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Evaluation of the potential of an operational hydrological model for providing seasonal forecasts in Sweden

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Long-range forecasts, and particularly seasonal forecasts, are important tools for decision making in services such as water resources planning and hydropower production as they provide future hydrological information that may help optimise operations and improve societal resilience. However, although seasonal hydrological forecasts have been used for a long time, their inherent uncertainties and technical challenges have hindered their adoption in operational settings. Nevertheless, advances in e.g. downscaling and bias-adjustment methods have greatly improved the reliability of these forecasts, making them more suitable for operational purposes.
The Swedish Meteorological and Hydrological Institute (SMHI) has long provided hydrological forecasts for up to 10 days into the future and has recently started providing long-term climatological forecasts for low flows, with the ambition of providing reliable seasonal forecasts for both high and low flows for Sweden. In this context, this study investigates the potential of the S-HYPE hydrological model, which is currently used for operational forecasting and research purposes at SMHI, in providing informative seasonal forecasts. To this purpose we evaluate the aforementioned model using both an Ensemble Streamflow Prediction (ESP) approach, as well as a series of seasonal hindcasts from the European Centre for Medium-Range Weather Forecasts (SEAS5) for the period 1981–2015. We assess the relative benefit of using dynamic forecasts as forcing data instead of climatological data as a function of lead time. We finally present the differences in forecasting accuracy between ESP and SEAS5 respect to both the observed and simulated streamflow, and relate their spatial pattern into underlying hydrological characteristics.