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Weather forecast uncertainty affecting hydrological modelling at different spatial scale: the key role of temperature in the evaluation of discharge

Alessandro Ceppi (1), Giovanni Ravazzani (1), Davide Rabuffetti (2), and Marco Mancini ()

(1) Politecnico di Milano, DIIAR, Milan, Italy (alessandro.ceppi@mail.polimi.it, +390223996207), (2) A.R.P.A. Piemonte – Via Pio VII 9, 10135, Torino, Italy

In recent years, the interest in the prediction and prevention of natural hazards related to hydro-meteorological events has increased the challenge for numerical weather modelling, in particular for limited area models, to improve the Quantitative Precipitation Forecasts (QPFs) for hydrological purposes. In mountain river basins, where snow dynamics can affect both precipitation (snow accumulation) and runoff (snow melting), uncertainty of air temperature has to be deeply investigated too.
After the encouraging results obtained in the MAP-D-PHASE Project and considering that orographic precipitation has often led to disastrous flooding events over the Alps, it was decided to devote further analyses to show recent improvements in the operational use of hydro-meteorological chain, consisting of atmospheric models, hydrological prediction systems and warnings for end users, but above all to investigate better the key role played by temperature during snowy precipitation.
In this study we present a hindcast for some precipitation events, occurred between 2007 and 2009 in Piemonte region and in the Maggiore Lake basin (between Italy and Switzerland).
The goal is to evaluate how the uncertainty of meteorological forecasts (precipitations and temperatures) influences the performance of hydrological predictions in terms of Quantitative Discharge Forecast (QDF) at different spatial scales.
A non-hydrostatic meteorological limited area model is used to force the rainfall-runoff distributed hydrological model (FEST-WB), developed at Politecnico di Milano to generate the runoff simulations; COSMO-LEPS model is based on the 16 meteorological members, provided by ARPA Emilia-Romagna, with 5 day lead-time and a horizontal resolution of 10 km. The observed hydro-weather data to run the control simulations were supplied by ARPA-Piemonte, which uses the same model every day for nowcasting monitoring and as a civil protection tool.