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ACD/EOL

The Giant Nuclei Impactor (GNI) and first results on marine boundary-layer measurements of giant sea-salt aerosols from VOCALS

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Monday, November 12th, 2012, 3:30 p.m.

3:00 p.m. – Refreshments & Socializing

Foothills Lab 2, Room 1022

Abstract

Giant sea-salt aerosol particles ($r_d > 0.5$ μm) are primarily important due to their radiative effect and their ability to serve as nuclei for droplet formation.

This study focuses on a new instrument, the Giant Nuclei Impactor (GNI). The measurement principle follows Woodcock (1953) with external impaction onto a microscope slide, followed by optical microscope analysis under humidified laboratory conditions. This is done using digital image recognition, and a highly automated process. The result is high-volume samples of NaCl equivalent size spectra of sea-salt particles in non-cloudy air.

The instrument uses light equalization, a threshold edge detection algorithm, Kohler theory to relate spherical cap volume to equivalent NaCl salt mass, and image shape to characterize particles. In addition, a Monte-Carlo model is developed to describe the change to size distributions due to impacting particles hitting previously impacted particles; i.e. coalesce on the slide. As particle splashing is a potential problem for measuring size distributions, an analysis of the spatial distribution of particles is developed to assess drop breakup. Spatial distribution of particles is also used to evaluate if slides have been affected by drizzle. Finally, the GNI instrument is characterized in terms of concentration and sizing uncertainties.

The instrument was used during the 2008 VOCALS deployment in the SE Pacific marine stratocumulus regime. The about 450 exposed slides yield an unprecedented statistical base of measurement of giant sea-salt particles. The discussion of these will focus on measurement in the mixed layer, typically 200 m above sea-surface. These measurements will be contrasted with prior studies that were typically sampling close to sea surface – with some surprising results.