Evolution of Meteorology and Ozone in Mexico City Pollution Outflow

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The goals of this project are to characterize the transport and dispersion of MC pollution outflow into the regional background, the impact of synoptic conditions, and the evolution of ozone, precursor molecules, and aerosols within the outflow. The project relies on Controlled Meteorological (CMET) balloons communicating in real time with participating MILAGRO aircraft (NSF C130 and DOE G1).

During the campaign, CMET balloons will be launched (in pairs) from the MCMA basin with launch sites and times determined by aircraft, satellite, and surface station data, as well as model predictions of the outflow. Launches will generally occur in the late afternoon and evening in the downwind quadrant of MC. The balloons will drift with the outflow at altitudes of 10-20 kft (3-6 km) msl for periods ranging from 24-72 hours. At intervals of 2-8 hours, one of the paired balloons will be commanded to perform soundings to probe the vertical structure of the outflow (U, V, P, T, RH) with data communicated in near-real time to aircraft and mission planners. The second balloon will be maintained at the altitude of the main outflow as determined by balloon and aircraft data. On several of the flights, one of the CMET balloons will carry a miniature ozone instrument developed by collaborators at the University of New Hampshire.

We anticipate that this work will complement the extensive aircraft, surface, satellite, and modeling resources of MILAGRO. The CMET balloons will provide real-time trajectory data that will allow instrumented aircraft to make quasi-Lagrangian measurements of trace gases and aerosols with a high degree of confidence. Such coordinated measurements have the potential to provide insight into photochemical, physical, and heterogeneous processes.

This project will also provide research experience for three undergraduates at Smith College, up to two students from Universities in Mexico, and possibly a science teacher from the United States. In addition, the project will support research and development needed to increase the altitude range of the CMET balloons and improve real-time communication of transport and dispersion data products.