Geophysical Research Abstracts
Vol. 18, EGU2016-7824, 2016
EGU General Assembly 2016

A spatio-temporal reconstruction of sea surface temperature during Dansgaard-Oeschger events from model-data integration

Mari F. Jensen (1), Aleksi Nummelin (2), Søren Borg Nielsen (3), Henrik Sadatzki (1), Evangeline Sessford (1), Hannah Kleppin (3), Bjørg Risebrobakken (4), and Andreas Born (5)

(1) Department of Earth Science, University of Bergen and Bjerknes Centre for Climate Research, Bergen, Norway , (2) Geophysical Institute, University of Bergen and Bjerknes Centre for Climate Research, Bergen, Norway , (3) Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark, (4) Uni Research Climate and Bjerknes Centre for Climate Research, Bergen, Norway, (5) Institute of Physics, University of Bern, Bern, Switzerland

Proxy data suggests a large variability in the North Atlantic sea surface temperature (SST) and sea ice cover during the Dansgaard Oeschger (DO) events of the last glacial. However, the mechanisms behind these changes are still debated. It is not clear whether the ocean temperatures are controlled by forced changes in the northward ocean heat transport or by local surface fluxes, or if, instead, the SST changes can be explained by internal variability.

We address these questions by analyzing a full DO event using proxy-surrogate reconstructions. This method provides a means to extrapolate the temporally accurate information from scarce proxy reconstructions with the spatial and physical consistency of climate models. Model simulations are treated as a pool of possible ocean states from which the closest match to the reconstructions, e.g., one model year, is selected based on an objective cost function. The original chronology of the model is replaced by that of the proxy data. Repeating this algorithm for each proxy time step yields a comprehensive four-dimensional dataset that is consistent with reconstructed data. In addition, the solution also includes variables and locations for which no reconstructions exist.

We show that by only using climate model data from the preindustrial control simulations, we are able to reconstruct the SST variability in the subpolar gyre region over the DO event. In the eastern Nordic Seas, on the other hand, we lack the amplitude of the variations while capturing the temporal pattern. Based on our analysis, we suggest that the variability of the subpolar gyre during the analyzed DO event can be explained by internal variability of the climate system alone. Further research is needed to explain whether the lacking amplitude in the Nordic Seas is due to the model deficiencies or if external forcing or some feedback mechanisms could give rise to larger SST variability.