



Real-time mapping and forecasting of hydro-meteorological risks in South-Eastern France

Catherine Fouchier (1), Frédéric Atger (2), Frédéric Liebault (3), Coraline Bel (3), Dominique Batista (4), Pierre Azemard (4), Pierre Javelle (1), and Bertrand Mélanie (2)

(1) Irstea, Aix-en-Provence, France, (2) Météo-France, DIRSE, Aix-en-Provence, France, (3) Irstea, Grenoble, France, (4) Cerema, Aix-en-Provence, France

South-Eastern France is prone to a wide range of natural hazards that are largely dependent on rainfall such as flash floods, debris flows, landslides, rock falls, avalanches and forest fires. A real-time monitoring of these hazards over a large territory raises many technical and economic difficulties (choice of monitoring sites, in-situ devices costs, extrapolation of data to non-monitored areas . . .). To try to overcome these difficulties, Irstea and Météo-France have developed the RHYTMME warning and mapping system that uses as input the rainfall data provided by the French meteorological radar network. This system currently informs end-users (mainly operators in charge of risk management such as local and regional authorities, emergency and rescue services, road and rail networks managers. . .) on four types of hydro-meteorological events: extreme rainfall, flash floods, debris flows and ground movements.

Extreme rainfall and flash-flood warnings are delivered thanks to the AIGA warning system developed by Irstea and Météo-France. It compares real-time rainfall and forecasted runoff data with frequency estimates of rainfall and runoff.

Real-time rainfall data are computed for different time durations (1 hour, 2 hours, . . . 72 hours) from the information provided every 15 minutes by the radar network at the spatial resolution of 1 km². These data are compared to regionalized rainfall frequency estimates available for the same time durations and at the same 1-km² spatial resolution and for different return periods. Rainfall warnings are then provided on maps displaying the estimated return periods of the different radar rainfall accumulations for the ongoing event.

The forecasted runoff data are provided by a regionalized distributed hydrological model using as input the real-time 1-hour radar rainfall grids and run every 15 min at a 1-km² resolution. It produces discharge estimates along the river network which are compared to regionalized flood frequency estimates. Runoff warnings are then provided on a river network map showing the estimated return period of these forecasted discharges.

The system also provides maps showing the susceptibility of slopes to rock fall and landslide and the susceptibility of streams to debris flows. These susceptibility maps result from geotechnical and geomorphological analyses conducted on a fine spatial scale (50 x 50 m cells).

The RHYTMME system is therefore a combination of real-time ground based remote sensing data, hydrological flood modelling, rainfall and runoff frequency estimates and geotechnical and geomorphological approaches. Its main interest is to provide for operational services rainfall warnings at any point in their area of interest as well as runoff warnings at any point in their river network, even at ungauged locations, thus enabling them to assess the extent and severity of extreme hydrometeorological events and to anticipate floods.