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G.RISICO: a grid architecture for high resolution nation-wide forest fire risk assessment

M. D'Andrea (1), S. Dal Pra (2), V. Angelini (3), P. Fiorucci (1), F. Gaetani (1), P. Mazzetti (3), M. Verlato (2)

(1) CIMA Foundation - Centro Internazionale per il Monitoraggio Ambientale, Italy, (2) Istituto Nazionale di Fisica Nucleare, Italy, (3) Istituto di Metodologie per l'Analisi Ambientale - Consiglio Nazionale delle Ricerche, Italy

Since year 2003 the system RISICO (RISchio Incendi & COordinamento) is used by Italian National Civil Protection for daily dynamic forest fire risk assessment. RISICO is a fully operational system designed for nation-wide risk assessment, and based on a set of models capable to simulate the fuel moisture dynamics and the fire potential behaviour. The main use of RISICO is that to provide decision makers with information relevant to risk scenarios over medium-long (48-72 hours) time horizon.

The information that feeds the two models is both static and dynamic. The static information refers to topography and vegetation cover data; while the dynamic information is provided by the deterministic run of a meteorological non-hydrostatic Limited Area Model (LAM). The used meteorological variables are the 3-hour cumulated rainfall, the air temperature, the dew point temperature, and the wind speed/direction.

In its current version, the outputs of RISICO are defined over a regular grid of about 300.000 cells of 0.01 degrees side, for a 72-hour time horizon, and discretized in time steps of 3 hours.

Although the current configuration of the system proved very good performances (i.e., high rate of successful forecasts) under different risk scenarios (summer fires vs. winter fires), a general revision of the original design of RISICO is currently in progress to address both functional and non-functional (performances) issues. In particular, the following actions are planned: a) adoption of a more flexible architecture to pro-

vide the possibility of discovering and accessing data sources (e.g. from different data providers), and for integrating RISICO in a more complex Civil Protection applications workflow; b) integration in a powerful computing infrastructure for a general performances improvement. The recent advances in geospatial services architectures and grid technologies provide the basis for the design of the new version of RISICO.

As a result of a first test implementation performed with reference to a case-study in the ìINFN School for porting new applications to gridî held in Martina Franca, (Italy, November 2007) Grid technologies proved to be a promising approach for RISICO improvement. In particular, the developers of RISICO believe that its implementation within a GRID computing architecture can improve dramatically the performances of the system. In fact, a GRID structure make feasible a run of the system based on a finer grid (i.e., 0.001 km2) and, therefore, considering a more detailed set of data relevant to local environmental and physical parameters having significant effects on fuel conditions and fire propagation behaviour.

Starting from this experience, a further step was defined in collaboration with the CYCLOPS Project (Cyberinfrastructure for Civil Protection Operative Procedures) funded by the European Commission under the FP6 initiative. CYCLOPS selected RISICO as one of the pilot applications for testing the porting on top of an advanced Grid infrastructure. Such an infrastructure is based on a Service-Oriented-Architecture (SOA) providing a set of grid-enabled basic Geospatial services (data discovery, data access and processing). In this view the data sources are accessed through the standard OGC WCS (Open Geospatial Consortium – Web Coverage Interface) interface. This choice allows to open RISICO application to different data providers. Moreover, the RISICO internal models are accessed through a standard OGC WPS (Web Processing Service) interface. The internal implementation makes use of the gLite middleware to run on the EGEE Grid platform. In particular when the user sends a request, the main module splits the work in different jobs, which run in parallel on the Grid, and then collects the results providing the answer. The splitting logic allows taking advantage of the flexibility of the Grid infrastructure. Depending on the desired time-of-response, a greater or lesser number of jobs can be created providing computing power on-demand. This is greatly valuable for Civil Protection applications, which could require high computer power only in limited periods when an emergency situation arises.

A prototyping activity, whose goal is to demonstrate the feasibility and potentials of this approach, is under development.