VOC Measurements Using Whole Air Sampling (WAS) During ATom-1

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Volatile organic compounds (VOCs) play important roles in atmospheric chemistry and air quality in both remote and polluted environments. The first Atmospheric Tomography field mission (ATom-1) was deployed in summer 2016, using the NASA DC-8 aircraft as a research platform and flying over the Pacific and Atlantic oceans in both hemispheres. The flights performed repeated vertical sampling of the atmosphere, from 0.2 to 12 km, giving a rare three-dimensional view of the remote global troposphere. During the mission UC Irvine collected 1585 whole air samples (WAS) that were analyzed for ~80 C_1-C_{10} VOCs using multi-column gas chromatography. Ethane and propane showed characteristic north-south gradients, with distinct regional sources including biomass burning from Siberia and strong oil and gas signals over the Midwest U.S. Dichloromethane (CH_2Cl_2) and trichloromethane also showed north-south gradients, and CH_2Cl_2 levels were elevated in air masses that appeared to have Asian origins. Conversely, methyl nitrate ($MeONO_2$) showed a south-north gradient, with higher mixing ratios over the Pacific than the Atlantic. $MeONO_2$ enhancements were also observed over California, possibly from photochemical production during high nitrous oxide (NO_2) conditions. The transition from predominantly oceanic to photochemical alkyl nitrate sources was clear as the alkyl nitrate carbon number increased. Maximum $MeONO_2$ concentrations were observed over the equatorial Pacific, while maximum *i*-propyl nitrate and 2-butyl nitrate levels were measured over the Midwest U.S. oil and gas regions. These and other results will be presented and discussed.

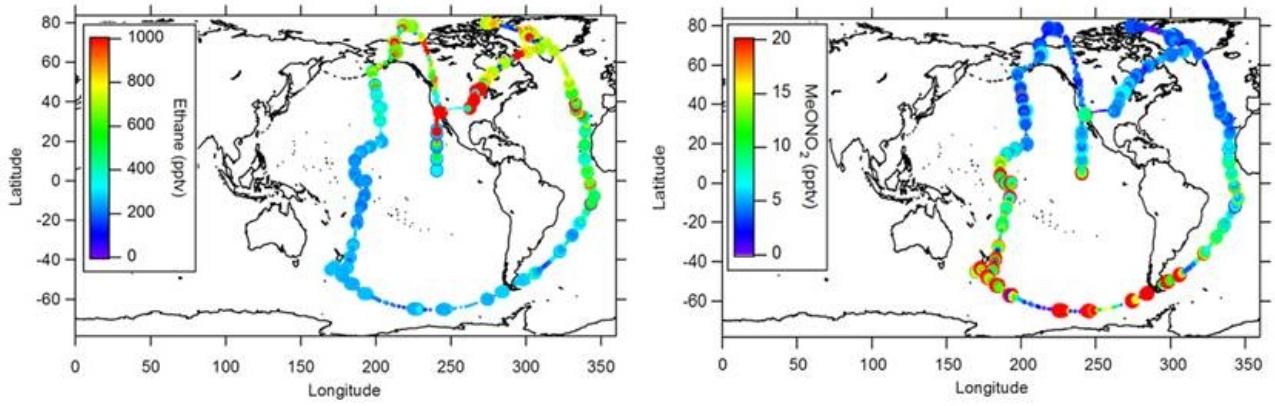

Figure 1. Mixing ratios of ethane (left panel) and methyl nitrate (right panel) measured during the airborne ATom-1 mission in summer 2016. Bigger markers represent lower altitudes.