Short Project Summary

Probabilistic evaluation of downscaled seasonal predictions

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We evaluate atmospheric seasonal predictions (ECMWF/SEAS5) as downscaled by two methods, the quantile-mapping based approach BCSD and the regression variant XDS. The probabilistic evaluation is conducted for the two semiarid regions of the Karun river basin (KB) in Iran and the São Francisco basin (SFB) in Brazil. Upper, medium, and lower tercile are probabilistically predicted, and corresponding skill is estimated for lead times from 1 day to 6 months. To be able to compare different lead times, a seamless filer is applied (Bürger 2020). The potential for water management applications in semiarid regions is discussed.

Methods and Data

The downscaling schemes were applied following Wood et al. (2002) for BCSD and Bürger et al. (2009) for XDS. The corresponding output was fed into the seamless filter. Remaining biases from the SEAS5 ensemble were removed by applying ensemble calibration by way of logistic regression.

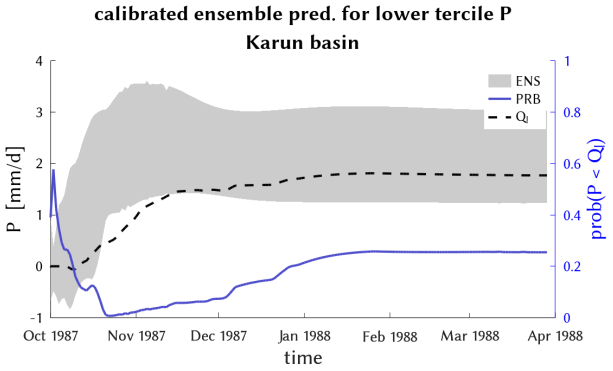

Figure 1. Probabilistic SEAS5/XDS forecast issued October 1987. The observed lower tercile (black dashed) is compared to the calibrated ensemble (90% confidence band as gray strip), resulting in a corresponding probabilistic prediction (blue).

Results and Conclusions

Figure 1 shows as a typical result for the lower tercile forecast issued October 1987. After about a month, observed and forecast precipitation (P) do not change much anymore due to the stronger filtering with lead time. Please note that ensemble calibration may occasionally produce P<0. While for the very first days very low precipitation is predicted with a corresponding larger lower tercile probability, probability drops after about a month as the predicted ensemble is persistently larger than the observed long-term lower tercile.

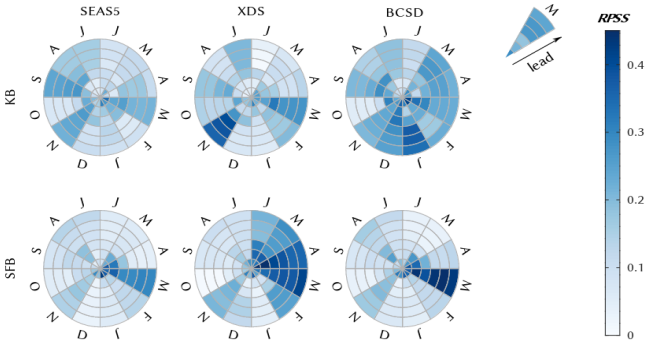

Figure 2. RPSS for predicting P terciles. For each disk, a sector represents the forecasts issued at the month depicted at the outer circle, each cylinder represents the lead time in months, starting at the center. Skill is reported as monthly average. The first column depicts no downscaling, followed by the two downscaling schemes; rows correspond to basin.

With results being quite diverse across predictands, regions, lead times, and methods, the application of downscaling generally improves prediction skill. This is confirmed in Figure 2, which summarizes our findings in a fairly consistent manner: For predicting (upper, medium, and lower)

terciles, the RPSS[1] shows that the KB is better predicted by SEAS5/BCSD and the SFB by SEAS5/XDS.

References

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Wood, A., E. Maurer, A. Kumar, and D. P. Lettenmaier, 2002: Long-range experimental hydrologic forecasting for the eastern United States. *Journal of Geophysical Research (Atmospheres)*, **107**, 4429.

1 Ranked Probability Skill Score