

***AEROSOL COMPOSITION, CHEMISTRY, AND SOURCE CHARACTERIZATION
DURING THE 2008 VOCALS EXPERIMENT***

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ABSTRACT

Chemical composition of fine aerosol particles over the northern Chilean coastal waters was determined onboard the U.S. DOE G-1 aircraft during the VOCALS (VAMOS Ocean-Cloud-Atmosphere-Land Study) field campaign between October 16 and November 15, 2008. SO₄²⁻, NO₃⁻, NH₄⁺, and total organics (Org) were determined using an Aerodyne Aerosol Mass Spectrometer, and SO₄²⁻, NO₃⁻, NH₄⁺, Na⁺, Cl⁻, CH₃SO₃⁻, Mg²⁺, Ca²⁺, and K⁺ were determined using a particle-into-liquid sampler-ion chromatography technique. The results show the marine boundary layer (MBL) aerosol mass was dominated by non-sea-salt SO₄²⁻ followed by Na⁺, Cl⁻, Org, NO₃⁻, and NH₄⁺, in decreasing importance; CH₃SO₃⁻, Ca²⁺, and K⁺ rarely exceeded their respective limits of detection. The SO₄²⁻ aerosols were strongly acidic as the equivalent NH₄⁺ to SO₄²⁻ ratio was only ~0.25 on average. NaCl particles, presumably of sea-salt origin, showed chloride deficits but retained Cl⁻ typically more than half the equivalency of Na⁺, and are externally mixed with the acidic sulfate aerosols. Nitrate was observed only on sea-salt particles, consistent with adsorption of HNO₃ on sea-salt aerosols, responsible for the Cl⁻ deficit. Dust particles appeared to play a minor role, judging from the small volume differences between that derived from the observed mass concentrations and that calculated based on particle size distributions. Because SO₄²⁻ concentrations were substantial (~0.5 - ~3 µg/m³) with a strong gradient (highest near the shore), and the ocean-emitted dimethylsulfide and its unique oxidation product, CH₃SO₃⁻, were very low (i.e., ≤ 40 parts per trillion and <0.05 µg/m³, respectively), the observed SO₄²⁻ aerosols are believed to be primarily of terrestrial origin. Back trajectory calculations indicate sulfur emissions from smelters and power plants along coastal regions of Peru and Chile are the main sources of these SO₄²⁻ aerosols. However, compared to observations, model calculations appeared to underestimate sulfate concentrations based on an existing emission inventory. The agreement between observations and model predictions of CO as well as total sulfur is reexamined in this work with a new emission inventory made available recently.

This poster will be displayed at ASR Science Team Meeting.

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