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Development of a flood early warning system and communication with end-users: the Vipava/Vipacco case study in the KULTURisk FP7 project

Giovanna Grossi, Paolo Caronna, and Roberto Ranzi
University of Brescia, DICATAM, Brescia, Italy (giovanna.grossi@ing.unibs.it)

Within the framework of risk communication, the goal of an early warning system is to support the interaction between technicians and authorities (and subsequently population) as a prevention measure. The methodology proposed in the KULTURisk FP7 project aimed to build a closer collaboration between these actors, in the perspective of promoting pro-active actions to mitigate the effects of flood hazards. The transnational (Slovenia/ Italy) Soča/Isonzo case study focused on this concept of cooperation between stakeholders and hydrological forecasters.

The DIMOSHONG_VIP hydrological model was calibrated for the Vipava/Vipacco River (650 km2), a tributary of the Soča/Isonzo River, on the basis of flood events occurred between 1998 and 2012. The European Centre for Medium-Range Weather Forecasts (ECMWF) provided the past meteorological forecasts, both deterministic (1 forecast) and probabilistic (51 ensemble members). The resolution of the ECMWF grid is currently about 15 km (Deterministic-DET) and 30 km (Ensemble Prediction System-EPS).

A verification was conducted to validate the flood-forecast outputs of the DIMOSHONG_VIP+ECMWF early warning system. Basic descriptive statistics, like event probability, probability of a forecast occurrence and frequency bias were determined. Some performance measures were calculated, such as hit rate (probability of detection) and false alarm rate (probability of false detection). Relative Opening Characteristic (ROC) curves were generated both for deterministic and probabilistic forecasts. These analysis showed a good performance of the early warning system, in respect of the small size of the sample.

A particular attention was spent to the design of flood-forecasting output charts, involving and inquiring stakeholders (Alto Adriatico River Basin Authority), hydrology specialists in the field, and common people.

Graph types for both forecasted precipitation and discharge were set. Three different risk thresholds were identified ("attention", "pre-alarm" or "alert", "alarm"), with an "icon-style" representation, suitable for communication to civil protection stakeholders or the public. Aiming at showing probabilistic representations in a "user-friendly" way, we opted for the visualization of the single deterministic forecasted hydrograph together with the 5%, 25%, 50%, 75% and 95% percentiles bands of the Hydrological Ensemble Prediction System (HEPS). HEPS is generally used for 3-5 days hydrological forecasts, while the error due to incorrect initial data is comparable to the error due to the lower resolution with respect to the deterministic forecast. In the short term forecasting (12-48 hours) the HEPS-members show obviously a similar tendency; in this case, considering its higher resolution, the deterministic forecast is expected to be more effective. The plot of different forecasts in the same chart allows the use of model outputs from 4/5 days to few hours before a potential flood event.

This framework was built to help a stakeholder, like a mayor, a civil protection authority, etc, in the flood control and management operations, and was designed to be included in a wider decision support system.