under the supervision of the Intergovernmental Oceanographic Commission (IOC) of UNESCO. More recently, other regional systems were also developed in the Pacific Ocean and currently are in operational use. Because of the lack of TWS's in other parts of the globe, the national delegations participating at the IOC General Assembly on June 2005 took decision for the development of such systems in Indian Ocean, in the Carribean Sea as well as in the NEAM region, which includes the North East Atlantic, the Mediterranean and its connected seas. The TWS system in NEAM, called NEAMTWS, is still under construction with the active participation of many country members and specialists with the IOC playing the role of catalyst for the better coordination. What was already achieved is the drastic improvement of the instrumental infrastructure and technology, the elaboration of requirements and protocols for the data, signal and message transmissions,

while pre-operational tests started in 2010. In June 2011 a special workshop on tsunami and civil protection co-organized by the JRC/EC and IOC/UNESCO was held in Ispra, at the JRC premises, withthe aim to prepare an exercise before NEAMTWS becomes operational during 2012. In the Pacific Ocean, the ocean-wide TWS's have proved effective in the far-field, that is in the regional and transoceanic domains, for issuing reliable warnings for coastal zones threatened by tsunami waves that may arrive more than 1 hour after their generation. Unfortunately, those systems are not capable to provide warnings in the near-field (local) domain, that is for coastal zones which are inundated by tsunamis within a few minutes and certainly less than 1 hour after the wave generation. This is also the foreseen prospect for the other systems which are under development, including NEAMTWS, since they are designed to issue warnings only for far-field tsunamis. However, the most important tsunami sources around the world are situated very close to the coasts. In the NEAM region nearly all coastal zones are threatened by near-field tsunamis, with the highest hazard bring in the eastern Mediterranean, as it comes out from the tsunami history. Therefore, the crucial challenge is to warn in conditions of time constraints of the order of 5 to 30 minutes at maximum, which is the most common time window for the arrival of the first tsunami wave. There is urgent need to investigate advanced technologies for the near-field tsunami warning and its standardized implementation for the prevention of, and the preparedness against, tsunami risk in the NEAM region. The output of such an effort is expected to act in synergy to NEAMTWS and to close the gap between the regional possibilities of NEAMTWS and the local needs of coastal zones threatened by near-field tsunamis. In addition, infrastructures that may develop for the near-field tsunami warning will be useful in the overall infrastructure needed for NEAMTWS anyway.

Plinius13-132

Survey of the Physics of Ocean waves from global to regionalscales.

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In this talk I would like to discuss the Physics of ocean waves, which includes the generation of ocean waves by wind (and the feedback of the growing ocean waves on the atmospheric circulation) four-wave interactions and dissipation by wave breaking. This is followed by a brief discussion on the present-day quality of operational wave forecasting results, while also new applications such as freak wave forecasting and the interaction of ocean waves and ocean circulation are presented.

Plinius13-135

Disaster Risk Reduction: Form global strategies to local implementation

H. Molin Valdes

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The United Nations secretariat for the International Strategy for Disaster Reduction (UNISDR) aims at the substantial reduction of disaster losses, in lives and in the social, economic and environmental assets of communities and countries. UNISDR supportsthe International Strategy Disaster Reduction and related instruments, like the Hyogo Framework for Action, to assist government and institutions to reduce the impacts of disasters on lives and in the social, economic and environmental assets of communities and countries.

The United Nations 2011 Global Assessment Report (GAR) on Disaster Risk Reduction "Revealing Risk, Redefining Development" is a resource for understanding and analysing global disaster risk today and in the future. It highlights the political and economicimperative to reduce disaster risks, and the benefits to be gained from doing so. Importantly, it offers guidance and suggestions to governments and non-governmental actors alike on how they can, together, reduce disaster risks.

Plinius13-2

Numerical simulation of thermodynamic and microphysical features of heavy snowfall caused by Mediterranean cyclones over Ukraine

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Three-dimensional time-depend and time-independ numerical models for complex and plain relief developed in UHMI have been used in numerical experiments for investigation of thermodynamic and microphysical conditions of heavy snowfall formation on the territory of Ukraine caused by Mediterranean cyclones in December 2009. The winter 2009-2010 was very snowy in northern hemisphere, especially heavy snowfalls were in December on the territory of Ukraine. Heavy snowfalls covered the whole Ukraine except for west regions. Cases of these snowfalls in different parts of Ukraine have been investigated. Heavy snowfall near Bilgorod-Dnistrovsky on December 15 was chosen for presentation in detail. Complex researches including natural measurements and numerical simulations based on all possible data were used in the study of inner structure of atmospheric front and its cloud systems.
The three-dimensional diagnostic numerical models were used to diagnose the atmospheric state during whole snowfall period. These models helped to investigate the features of atmospheric characteristics such as temperature, pressure at the sea-level and complex relief, supersaturation, condensation rate, ice nuclei concentration (INC) etc. every 12 hours.
The three-dimensional prognostic models were used for numerical simulation of the evolution of the most interesting cases to find out key parameters caused heavy snowfall. Series of numerical experiments were fulfilled using different combination of precipitation formation mechanisms by variation of INC, coagulation intensity, surface relief. Experiment showed that catastrophic precipitations are caused by including: 1) coagulation of rain drops with cloud drops; 2) optimal INC; 3) complex relief. The main reason of such dangerous events was the moving of three active Mediterranean cyclones to the Black Sea and their blocking by powerful cold anticyclone with its centre in Moscow.
Key words: Mediterranean cyclones, numerical models, heavy snowfall.

Plinius13-5

Analytic estimates of tsunami amplitude near the beach

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We show analytic formulas which give explicitly the amplitude of a tsunami wave near the beach under the hypothesis that the depth profile is proportional to the distance from the beach. These formulas are derived using an asymptotic expansion of the wave equation in the parameter $\mu = \frac{a}{L}$, where a is the width of the initial perturbation and L is the length of the basin. The asymptotic expansion is following the Maslov approach which gives an analytic representation of the solution as an explicit function of the initial perturbation by means of the Maslov canonical operator. We generalize this approach to the case of the singularity given by the beach. The initial perturbation is

$$V(y) = V^0(T(\theta y)) \quad T(\theta) = \begin{pmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{pmatrix} \quad (1)$$

$$V^0(y) = \frac{1}{(1 + \frac{(y_1)^2}{(b_1)^2} + \frac{(y_2)^2}{(b_2)^2})^{\frac{3}{2}}}$$

$$V(y) \to V(\frac{y-a}{\mu})$$

$T(\theta)$ is a rotation of the initial perturbation which is not of a gaussian type, differently from the other cases. The reason of this choice is that the Fourier transform of this perturbation is rather simple. The amplitude is an explicit function of the parameters of the perturbation and so it is possible to find the initial shape of the wave from the measures of the waves in some points of the ocean and then reconstruct the wave amplitudes in real time.

$$u = \mu \mathrm{Re} \frac{\tau^0(\mathrm{x}_2, \mathrm{t}) - \mathrm{t} + \mathrm{i}\mu\beta(\psi^0(\mathrm{x}_2, \mathrm{t}))}{(-4\mathrm{x}_1 + (\tau^0(\mathrm{x}_2, \mathrm{t}) - \mathrm{t} + \mathrm{i}\mu\beta(\psi^0(\mathrm{x}_2, \mathrm{t})))^2)^{3/2}}. \quad (2)$$

The function β contains the information of the initial amplitude

$$\beta(\psi) = \sqrt{b_1^2 \cos^2(\psi) + b_2^2 \sin^2(\psi)}$$

τ^0, ψ^0 are parameters used for defining the front in the position x_1, x_2. τ^0, ψ^0 are the initial conditions of the system of characteristics; the solution of this system gives the front at different times. This approach can be used for a real time tsunami alarm system.

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Plinius13-7
The summer North Atlantic Oscillation influence on the Eastern Mediterranean.

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This study highlights an important and previously overlooked summer NAO influence over the eastern Mediterranean. The featured analysis is based on a synergistic use of reanalysis data, satellite retrievals, coastal and buoy meteorological observations. The physical mechanisms at play reveal a strong summer NAO involvement on the pressure fields over northern Europe and the Anatolian plateau. Especially during August, the summer NAO modulates the Anatolian low, together with the air temperature, meridional atmospheric circulation and cloudiness over the Eastern Mediterranean. Including the dominant action centers over Greenland and the Arctic, the identified modulations rank among the strongest summer NAO-related signals over the entire Northern Hemisphere.

Plinius13-10
Role of coastally-trapped long waves in the evolution of storm surge induced by atmospheric cyclones

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Some of the most severe storm events in the Mediterranean are forced by translating atmospheric cyclones. When the atmospheric cyclone approaches the coastline, it induces a storm surge, which can propagate along the continental shelf as a long wave trapped by bathymetry and/or coastline. Arrival of this wave at a certain location can significantly modify coastal circulation driven by the local wind. A set of numerical experiments has been performed in order to analyze a long-wave response of the coastal ocean to the translating mesoscale atmospheric cyclone crossing the continental shelf and approaching the coastline at a close to normal angle. The model is forced by a radially-symmetric atmospheric pressure perturbation with a corresponding gradient wind field. The cyclone's translation speed, radius, and the continental shelf width are considered as parameters, whose impact on the long wave period, modal structure, and amplitude is studied.
When the Eulerian time scale of the atmospheric cyclone is comparable to or longer than the inertial period, subinertial continental shelf waves (CSW) dominate the response. They are strongly affected by earth's rotation and propagate in the downstream (in the sense of Kelvin wave propagation) direction. These conditions are typically associated with extra tropical (synoptic-scale) atmospheric cyclones. Tropical-like mesoscale atmospheric cyclones are less frequent in the Mediterranean, and their Euleriantime scale can be less than the inertial period. In this case the generation of edge waves is possible, especially on wider shelves. Superinertial edge wave modes have a higher free surface amplitude and faster phase speed than the CSW modes and propagate in both directions relative to the coastline. Edge waves with the highest amplitude (up to 60% of the forced storm surge) propagate upstream. They are produced by the storm system with an Eulerian time scale equal to the period of a zero-mode edge wave with the wave length of the storm spatial scale. When the storm trajectory deviates from the normal approach, most of the edge wave energy propagates in the direction of the alongshore component of the cyclone's translation velocity.
Since the dimensions of sub-basins in the Mediterranean are smaller than typical synoptic-scale atmospheric systems, the adjustment of trapped waves to the curvilinear coastline and continental shelf is important, especially when the coastline changes orientation rather abruptly, in a corner-like manner. Such a configuration of the coastline causes a multi-mode response with smaller-scale but more energetic transient jets aligned with the "blocking" (deviating) coastline. The predominant trajectory of atmospheric cyclones in the Mediterranean is zonal so that numerous meridional coastal boundaries there can be affected by the described dynamics. For instance, coastally trapped waves generated at the southeastern coast (Tuscany) of the Ligurian Sea and subsequently entering Gulf of Genoa could exacerbate the impact of storm system on January 1-2, 2010, which resulted in unexpectedly high coastal damage.

Plinius13-12
The storms of the 18 September 2009: The dynamic processess and an analysis of some thermodynamic indices

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September is a transitional month for the area of the East Mediterranean, marking the change from the prolonged dry and hot period to the relatively cold and rainy period. The island of Cyprus, situated in the eastern Mediterranean basin, is affected by storms either initiated mainly by the baroclinicity of the advancing depressions during the cold period, or during the transitional months, initiated mainly by thermal instability.
The present study investigates some of the processes involved in the development of a storm which took place over the area of southern Nicosia, Cyprus on the 18th of September 2009. ?he storm was characterized as very extreme and the associated weather was very destructive. The storm was initiated by a weak disturbance in the medium troposphere, while the contribution of thermal instability was of considerable importance.
For a better understanding of the development of the storm but also for the estimation of the contribution of various factors in the development of the associated phenomena, a combined spatial and temporal study was performed on selected dynamic parameters and thermodynamic indices in order to check their performance and efficiency in such a diagnostic study.
The Weather Research and Forecast Model (WRF, ARW Core) was utilised in order to study the storm properties in detail and to help identify some of the dynamic and thermodynamic processes involved in the formation and development of the storm cell and subsequent activity.

Plinius13-15

Trends in rainfall regime over Israel, 1975-2010, and its relation with the variations in the synoptic systems and large-scale oscillations

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Future predictions for the Mediterranean region anticipate a drastic decline in rainfall, by tens of percents. Such predictions, when combined with the expected rise in temperatures, imply a growing water deficit over this water scarce region. The aim of the study was to assess recent trends in the rainfall regime and to estimate the possible role of natural variations imposed by the occurrence of rain-producing synoptic systems and large-scale oscillations.
The annual rainfall shows a long-term decreasing trend over the majority of Israel, though being significant mainly in its southern (arid) part. The polynomial trend approximation shows that the trend was positive from the mid-seventies toward the beginning of the 90s, then, decreased sharply toward the end of the study period. The climatic borders separating the Mediterranean climatic zone and the semi-arid and arid zones shifted northward during the study period, thus the Mediterranean climate area has been shrinking in favor of the arid and semi-arid parts. The inter-annual variation of the annual rainfall increased slightly, however, for the arid regions, it has increased significantly. The intra-annual distribution changed in a way that the rainy season has become shorter, especially due to the drying trend in the spring season. A significant increase in the average duration of the dry spells was found, while no significant trend was noted in the duration of the rain spells.
The inter-annual variation of the rainfall was found to be significantly correlated with the occurrences of Cyprus lows as well as with the Nino 3_4, the EA-WR and the NCP oscillations. It is shown that there is similarity between the polynomial course of both the EA-WR and that of the annual rainfall over Israel. This suggests that the recent decreasing trend of the rainfall is, at least in part, a reflection of regional natural climatic variations.

Plinius13-16

Sensitivity experiments for the simulations of a heavy rainfall event in Epirus, NW Greece

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In this work, a case of winter precipitation over Epirus, NW Greece, is simulated, by using the meteorological model MM5. For the model simulations, three domains are used: the "coarse", which covers Europe (24 Km grid spacing) the "inner", which covers Greece (8 Km grid spacing) and a third one, which covers Epirus, with a fine grid of 2 Km horizontal resolution. For this process, a one-way nesting technique is adopted, while Grell convective parameterization scheme (CPS) is utilized, for all the domains. In order to test the model set-up, two experimental runs are performed by using different initialization times. The results of these runs are compared with the corresponding 6-hourly observations by estimating the Mean Absolute Error. By using the optimum initialization time, at first, the Kain-Fritsch_2 CPS is employed, instead of Grell, for all domains, and then, Grell CPS is used in the two coarser grids but no CPS for the finest grid. Thus, the necessity of the usage of a CPS in the high resolutiongrid (2 Km) is examined and the comparison of two different CPS is achieved. Finally, the role of topography in the rainfall regime of this case is studied, by reducing the height of the mountains located southwest of an axis passing from Ioannina city and being parallel to the Pindus mountain range. This simulation is carried out by using the initialization time and the CPS which gave the best results in the previous stages of the study. The results show that the phenomenon is simulated best for initialization time 6 hours before the beginning of the event and by using Grell CPS even in the domain with the finest grid (Epirus). As far as its concerns the spatial distribution of precipitation after the modification of topography, it was found that rainfall decreases in the windward sides and over the tops of mountains with reduced height and increases in the lee sides, as was expected. In general, the modification of the coastal topography, results to a displacement of precipitation towards the flow of the prevailing wind.
This research work is co-funded by the European Union - European Social Fund (ESF) & National Sources, in the framework of the program "HRAKLEITOS II" of the "Operational Program Education and Life Long Learning" of the Hellenic Ministry of Education, Life Long Learning and religious affairs.

Plinius13-17

High temporal and spatial resolution X-band radar based system to monitor rainfall events and detect landslide risk in the Mediterranean area.

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In Mediterranean regions landslides and debris flows can be triggered by rainfall, with different frequency and under the effects of different types of storms. Moreover, increasing high intensity precipitations in the Mediterranean regions are often causes for landslides which can be seriously damaging for both ecosystems and urban settlements. Traditional rain gauge networks do not provide neither a useful spatial resolution nor a high frequency characterization of the events.
In order to improve the monitoring of extreme rainfall events and consequently to detect areas in which landslides may occur an experimental network of meteorological micro-radar has been installed in the

Italian regions of Sicily, Piedmont and Aosta Valley. The system is composed of several high temporal and high spatial resolution radars. Each radar acquires a rain map every minute with a spatial resolution around 60 meters and with a 30 km range. A first processing step is made by the software installed on each radar, in order to remove most of the ground clutter with a robust median threshold (time dependent) filter. Preprocessed data are then transferred in compressed form to the central server via a flexible communication system and here cleaned outfrom residual high frequency clutter.
A web site provides the real time rain maps to the operators, the maps are projected over a common cartographic system. In parallel, the rain data is fed to a Landslides Risk Estimation Software (LRE1.0):
1. it computes the precipitation accumulation map over the entire observed area at different time intervals: every hour, 6 hours, 12 hours and every day;
2. it arranges a weekly report with the accumulation maps;
3. it monitors specific locations defined by geologists taking into account hydro-geological studies and knowledge of past events (they can define several "sensitive zones" such as active landslides or unstable slopes with triggering thresholds for each of them).
4. Every day the software computes the mean accumulated rain in the area and a risk level (according to the given thresholds). In order to draw the attention of the computer operator the risk level is represented using four classes of risk from the green (no risk) to the red (high risk).
The system is a valuable aid in monitoring landslides triggering events, and it is flexible and open to the needs of the local authorities in charge of the risk management.

Plinius13-20
Verification of a probabilistic flood forecasting system for an Alpine Region of northern Italy

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Nowadays, probabilistic hydrometeorological forecasting chains are becoming an operational tool used for civil protection purposes and for issuing flood alerts. For this reason it becomes important to have a reliable system and so to validate its predictive performances.
The aim of this work is to validate a probabilistic flood forecasting system: Flood-PROOFS. The system works in real time, since 2008, in an alpine Region of northern Italy, Valle d'Aosta. Flood-PROOFS supports decision makers through the forecast phase and it's useful to manage critical situations. It is used by the Civil Protection regional service to issue flood warnings and by the local water company to protect its facilities.
Flood-PROOFS uses as input Quantitative Precipitation Forecast (QPF) derived from the Italian limited area model meteorological forecast (LAMI) and forecasts issued by regional expert meteorologists. Furthermore the system receives real time meteorological and satellite data and real time data on the maneuvers performed by the water company on dams and water captures. The main outputs produced by the computational chain are deterministic and probabilistic discharge forecasts in different cross sections ofthe considered river network.
The validation of the flood prediction system has been conducted on a 25 months period considering different statistical methods such as Brier score, Rank histograms and verification scores.
The results highlight good performances of the system as support system for emitting warnings but there is a lack of statistics especially for huge discharge events.

Plinius13-21
DRIHMS (Distributed Research Infrastructure for Hydro-Meteorology Study) project

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Hydrometeorological science has made strong progress over the last decade at the European and worldwide level: new modelling tools, post processing methodologies and observational data and corresponding ICT technologies are available. Recent European efforts in developing a platform for e-Science, such as EGEE (Enabling Grids for E-sciencE), SEEGRID- SCI (South East Europe GRID e-Infrastructure for regional e-Science), and the German C3-Grid, have demonstrated their abilities to provide an ideal basis for the sharing of complex hydrometeorological data sets and tools. Despite these early initiatives, however, the awareness of the potential of the Grid technology as a catalyst for future hydrometeorological research is still low and both the adoption and the exploitation have astonishingly been slow, not only within individual EC member states, but also on a European scale. With this background in mind and the fact that European ICT-infrastructures are in the progress of transferring to a sustainable and permanent service utility as underlined by the European Grid Initiative (EGI) and the Partnership for Advanced Computing in Europe (PRACE), the Distributed Research Infrastructure for Hydro-Meteorology Study (DRIHMS, co-Founded by the EC under the 7th Framework Programme) project was initiated. The goal of DRIHMS is the promotion of Grids in particular and e-Infrastructures in general within the European hydrometeorological research (HMR) community through the diffusion of a Grid platform for e-collaboration in this earth science sector: the idea is to further boost European research excellence and competitiveness in the fields of hydrometeorological research and Grid research by bridging the gaps between these two scientific communities.
Furthermore the project is intended to transfer the results to areas beyond the strict hydrometeorology science as a support for the assessment of the effects of extreme hydrometeorological events on society and for the development of the tools improving the adaptation and resilience of society to the challenges of climate change.
The results of the DRIHMS project have been collected in

the DRIHMS White Paper. They show a particular need for specific classes of solutions to support the full hydro-meteorologic forecasting chain. These solution will be in the focus of the DRIHM project to be started in Fall 2011.

Plinius13-22
Three-Dimensional Structure of the 4.24 Squall Line by Dual-Doppler

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There was a squall line moved from Guangxi province to Guangdong province in South China during 23 and 24 April 2007 that brings the heavy rainfall and gale. The 3D wind field of the squall line is retrieved by the Guangzhou and Shenzhen Dual-Doppler radar volume data.
In the mature phase of the squall line, there is a storm-relative front-to-rear flow in the low level of the squall line frontal in the low level clearly. On the other hand, the storm-relative rear-to-front flow is presented at the back of the squall line on the low level. The rear inflow enhances convergence in the frontal of the squall line. On the mid-level (i.e. 5.5km height), the storm-relative front-to-rear flow prevails. Near the density current front, there are strong updrafts at the low and middle level. The downdrafts are located at the back of the squall line. The updraft increases with height at the low and middle level. There are some convergence centres at the density current front on the low level. The value of the strong convergence is less than -25×10^{-3} s^{-1}. In the vertical cross-section, the storm-relative flow is perpendicular to the quasi-two-dimensional squall line, and there is a rear-to-front flow in the low level of the squall line. In the middle level of the density current front, there is a front to rear flow. Portion of the front-to-rear flow blow backward, and some flow blow upward and then forward with height. The difference between this squall line and the other subtropical squall line is also discussed. The 3D structure conceptual model of the squall line in South China is proposed firstly.

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Plinius13-23
Comparison of methodologies for flood rainfall thresholds evaluation

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A flood warning system based on rainfall thresholds allows to overcome classical real time flood forecasting systems, that generally require to run in real time a hydrological model. This approach is useful when dealing with medium and small size basins, often characterised by a very rapid response to the storms, leaving only a short lead time for events mitigation. Rainfall thresholds values specify the precipitation amount for a given duration that generates a critical discharge in a given cross section. The overcoming of these values could produce a critical situation in river sites exposed to alluvial risk. Rainfall thresholds values depend on soil moisture conditions and spatial and temporal distribution of rainfall. In this study a comparison of methodologies for estimating rainfall threshold values is presented. Critical precipitation amounts are evaluated using both hydrological simulation and probabilistic methods. The study is focused on three medium-small sized basins (areas ranging from 125 to800 square kilometres) located in North Lazio Coastal Region, in Central Italy. For each catchment a semi-distributed hydrological model is calibrated and validated with rain gauge and weather radar data. Then the optimal simulation models are used to evaluate critical rainfall depths for 1, 3, 6 and 12 h duration. In the probabilistic approach rainfall thresholds values result from the evaluation of the joint probability function of rainfall depth of a given duration (1, 3, 6 and 12 h) and the corresponding flow peak value, combined with an utility function minimisation. Two kind of utility function are examined, one following the Bayesian decision theory, the other the informative entropy concept. Finally, to assess the performance of each methodology,contingency table are constructed to highlight the system skill score, i.e. the capacity of correctly issuing warning against false and missed alarms.

Plinius13-24
Comparison of probabilistic methodologies for flood rainfall thresholds evaluation

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In medium and small size basins, floods are often characterised by a very rapid response to storms, leaving only a short lead time for triggering civil protection measures. For a given duration it is possible to identify rainfall values that generates a critical discharge in a given river cross section. If the rainfall threshold values are exceeded it can produce a critical situation in river sites exposed to alluvial risk. Comparing directly the observed or forecasted precipitation with critical reference values, allows to issue a flood warning without running online real-time forecasting systems.
The critical rainfall threshold values are evaluated by probabilistic methodologies, considering the joint cumulative distribution of cumulated rainfall and the corresponding peak discharge, for different soil saturation conditions (represented by AMC classes) and time durations. To estimate the joint distributions three approaches are examined: firstly, the data are transformed to normality by a Cox-Box Transformation, and the corresponding joint distribution is a bivariate normal. With the second methodthe marginal distributions are transformed via the Normal Quantile Transform, and the corresponding joint distribution is a meta-Gaussian. Finally, the Copula is applied to obtain joint distributions without assumptions about data or marginal. The joint distributions are then used to evaluate a risk function based on the informative entropy concept.

Plinius13-26
Climatic characteristics of summer human thermal discomfort in Athens and its connection to atmospheric circulation

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The variability of summer human thermal discomfort in Athens and its connection to atmospheric circulation is studied. The data used are daily values (12:00UTC) of air temperature, mixing ratio and atmospheric pressure at the National Observatory of Athens, for the warm season (1 May – 30 September) and for the period 1954-1999 (46 years). From the above parameters, the Predicted Mean Vote (PMV) discomfort index is calculated for calm and light wind (3m/s) conditions. The variability of thermal discomfort is examined in terms of the inter-annual variation of: i) the mean summer 12UTC PMV values and ii) the frequency of summer discomfort days (PMV>2 and PMV<-2). According to the results, a significant increase in discomfort (intensity and frequency) is found from the middle 1980's to the end of the period under study. Also, the seasonality of thermal discomfort is studied by examining the intra-seasonal variation of the 46-year mean daily 12UTC PMV values as well as the discomfort cases for each summer day during the 46-year period. From middle July to middle August, the mean 12:00 UTC PMV values exceed the discomfort thresholds (PMV>2). Furthermore, the onset and the cessation of the discomfort period are studied. The results show that the onset takes place around the beginning of July and the cessation around the end of August, but from the middle 1980's to the end of the period under study the dates of onset and cessation have slightly moved earlier and later, respectively, leading to a higher summer discomfort period. Finally, the connection between human thermal discomfort and atmospheric circulation is studied by examining the distribution of discomfort cases into 6 objectively defined circulation types for Athens. According to the results, the extreme high discomfort conditions prevail mainly under the two of the six circulation types, which dominate during July and August and can be characterized as the typical high-summer pressure patterns. Both of them are characterized by the presence of the summer thermal low of the SW Asia and high pressure values over Europe. The difference appears in the position and the intensity of the anticyclone center and the pressure gradient over the Aegean Sea. It is found that the discomfort increase after middle 1980's is more evident for the second circulation type. On the contrary, low PMV (<-2) discomfort conditions prevail mainly during the other four circulation types, which are more frequent during May, June and September.

Plinius13-27
Predicting Wave Overtopping Using an Integrated Modelling Suite

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Understanding future changes in flood risk from waves overtopping seawalls and other structures is a key requirement for the effective management of coastal defences. Occurrences of loss of life and economic damage due to the hazardous nature of wave overtopping are becoming more frequent and coastal managers and users are becoming more health and safety conscious. Seawalls make up most of these defences and range from simple earth banks through to vertical concrete walls and more complex, composite structures. Each of these require different methods for assessing the volume of water overtopping them during storms.

As an introduction to this topic, the EurOtop Overtopping Manual website, http://www.overtopping-manual.com/, presents a state of the art description of available methods for assessing overtopping and its consequences. This includes a comprehensive background, context and a detailed technical manual together with 3 independent methods for calculating wave overtopping - empirical methods (with a fully web-enabled tool), the PC Overtopping application (also web-enabled) and the Neural Network (downloadable).

This paper describes the application of an experimental operational coastal forecast and warning service developed by HR Wallingford and piloted in an area along the Dawlish coastline in South-West England. Infrastructure, in particular the main railway line, is situated right along this stretch of the sea front.

The usual purpose of such systems is to provide accurate and timely warnings of the source and magnitude of coastal hazard. This includes wave and surge levels that lead to potential coastal hazards such as severe wave overtopping or coastal erosion. Thisprototype example is based on the EuroTop Manual and a SWAN model driven by waves and winds from the UK Met Office North Atlantic European (NAE) wave model and also the UK Environment Agency surge level forecasts also generated by the UK Met Office. The model suite chains together nearshore, non-linear shoaling and breaking and EurOtop Empirical vertical wall methods to give a final overtopping volume at selected points on the coastline.

A suggested improvement to the process by using the OpenMI modelling interface standard is also given.

Plinius13-30
Air temperature induced uncertainty in real time flood forecasting over alpine basins

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Coupling meteorological and hydrological models is recognized by scientific community as a necessary way to forecast extreme hydrological phenomena, in order to active useful mitigation measurements and alert systems in advance.
In order to quantify uncertainty of flood prediction, the hydrological community is increasingly looking at the use of Ensemble Prediction System (EPS) that produce a suite of predictions in contrast to a single forecast of traditional deterministic modelling techniques. Due to an increase in computation power and data transmission

rates we are now in a position to use ensemble predictions effectively also for operational flood forecasting, but accurate reliability analysis should be performed.
The goal of this work is to evaluate how the uncertainty of EPS meteorological forecasts influences the performance of hydrological predictions in terms of Quantitative Discharge Forecast (QDF) over alpine basins, focusing the attention on precipitation and air temperature. We show that air temperature is a crucial feature in determining the partitioning of precipitation in solid (snow) and liquid phase (rainfall) and snow melting, therefore having possibility to significantly affect river discharge prediction in autumn and spring seasons even if good accuracy of precipitation forecast was reached.

Plinius13-47
Extreme Events and Wave Climate in the Central Mediterranean Sea

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The statistical analysis on more than 2 decades of wave data, collected on 15 locations in the Central Mediterranean Sea all around the Italian coasts, is here presented. Observations have been taken from the whole archive of the Italian National Wind Wave Measurement Network (RON), run by ISPRA since 1989. This study stem from the necessity of upgrading the last comprehensive report on the observed Italian wave climate, which dates 2002. An effort has been made in order to provide a common level of homogeneity and quality control to the series. The statistics considered are mainly the Joint Frequency Functions of significant wave heights with respect to directions, peak periods and mean periods. Results are shown in the form of two-entries tables and wind roses. In order to determine the relative importance of the historical storms and to estimate the expected values of the wave heights in 50 years period, the Peak Over Threshold method is applied to the sets of independent events, extracted from each series. Even though the series are limited to a 22 years period, the analysis gives valuable information about the spatial distribution of the extreme events of storms on a significant period of time, representing an important clue about the wave climate in the Central Mediterranean Area. The statistics are particularly relevant in order to assess the quality and the reliability of the wave climates obtained by means of numerical simulations on re-analysis of meteorological forecast.

Plinius13-49
Role of wind events in the generation of (sub)mesoscale structures and their implications on the biological activity of the North West Mediterranean Sea

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We study the mesoscale dynamics in the Ligurian Basin (NW Mediterranean Sea), combining the use of numerical models with satellite and in situ data. To this end, we use the Regional Ocean Modeling System (ROMS) configured at a resolution of 3 Km for a domain covering the West Mediterranean Sea.
The model is forced with daily-mean boundary (oceanic) conditions extracted from MERCATOR, and with three-hourly winds, extracted from COSMO-7, models. Analysis showed the formation of intense EKE, including mesoscale eddy structures, in association with strong wind episodes. Strong eddy activities have an impact on the dynamics of the MLD, thus conditioning higher productivity episodes with periods of intense vertical mixing. Wind-induced mesoscale oceanic dynamics has also implications on the transport of pollutants and/or of suspended matter across the Basin, with impacts for the risk assessment of adjacent coastal regions.

Plinius13-52
Operational soil moisture mapping from SAR: prospects offered by the short revisit time of the ESA Sentinel-1 mission

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Soil moisture content (SMC) is a key state variable that influences both global water and energy budgets by controlling the redistribution of rainfall into infiltration, runoff, percolation in soil, and evapotranspiration. It may have a strong impact on climate change dynamics and is, therefore, a very important parameter for hydrological applications, such as flood monitoring and weather forecasts.
The data provided by Synthetic Aperture Radar (SAR) systems are very useful to map SMC over wide areas because of the sensitivity of the electromagnetic surface scattering to the water content and the transparency of the atmosphere in the microwave range of the electromagnetic spectrum, even in cloudy conditions. Moreover, the high spatial resolution of SAR data in principle allows detecting the variability of soil moisture at small scales. This feature is particularly important in mesoscale models because of the continue increase of their spatial resolution. Indeed, sensitivity to spatial gradients of soil moisture was proved by past studies with mesoscale atmospheric models.
The possibility to map SMC at high spatial resolution is particularly important when dealing with the Mediterranean region, because many river basins of this geographical area have complex orography and include a large variety of land cover classes (also urban areas and forests in which retrieving SMC is unfeasible), so that moisture estimates from low resolution data are not particularly suitable. Moreover, floods occurring in small sized river catchments represent the most destructive natural hazards inthe Mediterranean area, so that extensive efforts are worthwhile to accurately forecast them and the quality of the forecasts might be improved by assimilating a high resolution soil moisture product.
With respect to the current state of the art in retrieving SMC from SAR data, an effort should be done to develop estimation methods exploiting the short revisit time of the future ESA Sentinel-1 mission, foreseen in the framework of the European GMES program. Indeed, the future availability of the C-band Sentinel 1 radar will allow generating frequent SMC products (every 3-6 days) and will permit developing multi-temporal inversion algorithms

that are expected to strongly increase the quality and the reliability of the SMC products.
This paper is mainly focused on the presentation of a multi-temporal algorithm conceived to be operationally used to map SMC from Sentinel-1 data. It has been developed in the framework of the "GMES Sentinel-1 Soil Moisture Algorithm Development" project funded by ESA. The algorithm assumes the availability of a time series of SAR images and is based on the hypothesis that a statistical relation exists among the soil conditions at the different times of the series (i.e. among some of the geophysical parameters involved in the problem). In particular, if the time interval between the images is sufficiently short, it can be assumed that the soil roughness does not substantially change throughout the period of SAR acquisitions, thus considerably reducing theill-posedness of the retrieval problem. The temporal series of radar data is integrated within the retrieval algorithm that is based on the Bayesian maximum posterior probability statistical criterion.
The results of some tests of the multi-temporal algorithm on a series of simulated Sentinel1-data as well as on a temporal series of ERS-1 acquisitions performed, in 1994, every 3 days over the Mediterranean region (central Italy) will be shown at the conference and the results of our multi-temporal approach will be compared to those obtained by using a conventional Bayesian mono-temporal algorithms, highlighting the improvement we obtained in terms of accuracy of the SMC estimates.

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Plinius13-53
On precipitation measurements collected by a weather radar and a rain gauge network

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The present work aims to analyze the correspondence between the rainfall radar estimates and the rain gauges measurements collected at different distances from radar. The radar data utilized in this work have been collected by the Polar 55C weather radar,located in Roma Tor Vergata research area, from 2008 to 2009. The scanning strategy adopted by Polar 55C prefigured the cyclical repetition of eight sweeps in all directions with constant elevation. Each 5 minutes 8 Plan Position Indicators are acquired,each one with a different elevation angle, ranging from 0.5 to 7.5 $^{\circ}$. This study considers measurements collected at 1.5 $^{\circ}$ elevation. The noise level is determined by supposing that at great distance the sampling volume is likely situatedin an atmospheric region above the precipitation. In this way the modal value in the last two range-bins has been chosen as a reference to determine the noise level at the receiver. The range-bins whose reflectivity doesn't exceed noise level were considered affected by noise. The modality developed for the ground clutter removal is based on the existence of typical values for the standard deviations of the differential reflectivity and of the differential phase when the radar return is caused by precipitation. In fact in the presence of meteorological echoes at the receiver, these standard deviations can be expressed by the width of the Doppler spectrum and the co-polar correlation coefficient, about which is well-known the variation range characteristic of rainfall. Only the radar reflectivity which corresponds to meteorological signal was converted into rainfall intensity by using a parametric algorithm. Finally, the radar rainfall intensity values were remapped onto a 1 square kilometre Cartesian grid, by assigning to each pixel the mean of the rainfall values estimated in the radar range-bins belonging to the pixel. Rain gauges located at different distances from Polar 55C were selected so that most of ranges in the scanning circle are covered. Moreover only rain gauges not placed in areas where the radar beam is blocked were considered. The rain gauges data were compared with rainfall radar estimates in the pixels where are located the rain gauges considered. The ratio G/R between rainfall amounts rain gauges measurements and rainfall amounts radar estimates was calculated against the distance from radar, by considering all the events utilized in this work. A trend was found; the greater the distance from the radar, the higher the ratio G/R. Once the trend has been found, a best fitting line was used to find the radar error at a given range and the radar rainfall estimates were consequently corrected.

Plinius13-56
Communication and perception of hydrometeorological risks in Catalonia

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One of the main objectives of the Hyogo Framework for Action 2005-2015 of United Nations is to increase public awareness to understand risk, vulnerability and disaster reduction globally. However, there are not so many studies that systematically assess the effectiveness of different public awareness generation strategies in actually reducing risk. This contribution presents the strategy conducted in Catalonia (NE of Spain) to improve risk awareness, the communication processes involved in the alert chain, and the risk perception of the population. With this aim we have analyzed the results obtained from the surveys about natural risk perception conducted by the General Direction of Civil Protection in Catalonia, for the period 2008-2010, with a sample composed by one thousand people approximately. According to this study, only 15% of surveyed people consider that their region can be affected by risks associated with natural phenomena like floods, windstorms, snowfalls or forest fires (in this order),although some scientific studies and reports shows than more than the major part of the population in Catalonia lives in regions than can be frequently affected by heavy rains, floods or other hydrometeorological risks (Vilaplana and Payàs, 2008; Llasat, 2010). The study also shows that people living in small towns have a lower risk perception level, while there are sectors of the population with low risk awareness, particularly between young people and people with low educational level or immigrants. To analyze these results, the main features of the present

Civil Protection plans on hydrometeorological risks are showed, with a special consideration to those aspects related with the communication to population as well as their role in the prevention, mitigation and resilience aspects. The study is completed with the analysis of the press influence in basis to the newspaper articles on natural hazards published by a Spanish journal for this period and its comparison with a longest one started in 1982 (Llasat et al, 2009b).

Plinius13-57
Social impact analysis of two heavy rain events in Catalonia: 14th and 15th July 2001 and 3rd April 2002

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Requests received in Meteorological Services arising out of the damage caused by weather events can be used as a proxy indicator of their impact on society. This contribution aims to continue the work started by the Social Impact Research Group of MEDEX project, which suggested some criteria about how to analyse these requests, and followed into the Working Group on Social Impact of HYMEX. A cumulative index (CI) was built for heavy rain events considering the following factors: maximum precipitation in 24 h, population affected by rainfall exceeding 60 mm, length of the event and coincidence with a strong wind event. The events with a higher number of requests should have a greater CI. However, some of the events couldn't be explained only by those factors, as the number of requests was lower than expected considering their high CI, or on the contrary, the number of requests received was high compared to their low CI.

These incongruities suggest that some other factors have to be taken into account. To identify them, two of the events are analysed here in detail: 14th and 15th of July 2001, when the maximum precipitation in Catalonia was 98 mm, and the Servei Meteorol'ogic de Catalunya received 129 requests, and 3rd of April 2002, when a maximum precipitation of 151.8 mm was recorded, but only 44 requests were received. For this purpose, a count of requests by municipality is carried out to obtain more detailed information. Therefore, this data is combined with population, precipitation intensity and total precipitation cartographies. One of the first results shows that in areas densely populated, the threshold used to define a heavy rain event has to be modified, mainly in cases of high intensity precipitation. This study could be a first approach to detect areas exposed to a higher impact.

Plinius13-58
Ensemble nowcasting of river discharge for flash flood warning in Mediterranean environment.

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Many efforts have been made in order to improve the reliability of quantitative precipitation estimation and to use radar data to forecast future rainfall evolution through nowcasting systems.
In this perspective the use of stochastic nowcasting algorithms plays a key role both for taking into account the uncertainty associated to the prediction of rainfall and for generation possible short term evolution of the precipitation field. Propagate the uncertainty to ground effects by using a rainfall-runoff model is a further step head to completely exploit the weather radar systems in forecasting severe events consequences.
We created a nowcasting chain for generating discharge scenarios based on the following procedures: i) an algorithm for observed rainfall estimation (RIME), ii) an algorithm for probabilistic nowcasting (PhaSt) and iii) a distributed hydrological model (DRiFt)
Some examples of application on an operational contest on small and medium-sized basins are presented.

Plinius13-62
Impact of dense shelf water and storm generated bottom currents on the seafloor of the Roses continental shelf, NW Mediterranean Sea, as evidenced by bedform analysis

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Recent studies have shown that strong bottom currents associated with short-lived (days to weeks) extreme events, such as large storms and dense shelf water flows, have the potential to transport large amounts of water and sediment over the shelf and off shelf, reshape submarine canyon floors and thus dramatically affect benthic and supra-benthic ecosystems. In this contribution we illustrate the seafloor morphology of the Roses continental shelf, in the NW Mediterranean Sea, between Cap de Creus and La Fonera submarine canyon heads, to improve the present understanding of the bottom current regime and its forcing mechanisms.

High-resolution bathymetry and very high-resolution seismic reflection data show a number of current-generated Holocene to modern bedforms and rocky outcrops on the Roses continental shelf. These bedforms include both erosional and depositional features, such as large-scale lineations, elongated and irregularly shaped overdeepenings, obstacle marks and sediment waves. Erosional bedforms cover most of the shelf in the vicinity of the Cap de Creus submarine canyon head, thus evidencing intense near-bottom sediment transport and shelf floor erosion. Depositional bedforms occur in the more sheltered middle shelf between Cap de Creus and La Fonera submarine canyon heads. The current regime interpreted from bedform analysis indicates a predominant flow towards the submarine canyons and the shelf edge, as well a depth contour parallel southwards flow along the Roses shelf. Seafloor features show a stronger impact by these bottom currents near the canyon heads, particularly near the Cap de Creus canyon head, where bedform estimated maximum bottom current velocity exceeds 60 cm s-1. The comparison between bedform-deduced information on bottom currents and present-day

oceanographic conditions, including in situ measurements, and numerical models show that the bedforms identified on the Roses shelf are inactive during fair-weather conditions. However, when high-energy events such as large storms and dense water flows occur, this bedform association becomes active. The formation and evolution of the Roses shelf bedforms must be primarily driven by intermittent erosion occurring during such extreme episodic events, which are able of remobilising shelf sediments, leading to local erosion and off shelf export mainly along canyon heads and rims.

Plinius13-63

Instantaneous rain field propagation from combined MW-IR satellite measurements using the Precipitation Evolving Technique (PET)

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When using microwave (MW) brightness temperature from AMSU/MHS cross-track scanning radiometers onboard low earth orbit (LEO) sun-synchronous operational satellites, it is possible to generate instantaneous precipitation maps for each satellite overpass. To this end, we use a retrieval algorithm which is based on a neural network trained by a pre-computed cloud-radiation database, that has been built from the application of a radiative transfer model to a series of cloud resolving model simulations of different meteorological and environmental situations.
To fill the large temporal gaps between consecutive MW snapshots, several combined microwave-infrared (MW-IR) algorithms have been proposed in the past. Their aim is the generation of High Resolution Precipitation Products (HRPP's) using the IR measurements from geostationary (GEO) satellites to enhance the spatial resolution and the temporal sampling of the intermittent rain fields estimated from the satellite-borne MW radiometers.
The Precipitation Evolving Technique (PET) produces a quasi real time HRPP by driving the evolution (shape and intensity) of the last available MW-estimated rain field by means of an iterative and statistical multi-scale pattern recognition procedure which is computed over two consecutive IR images. This allows to effectively recognize homogeneous cloud structures and their movements in the system by combining together the displacements occurring at each spatial scale. Since such an approach is spatially limited by the extension of the last MW swath coverage and temporally limited by the quick evolution of precipitating cloud structures, an *ad hoc* calibration procedure completes the algorithm.
In this paper, we show the results of the application of our latest version of PET to the analysis of some Mediterranean severe storms.

Plinius13-68

The utility of SAFRAN as analysis of near-surface atmospheric variables: the case of the snowstorm in Catalonia on 8th March 2010

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SAFRAN (Durand et al., 1993; Quintana-Seguí et al. 2008) is a mesoscale atmospheric analysis system for screen-level variables. It produces a meteorological analysis at the hourly time step using all available ground data observations and the outputsof a meteorological model, by means of optimal interpolation. One of its main features is that it is based on climatically homogeneous zones (areas where spatial gradients of meteorological variables are not very relevant) and it is able to reliably taketheir vertical variations into account.

We have implemented SAFRAN on the NE of the Iberian Peninsula (SAFRAN/NEIP). Currently, this project is being done in collaboration with AEMET, which provides us with all the available data from their synoptic and climatological networks and with the outputs of the HIRLAM meteorological model, to use as first guess. We have adopted the same grid as HIRLAM ($\sim$ 5 km of resolution). The first prototype of the system has benn implemented for the hydrological year September 2009 - August 2010.

In this contribution, we analyse the snow storm occurred on 8th March 2010 in Catalonia (in the northeast of Spain), with total amount that locally exceed 100 mm and snowfall amount of more than 40 cm measured in many places. In the Barcelona city as wellas in the Girona province, this precipitation were joint to thunderstorm and strong gusts. This snowfall had an high impact in Catalonia, during the event because it created hazardous road conditions, and afterwards because of the problem in the electrical supply in the Girona province. The precipitation was unusual for the low snow level for the month and for the electrical activity during the thunderstorms. In particular this event was characterized by the "wet snow", a kind of snow that favours the accretion on the electric lines and may cause the breaking of the line and often an electrical failure.

The added value of the SAFRAN analysis system is to provide a mesoscale atmospheric knowledge of near-surface atmospheric variables in which the observations are checked for their quality and finally the output variables are consistent among them. This last point permits to calculate risk indices as the wind-chill or the probability of "wet snow".

Plinius13-70
Atmospheric circulation characteristics favouring the development of desert dust storms in the Mediterranean

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Dust is the major component of aerosol burden in the Mediterranean, with the Sahara desert being its main source area. The transport of dust particles exhibits a significant spatial and temporal variability, primarily driven by the prevailing synoptic conditions. In the present work, the evolution of atmospheric circulation favouring intense dust episodes in the Mediterranean is examined for the period 2000-2007. An objective and dynamic algorithm is set up in order to identify desert dust (DD) episodes, and classify them to strong and extreme ones, according to their aerosol optical depth values at 550nm (AOD550nm). The algorithm identifies the DD episodes, based on the synergistic use of aerosol optical properties (e.g. Ångström Exponent) derived by MODIS-Terra, Earth Probe and OMI satellite databases. Strong and extreme DD episodes are determined at the geographical cell (1ox1o) level, on a daily basis, over the entire Mediterranean, for the study period. A desert aerosol episode day (DAED) is defined whenever DD episodes occur in at least 30 pixels, provided that AOD data are available for at least 300 pixels (50% of the study region), to ensure adequate spatial coverage. According to our method, 62 DAEDs are finally found during the 7-year period, taking into account that consecutive DAEDs are considered as a unique day. The corresponding atmospheric circulation before, during and after the DAEDs are objectively classified into 6 representative types of atmospheric circulation (clusters), byapplying S-mode Factor Analysis and Cluster Analysis to mean sea level pressure (MSLP) and 700 hPa geopotential height (Z700) data, obtained from the NCEP/NCAR Reanalysis Project.
According to Cluster 1 (8% of 62 DAEDs), a 700hPa trough is moving south-eastwards across the eastern Mediterranean, getting steeper, inducing DD episodes in the eastern coasts. In Cluster 2 (5%), a 700hPa trough is moving from the Iberian Peninsulaover W. Sahara, inducing a strong southwesterly airflow, carrying dust particles towards the E. Mediterranean. Cluster 3 is the most frequent (53%) and prevails during summer, with dust being transported towards the W. Mediterranean. In Cluster 4 (8. Mediterranean. In Cluster 5 (5%), the central and, secondarily, the eastern part of the Mediterranean are affected by intense dust outflows from Sahara, because of a southwesterly flow at 700hPa, getting more pronounced from DAED-2 to DAED, while a surface southerly flow is induced by the combination of a depression centered over Algeria and a high pressure system in the eastern part of the study region. Finally, in Cluster 6 (18%), a 700hPa trough is moving eastwards, from the Iberian Peninsula, while the combination between a depression over the C. Mediterranean and an anticyclone over the E. Mediterranean is getting stronger. The southeasterly and southerly flows at Z700 and MSLP, respectively, favour the dust transport towards the E. Mediterranean.

Plinius13-71
Merging radar data and raingauge observations: example of application

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The estimation of rainfall fields, especially its spatial distribution and position, is a crucial task both for rainfall nowcasting and for modeling catchment response to rainfall. Previous studies have suggested that discharge estimations are improved when radar and rain gauge data are combined to estimate input rainfall fields. A recently proposed merging algorithm is the so called Conditional Merging (CM), which makes use of an interpolation technique to extract the optimal information content from theobserved data. This work reports an application of CM in North-Western Italy with several elements of innovation. Over this area are both available a dense network of raingauge measurements and a C-band polarimetric weather radar located at Monte Settepani. The main innovation respect to classical CM is on the estimate of both the structure of semivariogram and the length of spatial correlation λ directly from the cumulated radar rainfall fields. An application to several test cases together withevaluation of algorithm performances are presented and discussed.

Plinius13-73
Operational application of a probabilistic flood forecasting chain in the Mediterranean environment

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The prediction of the small-scale spatial-temporal pattern of intense rainfall events is crucial for flood risk assessment in small catchments and urban areas. In this work we present a hydrometeorological probabilistic forecast system for small and medium size basins, designed for operational applications. Following the idea presented by Siccardi et al. 2005, the probabilistic approach allows to face the problems related to the reduced dimension of the basins and to properly account for uncertainty sources in the prediction chain. Starting from Quantitative Precipitation Forecasts (QPF) issued by a regional center which is in charge of hydrometeorological predictions in Liguria Region, the system is able to issue probabilistic warnings both following a catchment-based criterion (single site) or following an area-based approach (multi-catchment).

Plinius13-74
Towards tsunami hazard assessment for the coasts of Italy

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Mediterranean shorelines have been repeatedly struck by large tsunamis in the past. The current understanding of offshore seismogenic sources is indicative of a potentially destructive tsunami hazard, which is turned into potential high risk for the concentration of population, infrastructures, and activities on coastal plains. Nevertheless, official tsunami hazard maps do not exist for the Italian coasts.
Since large tsunamis are relatively rare events, tsunami hazard assessment must rely on diverse sources of information to integrate historical catalogues, including knowledge on the active tectonics and seismicity rates, geodetic monitoring, paleotsunami evidences, and any data that can be indicative of the frequency and magnitude of tsunamigenic events. Similarly to current practices in seismic hazard assessment, the bulk of this information should be conveyed into a probabilistic framework, taking intoaccount significant tsunami peculiarities, such as the role and importance of distant but large sources, while properly treating all of the relevant uncertainties. Differently from seismic hazard assessment where the ground shaking can be readily calculated by using ground motion prediction equations, probabilistic tsunami hazard implies the calculation of a huge number of numerical scenarios. Even with current computational capabilities, the production of probabilistic inundation maps requires specific strategies of computational burden reduction to make it a feasible task. Here, we present preliminary results of probabilistic tsunami hazard assessment for the coasts of (southern) Italy based on the above concepts. We mainly focus on methodological aspects, and limit our study to tsunamis of tectonic origin.

Plinius13-75
Probabilistic rainfall thresholds for debris flows triggering in pyroclastic soil mantled slopes of Campania (southern Italy)

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As reported by the chronicles of the last century and by the occurrences in recent years, the mountain ranges that surround the Somma-Vesuvius volcano are intensely affected by dangerous rainfall-triggered debris flows, which involve ash-fall pyroclastic deposits mantling slopes. In this framework, the proper identification of rainfall thresholds for landslides triggering is a challenging issue for the risk reduction in the towns located at the feet of the mountain slopes.
We carried out a research focused on the analysis of rainfall conditions that have triggered debris flows events whose occurrences were reported in chronicle sources since the beginning of the last century and collected in landslide archives. The rainfalldata of the day of the landslide event and of the antecedent period were chosen among those recorded by the most representative raingauge stations of the area in which the landslides have occurred. The rainfall events, which did not trigger landslides, were also considered through the acquisition of historical rainfall sequences derived from the most representative raingauge stations.
Rainfall thresholds were reconstructed considering two known hydrological empirical models, the first based on the intensity and duration (I-D) of the triggering rainfall and the second based on the triggering rainfall cumulated in the day of the event compared with the antecedent cumulated rainfalls (P-Pa). For each of the examined rainfall conditions that triggered debris flows, the return times were estimated allowing the evaluation of the significance of the collected rainfall data.
The rainfall thresholds for triggering debris flows were calculated with a probabilistic approach by means of the bivariate logistic regression model. Moreover, the conditional probability of the landslide occurrence, considering also the probability of occurrence of rainfall conditions, was estimated. All collected data were used to obtain probabilities of slope failure with different combinations of rainfall intensity and duration as well as different combinations of rainfalls in the day of the landslide event and the antecedent rainfalls.

The logistic regression model was found as a suitable method for analysing the rainfall data, related to landslide and non-landslide events, which were scattered and overlapped due to biasing factors such as the not representativeness of the rainfall records respect to real values fallen in the landslide source area and the different hydrogeomorphologic conditions of each landslides. The obtained results indicated a reduction of the conditional probability of landslide occurrence for rainfall eventsassociated with high values of the return period, while, for the events associated with values of return period under 10 years, a value not very different from the normal probability.

Plinius13-76
Combining TerraHidro and SISMADEN Open Source Systems use as Warning for Extreme Natural Disasters

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Climate changes and disorderly anthropic land occupations have been causing social and economical damages due to extreme natural disaster occurrence. Understanding how these disasters happen before their occurrences is fundamental to avoid damages. Computational tools have been created and are fundamental to support experts who work to mitigate these situations. Therefore, we present TerraHidro and SISMADEN, open source systems, which work together to prevent extreme disaster situations. TerraHidro is a platform designed to develop distributed hydrologic models. Natural Disaster Monitoring and Warning System – SISMADEN is a computational system which provides the technological infrastructure required to develop operational systems for environmental risksmonitoring

and alert. SISMADEN provides alerts using data extracted from environmental remote databases, in real time. Alerts can be trigged by specific points, for instance, at the water quality sensor coordinate, or by regions as cities, hydrographic basins, or other region partitions. Here we use the hydrographic basin partitions. Both systems are being developed at Image Processing Division – DPI of the National Institute for Space Research - INPE, Brazil.
TerraHidro has a tool to extract local flows from DEM and to calculate the accumulated area flows for each local flow, i.e. the number of upstream local flows that contributes to the considered local flow multiplied by the grid cell area of DEM. TerraHidro also extracts drainage network from accumulated area flows, as well as defines basins and sub basins. Basin determinations are flexible. Experts can choose several drainages using different thresholds that result in different basin partitions, and in different basin sizes.
These basins are used by the SISMADEN system. Each basin will represent a disaster alert area. In case of flooding, it is important to identify the basins with high flood risks. To calculate a region risk level, SISMADEN accesses remote databases containing climatic and environmental information regarding the specific disaster type that is being modeled by SISMADEN. Whenever a database is updated, the process that calculates the disaster is triggered and a model is executed.
As TerraHidro and SISMADEN share the same local database structure, the basin partitions defined in the TerraHidro can be used directly by SISMADEN. Similarly, the alert values generated by SISMADEN can be used by TerraHidro to study and analyze disaster behaviors in time/space. This synergy is possible because both systems use the same software platform named TerraLib, also developed at DPI/INPE. It is an open-source GIS software library that supports coding of geographical applications using spatial databases, and stores data in different DBMS including MySQL and PostgreSQL. An example of the match between TerraHidro and SISMADEN will be presented, emphasizing the basin division of the Liguria Mediterranean region.

Plinius13-84
A study of the urban Heat Island effect in Cyprus using Artificial Neural Networks

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The intensification of urbanization evidenced in Cyprus during the last 30 years has caused a rapid growth of the size of the Cyprus' main cities which has affected the local climate. The contrast of energy absorption from developed urban areas and surrounding rural areas results in a differentiation of the local climate, as evidenced from climatological records, known as the Heat Island effect. The direct effect on increasing the maximum and minimum temperature in urban environments affects also extreme weather events (e.g. the frequency of occurrence and intensity of thunderstorms).
It is not feasible to study the Heat Island effect with the traditional observational methods: even a dense network of temperature sensors is not sufficient to provide the necessary detail to identify the effect. However, available tools to investigate this phenomenon comprise high-resolution skin surface temperatures detected from polar orbiting satellites. Regarding the usage of satellite information, there is a trade-off between the spatial scale and image availability. The MODIS satellite passes twice a day over Cyprus, roughly at the same time, and provides skin surface images at 1km^2 resolution.
This research focuses on the identification and mapping of the hotspots in urban areas and the creation of a neural network model able to connect the skin temperature fields from the satellite, air temperature from climatological networks and numerical weather prediction models and to offer this site-specific information to public through mobile technologies.
The project is funded by the Cyprus Research Promotion Foundation.

Plinius13-85
Recent advances and challenges in storm surge and flood forecasting: Examples from Delft-FEWS

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Modern open-platform forecasting systems enable the forecasting agencies to run multiple models or even model chains in parallel. They provide a one stop shop for forecasting, displaying and analyzing measurements and forecasts, and creating forecast products. In addition, modern open-platform forecasting systems enable the introduction of new methods for improving forecasts and quantifying uncertainties.
An overview will given of current advances and challenges in forecasting in different parts of the world. Examples include flood, storm surge and wave forecasting in the Netherlands, rapid satellite-based flood mapping, dike/levee or seawater defense strength forecasting, predictive uncertainty estimation, and examples of early warning systems for tsunami and typhoon prone areas.

Plinius13-91
Rainrate estimation and accuracy assessment in complex orography from C band single polarization weather radar

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Rainfall estimation errors by weather radars, are usually categorized into two main groups: systematic and random errors. Systematic errors include biases and range dependent effects. The main source of bias errors include drifts in radar calibration constant and systematic

variations in the relationship between radar reflectivity and rain-rate. For range-dependent errors, they are caused mainly by the scan geometry of weather radars, the variations in the reflectivity profile, the attenuation by rain andpartial beam filling. On the other hand, random errors could originate from the variability of rainfall within the resolution cell and radar hardware system noise. The presence of complex orography introduces amplification effects for some of these errors.
In this work an analysis of systematic errors from the single polarizarion radar of the Abruzzo region in the center of Italy is dealt with. To pursue this aim, a large set of data covering a two year period from 2008 to 2009 and consisting of radar scansand gauge measurements, have been collected and carefully processed. Efforts to mitigate systematic errors of radar rain estimation are mainly based on the modelling of the ratio between gauge observed and radar derived rain as a function of spatial coordinates. On the other hand, the assessment of the accuracy associated to the radar rainfall estimations is achieved by the definition of the spatio-temporal correlation function of the rain estimation error and biases as a function of the orography and seasonal effects.

Plinius13-92
Mediterranean Atmospheric Fronts. Analysis and Forecast of the Three-Dimensional Geometry

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The atmospheric fronts' geometry is evaluated on standard baric levels according to data of the objective analysis (or of the forecast) of basic meteorological fields on global regular latitude-longitude grids. The traditional predictors of the fronts are1) vertical component of the wind's vorticity; 2) Laplacian of pressure upon a sea level; 3) temperature gradient. We use (instead of the first ones) maximal eigenvalues of the following matrices: a symmetric part of matrix Jacobi horizontal wind and thesecond horizontal derivatives (matrix Hesse) geopotential (or pressure upon a sea level), correspondingly. We use also vertical derivatives of the wind. Then we search the optimal weight, dependent on the season and the baric level, for these four predictors' combination.
We use high order approximations (fast Fourier transform and compact scheme approaches). Heuristic methods of construction of the frontal thin zones along "crests" in the predictor's 2D field are developed. Also we use some algorithms for a vertical adjustment of the frontal lines.
A validation of the geometry's evaluation is considered, too. We calculate two kinds of correlation functions (CF) for the basic meteorological fields. CF are functions of the distance between to points. Two clusters of points' pair are used: the points are divided by a frontal zone and points not are divided by a frontal zone. Our algorithm (with optimal weights of various predictors) provides significant difference (in the integral norm) between these CF.
Thus, we demonstrate an algorithm, codes and results, base 0.5? NCEP analysis and 12-, 24- or 36-hour forecasts that construct frontal surfaces. Usually we obtain frontal surface that across all troposphere. However, sometimes we observe such surface nearEarth only, or, on the contrary, in higher troposphere only. The 3D-geometry of such surfaces is sometimes sophisticate. We compare our results with satellites photos.
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Plinius13-96
Potential of High-resolution Detection and Retrieval of Precipitation Fields from X-band Spaceborne Synthetic Aperture Radar

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X-band Synthetic Aperture Radars (X-SARs), able to image the Earth's surface at metric resolution, may provide a unique opportunity to measure rainfall over land with spatial resolution of about few hundred meters, due to the atmospheric moving-target degradation effects. This capability has become very appealing due to the recent launch of several X-SAR satellites, even though several remote sensing issues are still open. This work is devoted to: i) explore the potential of X-band high-resolution detection and retrieval of rainfall fields from space using X-SAR signal backscattering amplitude and interferometric phase; ii) evaluate the effects of spatial resolution degradation by precipitation and inhomogeneous beam filling when comparing to other satellite-based sensors. Our X-SAR analysis of precipitation effects has been carried out using both a TerraSAR-X (TSX) case study of Hurricane "Gustav" in 2008 over Mississippi (USA) and a COSMO-SkyMed (CSK) X-SAR case study of orographic rainfall over CentralItaly in 2009. For the TSX case study the near-surface rain rate has been retrieved from the normalized radar cross section by means of a modified regression empirical algorithm (MREA). A relatively simple method to account for the geometric effect of X-SAR observation on estimated rainfall rate and first-order volumetric effects has been developed and applied. The TSX-retrieved rain fields have been compared to those estimated from the Next Generation Weather Radar (NEXRAD) in Mobile (AL, USA). The rainfall detection capability of X-SAR has been tested on the CSK case study using the repeat-pass coherence response and qualitatively comparing its signature with ground-based Mt. Midia C-band radar in central Italy. A numerical simulator to represent the effect of the spatial

resolution and the antenna pattern of TRMM satellite Precipitation Radar (PR) and Microwave Imager (TMI), using high-resolution TSX-retrieved rain images, has been also set up in order to evaluate the rainfall beam filling phenomenon.As expected, the spatial average can modify the statistics of the high-resolution precipitation fields, strongly reducing its dynamics in a way non-linearly dependent on the rain rate local average value.

Plinius13-97
W-band Radar aboard the International Space Station for Geo-climatic and Hydro-meteorological Tracing: a mission concept

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The basic idea of the WRIGHT (W-band Radar aboard the International Space Station for Geo-climatic and hydro-meteorological Tracing) mission is to foster the measurement of one of the key issue in global and regional climate, namely the hydro-meteorological cycle, and specifically the cloud water content spatial and temporal microphysics and dynamics. Cloud water distribution is one of the most important issues in heat exchange and transfer for Earth climate and Earth-Sun radiative balance. At regional and global level perturbations of the hydro-meteorological cycle are the driving features of climate changes with huge impact on economical and social aspects of human lives.
Cloud water phase, either liquid or ice or mixed, is an essential knowledge for properly characterizing the climate feedbacks due to the atmosphere. Cloud vertical and horizontal distribution, in terms of texture and stratification, is also crucial to understand its albedo properties and to further study the nucleation processes due to atmospheric aerosols at different layer heights. Light stratiform precipitation is of outmost importance within the global hydrological cycle, as it accounts for more than 75% of global precipitation. Moreover, the three-dimensional (3D) dynamics of clouds, in terms of wind field mean and deviation, is crucial to assess the cloud formation and development phenomena as well as the atmospheric turbulence processes. The assessment of cloud microphysical and dynamical properties for geo-climatic applications needs a mid-long term measurement baseline with stable and accurate instrumentation.
The WRIGHT mission is able to cope with above mentioned issues by exploiting new capabilities of the emerging millimeter-wave technology. The WRIGHT mission is aimed at embarking a W-Band Hybrid Imaging Radar (WHIR), with a 94-GHz scanning, Doppler, and pulse-compression capabilities, aboard the International Space Station (ISS) at 355-km orbit height with an inclination of 51.6°. The employment of a W-band radar is not new in space, as CloudSat satellite has been carrying a nadir-pointing incoherent one since 2007 whereas the EarthCARE mission foresees a W-band nadir-pointing incoherent radar together with a lidar, both in a sun-synchronous. However, the unique features of the WRIGHT advanced radar are: i) WHIR will be a scanning instrument thusproving multi-level reflectivity imagery of the cloudy atmosphere for the first time from space; ii) WHIR will be coherent and capable to measure slant-path radial Doppler frequency whose knowledge will provide a velocity field for the first time from space; iii) the pulse-compression capability of WHIR will provide a range resolution of few hundreds of meters with a fine detailed vertical sampling of the atmospheric scenario; iii) the embarkment aboard the ISS will allow WHIR to be a well-maintained andeasily replicable instrument thus allowing a mid-long term scenario (if the ISS program will last) of stable and homogeneous measurements for the equatorial, tropical and mid-latitude regions.

Plinius13-101
Sensitivity of precipitation mesoscale numerical forecast to different initial conditions and weather radar data assimilation strategy

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To evaluate the impact of radar data assimilation on a heavy rainfall case, different simulations are performed using the Weather Research Forecast (WRF) version WRFV3.2 model and the 3-dimensional variational (3DVAR) assimilation technique. The case study is the Aniene flood, occurred during May 19-22 2008 in the urban area of Rome causing severe damages. Weather radar data derived from Monte Midia single-polarization instrument (located at the border between the Abruzzo and Lazio regions) have been assimilated to improve high resolution initial conditions.
A set of numerical experiments is performed, making sensitivity tests both to different set of Initial Conditions (ECMWF analyses and so called 'warm start') and to a different assimilation strategy (3-hours data assimilation cycle). In addition, sensitivity tests to outer loops to include the non-linearities in the observation operators are performed for each of the previous experiments. To objectively identify the best simulations, statistical indicators are used as FBIAS, RMS and EQTS for the accumulated precipitation. Results will be presented and discussed during the talk together with open issues and ongoing work. The latter includes the tuning of the length scale of the background error covariance and observation error parameters.

Plinius13-102
Multi-approach analysis of a Mediterranean storm in complex orography: case study on 19-21 September, 2009

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A Mediterranean storm developed on 19-21 September, 2009 has been observed by two radars located on the central Italy (i.e.: single polarization Monte Midia and dual polarization Il Monte radar). This storm produced a strong and intense surface precipitation with a maximum rain rate of approximately 70 mm/h. The storm has been

investigated by a multi-approach analysis, focusing on both the meteorological and hydrological aspects using WRF model and Radar data. The numerical simulations have been performed using the new generation mesoscale model WRF. The model simulations have been used to test the following aspects: - the microphysical performance of the model, comparing the simulated hydrometeors contents of rain, graupel and snow with those retrieved by the Il Monte radar. Vertical profiles and horizontal distributions of the radar-derived and simulated microphysical quantities have been used for the comparison. In principle, this allows investigating the role of the WRF microphysical parameterizations and testing the better scheme to adopt for operational purposes. - the characterization of the planetary boundary layer (PBL) and the modeled parameterizations performances with different surface schemes by comparing model result with observations coming from different ground based instruments. - the impact of radar data assimilation to improve high resolution initial conditions; both reflectivity and radial velocity, with or without conventional observations like soundings and surface data, are ingested in the WRF model using 3D-Var assimilation technique. About the hydrological aspect a sensitività analysis has been performed to evaluate the impact of the various modeling strategies of the CETEMPS distributed hydrological model (CHyM).

Plinius13-103

Investigating the impact of high resolution surface humidity on WRF PBL and microphysics fields

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In weather forecast models the representation of land-atmosphere interactions has a strong impact on the Planetary Boundary Layer (PBL) and, in turn, on the forecast. Soil moisture is one of the key variables in land surface modelling, and inadequate initial soil moisture field can introduce major biases in the surface heat and moisture fluxes. In previous studies, the soil moisture field derived from high spatial resolution ENVISAT/ASAR observations has shown significant biases and variability compared to the soil moisture field available from ECMWF analysis. In some cases, such as the Tanaro flood event of April 2009, the use of drier and highly resolved soil moisture field in the initial conditions of weather forecast model, lead to a significant impact on the precipitation forecast, particularly evident during the early phase of the event. The timing of the onset of the precipitation, as well as the intensity of rainfall and the location of rain/no rain areas, were better predicted using ASAR derivedsoil moisture field as initial condition in the forecast model. With the advent of future generation of SAR systems such as Sentinel-1, with an improved temporal resolution due to a revisiting time of few hours, it is important to investigate further on the usefulness of SAR derived soil moisture field on weather forecast, also for operational purposes. The effect of soil evaporation on the PBL structure is determined not only by the soil conditions, but also by a number of climatological parameters. Depending on the atmospheric conditions, a significant variation of land surface moisture can produce an increase, decrease or no change of cloud amount and precipitation. The sensitivity of a weather forecast model to initial soil moisture conditions depends not only on the thermodynamic structure of the atmosphere and on the role of synoptic forcing for a specific event, but also on the ability of the model to reproduce the large and small scale interactions, which, in turn, depends on a number of assumptions and parameterizations in the model.
In this study, the Advanced Research WRF (ARW) model is used to explore the response of both PBL and microphysics fields to initial high spatial resolution soil moisture data. Sensitivity studies are carried out using different PBL and microphysics schemes to investigate how specific parameterizations make the precipitation forecast more or less sensitive to the initial soil moisture field. Rain gauges and/or radar data available for selected case studies are used as ground truth.

Plinius13-104

Investigation of urban boundary layer by high resolution models and ground based observations in Rome area: understanding parameterizations potentialities

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The urban areas largely influence local evolution of the atmospheric boundary layer as the urbanization represents a significant forcing on thermo-dynamical state. The efficiency of the urban areas in storing heat can produce noteworthy mesoscale perturbations of the lower atmosphere. The new generations of high-resolution numerical weather prediction (NWP) models has been also applied to urban area for both weather forecast and research. Therefore, it is critical to correctly reproduce the urban forcing which turns in variations of wind, temperature and water vapour content of the PBL. The new generation model WRF has been used to reproduce the circulation in the urban area of Rome. A sensitivity study is performed using different PBL parameterizations and different surface schemes. The significant role of the surface forcing in the PBL evolution has been verified by comparing model results with observations coming from LIDAR, SODAR, sonic anemometers, soundings and surface stations measurements. A further comparison is performed with the mesoscale model MM5. Different urban canopy models (UCM) have been tested, showing the fundamental role of a correct urban representation at high resolution. Three meteorological event have been studied, chosen as statistically relevant for the area of interest; the WRF model shows a reiterated tendency in overestimating vertical transmission of horizontal momentum from upper levels to low atmosphere, that can be partially corrected if a local PBL is used coupled with an advanced UCM. Depending on background meteorological scenario, WRF shows a reversed behavior in correctly representing canopy layer and upper levels when local and non local PBL are compared. Moreover a tendency of the model in largely underestimating vertical motions has been verified. Comparison with data from surface stations outside the urban area allowed to study its influence on surroundings; also in this case the role of UCM on correctness of high resolved forecast has been evaluated.

Plinius13-106
Spatio-temporal relative humidity patterns and extreme wildfires in the Mediterranean

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Extremely hot temperature, strong winds and the actions of arsonists are usually referred as major causes of the thousands wildfires which spread every year through the Mediterranean countries. Of all these wildfires, only few rare events can be considered as a major threat to the population and a civil protection emergency. Since, in case of severe weather conditions, the causes of fire ignition are often related with negligence, it is extremely important to be able to predict and discriminate extreme danger conditions, in order to avoid fire ignitions by means of preventive actions.

Many peculiarities make Mediterranean wildfires different from other natural risk: the most relevant is that fire ignitions are human caused in more than 90% of fire events. Fire spread is related with vegetation cover, orography, and fuel moisture content and wind conditions. The ability of fire fighters to cope with the fire front is also a major factor in determining the area potentially covered by a wildfire and the damages caused by the event. In literature all these aspects are considered, in order to define tools able to predict and manage wildfire risk.

Finding precursors for extreme wildfires throughout Mediterranean regions is the focus of this work. As Mediterranean storms are usually related with extreme precipitation and consequent floods, in this paper we propose to consider extreme wildfires in the Mediterranean as a specular aspect of "traditional" Mediterranean storms. While floods are related with soil moisture conditions, vegetation cover, topography and their main trigger are extreme precipitation events, wildfires are usually considered as the complex results of several heterogeneous aspect, and strong winds and high temperature are often considered as the main drivers in extreme wildfire risk conditions.

In this work, we considered the extreme events occurred during the 2007 summer season , highlighting the extremely low relative humidity of the air at the soil level associated with the occurrence of extreme wildfires. The summer of 2009 is also taken into account, because the same meteorological scenario characterized the extreme wildfires that spread across Sardinia (Italy).

We propose to consider space-time relative humidity patterns in the closest layer to the soil as the main driver of extreme Mediterranean wildfires. Hourly data, gathered so far from 1st January 2007 by the hygrometers available by the Network of Civil Protection Functional Centers have been analyzed. Minimum values of 48h moving average and their coefficient of variation have been analyzed in connection with the most severe events occurred in Italy. Despite the day-night cycle has a very strong influenceon relative humidity at the ground level, minima around 30% are revealed to occur often in the very proximity of the burnt areas less than 24 hours before the fire breakout.

Results show that extreme Mediterranean wildfires can be related with anomalies in space-time distribution of atmospheric relative humidity (extremely dry conditions).

Plinius13-108
Estimation of Water saturation in Porous Media by Imaging technique

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A variety of non-destructive, non-invasive laboratory techniques currently are utilized for the measurement of water saturation in porous media. Common examples include: gamma-ray attenuation. X-ray transmission and light transmission/reflection; of thesetechniques, light transmission requires the least amount of specialized equipment and is by far the lowest cost alternative.
In this research we develop a light transmission technique and we assess the experimental error associated with the calibration and experimental methodology. The experimental apparatus, here considered, is constructed of a transparent Perspex chamber of internal dimension 0.2 x 0.28 x 0.01 m, simulating a quasi-2D porous media, and is filled with transparent glass beads. The thickness of the chamber is sufficiently thin to let the possible effects of non-homogeneity be mediated all along the thickness. The model is illuminated by a diffuse-backlight source whose wavelength peak is tuned to match the absorption band of the water. In order to establish the relationship between the image intensity, detected by the CCD camera, and water content (water saturation) in the physical model, a calibration over the whole imaged area was conducted. Different source of error has been investigated: error on the recorded light intensity, error of the parameter estimation of the calibration algorithm, uncertainty on the size of the averaging volume needed for the estimation of the water saturation.
The water saturation is estimated under hydrostatic condition and steady water injection in the unsaturated zone. The imaged saturation field is compared with analytical solution of vertical distribution of saturation in a simple hydrostatic case. e

Plinius13-109
A Early Warning System Based On Grid Infrastructure

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The Early Warning System is developed by ITHACA (Information Technology for Humanitarian Assistance, Cooperation and Action) in collaboration with Istituto Superiore Mario Boella (ISMB), under a special request made by World Food Programme (WFP), the foodaid branch of the United Nations, in order to increase efficacy in approaching emergency preparedness related to flood events. The system is conceived to give an alert in advance about the occurrence of heavy rainfalls around the world which can be used by WFP or other humanitarian assistance organizations to evaluate the event and understand the potentially floodable areas where their assistance is needed. The rainfall dataset used in this project is the Tropical Rainfall Measuring Mission (TRMM) Multisatellite Precipitation Analysis (TMPA). The expected amount of data received every day are approximately 2.5 million rainfall values,

corresponding to 312000 values each three hours. The first requirement is related to the hydrological analysis in a time not exceeding three hours, since after this time the next values of rainfall are downloaded and prepared for a new analysis. This product is delivered in near real-time for monitoring the current rainfall condition over the world. Considering the great deal of data to process continuously, this contribution presents a flexible architecture based on Grid Computing technique in order to reduce the total processing time for the real time rainfall analysis. The Flood Grid Architecture is composed of 11 nodes:a master nodes and 10 worker nodes for the analysis. Each worker node is configured to run the hydrologic model, while the master node is configured to download data file from NASA Server and distribute these data to each node on the grid architecture. We want to focus the attention on the advantages of using a distributed architecture in terms of performances comparing the different processing time between a sequential approach on a single node and a parallel approach on a distributed architecture.

Plinius13-112
Temporary intervention for coastal risk mitigation with low environmental impact

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As well known, the ionic coast of Basilicata (Southern Italy) is strongly affected by erosion processes inducing severe critical condition for both urban areas and local tourism economic. Topographic/bathymetric information, collected by different sourceslike multisource platforms, IGMI cartographic data, airborne and satellite imagery, as well as echo-sound, clearly outline such processes staging from the early ’50 with an increasing rate observed in the ’60-’80 period. These phenomena have different features and effects in both southern and northern parts of the coastal area, between Sinni - Agri deltas and Basento - Bradano deltas respectively, compared to the central littoral area, located between Agri - Cavone - Basento deltas. Such different effects are relevant in terms of maritime vulnerability and shoreline changes sensitivity mainly due to the drastic reduction of sediment supply from river catchments induced by human activities, land use changes, land defence interventions water resources infrastructures and management interesting all the Lucanian river basins.
Further, in the last 15 years, coastal erosion produced critical effects on the Metaponto Lido area, located in the northeast part of the littoral, and characterised by typical fine sandy beaches with a shoreline of about 6 km, gently sloping off shore by1-2 %, branded by the presence of 2 and 3 orders of natural bars. The urban area has a sea side town village with a longshore promenade water front designed for rehabilitation and requalification of the beach fruition.
The widespread presence of permanent and seasonal structures, built on the longshore sand dune close to the foreshore, amplified the wave actions increasing the local erosion rates.
The severe winter and spring sea storms in 2008 and 2009, emphasized the erosion intensity and trend until to induce structural falls and partial collapse of the promenade, changing the scenario from "ordinary" environmental risk up to civil protection setting due to the increasing coastal inundation risk. Further, during the spring 2009, a simply beach nourishment, of about 50.000 m3, was easily performed with any stabilization structures such as groins or breakwaters, suddenly eroded during the winter season 2009-2010.
In such scenario, the Department of Environmental Engineering and Physics (DIFA) of Basilicata University and the Regional Authority proposed an experimental temporary intervention with a low environmental impact able to mitigate and contrast the coastal risk. The intervention aimed to reduce the spring storm damage, for both town safety and beach erosion, arranging a "no structural" stone barrier all shore long periodically moved out-beach once the storm set down. Such maintenance, performed during the spring season 2010 produced a natural beach nourishment with a sensitive average coastline advancing. The temporary intervention allowed the reduction of fill sand volume for the summer 2010 re-nourishment at 5.000 m3, to be located only in few parts of the interested littoral with extremely positive effect for public finance and local tourism economy. The maintenance activities have been performed even during the spring season 2011 employing the same used materials and obtaining a positive effect on the beach extension too. The temporary character of the intervention, of course, does not avoid the structural works to be further achieved for coastal protection and erosion mitigation.

Plinius13-114
Spatiotemporal hazard assessment of rainfall-induced shallow landslides in Italy

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The use of real-time early warning systems for shallow rainfall-induced landslides is attracting the attention of the scientific community, even if effective landslide warnings are far from reality in most landslide-prone areas. Some of these systems, which are based on empirical precipitation thresholds for landslide occurrence, are starting to be used more and more as a tool in territory administration, since they allow a "dynamic" (time varying) monitoring on regional scale and environmental management. It is clear that the most innovative systems require coupling between rainfall amounts, hydrological models, and slope-stability models, without disregarding the interaction between the different aspects of the problem. The paper deals with the application, on a regional scale in the Italian territory, of a physically-based stability model (SLIP - Shallow Landslides Instability Prediction). The SLIP model has been firstly developed at the Department of Civil Engineering of University of Parma since 1997, to describe the triggering mechanism of soil slips. More recently the SLIP model has been adopted by the Department of National Civil Protection as a prototype early warning system for rainfall-induced landslides in Italy, using rainfall data and geospatial datasets. The model, which is based on the limit equilibrium method, is deliberately simplified, in order to evaluate the safety factor of a slope in function of the

geotechnical characteristic of soil, of geometrical features of the slope and of rainfall depth.
A back analysis concerning the occurrence of some recent case-histories of soil slips in the Italian territory is carried out and the main results are shown. The main features of the SLIP model are briefly recalled and particular attention is devoted to the discussion of the input data, which have been collected through a Geographic Information System (GIS) platform. Results of the slope-stability analysis on national scale, over a one year time interval (October 2009 – October 2010), are finally presented. The results predicted by the SLIP model are analyzed in terms of safety factor (Fs) maps, corresponding to some particular rainfall events. The paper shows the comparison between observed landslide localizations and model predictions. Notwithstanding an improvement in terms of accuracy is needed, the application of the model on the study area guarantees a good agreement between the instability condition and the expected date and localization of the considered events. The obtained results suggest thatthe output of the SLIP model could be used to define different levels of "dynamic" susceptibility. If coupled with a model of forecast rainfall, SLIP could be the basis for the development of an early-warning alert system against the phenomena of interest, especially if adopted as a local scale tool, in the framework of an alert system at a wider scale.

Plinius13-115
The uncertainty impact of multiple linear statistical downscaling model (SDSM) on runoff

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The pattern with the center of high/low pressure over the western Mediterranean which reflects the Mediterranean oscillation is the most important climate variability mode in the region. Atmospheric systems affecting the West of Iran are mostly Mediterranean. Semiarid landscapes represent an important ecosystem surrounding the Mediterranean Basin for which little is known on runoff generation. Knowledge of the sources and patterns of variation in infiltration–runoff processes and their controls is important for understanding and modeling the hydrological functions of such ecosystems. The purpose of this study is runoff modeling during the years of 2040 to 2069 on Behesht- Abad sub-basin. For this purpose, first using AOGCM model's climate scenarios, the best model for the area was selected on the years 1961 to 1990. Then, by record of Shahrekord and Borujen synoptic stations Precipitation, Minimum temperature and Maximum temperature in these stations were downscaled. In the next step, the uncertainty analysis of downscaled data and possible use in SWAT Hydrological Model were considered. After running SWAT model, Calibration and validation using SUFI-2 reverse modeling method have been done and capability of SWAT model to predict runoff was determined. In the last step, using climate scenarios generated for the period 2040 to 2069, runoff was estimated. Results indicate that the HADCM3 is the best GCM Model in this area. Uncertainty analysis was shown that the SDSM model has a good result in downscaling at Shahrekord synoptic station opposite to Borujen station and the SWAT model has a good result for calibration and validation. Based on the obtained results, total annual rainfall will reduce 49%, minimum and maximum temperature will increase 10% and 30% respectively. Generally, the results of this study indicate a reduction in runoff and the changes of the climate from Semi-arid to dry. From the viewpoint of possibility of flood, the years of 2046, 2040, 2056, 2058, 2055 and 2048 are the most critical.

Keywords: Uncertainty, Statistical Downscaling Model (SDSM), Runoff, North Karon, Iran

Plinius13-116
Added value flooding products coupling hydraulic modeling and COSMO Sky-Med SAR imagery

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In this work the real time use of a simplified two dimensional hydraulic model constrained by satellite data for the simulation of flooding events is studied. The main features of such a model are computational speed and simple start-up, with no need to insert complex information but a subset of simplified boundary and initial condition. Those characteristics allow the model to be fast enough to be used in real time for the simulation of flooding events. The model fills the gap of information left by single satellite scenes of flooded area, allowing for the estimation of the maximum flooding extension and magnitude. The static information provided by earth observation (like SAR extension of flooded areas at a certain time) are interpreted in a dynamic consitent way and very useful hydraulic information (e.g., water depth, water speed and the evolution of flooded areas)are provided. The model has been applied in several flooding events occured wordwide. amongst the other activations in the mediterranean areas like Veneto (IT) (October 2010), Basilicata (IT) (March 2011) and Shkoder (January 2010 and December 2010) are considered and compared with larger types of floods like the one of Queensland in December 2010

Plinius13-122
Long term monitoring of reforestation activities in Liguria: social and environmental impacts

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From late XIX to the second half of XX century, in order to increase the income deriving from silvicultural practices, some areas of Liguria Region (Italy) have been subjected to afforestation and reforestation interventions. Albeit their socio-economic importance, many of these areas have been frequently damaged by wildfires; some of them are currently amongst the most vulnerable districts for forest fires in the entire Region. This work

seeks to define a possible causal link between forestry operations and the evolution of the risk of forest fires in the last century.
A recent census and cataloging of historical archives preserved by State Forestry Corps (SFC) in Savona (Italy), has brought to light a conspicuous cartography of these interventions. These historical documents allowed to precisely locate the perimeters affected by forestry operations. Moreover, the analysis of annual reports, to which the maps were annexed, permitted to date back the evolution in terms of variation of plant species present on the territory. These new information have a great importance in the study of the evolution of forest fires dynamics since data until now used account for about two decades. This new historiographical approach has extended the observation time horizon, depicting an essential long-term frame of reforestation and land management practices.
The analysis took into consideration seven areas within Savona province. Maps relative to reforestation practices in these zones have been digitalized and converted into GIS layers. The obtained data has been linked with the static forest fire risk maps, used in the latest regional Forest Fire Risk Plan, produced by CFS, Region Liguria and CIMA. Subsequently the documentation contained in the annual reports, for the time interval 1930 -1970, has been analyzed obtaining the time series of the occurred forest fires. Additional information was gathered on the typology of planting techniques, on the social impacts of silvicultural activities in postwar Italy and, furthermore, on the development in time of an experimental approach for the utilization of different essences in forestry operations.
The methodology used for the analysis of these series has been predominantly a GIS analysis. The considered variables where: the morphological configurations of the reforested areas, proximity to residential areas, crops and other clusters of vegetation. The results, as well as having increased the evidence supporting the phenomenological study of the risk of forest fires, can provide a new basis for an improved planning of forest operations.

Plinius13-126
The digital Earth action: an augmented knowledge of reality for risk scenarios representation and operational evaluation of damages

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In the geospatial representation of a disaster scenario we can move inside a multilevel interconnected four dimensional reality, trying to understand, predict or trace back the causes of an hazardous event. The DIGITAL EARTH ACTION (DEA) of CIMA Foundation starts from this statement in order to develop new strategies and techniques for the studies of risk reduction and environmental remediation.
The operational testing of OPERA project, an Italian Spacer Agency pilot project for flood risk prediction and management, has taught us some ways to create virtual representations of specific target areas: beginning with a "scene" we can transform it into a specific "scenario", the former being a collection of still images or maps, the latter the dynamic set of observational data linked by processes underlying physics. Starting from this experience, the DEA wants to face a new challenge, that is a scientific deep investigation of instruments and methods that can be used to represent the world. We focus on three subjects: the most important geodatabases existing in the world paired with non-conventional data; the physical modeling of affected systems; thestudies at single element.
The matters are strictly connected each other: the first provides the substrate upon which we can derive the representation; different accuracies or themes can deeply change the modeling of the scene. The study of the inner behavior of exposed systems needs a lot of information and has to be represented by creating a simulation model: the dynamic response of active and passive subjects is able to identify strategic elements of the network. Studies at detailed scale are able to identify single elements andto represent them in a 3D vision, by using specific tools: manipulation of buildings and infrastructures can be performed by using conventional or non-conventional data and provides us detailed knowledges on residual functionalities of elements to the network they belong to. This point feeds the modeling of the system and helps the planners or the emergency managers to deal with on-going events.

Plinius13-127
Evaluation and comparison of satellite precipitation estimates with reference to a local area in the Mediterranean Sea

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Precipitation measurement is a key activity for the analysis of storm processes as well as every hydrological process. Satellite retrieval systems, rain-gauge network and radar systems are complement to each other in terms of their coverage and capabilityof monitoring precipitation. Satellite rainfall estimates systems produce data with global coverage that can provide information in areas for which data from other sources are unavailable. Without referring to ground measurement, satellite-based estimates can be bias. Although some gauged adjusted satellite precipitation products are developed, an effective way of integrating multi-sources of precipitation information is still a challenge.
In this study we select a specific area in Sicily (Italy) having high density rain gauges to evaluate of satellite precipitation products. Sicily has an area of 26,000 km^2 and the gauge density of the network considered in this study is about 250 km^2 /gauge. It is an island in the Mediterranean sea with a particular climatology and morphology, which is considered as an interesting test site for satellite precipitation products on the European mid-latitude area. Three satellite products (CMORPH, PERSIANN, TRMM_3B42) along with two adjusted products (TRMM_3B42RT and PERSIANN Adjusted) have been selected for the evaluation. Evaluation and comparisons between selected products is performed with reference to the data provided by the gauge network of Sicily and using statistical and visualization tools. Considerations about differences between the point estimation given by gauges and the gridded surface provided by satellites are discussed as well as the difference between an evaluation based on point estimation and an evaluation based on interpolated data. An analysis of typical interpolation methods used for

hydrometerological purposes has been done to choose the most appropriate method considering size of grid satellite data and the density of gauge network. Finally natural neighbor interpolation procedure was adopted to obtain gridded surface data with the same resolution of satellite products. Results show that bias is considerable for all satellite products and climatic considerations are reported to address this issue along with an overall analysis of the PMW retrieval algorithm performance.

Plinius13-128
Enhancing Resilience to Reduce Vulnerability in the Caribbean Project

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The modern Italian Civil Protection System emerged after 1985. Prior to this it was based on a search and rescue basis managed by the Fire Brigade National Corps and their local detachments. In 1985 the Ministry for Civil Protection was established, with the task of coordinating the resources needed for the search and rescue but also with the task of designing a national policy for preparedness and prevention. In 1992 legislation at the national level was passed to give effect to differentiated levels of responsibility and coordination. Additionally, roles for various sectors including the research community and the volunteer system were enhanced.
The Italian model has therefore developed substantial experience in evidenced based policies and strategies as well as defining roles for the various stakeholders including volunteers. Key elements of the Italian model for Civil Protection includes: a systematic management plan that incorporates all stakeholders in order to deliver maximum effect; a system of monitoring and research to improve response and reduce vulnerability; a strong system of volunteers to give effect to the program at the municipal and local levels.
In this context the Enhancing Resilience to Reduce Vulnerability in the Caribbean project takes an integrated approach to vulnerability reduction and enhancing resilience to climate change, natural hazards and poverty through enhanced civil protection. $\neq wline$
It covers Barbados and the Organisation of Eastern Caribbean States (Anguilla, Antigua and Barbuda, British Virgin Islands, Dominica, Grenada, Montserrat, St. Kitts and Nevis, St. Lucia and St. Vincent and the Grenadines). They are highly vulnerable to various natural hazards and climate change impacts, also having fragile ecosystems and concentrations of settlements and major functions in low lying coastal areas and other hazard prone locations. The project focuses on knowledge sharing and building linkages across Caribbean institutions, capacity development, and advancing the linkages between climate change and disaster risk reduction.
This project is funded by the Italian Development Cooperation covering a period of 3 years (2009-2011). By the end of the project it is expected that there will be:
- A network of real-time decision support centres for early warning systems through real-time sharing and use of hydrometeorological data
- Strengthened national disaster management mechanisms

Initial emphasis will be on comprehensive data collection and storage. Lack of current and accurate data has been a significant challenge in the region for planning, decision making and response. There will also be activities surrounding the acquisition and application of ICT tools for rapid acquisition and dissemination of information through the disaster management system and to the community. The Italian civil protection model will be a vital source of learning and adapting best practices, being one of the best civil protection systems in the world. The importance of volunteerism in disaster management will also be highlighted, with capacities being built to enhance this aspect of community involvement.

Plinius13-130
The digitalization of civil protection knowledge in forecasting and monitoring activities: the DEWETRA platform

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From a common necessity of establishing an integrated forecasting and warning system, for the entire Italian territory, stemmed the project that led to the implementation of the first Italian web platform for Civil Protection activities.
The system, designed by CIMA Research Foundation and ACROTEC on behalf of Italian Civil Protection, was firstly and experimentally used as a support for a real-time monitoring and forecasting of natural events, during the G8 meeting in l'Aquila (2009). The responsiveness of Dewetra platform during the first phase of tests led to a rapid adoption of the system by the National Department of Civil Protection. Dewetra has been technically and operationally certified and is currently being exported abroad for International Cooperation initiatives (i.e. Lebanon and Albania).
The effectiveness of the platform relies on the rapid availability of data which strengthen the forecasting system enabling to produce up-to-date and consistent forecasts. Dewetra uses a hybrid architecture which combines a clientserver middle-ware to ensure robustness and data local back-up, with a web-based application to ensure capillary distribution of information. The added value of Dewetra is its capability of merging hydrometeorological knowledge with innovative informatics tools and a user friendly GUI (Graphic User Interface).
As of may 2011, the access to Dewetra has been granted to all the Italian administrative Regions which can request a personalized account to access the network. By so doing decisional centers are increasingly becoming connected into a network that shares data, procedures, models and expertise. Thus, a widespread knowledge of Civil Protection activities is being codified into an unambiguous language recognizable at all levels. This work wants to give an account of what has been done so far.

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Potential Reduction of Uncertainty in Passive Microwave Precipitation Retrieval using the Cloud Dynamics and Radiation Database with the Inclusion of Dynamic and Thermodynamic Constraints: Results and Analysis

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The type of physically based precipitation retrieval algorithm under study uses Bayesian approach to find microphysical profiles solution applied within a subset of Cloud Radiation Database (CRD), which consists of many realizations with sets of relationships between brightness temperatures (TBs) and rain rates. However, the relationship between the simulated microphysical profiles and the simulated multispectral TBs are not likely unique, as many configurations of liquid and ice hydrometeors can generate similar observed set of multispectral TBs. Therefore during precipitation retrieval, given a set of observed TB's, one can often match with sets of simulated microphysical profiles with strongly different precipitation outcomes. To improve precipitation estimation, additional constraints that could describe the dynamical and thermodynamical state of the atmosphere at the time of retrieval are needed. Fortunately, such constraints are virtually always available in the form of recent or short-term projections of the synoptic situation, which dramatically reduces the number of applicable profiles in the database, when the profiles include information of the synoptic situation in effect when they were simulated.
The Cloud Dynamics and Radiation Database (CDRD) is an attempt to include this additional information in the CRD to increase the available constraints in selecting applicable database entries used in the estimation procedure. This additional information includes the dynamical and thermodynamical structure of the atmosphere, which are stored as dynamical and theromodynamical tags in the CDRD. By using a Bayesian-based statistical estimation method, it is expected that more appropriate microphysical profiles can be chosen and thus precipitation retrieval uncertainties can be reduced.
In this study, the degree to which uncertainty in precipitation estimation can be reduced through the addition of these dynamic and thermodynamic constraints is estimated quantitatively. This is accomplished through a procedure whereby a CDRD of 120 cloud resolving model simulations is statistically analyzed to determine the impact which several of the strongest dynamic and thermodynamic constraints have on the variance in the predicted columnar liquid water paths, ice water paths, and surface rain ratesassociated with simulated multichannel brightness temperatures.

This work is being done at University of Wisconsin, Madison.

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Severe events determined by the Mediterranean lows over eastern Romania

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Although Romania is placed at a considerable distance from Mediterranean basin, the cyclones generated in this area, currently affects its territory, particularly the extra-Carpathian area. They discharge here different amount of precipitation, depending on their moving trajectories. A particular kind of trajectory, known in Romanian scientific literature as "trans-Balkan trajectory", can generate heavy rainfalls. In the last couple of years, especially during the summer season, few severe meteorological events, with a high societal impact, have been reported. The heavy rain recorded during July, 2008 and June–July, 2010 have determined increases in levels and flows of eastern Romania rivers and floods. The subsequent flooding has resulted in casualties and significant damages. The present study is focused on the synoptic context analysis of the above mentioned hazardous events, emphasizing both similarities and differences.