

Virtual ACOM Seminar

Investigating the Chemistry of Pollution Plumes from Strong Emission Sources Using Semi-Lagrangian Observations from Aircraft

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Link: <https://operations.ucar.edu/live-acom>

ABSTRACT

The investigation of air quality impacts on a given region requires measurements of both transport and atmospheric chemical transformation processes to inform chemical transport model input and validation. Atmospheric chemistry observations from aircraft are the best way to observe the temporal evolution of chemical processes from the point of emission to the point of impact. Depending on the type and spatial distribution of pollution sources, the flight plans and aircraft payload must be designed to properly address the science questions which are to be investigated.

In this seminar, I will describe the process of planning, executing, and analyzing semi-Lagrangian aircraft observations of pollution plumes from large single point sources like wildfires and large-area sources such as urban centers and oil and gas fields. An overview of the Front Range Air Pollution and Photochemistry Experiment (FRAPPÉ) and the Western Wildfire Experiment for Cloud Chemistry, Aerosol Absorption and Nitrogen (WECAN) field campaigns will be presented. FRAPPÉ required the sampling of large-area sources such as urban centers and oil and gas fields, and the interaction of their respective emissions to form regional ozone. WECAN was focused on sampling the chemical evolution of wildfire plumes that can be regarded as intense, single sources. The results from FRAPPÉ were used to provide valuable input to policymakers on how to address the persistent air quality standard violations prevalent in the Northern Colorado Front Range, while the results from WECAN will improve the scientific understanding of the influence of wildfire smoke on air quality in the Western United States and elsewhere.

State-of-the-art air quality investigations need to include the extreme chemical complexity of atmospheric oxidation processes of organics. Recent developments in advanced aircraft instrumentation to address this complexity have in turn exposed shortcomings in aircraft sampling techniques using in-cabin instrumentation. These often occur as a result of the long air inlet lines necessitated by aircraft layout. Solving these problems requires the development of new sampling methods, and also rethinking the design strategy for field campaigns targeting reactive carbon chemistry. I will discuss plans to develop an aircraft wingpod-based instrument that allows for a wall-less air inlet system, and ideas for field campaigns that will attempt to investigate separately the atmospheric oxidation processes of families of organic compounds and their impacts on air quality.

For more information please contact Mary Anne Cervantes mcervant@ucar.edu, phone 303-497-1484.

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