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Pre- and Post-processing of an Extended-range Hydrometeorological Ensemble Prediction System for Alpine Catchments in Switzerland

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In recent years meteorological ensemble prediction systems have increasingly be used to feed hydrological models in order to provide probabilistic streamflow forecasts. Such hydrological ensemble prediction systems (HEPS) have been analyzed for different lead times from short-term to seasonal predictions and are used for different applications. Especially at longer lead times such forecasts exhibit systematic biases which can be removed by applying bias correction techniques to both the meteorological and/or the hydrological output. However, it is still an open question if pre- or post-processing or both should be applied.

We will present first results of an analysis of pre- and post-processed extended-range hydrometeorological forecasts. In a first step the performance of bias corrected and downscaled (using quantile mapping) extended-range meteorological forecasts provided by the European Centre for Medium Range Weather Forecasts (ECMWF) is assessed for approximately 1000 ground observation sites across Europe. Generally, bias corrected meteorological forecasts show positive skill in terms of CRPSS up to three (two) weeks for weekly mean temperature (precipitation) compared to climatological forecasts. For the Alpine region skill is generally lower but the relative gain in skill resulting from the bias correction is larger.

The pre-processed meteorological input of one year of ECMWF extended-range forecasts and corresponding hindcasts is used to feed a hydrological model for selected catchments in the Alpine area in Switzerland. Different post-processing techniques are applied to correct the resulting streamflow forecasts. Our result indicates a positive effect of pre-processing on the skill of streamflow forecasts for all lead times. However, seasonal differences are evident with a stronger positive effect on the skill in the transition seasons (spring and autumn) when the effect of temperature and corresponding snowmelt plays an important role. Novel developed statistical methods based on quantile regression and neural networks have been applied at four selected catchments in order to test the effect of post-processing hydrological predictions directly. It could be shown that depending on the catchment and its hydro-morphological characteristics the skill can be enhanced significantly for the first two weeks only. Future work will include the combination of these corrected streamflow forecasts with electricity price forecasts to optimize the operations and revenues of hydropower systems in the Alps.