M.S. Defense Announcement
Lilly Naimie
Wednesday, March 2, at 9:00 a.m.

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M.S. Defense

March 2, 2022
9:00 a.m.

Defense
CIRA Director's Conference Room (135 CIRA) or Teams

Post Defense Meeting
Riehl Conference Room (211 ACRC)

Committee:
Jeffrey L. Collet (Advisor)
Emily Fischer
Katie Benedict
Shantanu Jathar (Mechanical Engineering)

Composition of Fine Particles in Carlsbad Caverns National Park and Implications for Sources and Visibility Impacts

Carlsbad Caverns National Park in southeastern New Mexico is adjacent to the Permian Basin, one of the most productive oil and gas regions in the country. The 2019 Carlsbad Caverns Air Quality Study (CarCavAQS) was designed to examine the influence of regional sources, including urban emissions, oil and gas development, wildfires, and soil dust on the park, including impacts on fine particle haze, ozone, and nitrogen deposition. Field measurements of aerosols, trace gases, and deposition were conducted from 25 July through 5 September 2019. Here we focus on observations of the composition and concentration of fine particles and key trace gas precursors to understand important contributing species and their sources and associated impacts on haze. Key gases measured included aerosol precursors: nitric acid and ammonia, and oil and gas tracer: methane. PM2.5 mass ranged up to 31.8 µg m-3, with an average of 7.67 µg m-3. The main inorganic ion contributors were sulfate (avg 1.3 µg m-3), ammonium (0.30 µg m-3), calcium (Ca2+) (0.22 µg m-3), nitrate (0.16 µg m-3), and sodium (0.057 µg m-3). The WSOC concentration averaged 1.2 µg C m-3. Significant, sharp spikes were observed in Ca2+, consistent with local dust generation and transport. Ion balance analysis and abundant nitric acid suggests sampled dust often reflected reaction between calcium carbonate and nitric acid, forming calcium nitrate. Sulfate and soil dust are the major contributors to light extinction in the 24-hour avg daily IMPROVE observations. Higher time resolution data revealed a maximum 1-hour extinction value of 77 Mm^{-1} and included periods of significant light extinction from BC as well as sulfate and soil dust. Residence time analysis indicated clear enrichment of sulfate, BC, and methane during periods when transport came from the southeast, the direction of greatest abundance of oil and natural gas development.

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