EGU23-7168, updated on 19 Apr 2024
https://doi.org/10.5194/egusphere-egu23-7168
EGU General Assembly 2023

European S2S streamflow forecasting: Towards a seamless communication

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Information at the sub-seasonal to seasonal (S2S) time scale can be of high socio-economic value to a variety of users whose decision-making depends on climate variability. The usability of S2S forecasts generated by Numerical Weather Prediction (NWP) systems has increased over the years not only due to their skill improvement but also due to their potential to bridge the medium-range and seasonal horizons. The skill of the sub-seasonal (4-6 weeks ahead) and seasonal (6-12 months ahead) NWP-based forecasts in space and time depends on different factors, including the representation of the physical process, the initialization frequency and the spatial resolution. However, the NWP model setups differ between the two time horizons, and this consequently intrinsic differences between the two forecast products. To date, it has been subjectively accepted that during the first time horizons, e.g. up to 6 weeks ahead, the sub-seasonal forecasts are more informative than the seasonal forecasts, and hence all efforts on generating a seamless product are implemented through a direct merging of the two products. This unfortunately masks the potential for tailored seamless products that extract the best S2S information available.

Here, we evaluate the S2S hydro-meteorological forecasts from the ECMWF sub-seasonal (ENS-ER) and seasonal (SEAS5) products, aiming to identify their skill complementarity in space and time and further seamlessly communicate them for improved decision-making. Both the ENS-ER and the SEAS5 precipitation and temperature forecasts were bias-adjusted prior to forcing the E-HYPE hydrological model. The investigation focuses on the period 1999-2015. Overall, results highlight both spatial and temporal complementarities between the two systems, which is very encouraging for a seamless communication. In particular, ENS-ER-based hydro-meteorological forecast skill patterns appear to be more homogeneous spatially, while SEAS5-based forecasts ensure skill at longer forecast horizons. This diagnostic analysis is a step forward in hydro-climate services, indicating the tipping points in all European river systems for switching from ENS-ER to SEAS5 forecasts.