Analytical Seminar

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Analytical and Physical Chemistry concepts applied to the atmosphere: Surface ocean impacts on the chemistry of the tropical free troposphere

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12:15 pm, 1315 Chemistry

Oceans cover 70% of the Earth surface, yet ocean emissions of organic carbon molecules (gas- and aerosol phase) are currently estimated to be 1-2 orders of magnitude smaller than the homologue emissions from land. Thus the ocean is believed to be a net receptor for organic carbon that is emitted over land. Recent our observations of very short-lived and very water soluble oxygenated hydrocarbons -like glyoxal- in the remote marine boundary layer (Sinreich et al., 2010, ACP), and iodine oxide in the tropical free troposphere (Dix et al., 2013, PNAS) remain unexplained by atmospheric models. Organic carbon and halogens are relevant to climate discussions, because they modify oxidative capacity of the atmosphere, i.e., the rate at which climate active gases such as ozone, and methane are removed from the atmosphere. They can further modify aerosols that influence Earth albedo. Here we present measurements of tracer molecules for marine organic carbon oxidation, and active halogen chemistry that indicate novel chemistry is operative at interfaces near the ocean surface, and in the tropical free troposphere. As part of the "Tropical Ocean Troposphere Exchange of Reactive halogens and Oxygenated VOC" experiment TORERO (Jan/Feb 2012) we deployed NSF's HIAPER aircraft (Highly Instrumented Atmospheric Platform for Environmental Research) and a NOAA ship over the Eastern tropical Pacific Ocean to probe air-sea gas exchange, and test our process level understanding of the sources and sinks of reactive trace gases and radicals. We have measured oxygenated hydrocarbons and volatile organic compounds, halogen oxide radicals and very short lived halogen species (VSLS) precursors (some 50+ species), aerosol size distributions, optical properties, and photolysis frequencies. 21 research flights were conducted to probe the full tropospheric air column (0-15km altitude) between 40N to 40S latitude, where most of tropospheric ozone mass resides, 60-80% of the global methane destruction occurs, and mercury oxidation rates are accelerated at low temperatures.