Geophysical Research Abstracts
Vol. 12, EGU2010-5468, 2010
EGU General Assembly 2010

Remote Sensing of Aerosol-Cloud Interactions above an Ocean Platform

Gregory Schuster (1), Wenying Su (2), Bryan Fabbri (2), Rabindra Palikonda (2), and Patrick Minnis (1)

(1) NASA LaRC, Hampton, United States (gregory.l.schuster@nasa.gov), (2) Science Systems and Applications,Inc.(SSAI), Hampton, Virginia, USA

Clear sky areas in the vicinity of low level cumulus clouds are attractive regions for studying the aerosol indirect effect. Passive satellite remote sensing indicates that aerosol optical depth (AOD) and fine mode AOD fractions increase in these areas, but there has been much discussion about whether these retrievals represent true changes in particle microphysics (as opposed to 3D effects not considered in the retrievals). Three-dimensional effects are not an issue for narrow field of view sun photometers and high spectral resolution lidars (HSRL), and limited flight measurements with these instruments also indicate an increase in AOD within 2-5 km of cumulus clouds. The study we present here utilizes sun photometer measurements on partly cloudy days at an ocean platform located 25 km of the East Coast U.S. (i.e., the Chesapeake Lighthouse).

We consider only days when clear-sky and partly-cloudy conditions occur on the same day (to limit dynamic meteorological effects), and parse the dataset into two populations: “clear” and “partly cloudy.” We define skies as “clear” when the cloud fraction determined by Geostationary Operational Environmental Satellite (GOES) imagery is less than 5%. and as “partly cloudy” for scenes with single-layer cloud fractions of 0.5-0.8, maximum cloud heights of 2 km, and less than 1% ice. We require GOES imagery to be obtained within 15 minutes of all sunphotometry measurements used in this study. We evaluate differences in surface meteorology (pressure, temperature, wind speed, wind direction, and relative humidity) and aerosol optical depth for the clear and partly cloudy populations.

Our results for 33 partly cloudy periods indicate that the 870 nm wavelength optical depths are greater for the partly cloudy populations than corresponding clear populations (> 67% confidence level), but wavelengths shorter than 870 nm indicate less significant change. Consequently, the 500-870 Angstrom Exponent (AE) indicates a significant decrease at the 95% confidence level in the partly cloudy population, but the 380-440 AE does not indicate a significant change (nor does the surface meteorology). We have previously shown that long wavelength AE are sensitive to the aerosol fine mode volume fraction, and the short wavelength AE are sensitive to the fine mode effective radius. Hence, these AE observations are consistent with an aerosol system that has reduced fine mode aerosol volume fractions in the partly cloudy regions, but not necessarily larger fine mode particles. Similar results occur when the meteorology is further constrained to RH values < 80% and RH differences < 5% (thus minimizing the effects of aerosol swelling).