Abstract

A hydro-meteorological ensemble prediction system in the Milano area using a probabilistic approach

Presenter: G. Lombardi
G. Lombardi (1), A. Ceppi (1), G. Ravazzani (1), V. Homar (2), A. Amengual (2), R. Romero (2)
(1) Politecnico di Milano, Piazza Leonardo da Vinci 32, Milano, Italy (2) Universitat de les Illes Balears, Cra. de Valldemossa km 7.5, Palma (Illes Balears), Spain

The number of important natural catastrophes is increasing worldwide; among these, the hydro-meteorological events represent the worst scenario due to thousand dead and huge damages to private and state ownership they can cause (Munich Re, 2015). To prevent this, beside various structural measures, many non-structural solutions have been proposed in the recent years.

In this study, we suggest a low computational cost method to produce a probabilistic prediction system starting from a single forecasted precipitation scenario through a spatial shift and an intensity variation.

In fact, it is well-known that accurate forecasts of deep moist convection and extreme precipitation are arduous due to uncertainties arising from the numeric weather prediction (NWP) physical parameterizations and high sensitivity to misrepresentation of the atmospheric state. These uncertainties in precipitation forecasts can be seen as a misplacing, in space and time, plus an under/over-estimation of the observed precipitation.

In order to run hydro-meteorological simulations and forecasts, we use a flood forecasting system which comprises the physically based rainfall-runoff hydrological model FEST-WB, developed by the Politecnico di Milano, and the Weather Research and Forecasting (WRF) meteorological model provided by the Universitat de les Illes Balears. The area of study are the hydrological basins of the rivers Seveso, Olona and Lambro, located in the northern area of Milan city.

We selected thirty severe hydro-meteorological episodes that affected the Milano urban area between the years 2008 and 2016 for which the complex flood protection system of the city did not completely succeed. These thirty events are sixteen stratiform and fourteen convective, subdivided in calibration and validation set.

The calibration consists in the research of errors, in terms of longitude and latitude (spatial shift), time and intensity of the forecasted precipitation area hourly compared with the observed field for every investigated event. The results show how an error distribution is mainly present in the spatial shift of precipitation target (North-South and West-East) and in the intensity of rainfall, while no significance errors in time are highlighted. Hence, in validation, we apply these error PDFs in order to generate probabilistic simulations, testing the performance of this statistical method. These findings could help to predict flood episodes supporting the civil protection and local authorities for operational purposes.