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An operational hydro-meteorological chain to evaluate the uncertainty in runoff forecasting over the Maggiore Lake basin

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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. The development and implementation of a real-time flood forecasting system with a hydro-meteorological operational alert procedure during the MAP-D-PHASE Project is described in this paper. D-PHASE stands for Demonstration of Probabilistic Hydrological and Atmospheric Simulation of flood Events in the Alpine region and is a Forecast Demonstration Project (FDP) of the WWRP (World Weather Research Programme of WMO). It aims at demonstrating some of the many achievements of the Mesoscale Alpine Programme (MAP). The MAP FDP has addressed the entire forecasting chain, ranging from limited-area ensemble forecasting, high-resolution atmospheric modelling (km-scale), hydrological modelling and nowcasting to decision making by the end users, i.e., it is foreseen to set up an end-to-end forecasting system. The D-PHASE Operations Period (DOP) was from 1 June to 30 November 2007. In this study the hydro-meteorological chain includes both probabilistic forecasting based on ensemble prediction systems with lead time of a few days and short-range forecasts based on high resolution deterministic atmospheric models. D-PHASE hydrological ensemble forecasts are based on the 16 meteorological members, provided by COSMO-LEPS model (by ARPA Emilia-Romagna) with 5 day lead-time and a horizontal resolution of 10 km. Deterministic hydrological D-PHASE forecasts are provided by MOLOCH weather model (by ISAC-CNR) with a horizontal resolution of 2.2 km, nested into BOLAM, based on GFS initial and boundary conditions with 48 h lead-time. The hydrological model used to generate the runoff simulations is the rainfall-runoff distributed FEST-WB model, developed at Politecnico di Milano. The observed data to run the control simulations were supplied by ARPA-Piemonte. The analysis is focused on Maggiore Lake basin, an alpine basin between North-West of Italy and Southern Switzerland. The aim of this work is to evaluate how the uncertainty of the QPF affects the reliability of the whole hydro-meteorological alert system for a mountain catchment. Two significant events are analysed in order to compare the behaviour of the model driven by different weather scenarios: one convective in June that has yielded a high peak flow and one light stratiform in November that has been studied for the snow melt temperature which has affected the liquid precipitation and therefore the forecasted runoff.