Airborne Measurements of Chemistry and Aerosol Optical Properties During the UORVP and ESP01 Summer 2001 Intensives

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Summary

Anthropogenic emissions from rapid urban sprawl, commuter/commercial traffic and industrialization in the eastern United States have a profound effect on urban and regional air quality. Surface air quality over populated areas is important given persuasive evidence linking high levels of atmospheric oxidants and particulate matter to deleterious human health effects and habitat degradation. In 2001 during July eleven research flights over four operational days were conducted in the Pittsburgh, PA area. These flights were in primarily support of the Upper Ohio River Valley Project (UORVP) and the Pittsburgh Air Quality Study (PAQS) under the 2001 Eastern Supersites Program (ESP01), but data were further integrated with those from two larger regional programs: the Regional Atmospheric Measurement Modeling and Prediction Program (RAMMPP) and the NARSTO Northeast Oxidant and Particle Study (NE-OPS) operating concurrently. The University of Maryland aircraft was also involved in an airborne comparison of opportunity west of Pittsburgh on July 6 with two other ozone/haze research aircraft involved in ESP01, these from Purdue University the Wisconsin State DNR.

A total of nineteen vertical profiles from the near surface to 3.0 Km and a number of constant altitude traverses were conducted surveying air aloft upwind and downwind of the Pittsburgh city area. On these flights the following were measured: position and pressure altitude (Lat., Lon., Palt); meteorological scalars (T, P, RH); selected trace gases (O_3, CO, SO_2); and aerosol optical properties (B_{ap}, B_{scat}). Morning and afternoon daytime flights were conducted in order to evaluate overnight remnant/precursor transport and dynamical mixing/photochemical production, respectively. Although conditions rarely produced high ozone during summer 2001 some interesting features were observed during these flights. Some stratified pollution layering was observed over the Pittsburgh area, and these layers were seen to be entrained into the developing planetary boundary layer (PBL) during the course of the afternoon. Also, substantial ozone and total aerosol scattering enhancements were observed within the afternoon PBL downwind of the Pittsburgh city center, with visibility greatly impaired in some instances.

Research flight data indicated substantial diurnal changes in boundary layer height and chemical character over the region during the course of high ozone/haze episodes, and showed evidence of significant influence at times from synoptically forced regional scale transport of pollution. Emissions from the Pittsburgh city itself also made substantive contributions at times, leading to enhanced in situ ozone and haze formation downwind of the city during the afternoon. Detailed event summaries and specific flight data can be obtained from the RAMMPP aircraft web page at URL: http://www.meto.umd.edu/~bruce/rammpp01.html