Emissions of SO_2, NO_x, CO_2, and Hydrocarbons from Industrial Sources in Houston Measured by the NOAA WP-3

R. A. Washenfelder, G. J. Frost, J. S. Holloway, J. W. Peischl
F. C. Fehsenfeld
Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado
325 Broadway, Boulder, Colorado, 80305
rebecca.washenfelder@noaa.gov

T. B. Ryerson, C. A. Brock, M. Trainer
Chemical Sciences Division, National Oceanic and Atmospheric Administration
325 Broadway, Boulder, Colorado

S. M. Schauffler
Atmospheric Chemistry Division, National Center for Atmospheric Research
Boulder, Colorado, 80301

E. L. Atlas
Division of Marine and Atmospheric Chemistry, University of Miami
4600 Rickenbacker Causeway, Miami, Florida, 33149

ABSTRACT

The Houston-Galveston urban area regularly exceeds the EPA's 85 ppbv O_3 standard. This area contains a number of large industrial sources, including facilities along the Houston Ship Channel and Galveston Bay. Together these comprise a 25-mile long complex of diversified public and private facilities, including a petrochemical complex that is among the largest in the world. The Houston Ship Channel is a major source of industrial pollution, emitting sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), carbon dioxide (CO_2), and volatile organic compounds (VOC). In addition to the Houston Ship Channel, a number of smaller petrochemical facilities in the Houston area also emit SO_2, NO_x, CO_2, and VOCs.

Unlike a single large power plant, these industrial complexes consist of numerous sources that can be difficult to quantify in inventories. In order to evaluate and predict air quality in the Houston area, it is important to understand the magnitude and variability of these industrial sources, and how these sources are evolving over time.

During September – October 2006, the NOAA WP-3 aircraft conducted research flights as part of the Second Texas Air Quality Study (TexAQS II). We examine measurements of NO_x, SO_2, CO_2, and speciated hydrocarbons from the Houston Ship Channel and isolated petrochemical facilities. These measurements are used to derive source emissions estimates, which are then compared to estimates in the 2004 TCEQ regulatory inventory. Ethene and propene are found to be major contributors to O_3 formation. High hydrocarbon emissions are typical for the Houston Ship Channel and isolated petrochemical facilities. Ratios of ethene / NO_x and propene / NO_x at the isolated petrochemical facilities exceed emission inventory values by factors of 10 – 50. These findings are consistent with results from the first TexAQS study in 2000.