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Bias correction and verification of extended-range ECMWF forecasts against ground observations in Europe

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In recent years large progress has been made in numerical weather prediction. The implementation of ensemble forecasts has led to better predictability especially at longer lead times, including extended-range (monthly) to seasonal time horizons. The verification of such predictions is often done for areal averages of upper air parameters. Only few studies exist that verify the forecasts for surface parameters at point locations although applications often require local information. With this study we aim at providing an extensive station-wise verification of extended range forecasts in Europe.

We therefore verified the ECMWF extended-range forecast against approximately 1000 ground based observational time series across Europe. To do so, we made use of 20 years of hindcasts of the forecasting system that was operational from May 2014 to April 2015 (cycle 40r1), yielding an analysis period of May 1995 to June 2014. This data set is large enough to stratify the performance of the forecast system with season and region. Weekly temperature and precipitation of both raw hindcasts and post-processed hindcasts were analyzed. For the post-processing two techniques were compared, a mean debiasing (MD) and a quantile mapping (QM) approach. Various skill scores (RPSS, CRPSS, ROCSS) characterizing different aspects of forecast quality were computed using simple forecasts based on climatology as a benchmark.

Overall, skillful forecasts were found in some regions and seasons up to three weeks of lead time in case of temperature and up to two weeks for precipitation, respectively. Bias-corrections allowed to enhance forecast skill in the first two weeks for most of the stations. QM generally performed better in particular concerning the improvement of reliability as illustrated by the resulting spread to error ratios close to one. Spatial and seasonal differences in skill were found both for temperature and precipitation, with winter forecasts generally being better than those of other seasons. Geographically, forecasts tend to show higher skill in Northern Europe.