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Bias correction and verification of a sub-seasonal prediction system against ground observations in Europe and its potential for hydropower optimization

Samuel Monhart (1,2,3), Christoph Spirig (2), Jonas Bhend (2), Konrad Bogner (1), Massimiliano Zappa (1), Christoph Schär (3), and Mark A. Liniger (2)

(1) Swiss Federal Institute for Forest, Snow and Landscape Research, WSL, Mountain Hydrology and Mass Movements, Birmensdorf, Switzerland (samuel.monhart@wsl.ch), (2) Federal Office of Meteorology and Climatology MeteoSwiss, Climate Prediction, Zurich-Airport, Switzerland, (3) ETH Zurich, Institute for Atmospheric and Climate Science, Zurich, Switzerland

Sub-seasonal predictions bridge the gap between medium-range weather forecasts and seasonal climate predictions. This time horizon is of crucial importance for many planning purposes, including energy production, agriculture and early mitigation of extreme events. The verification of such predictions is normally done for areal averages of upper-air parameters. Only few studies exist that verify the forecasts for surface parameters with observational stations, although this is crucial for socio-economic applications making use of such predictions in an optimal way.

With this study we provide an extensive station-based verification of sub-seasonal forecasts against 1637 ground based observational time series across Europe. 20 years of temperature and precipitation re-forecasts of the ECMWF Integrated Forecasting System (IFS) are used to analyze the period of April 1995 to March 2014. A lead time and seasonally dependent bias correction is performed to correct the daily temperature and precipitation forecasts at all stations individually. Two bias correction techniques are compared, a mean debiasing and a quantile mapping (QM) approach.

Overall, promising skill is found for temperature in most seasons. Temperature forecasts tend to show higher skill in Northern Europe and in particular around the Baltic Sea, and in winter. Bias correction is shown to be essential in enhancing the forecast skill in all four weeks for most of the stations and for both variables with QM generally performing better than a mean debiasing.

The corrected meteorological forecasts are intended to be used for hydrological streamflow predictions in Alpine catchments. This information will serve to optimize the management of hydropower reservoirs in Switzerland. These results indicate that such a hydrological pre-processing or meteorological post-processing as described above can substantially increase the revenues of existing hydropower reservoirs in the Alps.