Seasonality and Trends of Atmospheric Transport Events to Summit, Greenland Derived from Long-term Non-methane Hydrocarbon Observations

C. Thompson[1], J. Hueber[1], R. Terrell[1], D. Helmig[1], L. Kramer[2] and J. Burkhart[3]

[1]Institute of Arctic and Alpine Research (INSTAAR), University of Colorado, Boulder, CO 80309; 303-492-5059, E-mail: chelsea.r.thompson@colorado.edu
[2]Michigan Technological University, Atmospheric Sciences Program, Hougton, MI
[3]Norwegian Institute for Air Research (NILU), Oslo, Norway

Due to large-scale atmospheric circulation patterns, the Arctic is a large receptor for pollution from across the Northern Hemisphere. Transport efficiency varies seasonally depending on circulation changes and photochemical removal rates. Non-methane hydrocarbons exhibit a distinct seasonal cycle, with maxima in the winter and minima in the summer, that has been well-studied and is captured sufficiently from flask sampling performed by the NOAA Cooperative Air Sampling Network. There is, however, little knowledge regarding the frequency and seasonal or inter-annual trends of individual pollution transport events impacting the Arctic region, as elucidation of these behaviors requires higher time-resolution data. The non-methane hydrocarbons in particular, are valuable tracers for pollution events as specific compounds or ratios can be used to identify periods of anthropogenic pollution (e.g., light alkanes, chlorofluorocarbons/hydrochlorofluorocarbons), biomass burning (e.g., acetylene, benzene), or stratospheric intrusions (e.g., low alkane, high ozone events). Here, we utilize long-term observations of methane and non-methane hydrocarbons conducted at Summit Greenland from 2008 – 2010 and 2012 – 2014, in conjunction with flask data from the NOAA Cooperative Air Sampling Network and FLEXible PARTicle Dispersion Model (FLEXPART) back-trajectory analysis, to investigate the frequency, seasonality, and source distribution of atmospheric transport events impacting the Arctic.

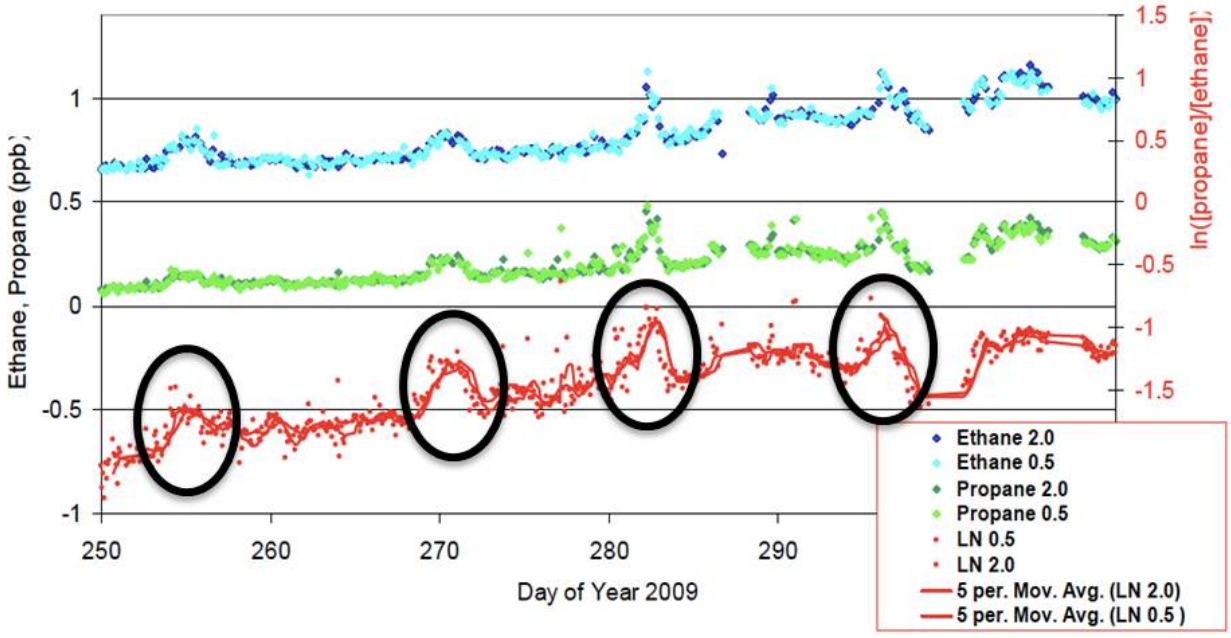

Figure 1. Record of *in situ* measurements of propane (green) and ethane (blue) at Summit for Fall 2009. The ln([propane]/[ethane]) is shown as the red trace. Four pollution transport events are indicated by the circled periods.