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Drought forecasting over Europe using Standardized Precipitation Index and monthly forecasts

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In this study drought forecasting with the Standardized Precipitation Index - SPI computed from monthly meteorological forecasts and ERA-40 data is presented. Both datasets are produced and delivered by European Centre for Medium-Range Weather Forecasts (ECMWF).

The SPI is based on rainfall only. It is a statistical indicator evaluating the lack or surplus of precipitation during a given period of time as a function of the long-term average precipitation and its distribution. It is calculated using a continuous, long-term (more than 30 years) series of historic monthly precipitation records. Depending on the purpose of the analysis the SPI can be calculated for different time scales (from less than 1 month to 24 or 48 months)

The forecasted 3 monthly SPI (SPI-3) is computed as a combination of ECMWF probabilistic monthly meteorological forecasts and two months of ERA-40 precipitation data over the European area. Probability that forecasted SPI-3 exceeds predefined threshold is derived from 50 ensemble states of the monthly forecast.

Brier Score (BS) and Brier Skill Score (BSS) methods have been used for validation of probabilistic SPI-3 forecasts against observations data derived from the Global Precipitation Climatology Centre - GPCC. Additionally also categorical verification has been applied with conversion from probabilistic to categorical forecast system using probabilistic thresholds (60 % and 75 %). Performance measures, such as Proportion correct (PC), Hit rate (HR) and False alarm ratio (FAR) together with Pierce's skill score (PSS), have been applied.

In the analyzed spatial and temporal domain BS values for ECMWF forecast are generally low. Higher BS has been calculated in the winter 2005/2006 and in the areas where instability of SPI is quite high. BSS shows the ECMWF forecasts are better skilled than climatology in spatial and temporal domain. BSS values are positive in around 55 % of the cases.
Adjusted contingency table verification show similar behaviour independently from selection of probabilistic threshold. According to the PC, forecasts perform better in the wet periods. The performance of the forecasts in dry periods is tested with HR, FAR and PSS. According to the results, positive value of PSS (HR is higher than FAR) is in more than 65 % of the cases.

Draw from probabilistic and categorical performance measures, we can conclude that SPI-3 forecasting with monthly forecasts can be a suitable tool for drought forecasting over Europe.