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Hydrological Ensemble Prediction System: a "target-basin" approach

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The great advantage of using Hydrological Ensemble Prediction Systems (HEPS) for flood forecasting is not only to predict the most likely hydrological scenario, but also to estimate the uncertainty of such a prediction due to the meteorological forecast uncertainty. In HEPS, ensembles of flood hydrographs are generated using meteorological fileds forecasted by Global Circulation Models (GCMs), usually downscaled to the mesoscale with mesoscale meteorological models (MMMs). On the other hand, the operational use of HEPS implies high computational costs required to integrate the very high-resolution MMMs. For this reason new procedures can be investigated in order to reduce the computational costs of HEPS application.

In the 'target-basin' approach, first the area surrounding a river basin where a given fraction of the members of the meteorological GCM ensemble exceeds an areal rainfall threshold level, RA, is defined. Then, a sub-set N_T of the N_{EPS} GCM ensemble members is selected, such that the tail (P$>$ .90) and some representative quantiles (e.g. .10, .30, .50, .70) of the Cumulative Distribution Function of the flood peak forecasted for this 'target area' by the ECMWF-Hydro chain are well represented.

This new approach was applied to the November 1966 flood event, which caused severe damages and tens of casualties over north-eastern and central Italy, including Florence. The event was studied with a 2-step cascade of models in a probabilistic framework, i.e.:

- the ECMWF Ensemble Prediction System, based on 51 forecasts run at the TL399L62 resolution,

- the hydrological model.

Preliminary results of the ‘target-basin’ HEPS are discussed and compared to the deterministic forecast experiment carried out through a 4-step cascade of models.

The spread of areal precipitation predicted by the ECMWF EPS members and the HEPS flood volumes over the Arno basin, where convective precipitation is relevant, is higher than over the Alps, where the orographic forcing is the dominant precipitation generating mechanism. The uncertainty in the results obtained for the two target areas is discussed. For the Arno basin dynamic downscaling using mesoscale models could improve the performance of the prediction system.