

Executive Summary

- Formaldehyde fluxes were successfully measured using two multi-axis differential optical absorption (MAX-DOAS) spectrometers in Texas City, Texas from 21 April – 15 May 2009 during the *Study of Houston Atmospheric Radical Precursors (SHARP)* field campaign. The MAX-DOAS instruments measured ultraviolet spectra of scattered sunlight by observing the sky at east and west azimuths at various elevation angles ranging from 2° to 90° above the horizon continuously from sunrise to sunset over the time period of the campaign. Time required for an azimuth/elevation sweep was 20 minutes, and this is the resulting time resolution of the deduced fluxes. The known photoabsorption cross sections of formaldehyde were used in an iterative spectral least squares algorithm to deduce slant column abundances of formaldehyde (HCHO). The UCLA instrument was located south and upwind of the large industrial complex in Texas City to measure HCHO abundances in the nominally clean environment to the south, and the WSU instrument was located north and downwind of the complex to measure the combination of HCHO from the complex including HCHO that was present to the south. Using the time-coordinated differences between the measurements of the two instruments, the HCHO contribution of the refinery complex was determined. Using two models, fluxes of formaldehyde were then deduced. This is the first time an experiment using this technique was attempted.
- High quality data was obtained from both instruments for nearly the entire duration of the SHARP campaign from sunrise to sunset except the week of 15 April during which power problems at the WSU site prevented operation of the instrument and during short down times when the instruments required work maintenance or during strong thunderstorms.
- While a number of challenges were discovered in application of this new technique and which are discussed in some detail in the body of the report, sorting data to eliminate periods with those problems produced HCHO fluxes from the refinery complex as a function of time for daylight hours. The uncertainties in the flux determinations are large due to a number of unforeseen problems discussed in the report.
- The average daytime flux from the entire Texas City petrochemical complex was measured to be on average approximately 0.03 ± 0.03 kg/s prior to 6 May 2009, and 0.08 ± 0.06 kg/s afterwards.
- This was the first time this technique has been used. Application of the technique in the future can be made more successful (i.e. smaller errors in flux determination) by including in detail the optical opacity of the slant paths involved in the flux measurement and in measuring the meteorology of the region with a SODAR that gives wind speed/directions as a function of height. Additionally, integration of the HCHO profiles from the Baylor aircraft measurements would be valuable to give an HCHO height profile useful in the radiative transfer calculations.