



Operational flood forecasting system of Umbria Region “Functional Centre” - Italy

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The hydrometeorological alert office (called “Decentralized Functional Centre” - CFD) of Umbria Region, in central Italy, is the office that provides technical tools able to support decisions when significant flood/landslide events occur, furnishing 24h support for the whole duration of the emergency period, according to the national directive DPCM 27 February 2004 concerning the “Operating concepts for functional management of national and regional alert system during flooding and landslide events for civil protection activities purposes” that designs, within the Italian Civil Defence Emergency Management System, a network of 21 regional Functional Centres coordinated by a central office at the National Civil Protection Department in Rome.

Due to its “linking” role between Civil Protection “real time” activities and environmental/planning “deferred time” ones, the Centre is in charge to acquire and collect both real time and quasi-static data: quantitative data from monitoring networks (hydrometeorological stations, meteo radar, ...), meteorological forecasting models output, Earth Observation data, hydraulic and hydrological simulation models, cartographic and thematic GIS data (vectorial and raster type), planning studies related to flooding areas mapping, dam managing plans during flood events, non instrumental information from direct control of “territorial presidium”.

A detailed procedure for the management of critical events was planned, also in order to define the different role of various authorities and institutions involved. Tiber River catchment, of which Umbria region represents the main upper-medium portion, includes also regional trans-boundary issues very important to cope with, especially for what concerns large dam behavior and management during heavy rainfall. The alert system is referred to 6 different warning areas in which the territory has been divided into and based on a threshold system of three different increasing critical levels according to the expected ground effects: ordinary, moderate and high. Particularly, hydrometric and rainfall thresholds for both floods and landslides alarms were assessed. Based on these thresholds, at the Umbria Region Functional Centre an automatic phone-call and SMS alert system is operating.

For a real time flood forecasting system, at the CFD several hydrological and hydraulic models were developed. Three rainfall-runoff hydrological models, using different quantitative meteorological forecasts, are available: the event based models X-Nash (based on the Nash theory) and Mike-Drift coupled with the hydraulic model Mike-11 (developed by the Danish Hydraulic Institute – DHI); and the physically-based continuous model Mobidic (MOdello di Bilancio Idrologico DIstribuito e Continuo – Distributed and Continuous Model for the Hydrological Balance, developed by the University of Florence in cooperation with the Functional Centre of Tuscany Region). Other two hydrological models, using observed data of the real time hydrometeorological network, were implemented: the first one is the rainfall-runoff hydrological model Hec-Hms coupled with the hydraulic model Hec-Ras (United States Army Corps of Engineers - USACE). Moreover, Hec-Hms, is coupled also with a continuous soil moisture model for a more precise evaluation of the antecedent moisture condition of the basin, which is a key factor for a correct runoff volume evaluation. The second one is the routing hydrological model Stafom (STage FOrecasting Model, developed by the Italian Research Institute for Geo-Hydrological Protection of the National Research Council – IRPI-CNR). This model is an adaptive model for on-line stage forecasting for river branches where significant lateral inflow contributions occur and, up to now, it is implemented for the main Tiber River branch and it allows a forecasting lead time up to 10 hours for the downstream river section.

Recently, during the period between December the 4th and the 16th 2008, Umbria region territory was interested by a severe rainfall event causing many floods and landslides. During the mainly critical phases the CFD furnished

an immediate, significant 24h support for the decision support activities. The official web site (www.cfumbria.it), entirely developed with open source tools, represented a very useful device furnishing good performances for the monitoring and data dissemination to all the subjects involved, especially to the National/Regional Civil Protection offices and territorial presidium. Thresholds presented good accordance with non instrumental observations and automatic alert system was very effective. At last, during the flooding event a continuous link with the National Department, regional Civil Protection offices, territorial presidium and local public services, together with real time instrumental monitoring and now-casting hydrological activities performed by available models, represented a suitable junction between practice and science in CFD operational forecasting system at local, regional and national scale.