Geophysical Research Abstracts
Vol. 12, EGU2010-12393, 2010
EGU General Assembly 2010

Airmass characterisation along the 20-degree South parallel during the VOCALS-REx campaign

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The VAMOS Ocean-Cloud-Atmosphere-Land Study (VOCALS) is a collaborative international campaign to better understand physical and chemical processes central to the climate system of the Southeast Pacific (SEP) region - a tightly coupled system involving poorly understood interactions between the ocean, atmosphere and steep continental tomography. The VOCALS Regional Experiment (REx), conducted from Arica, Chile, in October/November 2008, consisted of five well-equipped research aircraft, two scientific marine vessels and two land sites - and was ultimately driven by a need for accurate and detailed in situ and remote-sensing data in order to improve model simulations of the coupled climate system, both in the SEP and over the wider tropics and subtropics. The coordination through VOCALS of observational and modeling efforts will lead to improved forecast models for climate and regional forecasting agencies.

A key aircraft sampling methodology during VOCALS-REx involved an intense and frequent survey of the 20-degree South parallel from 72 to ∼85 degrees West to capture spatially and statistically representative diurnal and inter-day variability in MBL and free tropospheric thermodynamics, cloud properties and composition.

This paper will discuss the context of the prevailing meteorology in the SEP during VOCALS-REx, together with the character, origins and composition of MBL and free tropospheric airmasses sampled along the 20-degree South line, with particular emphasis on the observed gradient in chemical and particulate concentrations from a coastally-influenced zone to the more remote SEP. This study makes use of available gas phase and aerosol data from the five research aircraft, which synergistically sampled the area, as well as available data from surface sites. The observed spatial and temporal gradients in composition along the 20-degree South line, will be discussed in relation to the ability of particulate matter to act as cloud condensation nuclei, and hence their potential influence on observed cloud bulk properties. The representativeness of the airmasses sampled during VOCALS-REx, in terms of pollutant sources and atmospheric dynamics, will be discussed with modeling requirements in mind.