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Constructing a High-Resolution Holocene Interpolar Methane Gradient

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The concentration of methane (CH_4) in the northern hemisphere is elevated relative to the southern hemisphere primarily because of enhanced northern hemisphere CH_4 emissions. During the preAnthropogenic era (prior to 1600AD) the interpolar CH_4 gradient (IPG) is effectively dictated by the ratio of tropical to Pan Arctic CH_4 emissions. IPG records from ice cores in Greenland and Antarctica therefore provide fundamental information for assessing the latitudinal distribution of CH_4 emissions and their relation to global climate change.

We recently constructed a high-resolution (100yr) record of IPG changes throughout the Holocene using the Re-CAP (E. Greenland) and WAIS (W. Antarctica) ice cores. Contemporaneous samples from both cores were analyzed on the same day to minimize analytical uncertainties associated with IPG reconstructions. CH_4 results from the WAIS core were indistinguishable from previous results suggesting our analytical scheme was intact ($\pm$ 3ppb). Our reconstructed IPG showed early Holocene IPG values of $\sim$65ppb declining throughout the Holocene to values approximating $\sim$45 ppb during the latest portion of the Holocene (preAnthropogenic). Our results are consistent with the idea that early Holocene peatland development in the PanArctic regions followed glacier retreat near the end of the last glacial termination. These newly formed PanArctic peatlands contributed an additional 20Tg of CH_4/yr during the Early Holocene relative to the late Holocene.