2.062 Outcomes of the Whiteface Mountain Cloud Chemistry Initiative: Model Intercomparison and Pilot Field Study.

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Abstract:

Clouds affect tropospheric composition by enhancing vertical transport of trace gases and aerosols, scavenging of soluble trace gases and hygroscopic aerosols, and supporting aqueous-phase oxidation reactions that contribute to increased aerosol mass. Many regional and global-scale models do not include detailed aqueous-phase chemical mechanisms due to the lack of complete understanding of the underlying aqueous-phase chemistry, but also due to the computational burden of adding more constituents. The cloud chemistry community has initiated an effort in connection with the Whiteface Mountain Observatory (WFM) in New York to evaluate the state of knowledge of current gas-aqueous chemistry 0-dimensional models.

The box model intercomparison utilizes meteorological and available gas-phase chemical composition data obtained during the 17-18 September 2016 cloud event at WFM to initialize the box models. It focuses on comparisons of oxidants, aldehydes, and organic acids. The participating models have different gas and aqueous phase mechanisms ranging from moderately complex appropriate for 3-d chemistry models to highly complex with thousands of reactions. Because of differences in the chemistry

represented and some Henry’s Law coefficients, variability of up to an order of magnitude is seen among the different model predictions. While we can compare the model results to measured inorganic anions and water soluble organic carbon, we cannot evaluate the predicted oxidant concentrations.

The differences among the model results can guide the design of future field experiments. The Chemical Processing of Organics within Clouds (CPOC) pilot study, conducted in August 2017, provides an initial assessment for cloud chemistry research at WFM. During CPOC, upwind below-cloud aerosol composition was measured and compared to similar measurements at the summit, including cloud water composition. These observations are being analyzed in the context of airflow measured by wind LIDAR and radiosondes. A preliminary assessment of how well the CPOC sampling strategy worked will be discussed.