An example of an operational real-time hydrological forecasting chain in southern France: the AIGA warning tool.

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In order to cope with the needs of flood warning for ungauged basins, CEMAGREF and Météo-France have developed an operational real-time hydrological forecasting chain named AIGA. It is based on a regionalized rainfall-runoff model, and can thus be applied to any watershed including ungauged catchments. It is designed for small watersheds (from a few tens to a few hundreds of km^2), where the implementation of a rainfall-runoff model is useful to increase the warning lead-time. The chain is currently operational in the French Mediterranean area.

The inputs consist of 3 kinds of distributed data on grids of 1 km^2 resolution:

- real-time estimates of the hourly rainfall provided every 15 minutes by the weather radar network, and calibrated by raingauges,

- daily estimates of the soil water deficit,

- statistical databases providing for different return periods and durations, (i) rainfall quantiles in any point of the studied area and (ii) runoff quantiles in any point of its hydrographic network. These databases result from the implementation of the SHYREG method, developed by CEMAGREF, which combines a rainfall simulator with a rainfall-runoff model. The parameters of this last model were regionalized on the basis of a very broad sample of basins (approximately 400 for the French Mediterranean area).

The flood warnings provided by AIGA are the result of the comparison of the real-time data with the statistical SHYREG database. The pluviometric risk is thus assessed by comparing the real-time radar data with the rainfall statistical database.

The real-time radar rainfall estimates are then used as inputs for a 1-parameter rainfall-runoff model implemented in each 1 km^2 pixel. The pixels are regarded as independent watersheds. The local value of the model parameter is deduced from a daily modelling of the soil moisture. The rainfall-runoff model thus provides a real-time estimate of the flow contribution for each pixel. This information is put together on the scale of the basins in order to estimate the discharge at the outlet of any catchment. The hydrological risk is then assessed by comparing these discharges with the hydrological

statistical database.

The levels of the pluviometric and hydrological risks are mapped according to a 3-color scale representing the level of risk: yellow for the ordinary events (return period between 2 and 10 years), orange for the large events (return period between 10 and 50 years) ant red for the rare ones (return period more than 50 years). These maps are automatically produced every 15 minutes and are made available in real-time to the Flood-forecasting Services of the French Mediterranean Area.

The AIGA method has been implemented on 2 samples of watersheds. The first sample consists of a 500 km^2 catchment and its 2 sub-basins, affected by a dozen of floods since 1994. The second sample is made of a very large number of catchments (more than 300), some of which have been affected at least by one flood since 2005. The first sample has enabled us to build a satisfactory rainfall-runoff transformation, resulting in realistic simulated hydrographs. The second sample has given the opportunity to test this model on different watersheds with various rainfall and antecedent moisture conditions.