Interannual variability of the atmospheric blocking circulation in the North Atlantic under different climatic conditions (e.g. Last Glacial Maximum and Holocene)

The midlatitudes westerly jet and the eastward progression of synoptic systems are frequently interrupted by prolonged periods of atmospheric blocking, a large-scale quasi-stationary extratropical flow regime. Blocking episodes can be associated with extreme weather such as drought in summer and severe cold spells in winter. Therefore, analysis of variability and predictability of atmospheric blocking could lead to a significant advance in understanding variability of extratropical climate, especially the variability and predictability of extreme phenomena.

Both atmospheric general circulation (GCM) simulations and analyses of long data sets suggest the existence of considerable interannual to inter-decadal variability in blocking frequency (Shabbar et al., 2001; Barriopedro et al., 2006). Decreasing trends as well as significant decadal variations in the frequency of atmospheric blocking in the Atlantic and European sectors during last decades were detected (Barriopedro et al., 2006). Changes in both blocking frequency and blocking location were detected over the North Atlantic and European region (Shabbar et al., 2001). Such variations were related to the variability of the North Atlantic Oscillation (NAO). Rimbu et al. (2010) identified significant decadal variability in blocking frequency in the North Atlantic region during the 20th century. Proxy data can be used to put the interannual to multidecadal variability of blocking into a long-term context. Ice core from Greenland, tree rings or corals can be used to obtain information about interannual to decadal variations in blocking during past periods.

The blocking variability, as described in the above mentioned studies, is established using high-resolution observational data for the last decades. However, this period is too short to give a clear picture of decadal and multidecadal variation in the blocking frequency in the North Atlantic region. Therefore to have a clear picture of interannual to decadal variability of blocking long-term high resolution atmospheric circulation observations, long-term climate model simulations as well as proxy data should be used.

The aim of the master subject will be to study the variability of the atmospheric blocking in different climate models. In particular, we are interested in the blocking and synoptic patterns during glacial times and deglaciation compared to present day conditions.

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Requirements: good background in climate dynamics; basics in programming

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