



Trends and Climatology of Northern Hemisphere Non-Methane Hydrocarbon Emissions

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Atmospheric non-methane hydrocarbon (NMHC) data can yield valuable insight into anthropogenic and biogenic emissions into the atmosphere. For instance, recent research has pointed out a tight linkage of the atmospheric concentration of the NMHC ethane to the atmospheric growth rate of methane, and this relationship has been used to infer global changes in methane emission sources. Furthermore, NMHC play a pivotal role in photochemical production of ozone in the troposphere. We reconstructed the 1950-2010 Northern Hemisphere concentrations of the NMHC ethane, propane, i-butane, n-butane, i-pentane, and n-pentane using 1. measurements of air samples extracted from three boreholes in the firn layer at North Greenland Eemian Ice Drilling (NEEM) project site; 2. a firn air transport model that allows reconstructing atmospheric concentrations of trace gas from borehole measurements; and 3. eight years of data from ambient NMHC monitoring at five Arctic sites within the NOAA Global Monitoring Division Cooperative Air Sampling Network. Results indicate that these C₂-C₅ NMHC increased by ~ 40-120% after 1950, then peaked between 1965-1985, and have since dramatically decreased to near-1950 levels. Different peak times of ethane versus C₃-C₅ NMHC suggest that different processes and emission mitigation measures contributed to the decline in these NMHC. NMHC mole fraction trends, observed changes in the ratio of selected NMHC pairs, and NMHC/carbon monoxide ratios are used to infer post-1950 changes in fossil fuel sources and tropospheric ozone production.