Source attribution of climatically important aerosol properties measured at Paposo (Chile) during VOCALS

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Measurements of submicron aerosol composition, light scattering, and size distribution were made from 17 October to 15 November 2008 at the elevated Paposo site (25° 0.4' S, 70° 27.01' W, 690 m a.s.l.) on the Chilean coast as part of the VOCALS* Regional Experiment (REx). Based on the chemical composition measurements, a receptor modeling analysis using Positive Matrix Factorization (PMF) was carried out, yielding four broad source categories of the aerosol mass, light scattering coefficient, and a proxy for cloud condensation nucleus (CCN) concentration at 0.4% supersaturation derived from the size distribution measurements assuming an observed soluble mass fraction of 0.53. The sources resolved were biomass burning, marine, an urban-biofuels mix and a somewhat ambiguous mix of smelter emissions and mineral dust. The urban-biofuels mix is the most dominant aerosol mass component (52%) followed by biomass burning (25%), smelter/soil dust (12%) and marine (9%) sources. The average (mean±std) submicron aerosol mass concentration, aerosol light scattering coefficient and proxy CCN concentration were, 8.77±5.40 μg m−3, 21.9±11.0 Mm−1 and 548±210 cm−3, respectively. Sulfate is the dominant identified submicron species constituting roughly 40% of the dry mass (3.64±2.30 μg m−3), although the indentified soluble species constitute only 53% of the mass. Much of the unidentified mass is likely organic in nature. The relative importance of each aerosol source category is different depending upon whether mass, light scattering, or CCN concentration is being considered, indicating that the mean size of aerosols associated with each source are different. Marine aerosols do not appear to contribute to more than 10% to either mass, light scattering, or CCN concentration at this site. Back trajectory cluster analysis proved consistent with the PMF source attribution.

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