



Pre- and post-processing of hydro-meteorological ensembles for the Norwegian flood forecasting system in 145 basins.

Trine Jahr Hegdahl (1,2), Ingelin Steinsland (3), Lena Merete Tallaksen (2), and Kolbjørn Engeland (1)

(1) Norwegian Water Resources and Energy Directorate, Oslo, Norway, (2) Department of Geosciences, University of Oslo, Oslo, Norway, (3) Department of Mathematical Sciences, The Norwegian University of Science and Technology, Trondheim, Norway

Probabilistic flood forecasting has an added value for decision making. The Norwegian flood forecasting service is based on a flood forecasting model that run for 145 basins. Covering all of Norway the basins differ in both size and hydrological regime. Currently the flood forecasting is based on deterministic meteorological forecasts, and an auto-regressive procedure is used to achieve probabilistic forecasts. An alternative approach is to use meteorological and hydrological ensemble forecasts to quantify the uncertainty in forecasted streamflow. The hydrological ensembles are based on forcing a hydrological model with meteorological ensemble forecasts of precipitation and temperature. However, the ensembles of precipitation are often biased and the spread is too small, especially for the shortest lead times, i.e. they are not calibrated. These properties will, to some extent, propagate to hydrological ensembles, that most likely will be uncalibrated as well. Pre- and post-processing methods are commonly used to obtain calibrated meteorological and hydrological ensembles respectively. Quantitative studies showing the effect of the combined processing of the meteorological (pre-processing) and the hydrological (post-processing) ensembles are however few. The aim of this study is to evaluate the influence of pre- and post-processing on the skill of streamflow predictions, and we will especially investigate if the forecasting skill depends on lead-time, basin size and hydrological regime. This aim is achieved by applying the 51 medium-range ensemble forecast of precipitation and temperature provided by the European Center of Medium-Range Weather Forecast (ECMWF). These ensembles are used as input to the operational Norwegian flood forecasting model, both raw and pre-processed. Precipitation ensembles are calibrated using a zero-adjusted gamma distribution. Temperature ensembles are calibrated using a Gaussian distribution and altitude corrected by a constant gradient ($-0.6^{\circ}\text{C}/100\text{m}$). The streamflow ensembles are post-processed to improve sharpness and generate calibrated forecasts. The skill of combinations of pre- and post-processed hydro-meteorological ensembles are further analyzed focusing on high streamflow and floods.