The Drivers of the CH_4 Seasonal Cycle in the Arctic and What Long-Term Observations of CH_4 Imply About Trends in Arctic CH_4 Fluxes

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The large seasonal signal in Arctic CH_4 is driven by two dominant processes: transport of CH_4 from low latitude and local emissions. In collaboration with NASA Jet Propulsion Laboratory, the NOAA ESRL Carbon Cycle Group Aircraft Program is launching a new initiative entitled "Carbon in Arctic Reservoirs Vulnerability Experiment" (CARVE) to better understand the factors controlling the seasonal and spatial variability of CH_4 and CO_2 fluxes in the Alaskan Arctic. This initiative includes a new ground measurement site and three aircraft campaigns in early, mid and late summer of each of the next four years. Aircraft observations will include *in situ* measurements of CO_2, CH_4 and CO, as well as flask measurements of these same gases, plus N_2O, SF_6, H_2, halo- and hydro-carbons and isotopes of CH_4 and CO_2. Additionally, the payload includes the Passive/Active L-band System and a nadir-viewing Fourier transform spectrometer to deliver the first simultaneous measurements of surface parameters that control gas emissions (i.e., soil moisture, freeze/thaw state, surface temperature) and total atmospheric columns of carbon dioxide, methane, and carbon monoxide.

A 20-year record of ground observations made at Barrow, AK, and Alert, Nunavut show a pronounced increase in CH_4 mixing ratios and decrease in C-13 isotopes of CH_4 in the late summer, which are indicative of local CH_4 emissions. Analysis of this late summer increase in CH_4 shows inter-annual variability shared by many other CH_4 analyses, but does not indicate that natural emissions in the Arctic are increasing due to observed warming. This presentation will review the major contributors to the seasonal cycle of methane over the Arctic and the likely source of the late summer increase in the methane mixing ratios observed throughout the Arctic.

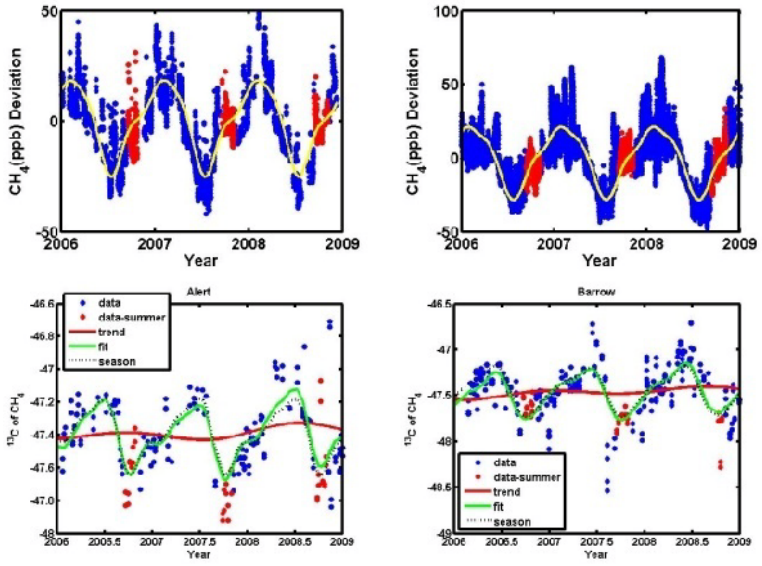

Figure 1. Methane and $^{13}C/^{12}C$ ratio in methane from Barrow and Alert Stations. Both methane time series show a very rapid increase in methane in late summer (red, top figures) which is coincident with a rapid decrease in $^{13}C/^{12}C$ of CH_4 measurements (red, bottom figure).