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Changes in atmospheric variability in a glacial climate and the impacts on proxy data: a model intercomparison

F. S. R. Pausata[1,2], C. Li[1,3], J. J. Wettstein[1], K. H. Nisancioglu[1], and D. S. Battisti[2,4]

[1]Bjerknes Centre for Climate Research, Allegaten 55, 5007 Bergen, Norway
[2]Geophysical Institute, University of Bergen, Allegaten 70, 5007 Bergen, Norway
[3]Department of Earth Science, University of Bergen, Allegaten 41, 5007 Bergen, Norway
[4]Department of Atmospheric Sciences, University of Washington, Seattle, WA 98195, USA

Abstract. Using four different climate models, we investigate sea level pressure variability in the extratropical North Atlantic in the preindustrial climate (1750 AD) and at the Last Glacial Maximum (LGM, 21 kyrs before present) in order to understand how changes in atmospheric circulation can affect signals recorded in climate proxies.

In general, the models exhibit a significant reduction in interannual variance of sea level pressure at the LGM compared to pre-industrial simulations and this reduction is concentrated in winter. For the preindustrial climate, all models feature a similar leading mode of sea level pressure variability that resembles the leading mode of variability in the instrumental record: the North Atlantic Oscillation (NAO). In contrast, the leading mode of sea level pressure variability at the LGM is model dependent, but in each model different from that in the preindustrial climate. In each model, the leading (NAO-like) mode of variability explains a smaller fraction of the variance and also less absolute variance at the LGM than in the preindustrial climate.

The models show that the relationship between atmospheric variability and surface climate (temperature and precipitation) variability change in different climates. Results are model-specific, but indicate that proxy signals at the LGM may be misinterpreted if changes in the spatial pattern and seasonality of surface climate variability are not taken into account.

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