Geophysical Research Abstracts
Vol. 20, EGU2018-4892, 2018
EGU General Assembly 2018

Terrestrial CH_4 emissions from LGM to preindustrial

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The time between last glacial maximum (LGM) and preindustrial (PI) is a highly interesting time with regard to atmospheric methane concentrations. Between LGM and 10 ka BP atmospheric CH_4, as reconstructed from ice cores, nearly doubled, with very rapid concentration changes of about 200 ppb occurring during the Younger Dryas and Bolling Allerod transitions. Although atmospheric CH_4 is nearly identical for 10 ka BP and PI, CH_4 decreased by 15% between 10 ka and 5 ka BP, with a subsequent increase back to the PI concentration.

Terrestrial wetlands are the largest natural source of CH_4, and we use a methane-enabled version of MPI-ESM, the Max Planck Institute Earth System Model, to investigate changes in terrestrial methane emissions from LGM to PI. We extended JSBACH, the MPI-ESM land surface component, with a TOPMODEL-based module determining wetland extent, as well as a methane production and transport model, modified from Riley et al. Modules for CH_4 emissions from fire and termites are included as well. We initialise MPI-ESM for time slices at LGM, 15 ka BP, 10 ka BP, 5 ka BP, and PI, as well as 13 ka and 11.5 ka, with climate states derived from a transient model experiment from LGM to PI recently performed with MPI-ESM.

We will present wetland distributions and CH_4 emission patterns for these periods in order to determine the factors leading to the reconstructed changes in atmospheric CH_4.