Geophysical Research Abstracts
Vol. 19, EGU2017-2862, 2017
EGU General Assembly 2017

Ground-ice stable isotopes and cryostratigraphy reflect late Quaternary palaeoclimate in the Northeast Siberian Arctic (Oyogos Yar coast, Dmitry Laptev Strait)

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To reconstruct palaeoclimate and palaeonvironmental conditions in the Northeast Siberian Arctic, we studied late Quaternary permafrost deposits at the Oyogos Yar coast (Dmitry Laptev Strait). New infrared stimulated luminescence ages for distinctive floodplain deposits of the Kuchchugui Suite (112.5±9.6 kyr) and thermokarst lake deposits of the Krest Yuryakh Suite (102.4±9.7 kyr), respectively, provide new substantial geochronological data and shed light on the landscape history of the Dmitry Laptev Strait region during the Marine Isotope Stage (MIS) 5. Ground ice stable-isotope data are presented together with cryolithological information for eight cryostratigraphic units and are complemented by data from nearby Bol'shoy Lyakhovsky Island. Our combined record of ice-wedge stable isotopes as proxy for past winter climate conditions covers the last about 200 thousand years and is supplemented by texture-ice stable isotopes which contain annual climate conditions overprinted by freezing processes. Our ice wedge stable-water isotope data indicate substantial variations in Northeast Siberian Arctic winter climate conditions during the late Quaternary, in particular between Glacial and Interglacial but also over the last millennia to decades. Stable isotope values of Ice Complex ice wedges indicate cold to very cold winter temperatures about 200 kyr ago (MIS7), very cold winter conditions about 100 kyr ago (MIS5), very cold to moderate winter conditions between about 60 and 30 kyr ago, and extremely cold winter temperatures during the Last Glacial Maximum (MIS2). Much warmer winter conditions are reflected by extensive thermokarst development during the MIS5c and by Holocene ice-wedge stable-isotopes. Modern ice-wedge stable isotopes are most enriched and testify the recent winter warming in the Arctic. Hence, ice-wedge based reconstructions of changes in winter climate conditions add substantial information to those derived from palaeoecological proxies stored in permafrost and allow for distinguishing between seasonal trends of past climate dynamics. Future progress in ice-wedge dating and an improved temporal resolution of ice-wedge derived climate information may help to fully explore the palaeoclimatic potential of ice wedges.