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On the impact of bias correcting and conditioning precipitation inputs on seasonal streamflow forecast quality

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Skillful seasonal streamflow forecasts are increasingly requested for decision-making in areas such as drought risk assessment or reservoir management. Meteorological forcing can be the major source of uncertainty in seasonal forecasts as early as in the first month of the forecast period. The choice of the hydrological model inputs thus has a major impact on the quality of generated streamflow forecasts. In this study, we assess the impact of two types of precipitation forecast post-treatment: 1) bias correction and 2) conditioning, on streamflow forecast quality.
We first evaluated several bias correction approaches and conditioned precipitation scenarios in sixteen catchments in France, with the help of ECMWF System 4 seasonal precipitation forecasts and the GR6J hydrological model. The results show that, in most catchments, raw seasonal precipitation and streamflow forecasts are often sharper than the conventional ESP method. However, they are not significantly better in terms of reliability. Forecast skill is generally improved when applying bias correction. The empirical distribution mapping of daily values was successful in improving forecast reliability, but sometimes at the expense of forecast sharpness.
We also evaluated several conditioning methods based on ECMWF System 4 precipitation forecasts to generate seasonal streamflow forecasts in the same sixteen catchments. Four precipitation indices based on System 4 precipitation were used to condition historical streamflow or historical precipitations to be used as input to the GR6J model. Our results evaluate how the conditioning impacts the reliability and sharpness of streamflow forecasts, as well as forecasts of drought indices. We show that conditioning past observations based on the three-month Standardized Precipitation Index (SPI3) can improve the sharpness of ensemble forecasts based on historical data, but also often decrease reliability.

References:

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