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Pre-operational use of a meteorological and hydrological/hydraulic ensemble approach on the Po River

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The Po river is the longest and most important Italian river. It is located in the Northern part of Italy and its basin is about 70000 km2 wide.
The lower part of the basin is prone to hydrogeological disasters related to high-impact weather events which can cause severe flooding by the Po river and its tributaries.
Starting from year 2005, a national and regional agreement for the construction of a Po river flood forecasting system and control strategies was established among the main agencies and public administrations operating over the Po basin: Civil Protection Department, the Authority for Po River Basin, the Interregional Agency for the Po River and Emilia-Romagna, Lombardia, Piemonte, Valle D'Aosta and Veneto Regions.
Nowadays, the Po river basin is covered by a dense observational network, with rain-gauges, thermometers and hydrometers, as well as a radar network which ensures a spatial coverage of Northern Italy.
The flood forecasting system is fed by both the monitoring networks as well as by the meteorological forecasts of the atmospheric deterministic model COSMO-LAMI and of the limited-area ensemble prediction system COSMO-LEPS, both based on the non-hydrostatic limited-area model COSMO.
This methodology enables to quantify the meteorological uncertainty, which can be propagated to the hydrological/hydraulic models so as to provide an estimate of the probability of river floods.
At the moment, the forecasting system is composed by three different hydrological/hydraulic chains, based on the hydrological models NAM, HEC-HMS and TOPKAPI and on the hydraulic models Mike11, HEC-RAS, Sobek and PAB.
These models are encapsulated in the FEWS system, which enables to connect the different modules and to handle them via an open interface.
The FEWS system is also linked with a third-parties open source software called CONDOR for grid computing (parallelization) of the very computationally intensive ensemble forecasting processes.
A pre-operational multi-model approach for ensemble prediction for the Po river is shown, in which the three operational hydrological/hydraulic chains are fed by COSMO-LEPS. The resulting forecasts are then post-processed with a statistical approach to make the results more readable and useful to the end user.
The real time ensemble forecasting system produce a new forecast every 3 or 4 hours with a lead time of 72 or 120 hours, depending on the hydrological/hydraulic chain. This big amount of information regarding the meteorological uncertainty of the prediction system is not the only important plus of the system; also, the multi-model approach helps to take into account the hydrological/hydraulic model and calibration uncertainty.
The problem of transferring and communicating uncertainty information to the end user is also recognized to be the key challenge for the complete operational use of the Po River ensemble prediction system.