Session: C12 Poster: M58A

VOCALS/Southeast Pacific science: Does precipitation susceptibility change with increasing cloud thickness in marine stratocumulus?

Christopher Terai[†]; Robert Wood; David Leon
[†] University of Washington, USA
Leading author: csterai@yahoo.com

A better understanding of the precipitation suppression by aerosols in low level warm clouds is essential to reduce the uncertainties of the aerosol indirect effect. Recent studies have quantified the suppression of warm rain due to increased aerosol concentrations by using the precipitation susceptibility construct. The precipitation susceptibility quantifies the fractional decrease in precipitation due to a fractional increase in aerosol or cloud droplet number concentration. Using aircraft data of marine stratocumulus from the VOCALS Regional Experiment, we investigate whether precipitation susceptibility varies with increasing cloud thickness and explore the sensitivity of the results to averaging length and to the altitude at which the precipitation is measured. In-situ aerosol concentrations from the Passive Cavity Aerosol Spectrometer Probe (size range: 0.1 - 3 microns) and cloud properties from the Wyoming Cloud Radar and Wyoming Cloud Lidar are used to calculate the susceptibility. We find that across observed cloud thicknesses the precipitation susceptibility is positive (decreases in precipitation correlate with increases in aerosols). We also find that the precipitation susceptibility decreases with increasing cloud thickness. We attribute much of the decreasing trend to the decreasing sensitivity of drizzle fraction (fraction of clouds that are drizzling) to aerosol concentrations at increased cloud thicknesses. Using liquid water path retrievals from the G-band Vapor Radiometer, we also investigate how precipitation susceptibility varies with increasing cloud liquid water path. We find a similar behavior of decreasing susceptibility with increasing cloud liquid water path. This result is despite the fact that the G-band Vapor Radiometer is able to retrieve cloud properties from a larger percentage of the total observed clouds, compared to the Wyoming Cloud Radar.