Geophysical Research Abstracts
Vol. 21, EGU2019-18848, 2019
EGU General Assembly 2019

The dynamics of abrupt climate changes during the last glacial cycle

Kerim Nisancioglu (1,2), Chuncheng Guo (2,3), Mari Jensen (1,2)

(1) Department of Earth Science, University of Bergen, Bergen, Norway , (2) Bjerknes Centre for Climate Research, Bergen, Norway, (3) NORCE Research Climate, Bergen, Norway

The last glacial cycle was punctuated by multiple abrupt climate transitions between cold stadial and warm interstadial climate conditions. These fluctuations are know as Dansgaard-Oeschger (D-O) events, featuring rapid warming from stadial to interstadial states in a few decades, as revealed by the deep Greenland ice cores. D-O events are particularly prevalent during Marine Isotope Stage 3 (MIS3; about 60-30 ka BP), and less so during the seemingly stable Last Glacial Maximum (LGM). Why these extreme climate events, with repeated warming of up to 15 degrees in a course of a few decades, occurred, has eluded scientists since their discovery in the Camp Century and GISP ice core records. Here we present a detailed discussion of the dynamics of these abrupt events as seen in high resolution Greenland ice cores, marine sediment cores, as well as simulations with climate models. The prevailing hypothesis for D-O events is that they are caused by abrupt changes in the Atlantic Meridional Overturning Circulation (AMOC), Nordic Seas sea ice cover, or a combination of these. Given the abruptness of the events and the mounting evidence for past rapid changes in sea ice, we present a theory for D-O events based on the interplay between Atlantic water temperature, surface fresh water input and the impact of hydrography on the stability of Nordic Seas sea ice. These conclusions are corroborated by a series of sensitivity studies with an idealised geometry, eddy permitting ocean model as well as a coupled global climate model forced with MIS3 boundary conditions. The experiments illustrate the high sensitivity of Greenland temperature to changes in Nordic Sea sea ice, as well as the potential for abrupt transitions and unforced oscillations in sea ice given relatively small changes in the hydrography.