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Changes in wetland exposure during Dansgaard-Oeschger events 19-21 suggested by atmospheric methane and temperature records from the Eastern Greenland RECAP ice core

Diana Vladimirova (1,2), Bo Vinther (1), Paul Vallelonga (1), Vasileios Gkinis (1), Todd Sowers (3), Helle Kjaer (1), Remi Dallmayr (4,7), Emilie Capron (1,5), Sune Rasmussen (1), Alexey Ekaykin (6,2), and Thomas Blunier (1)

(1) Centre for Ice and Climate, Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark (diana.vladimirova@nbi.ku.dk), (2) Earth Science Institute, St Petersburg State University, St Petersburg, Russia, (3) Penn State University, University Park, Pennsylvania, USA, (4) National Institute of Polar Research, Tokyo, Japan, (5) British Antarctic Survey, Cambridge, UK, (6) Climate and Environment Research Laboratory, Arctic and Antarctic Research Institute, St Petersburg, Russia, (7) now at Alfred Wegener Institute, Bremerhaven, Germany

The series of Dansgaard-Oeschger events occurring during the last glacial period is characterized in Greenland ice-core water isotopic (δ18O) records (a qualitative proxy for local temperature) by the succession of cold Greenland Stadials (GS) and relatively mild Greenland Interstadials (GI). Atmospheric methane (CH4) concentration closely followed Greenland temperature variations during these dramatic climatic shifts. However, the relative amplitudes of the variations in temperature and CH4 concentration vary across different DO events. Specifically, interstadials 19-20 (76.44-69.40 kyr b2k) are characterized by a pronounced stadial-interstadial δ18O contrast, while the stadial-interstadial amplitude of CH4 is relatively low (70 and 97$\pm$10 ppbv). In opposite, GI-21 (85.06-77.76 kyr b2k) is indicated by a modest increase of δ18O and an unusually large amplitude in CH4 (222$\pm$10 ppbv).
Here we present the recent high-resolution continuous flow analysis (CFA) CH4 record of the RECAP ice core. The CH4 and δ18O patterns are in agreement with previously published data over interstadials 19-21. We combine our high-resolution Greenland data with published high-resolution Antarctic data to calculate the CH4 interpolar difference (IPD) changes at centennial scale across the time interval 65-87 kyr b2k.
It is generally assumed that tropical wetlands are the main CH4 sources during the glacial. We find that CH4 IPD exhibits a spike at the onset of GI-21.1 pointing to an enhanced CH4 production from the Northern Hemisphere. We suggest that the Northern Hemisphere wetlands are potentially the main additional methane source at the onset of GI-21.1.
Published reconstructions suggest that approximately 85 kyr ago, the lakes in Northern Siberia dammed by the Barents-Kara ice sheet drained. We propose that this exposed vast wetland areas, which served as an additional CH4 source, while this was not the case at the onsets of GI-20 and GI-19.2.