Probabilistic verification of ECMWF monthly forecasts

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Monthly forecasting bridges the gap between traditional medium-range weather forecasts and seasonal predictions. Forecasts in the range of 1 to 4 weeks are vital to many applications in the context of weather and climate risk management. Since 2004, the ECMWF runs a monthly ensemble prediction system operationally.

It is the aim of this study to assess prediction skill of this monthly forecasting system in dependence of lead time, season and geographical location. The study considers all 12 years of hindcasts available. As a probabilistic skill metric, the discrete ranked probability skill score RPSSd, which is a modified version of the widely used RPSS, is applied. In contrast to the classical RPSS, the RPSSd is a debiased skill score in that it is insensitive to ensemble size. This is an important property in the present context, given the differing numbers of ensemble members in the data-sets available (51 in the forecasts, 5 in all hindcasts).

Weekly averages of near-surface (2m) temperature predictions are considered. The monthly ensemble forecasts are verified gridpoint-wise against ERA40 reanalysis data (until 2001) and the ECMWF operational analysis (after 2001), respectively. While our evaluations are carried out for the entire globe, special focus will be on skill in Europe. At individual grid points, skill reveals strong week-to-week fluctuations due to the comparatively short hindcast period. However, if spatial or temporal smoothing is applied, some seasonal variability of skill becomes visible, particularly for the second and third forecasting week. For example, in central Europe the first forecasting week (days 5-11) has an average RPSSd value of about 0.4 with only little seasonal variability. As lead time is increased by a week, skill drops significantly and reveals a pronounced seasonal signal, with winter and late summer being seasons of enhanced performance (maximum skill of about 0.2). In these seasons even the third week (days 19-25) exhibits some skill.