Climate and hydrology – understanding the engine that powers our rivers to improve seasonal forecasts

Kean Foster (1,2), Cintia Uvo (2), and Jonas Olsson (1)

(1) Swedish Meteorological and Hydrological Institute, Norrköping, Sweden (kean.foster@smhi.se),, (2) Division of Water Resources Engineering, Lund University, Lund, Sweden

The hydropower industry is highly reliant on hydrological forecasts to plan and operate their installations efficiently and like all forecasting the earlier the information is available the more useful it can be, providing they have skill. The aim of this work is to understand how large scale circulation patterns (LSCP) affect the local hydrology and use this knowledge to improve the quality and lead-time of hydrological seasonal forecasts. In this study Sweden is divided up into different strategic forecast regions (SFR) where the hydrological responses are similar and a composite discharge time series calculated. These composite time series were used together with LSCP indices to identify which LSCP can best explain the variance in each SFR. Analyses such as a PCA and a cross wavelet analysis were used to identify the correlation and period of this interaction and at what lead times it manifests itself. This knowledge together with the characteristics of the individual LSCP gave valuable understanding of how these LSCP affect the local hydrology. This understanding was used to modify the state of the art forecast system, used by many operators in Sweden, and to further develop a multi-model forecast system used for seasonal forecasts. These modifications were able to achieve an average reduction in forecast error by nearly 10 percent, when compared to the state of the art system, for stations in three catchments in northern Sweden.