1.027 Airborne Observations of Water Vapor Stable Isotope Ratios in the Lower Troposphere around Washington, D.C. and Indianapolis.

Early Career Scientist

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Abstract:

Water vapor is the most important greenhouse gas, contributing about 2/3 to the natural atmospheric greenhouse effect. Many studies provide evidence supporting the positive feedback between increasing global temperatures and atmospheric water vapor concentrations. In addition to being major sources of greenhouse gases contributing to warming, cities have also been shown to modify humidity levels, and influence the frequency and intensity of precipitation events due to differences in land cover and emissions relative to rural areas. Understanding the complex modifications urban areas can have on water cycling is important, as 54% of the world's population reside in cities, with this number projected to grow over the coming decades.

To investigate processes influencing atmospheric moisture levels around urban areas, such as evapotranspiration, tropospheric entrainment, and anthropogenic water vapor emissions from combustion and evaporative cooling, airborne measurements of water vapor isotopologues containing ^{2}H, ^{18}O, and ^{17}O were conducted in the boundary layer and free troposphere around the cities of Indianapolis and Washington, D.C.-Baltimore. These flights were prompted by periodic observations of elevated water vapor concentrations in the urban outflow of Washington, D.C.-Baltimore and Indianapolis since 2012. Airborne water vapor isotopologue measurements were conducted during February and March of 2016 using Purdue University's Airborne Laboratory for Atmospheric Research (ALAR) and an LGR water vapor isotope analyzer. Flights were designed to investigate the isotopic signature of water vapor above rural, suburban, and urban land cover, and included sampling of water vapor point sources, such as plumes from power plants and evaporative cooling towers. Additionally, vertical profiles extending several hundred feet above the boundary layer were conducted upwind and downwind of the urban areas to investigate entrainment effects on the isotopic signature of boundary layer water vapor. Results of the 2016 flights will be discussed.