Geophysical Research Abstracts
Vol. 13, EGU2011-1984, 2011
EGU General Assembly 2011

Aerosol optical and microphysical properties from POLDER-PARASOL multi-angle photo-polarimetric measurements

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In order to make full use of the capability of satellite instruments that measure intensity and polarization properties of reflected light at multiple viewing angles, algorithms are needed that consider a continuous parameter space for aerosol microphysical properties (size distribution, refractive index) and properly account for land or ocean reflection by retrieving land/ocean parameters simultaneously with aerosol properties. In this paper we apply a retrieval algorithm based on these principles to PARASOL measurements over the ocean. We fit a radiative transfer model for a coupled atmosphere-ocean system to the PARASOL measurements and retrieve the oceanic Chlorophyll-A concentration, wind-speed in 2 directions, and fractional foam coverage in addition to all parameters related to a bi-modal aerosol model. The retrieved values for Aerosol Optical Thickness (AOT) and Angstrom exponent agree well with sunphotometer measurements of the Aerosol Robotic Network (AERONET). We demonstrate that the PARASOL polarization measurements improve agreement with AERONET compared to intensity-only retrievals. Finally, based on comparison of our forward radiative transfer calculations and the PARASOL measurements, we discuss the high potenitial of multi-angle photopolarimetric for the simultaneous retrieval of aerosol and cloud properties.