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Impact of tropical ocean SSTs on the variability and predictable components of seasonal atmospheric circulation in the North Atlantic – European area

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Atmospheric variability and predictable components over North Atlantic-European area were analyzed using an atmospheric general circulation model of intermediate complexity (ICTP AGCM). In order to extract individual modes of variability occurring in the ensemble of numerical simulations, EOF analysis was applied onto the fields of the 200 hPa geopotential height and total precipitation. The same variables were selected for the signal-to-noise optimal patterns method, which identifies the patterns that maximize the signal-to-noise ratio, following Straus et al. (2003).

To detect the potential impact of tropical ocean SSTs, five experiments based on a 35-member ensemble of simulations for the 1855 – 2010 period were conducted. Each experiment was forced with observed SST anomalies prescribed in different ocean areas: the experiment with climatological SSTs (i.e. no SST forcing), SST anomalies prescribed globally, SST forcing prescribed in the entire tropical zone, SST forcing constrained to the tropical Atlantic, and the experiment with SST forcing constrained to the tropical Pacific.

SST forcing impacts the interannual variability of the geopotential height and total precipitation, represented with EOF1 and EOF2 patterns, only in the frequency of occurrence of a certain atmospheric mode. In the winter season the first EOF pattern projects onto the NAO, while the second EOF pattern projects onto the Atlantic ridge.

The signal-to-noise optimal patterns method has shown that the optimal patterns and signal-to-noise ratio are affected by the boundary forcing of the oceans.