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Continental-scale evaluation of subseasonal–to–seasonal (S2S) streamflow forecasts over South America

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Hydrological forecasts ranging from two weeks to months in advance are critical for decision making in water resources management and economic sectors. In the subseasonal timescale, there is an opportunity to anticipate events of hydrological interest, such as periods of floods and droughts. The development of subseasonal forecasts with good quality for decision support systems is still a great challenge for the technical and scientific community, as it fits into a predictability gap between medium-range weather (3 to 15 days) and seasonal climate prediction (2 to 7 months). In South America, the climate and weather variability can represent risk to activities such as agriculture and hydropower energy production. For instance, Brazil, the larger country in terms of area and economy in the continent, has an electrical power generation matrix with 63% of hydropower and rely on weather forecasts spanning multiple timescales for its integrated system operation. This work evaluated the potential skill of subseasonal streamflow forecasts over South America based on ECMWF ensemble forecasts with lead times up to 46 days obtained from the Subseasonal-to-Seasonal (S2S) project database. A continental-scale hydrologic-hydrodynamic model was used to carry out the simulation runs for obtaining subseasonal ensemble streamflow forecasts. Forecast bias was evaluated against a reference model run (i.e., pseudo-observations) for both raw and bias corrected precipitation, and the forecast skill was evaluated against the Ensemble Streamflow Prediction (ESP) method. Forecasts and pseudo-observations were aggregated into weekly averages, ranging 6 weeks for verification, and were divided into subsets for each season of the year (DJF, MAM, JJA, SON) to access seasonal patterns over South American regions. The results highlight that the forecast skill is dependent on initialization month, season, basin, and forecast lead time, with greater skill on shorter lead times. Bias correction was able to reduce the mean forecast error over most regions of the continent. In addition, the bias correction improved skill and maintained positive skill after the third week of forecast, especially in northeastern regions and on wet seasons (DJF, MAM), meanwhile in central regions the improvements were not clear. However, the ESP method outperformed the ECMWF-based ensemble in many regions. Finally, the results presented here provide insights for investigations and applications of S2S forecasts in the operational scope on a continental scale, which can bring benefits, for example, in the optimization of the operation of electricity generation

reservoirs.

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