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Analysis of ensemble forecasts over successive forecast lead times for decision support in flood management

Jens Grundmann[1] and Andy Philipp[2]
[1]TU Dresden, Institute of Hydrology and Meteorology, Dresden, Germany (jens.grundmann@tu-dresden.de)
[2]Saxon Flood Forecasting Centre, Saxon State Office for Environment, Agriculture and Geology, Dresden, Germany

Reliable warnings and forecasts of extreme precipitation and resulting floods are an important prerequisite for disaster mangers to initiate flood defence measures. Thus, disaster managers are interested in extended lead times, which can be obtained by employing forecast of numerical weather models as driving data for hydrological models. To portray the inherent uncertainty of weather model output, ensemble hydro-meteorological forecasts can be used, which offers the opportunity of probability based decision making for disaster managers. However, especially for changing weather systems under unstable atmospheric conditions and for small, fast-responding catchments, the signals of extreme precipitation in the forecasting models may change quickly in magnitude and ensemble spread for successive forecast in expectation of an approaching event.

With this contribution, we analyse the behaviour and reliability of ensemble hydro-meteorological forecasts depending on their lead time in order to derive appropriate indicators for decision making. We use results of our operational web-based demonstration platform for ensemble hydrological forecasting in small catchments, which is established for three pilot regions with different hydrological settings in Saxony, Germany. The demonstration platform processes ensemble forecasts of the ICON/COSMO-D2-EPS product of the German Weather Service, which provides an ensemble of 20 members each three hours, for lead times up to 27 hours. Each member is evaluated regarding specific extreme precipitation thresholds. If these thresholds are exceeded in a specific region, rainfall-runoff models for the associated catchments are used to propagate the meteorological uncertainty into the resulting runoff, followed by statistical post processing and visualization. In addition, different options for the visualization of the uncertainty information were developed to monitor the behaviour and reliability of the forecast ensemble over successive forecast lead times. These options contain exceedance probabilities for thresholds in rainfall and resulting runoff and were discussed with decision makers regarding their applicability for decision making. First results are presented for observed extreme events in the small pilot regions.