



Aerosol particle characterization and removal by clouds and precipitation in Puerto Rico:

Preliminary results from the Puerto Rico aerosol and cloud study

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Objectives

The Puerto Rico Aerosol and Cloud Study (PRACS) is a recently completed experiment to investigate the removal of aerosol particles by the clouds and rain that routinely develop on East Peak, the one of the highest points in the mountains of Puerto Rico. The study began in late November, 2004 and ended in late January 2005.

Methodology

The research approach was to measure aerosol particle (AP) properties at two points along the trajectories of air masses originating over the ocean and passing over the mountain range. Instrumentation to characterize particle properties was installed at the upwind location on the coast near the most northeast corner of the island and at East Peak, the highest point (1000 m) on the most northeast point of the mountain range. The parameters measured at each site were:

Condensation nuclei (CN) concentration (TSI CN counters)

Cloud Condensation Nuclei (CCN) concentration

Scattering and absorption coefficient (nephelometers and soot photometers)

Particle size distributions from 0.01 to 25 μm (SMPS + PMS LASAir)

Particle chemistry (Aerodyne aerosol mass spectrometers)

Meteorological parameters

Additionally at the coastal site were cascade impactors for particle collection and subsequent chemical analysis and an HTDMA for particle hygroscopicity studies. At the mountain site, usually enveloped in cloud with frequent precipitation, were additional measurements of:

Cloud droplet distributions (PMS FSSP-100)

Precipitation spectra (PMS 2D-C and 2D-P)

Cloud water collection (collector courtesy of Jeff Collett, CSU)

Rain water collection

The cloud and rain water samples will be analyzed for the concentration of selected inorganic and carbon species (organic and elemental carbon). In addition, the AMS sampled alternatively from an interstitial and counterflow virtual impactor inlet. Two CN counters and soot photometers were operated in parallel utilizing these two types of inlet, as well.

The air flow was predominantly from the ENE and ESE with occasional flows from the SSE. The horizontal distance between the two measurement sites was approximately 20 Km, and average wind speeds were 10 ms^{-1} . Hence, air sampled at the upwind site would arrive at the mountain site approximately 30 minutes later.

The preliminary results show that the cloud and rain water is acidic with PH values between 4.7 and 5.2 and the interstitial particles are primarily composed of sulfate, as determined from the AMS measurements; however, but an appreciable amount of organic material was correlated with events when CN counts exceeded 1000 cm^{-3} . The cloud droplet concentrations were in reasonable agreement with the CCN concentrations measured at 0.5% supersaturation, but more quantitative comparisons will be made once appropriate quality assurance and corrections are applied to the data.