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ENSO variability and teleconnections during glacial climates

U. Merkel (1), M. Prange (1,2), M. Schulz (1,2)

(1) MARUM - Center for Marine Environmental Sciences, University of Bremen, 28334 Bremen, Germany (umerkel@marum.de), (2) Faculty of Geosciences, University of Bremen, 28334 Bremen, Germany

Understanding the origin of sub-Milankovitch and millennial-scale abrupt climate change still poses a major challenge. An important role of communicating the orbital-scale forcing into abrupt climate change on millennial and centennial timescales has been hypothesized for the tropics in earlier studies. Moreover, it has been hypothesized that changes in ENSO variability would ultimately control the waxing and waning of northern hemisphere ice sheets during the last glacial cycles. We employ the comprehensive Community Climate System Model (version 3) to test how ENSO variability and the related global teleconnections varied for specific time intervals of the last glacial period. Thus, our study focusses on the Last Glacial Maximum (centered on 21 ka BP) and Marine Isotope Stage 3 (centered on 35 ka BP). Glacial boundary conditions and freshwater hosing at high latitudes of the North Atlantic are imposed to mimic a Heinrich Event and Dansgaard-Oeschger stadials and interstadials.
It is shown that glacial ENSO variability is strongly enhanced by a substantial slowdown of the Atlantic Meridional Overturning Circulation. The simulations also suggest that glacial boundary conditions induce major modifications of ENSO teleconnections with most prominent differences over the North American continent and the North Atlantic regions. Based on the strong dependence of ENSO teleconnections on the respective background climatic state, we conclude that the “blueprint” of modern ENSO teleconnections should only be applied with caution to glacial climate periods.