Geophysical Research Abstracts
Vol. 14, EGU2012-3211, 2012
EGU General Assembly 2012

Multidecadal variability and the Inter Polar Gradient of atmospheric methane in the late Holocene

L. Mitchell (1), E. Brook (1), T. Sowers (2), and J. Lee (1)

(1) Oregon State University, Department of Geosciences, Corvallis, OR United States (brooke@geo.oregonstate.edu), (2) Earth and Environment Systems Inst., Dept. of Geoscience, Penn State University, 2217 EES Building University Park, PA United States

Atmospheric methane is a potent greenhouse gas that is responsible for ∼20% of the total increase in radiative forcing since the industrial revolution. Despite methane's importance, the spatial and temporal variability of sources and sinks is poorly understood. Measurements of methane from the West Antarctic Ice Sheet (WAIS) Divide 05A ice core (WDC05A, ∼1.0-0.2 ka [Mitchell et al., 2011]), the WAIS Divide deep ice core (WDC06A, ∼4.7-0.2 ka) and the Greenland ice core (GISP2D, ∼2.8-0.2 ka) have been completed. These records have decadal scale resolution, analytical precision of <3 ppb, and are highly correlated with the only previous high resolution ice core methane record from Law Dome, Antarctica. The high degree of correlation between multiple ice cores demonstrates that the observed multidecadal variability is real and presents an opportunity to investigate the cause of this variability. In addition, these variations can be used to provide chronologic tie points between high resolution records because methane is a globally distributed greenhouse gas.

Methane records from Antarctica and Greenland can be used to reconstruct the methane Inter-Polar Gradient (IPG) which is controlled by the latitudinal distribution of sources and sinks as well as the interhemispheric mixing time. The IPG provides a constraint on the global methane budget which can be used with other parameters such as the isotopologues of methane to constrain past scenarios of the global methane budget. Our IPG reconstruction reveals that over the past 2.8 ka the IPG was ∼43 ppb with a standard deviation of 7 ppb. Over this time interval the IPG has a slightly decreasing trend punctuated by a short increase at ∼1 ka. This observed trend in the IPG rules out the possibility of the late Holocene increase in methane concentrations coming from anthropogenic activities which occurred primarily in the extratropical Northern Hemisphere. An Eight Box Atmospheric Methane Model (EBAMM) is ideally suited to investigate variations in the latitudinal distribution of methane sources as well as the isotopologues of methane. Progress on our efforts to use this model to understand the late Holocene methane budget will be presented.