EGU21-8974
https://doi.org/10.5194/egusphere-egu21-8974
EGU General Assembly 2021

The potential and limitations of long-term fire regime reconstructions in Eastern Siberia based on sedimentary charcoal and low-temperature fire markers

Elisabeth Dietze et al.

Forest fires are an important factor in the global carbon cycle and high latitude ecosystems. Eastern Siberian tundra, summergreen larch-dominated boreal forest on permafrost and evergreen boreal forest have characteristic fire regimes with varying fire intensities. Yet, it is unknown which role fire plays in long-term climate-vegetation-permafrost feedbacks and how high-latitude fire regimes and ecosystems will change in a warmer world. To learn from fire regime shifts during previous interglacials, prior to human presence, we use lake-sedimentary charcoal as proxy for high-intensity forest fires and monosaccharide anhydrides (i.e. levoglucosan, mannosan, galactosan: MA) as molecular proxies for low-temperature biomass burning, typical for surface fires in modern larch forest. However, MA pathways from source to sink and their stability in sediments are very poorly constrained. Recently, Dietze et al. (2020) found MA in up to 420 kyr old sediment of Lake El'gygytgyn (ICDP Site 5011-1), NE Siberia, suggesting that they are suitable proxies for fires in summergreen boreal forests. Surprisingly, the ratios of the MA isomers were exceptionally low compared to published emission ratios from modern combustions.

To understand what MA from Arctic lake sediments tell us, we have analyzed the MA and charcoal composition in modern lake surface sediments of Lake El'gygytgyn and three East Siberian lakes and we compare them to late glacial-to-interglacial El'gygytgyn records. The three Siberian lakes were chosen to represent spatial analogues to the El'gygytgyn conditions during MIS 5e and 11c. We discuss first results of the modern sediments in context of recent MODIS- and Landsat-based fire extents and biome-specific land cover data, a wind field modelling using climate data over eastern Siberia, and lake-catchment configurations from TDX-DEM analysis to assess potential fire proxy source areas and regional-to-local transport processes. Thereby, we provide insights into the meaning of sedimentary fire proxies, crucial for a sound reconstruction of long-term fire regime histories.

How to cite: Dietze, E., Mangelsdorf, K., Weise, J., Matthes, H., Lisovski, S., and Herzschuh, U.: The potential and limitations of long-term fire regime reconstructions in Eastern Siberia based on sedimentary charcoal and low-temperature fire markers , EGU General Assembly 2021, online, 19–30 Apr 2021, EGU21-8974, https://doi.org/10.5194/egusphere-egu21-8974, 2021.

Displays

Display file