Geophysical Research Abstracts,
Vol. 11, EGU2009-2155, 2009
EGU General Assembly 2009

Absorbing aerosols above clouds: Getting hold of the direct aerosol effect

K. Peters (1,2) and J. Quaas (2)

(1) University of Hamburg, Hamburg, Germany (karsten.peters@zmaw.de), (2) Max Planck Institute for Meteorology, Hamburg

Aerosol effects, direct as well as indirect, constitute the biggest uncertainties when it comes to quantifying human induced climate change. Understanding these will thus increase the credibility of climate predictions.
This study focuses on the direct aerosol effect when absorbing aerosols reside above clouds. In cloud-free conditions, absorbing aerosols usually exert a negative radiative forcing at TOA due to an overall enhancement of the shortwave local planetary albedo (LPA). When located above clouds, these aerosols can potentially reduce the shortwave LPA, resulting in an often significant local positive radiative forcing. Investigation of these situations on a global scale is particularly interesting, since this has not been done to satisfaction using measurements only.
A method for deriving the direct aerosol effect of absorbing aerosols above clouds solely from measurements is presented in this study. Global data of 2005 and 2006 from a number of sensors aboard satellites of the "A-Train" constellation is used, since these guarantee a very good correlation in time and space. Aerosol properties are taken from MODIS and OMI, cloud properties from MODIS and AMSR-E and radiation measurements from CERES (all on board EOS-Aqua, except for OMI on board EOS-Aura). A multiple linear regression is used to identify the dependence of the LPA in cloudy scenes on aerosol optical depth (AOD), using the OMI UV-Aerosolindex (UV-AI) as an indicator.
The results show a decrease of the LPA with increasing amount of absorbing aerosols in cloudy scenes, demonstrating that it is feasible to derive the direct aerosol effect of absorbing aerosols above clouds using a combination of remote sensing instruments. The direct radiative forcing of anthropogenic absorbing aerosols in cloudy scenes is then computed, showing pronounced positive radiative forcing values especially off the coast of southern Africa, depending on the season.