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Ensemble flood forecasting: One year of hindcasts and interpretation of the August 2005 floods in the upper Rhine catchment

S. Jaun (1), A. Walser (2), M. Zappa (3), B. Ahrens (1), J. Gurtz (1), C. Schär (1)

(1) Institute for Atmospheric and Climate Science, ETH Zurich, Switzerland (2) MeteoSwiss, Zurich, Switzerland (3) Swiss Federal Research Institute WSL, Birmensdorf, Switzerland

Appropriate dispositions in the case of flood occurrences require longer lead times in hydrological forecasting. This in turn implies an increased uncertainty, which cannot be accounted for by a deterministic simulation. A possibility to address this issue is the use of probabilistic forecasts driven by meteorological ensemble prediction systems (EPS), as the meteorological input is considered to represent a main source of uncertainty. Earlier experiments with a coupled atmospheric-hydrologic EPS for selected extreme events showed appropriate probabilistic forecast guidance that was clearly superior to deterministic guidance alone. Here we employ the same modelling approach but consider an extended continuous time period covering the year 2005.

An operational global atmospheric EPS (ECMWF EPS), dynamically downscaled with a limited-area atmospheric EPS (COSMO-LEPS), is used to drive a semi-distributed hydrological model (PREVAH). The study area covers the Rhine catchment till Rheinfelden and is further divided into 23 subcatchments, covering a total of 34,550 km2. The hydrological model runs at a spatial resolution of 500 meters and with hourly time steps. With this setup, a daily hindcast for the year 2005 was carried out with a forecast range of 120 h, using a subsample of 10 ECMWF ensemble members selected by the COSMO-LEPS cluster analysis. The actual analysis of the runoff forecasts focuses on the August event, where the model system showed a good performance. Beside this, the evolution of the ensemble spread and skill scores over time is of major interest to objectively evaluate the forecast performance and false alarm rate.