

## Aircraft-based Measurements of OH, H<sub>2</sub>SO<sub>4</sub>, and MSA during MIRAGE-Mex

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Platform: C-130

Instrument: SICIMS in Four-Channel MS System

Quantities: 1 minute average OH, H<sub>2</sub>SO<sub>4</sub> and MSA concentrations

We will deploy an instrument to quantify the concentrations of OH, H<sub>2</sub>SO<sub>4</sub> and MSA using chemical conversion (for OH) with selected ion chemical ionization mass spectroscopy. It is based on the addition of isotopically labeled SO<sub>2</sub> to ambient air in the upper part of an ambient pressure inlet which leads to conversion of OH radicals to isotopically labeled sulfuric acid (H<sub>2</sub>SO<sub>4</sub>). Nitrate ions (NO<sub>3</sub><sup>-</sup>) are produced in the lower part of the inlet by the interaction of gas phase nitric acid (HNO<sub>3</sub>) with alpha particles produced from Americium-241. The reaction between NO<sub>3</sub><sup>-</sup> and H<sub>2</sub>SO<sub>4</sub> leads to HSO<sub>4</sub><sup>-</sup> ions, while reaction with MSA leads to MS<sup>-</sup> ions. The reagent and product ions enter the vacuum system, which has ion optics and differential pumping followed by mass separation using a quadrupole filter and detection with a channel electron multiplier. The ion count ratios for mass 97 (corresponding to HSO<sub>4</sub><sup>-</sup>), mass 99 (corresponding to labeled HSO<sub>4</sub><sup>-</sup>), and mass 95 (corresponding to MS<sup>-</sup>) to mass 62 (corresponding to NO<sub>3</sub><sup>-</sup>) are proportional to the H<sub>2</sub>SO<sub>4</sub>, OH, and MSA concentrations entering the inlet, respectively. The proportionality coefficient is determined through in-flight calibrations of OH, by generating radicals via the UV photolysis of water vapor.

The instrument will make use of one channel of our group's four-channel mass spectrometer system (other channels for peroxy radicals, NH<sub>3</sub> and HNO<sub>3</sub>).

These measurements will address several MIRAGE-Mex scientific objectives, including helping to assess the geographical extent of influence of the MC outflow, an assessment of the oxidizing capacity and ozone tendency of the MC outflow, a connection to the assessment of the persistence of hydrocarbon oxidation products and how they influence the radical budgets, and connection to the reactive nitrogen budget particularly as it pertains to ozone production and the formation of nitric acid. We also will look at the influence of MSA and H<sub>2</sub>SO<sub>4</sub> on aerosol nucleation and growth.