Measurements of Formaldehyde Fluxes in Houston, Texas

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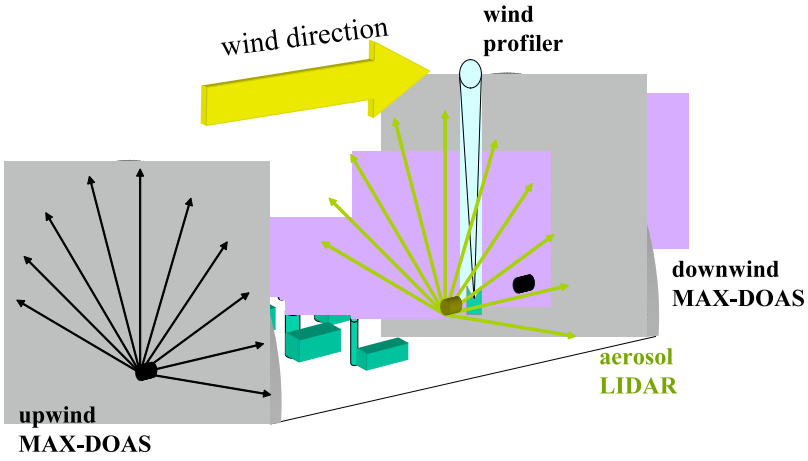
Project Description

Urban atmospheric chemistry is driven by radical species which participate in various chemical reaction cycles that ultimately lead to the formation of ozone and particulates. An accurate quantitative description of radical chemistry, as well as the chemistry and sources of the various radical precursors, is essential to an understanding of air quality in Houston, and measurement of formaldehyde, in particular, is important to understanding the radical budget in Houston. Sources of formaldehyde (HCHO) include direct emission from vehicles, potential emissions from flaring at petrochemical facilities, and its photochemical production from the oxidation of numerous VOC species such as ethene and propene. Understanding the sources and spatial and temporal variability of HCHO is important for photochemical modeling of ozone in the Houston airshed and related state implementation plan development. Measurements will be made during the SHARP campaign in Houston, TX 15 April – 15 May, 2009.

Technical Approach

The goal of this collaborative project is to determine the area-averaged HCHO fluxes in the Houston Ship Channel from industrial sources by using two MAX-DOAS instruments, one from UCLA, the other from Washington State University, which use scattered sunlight as a light source to measure the path-integrated concentration of HCHO. One instrument will measure upwind column densities, i.e. the HCHO concentration averaged over the absorption path as a function of time, while the other will measure downwind column densities as a function of time. The approach of these measurements is illustrated below. The two MAX-DOAS instruments will scan the sky in concert nominally perpendicular to the air flow. The column densities measured in this scanned "slice" will be converted into the number of HCHO molecules in this plane at any time. A wind profiler will provide wind speed and direction that will be used to convert the difference between the downwind and upwind averaged HCHO levels into an average HCHO flux from the facilities between the two instruments.



Both MAX-DOAS instruments, and the aerosol WSU LIDAR, are also capable of scanning in the azimuthal direction. This project will therefore also explore the possibility of mapping the distribution of individual HCHO emission sources and of identifying individual plumes.