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A rainfall estimation algorithm for hydrological purpose using satellite and radar data

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Since satellite and radar measurements have been possible precipitation estimates and watershed management have

generally improved all over the world. The first one are particularly important in regions of the globe where

satellites are the only resource for rainfall estimation for hydrological purpose at a typical chatcment

resolution. Inversion algorithms for rainfall estimation are many and have been done for manifold purposes

using several techniques and different satellites measurements.

A non linear estimation algorithm based on a Artificial Neural Network (ANN) has been developed for rainfall

estimation at a daily time step and it has been calibrated and validated in the tropical African regions.

The algorithm uses as input NWP fields together with derived infrared satellite measurements products for

producing daily precipitation estimates and it is validated against local gauge observations at different

space and time resolutions. The ANN algorithm is compared with a more conventional satellite estimation

algorithm and with a multiple linear regression one having the same inputs as the ANN

algorithm and it

clearly outperforms the two linear approaches.

As a second step the ANN based algorithm has been experimented in mid-latitude regions for instantaneously

rainfall estimation using both infrared and microwave satellites measurements. In this case the algorithm

calibrates the infrared measurements from geostationary satellites with the coincident microwave rainfall

estimates from polar orbiting satellite and the calibration and validation is carried on in the European area.

Based on ANN a radar estimation algorithm has been developed too in the European area where the radar

measurements are available.

In the mid-latitude regions the precipitation estimates from satellite and radar have been merged together with

observation and simulated rain

data using a Cellular Automata based algorithm and have been assimilated into CETEMPS HYdrological Model (CHYM)

for testing the reliability of the inversion algorithms in case of flooding events.

Overall in all the experiments the ANN based algorithms show a good capability in reproducing the

precipitation observations and this is confirmed as well by the satisfactory performances of the hydrological model simulation

in case of flood alert when the estimated rain is assimilated into it.