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Role of SST for the predictability of summer atmospheric teleconnections in the Euro-Atlantic region with Self-Organising Maps

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We investigate the seasonal predictability of the two dominant atmospheric teleconnections associated with the North Atlantic Jet: the Summer North Atlantic Oscillation (SNAO) and East Atlantic Pattern (EAP). We go beyond standard forecast practices by combining an ensemble predictions system with a machine learning approach. Specifically, we combine on the one hand a 30-member hindcast ensemble initialised every May between 1902 and 2008 in the Max Planck Institute Earth System Model in mixed resolution (MPI-ESM-MR), with on the other hand a neural network-based classifier Self-Organising Maps (SOM) in the ERA-20C reanalysis. We use the SOM to identify a sub-ensemble in which simulated North Atlantic sea surface temperatures (SST) at the initialisation of the prediction system (i.e. April) are linked to atmospheric modes.

While we find for summer climate at 3-4 months lead time only limited predictive skill in the ensemble mean of MPI-ESM-MR, we find significant predictive skill over many areas in the SOM-based sub-ensemble. Our results suggest that the predictive skill of European summer temperatures can be linked to the predictive skill of SNAO and EAP, which stems in turn from the – with skill predictable - temperature gradient between subpolar and subtropical gyres. We also demonstrate the predictive skill is time dependent, with high skill over the late half of the time series (1955 - 2008) and low skill in the early period (1902 - 1954).