

FLASH FLOOD WARNING SYSTEM IN MOUNTAINOUS AREAS USING X-BAND WEATHER RADARS

SOME PRELIMINARY RESULTS OBTAINED IN THE FRAMEWORK OF THE “RHYTMME” PROJECT

Pierre Javelle¹, Dimitri Defrance², Patrice Mériaux³, Frédéric Liébault⁴, Oldrich Navratil⁵,
Vincent Segel⁶ and Samuel Westrelin⁷

In most cases, natural hazards encountered in mountainous areas are largely dependent on precipitations: flash floods, debris flows, landslides, rock falls, snow avalanches. However, the knowledge of rainfall quantities still remains a tricky issue: the available rain-gauges are in a limited number and most often located in the valleys, and the radar rainfall estimates have to deal with a lot of problems due to the relief and the difficulty to distinguish the different types of hydrometeors (snow, hail, rain). In this context, the “RHYTMME” project (Westrelin and al., 2010) deals with two main issues:

- Providing an accurate radar rainfall information in mountainous areas.
- Developing a real-time hazards warning system based on this information.

In this context, a X-band doppler dual polarized radar network is currently implemented in the French South Alps (see Fig. 1). It completes a pre-existing radar already installed on the Mont Vial top since 2008 (Hydrix® technology developed by the Novimet company, and tested in a previous project).

The present communication focuses on the flash flood warning issue. It presents some preliminary results obtained by coupling the radar estimates to a simple distributed hydrological model (Javelle and al, 2010). The application is carried out for the 2008-2010 period, using both gauged hydrological stations (15 stations) and flood damages reports made on ungauged locations by local authorities (“Restoration of Mountainous Territories” Services) on the studied area (a 10 000 km² area). As an example, Fig. 2 illustrates some simulations obtained for a recent event (2010 October 30-th) on the Tuebi torrential river (30 km²) and its small Real tributary (2 km²), subject to frequent debris-flow events.

The interest and limits of using X-band radar data in mountainous areas for flood alert is studied, in comparison with a rainfall information provided only by local rain gauges. The use of flood damage reports for evaluating the performances of the warning system is also investigated (i.e. comparison of the warning provided by the system based on radar information with damages observed at ungauged locations).

ACKNOWLEDGEMENTS

The RHYTMME project is co-piloted by Meteo-France and the Cemagref and has the financial support of the European Union, the Provence-Alpes-Côte d’Azur Region and the French Ministry in charge of Ecology.

¹ Dr. Pierre Javelle. Cemagref, GR « Recherche en hydrologie » (RHAX), CS 40061, 13 182 Aix-en-Provence Cedex 5, France; (email: pierre.javelle@cemagref.fr)

² PhD student Dimitri Defrance. Cemagref, GR RHAX, Aix-en-Provence, France

³ Patrice Mériaux, Cemagref, GR « Ouvrages hydrauliques » (OHAX), Aix-en-Provence, France

⁴ Dr. Frédéric Liébault. Cemagref, UR ETNA, Saint-Martin-d’Hères, France

⁵ Dr. Oldrich Navratil. Cemagref, UR ETNA, Saint-Martin-d’Hères, France

⁶ Vincent Segel. Office National des Forêts, Service « RTM » des Alpes-Maritimes, Nice, France

⁷ Samuel Westrelin, Météo-France, Direction Sud-Est, Aix-en-Provence, France

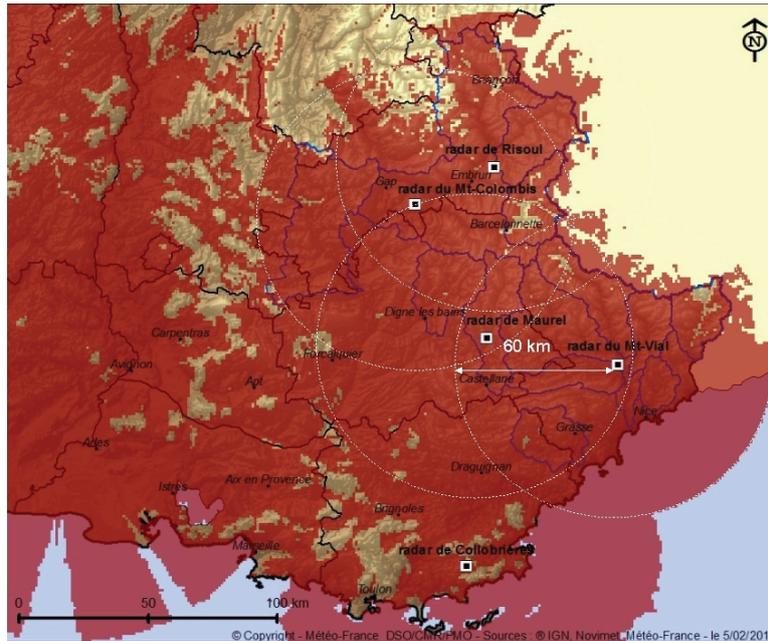


Fig. 1 Simulated coverage of the RHYTMME radar network in 2013. In dark tonality, ‘good’ quality indexes of the radar measurements.

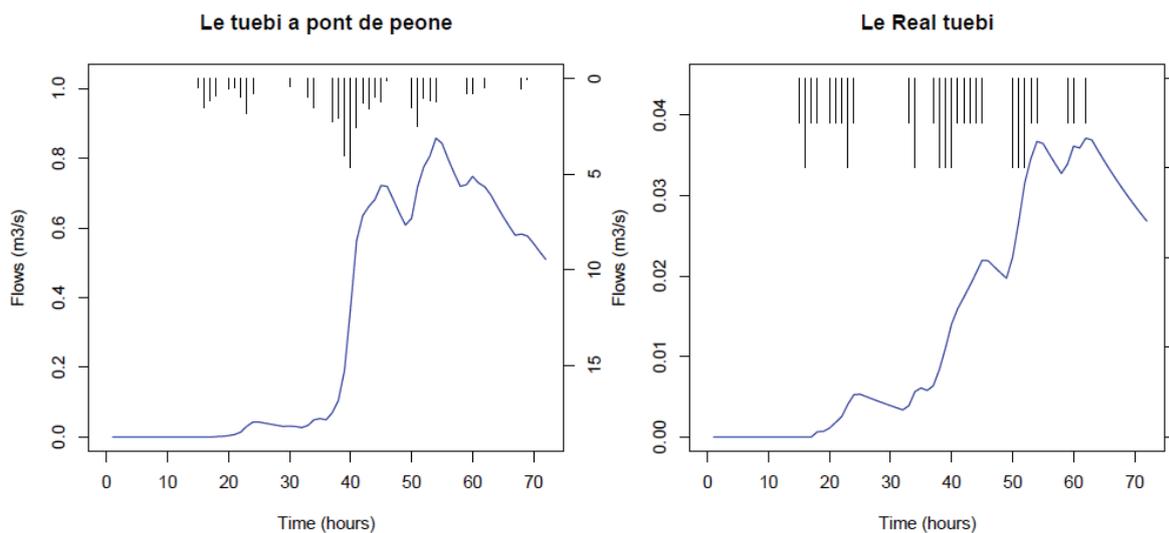


Fig. 2 Discharge simulation for 2010 October 30th event on the Tuebi river and its Real tributary. On the right axis, “Mont-Vial” Hydrix® radar rainfall in millimetres.

REFERENCES

- Westrelin S., Mériaux P., Diss S., Chèze J.L. (2010). RHYTMME: Hydrometeorological Hazards in Mediterranean Mountainous Areas. ERAD 2010, 5th European conference on radar in meteorology and hydrology (Sibiu, Romania), 6-10 September 2010.
- Javelle P., Fouchier C., Arnaud P. and Lavabre J. (2010). Flash flood warning at ungauged locations using radar rainfall and antecedent soil moisture estimations. *Journal of Hydrology*, Volume 394, Issues 1-2, 17 November 2010, Pages 267-274.

Keywords: flash flood forecasting, mountainous hazards warning system, weather radars