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Stability of northern hemisphere teleconnections in the last five centuries: Evidence from model, instrumental and proxy data

T. Laepple, M. Stendel, N. Rimbu and G. Lohmann

(1) Alfred-Wegener-Institute for Polar and Marine Research, (2) Danish Meteorological Institute

In the climate system, recurring and persistent large-scale patterns of pressure and circulation anomalies span vast geographical areas. These teleconnections are often the culprit for abnormal weather patterns occurring simultaneously over remote distances and have large social and economic impacts. It is therefore important to know the stability of these large scale patterns over time and their sensitivity to external forcing

In our study a state of the art five century simulation of the historical climate driven by the most relevant forcings, both natural (solar variability, volcanic aerosol) and anthropogenic (greenhouse gases, sulphate aerosol, land use change) is used to infer the stability of teleconnections. The time evolution of the main circulation patterns similar to the Pacific/North America (PNA) and North Atlantic Oscillation (NAO) are analyzed in the model simulation by a time sliding correlation and principal component analysis. To assess the quality of the model in simulating large scale atmospheric patterns, the same analysis is performed on the instrumental data. Ice core proxy data from Greenland and Canada is used to validate the model simulation further back in time. For this purpose the relation between the proxy data and the teleconnection pattern is determined for the instrumental period and extrapolated for the simulation period. The additional information from the unforced model control run and the forcing datasets used in the simulation allow us to study the fingerprint of natural and anthropogenic forcing on the teleconnection patterns and their interactions.