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An operational hydrological ensemble prediction system for the city of Zurich (Switzerland): assessing the added value of probabilistic forecasts

N. Addor (1,2,*), S. Jaun (1), F. Fundel (1), and M. Zappa (1)

(1) WSL Swiss Federal Institute for Forest, Snow and Landscape Research, Birmensdorf, Switzerland , (2) Institute for Atmospheric and Climate Science, ETH Zurich, Zurich, Switzerland , (*) now at: Department of Geography, University of Zurich, Zurich, Switzerland (nans.addor@geo.uzh.ch)

The Sihl River flows through Zurich, Switzerland's most populated city, for which it represents the largest flood threat. To anticipate extreme discharge events and provide decision support in case of flood risk, a hydrometeorological ensemble prediction system (HEPS) was launched operationally in 2008. This model chain relies on deterministic (COSMO-7) and probabilistic (COSMO-LEPS) atmospheric forecasts, which are used to force a semi-distributed hydrological model (PREVAH) coupled to a hydraulic model (FLORIS). The resulting hydrological forecasts are eventually communicated to the stakeholders involved in the Sihl discharge management.

This fully operational setting provides a real framework with which we assessed the potential of deterministic and probabilistic discharge forecasts for flood mitigation. To study the suitability of HEPS for small-scale basins and to quantify the added value conveyed by the probability information, a 31-month reforecast was produced for the Sihl catchment (336 km^2). Several metrics support the conclusion that the performance gain is of up to 2 days lead time for the catchment considered. Brier skill scores show that probabilistic hydrological forecasts outperform their deterministic counterparts for all the lead times and event intensities considered. The small size of the Sihl catchment does not prevent skillful discharge forecasts, but makes them particularly dependent on correct precipitation forecasts. Our evaluation stresses that the capacity of the model to provide confident and reliable mid-term probability forecasts for high discharges is limited. We finally highlight challenges for making decisions on the basis of hydrological predictions, and discuss the need for a tool to be used in addition to forecasts to compare the different mitigation actions possible in the Sihl catchment.