A simple linear model for radiative forcing of absorbing aerosol above clouds

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MODIS (Terra), Aug 15, 2006

Absorbing aerosol in cloudy scenes: effects on atmospheric radiation

Satellite observations reveal importance of accounting for aerosol-cloud overlap

Latest generation of satellite platform setups enables quantification

Absorbing aerosol in cloudy scenes: effects on atmospheric radiation

Motivation

The local-planetary-albedo linear model

\[ \alpha \approx a_0 + a_1 \ln(LWP) + a_2 \ln(AOD) \]

Methodology

The local-planetary-albedo linear model

Filter for abs. aerosols

UV-Aerosol Index (UVAI) from OMI instrument on EOS-AURA, daily values, 0.25°x0.25° resolution

UVAI < 0.7 < UVAI mostly scattering mostly absorbing

Regions defined for the analysis, data for Jan 2005 - Dec 2007

UV-AI off SW-Africa, July – October 2008

Results

Change of local planetary albedo \( \alpha \) with \( \ln(AOD) \)

The linear model reveals a reduction of albedo in cloudy scenes with absorbing aerosols being present

Cloud prevents aerosol-radiation interaction; small negative forcing, i.e. COOLING

Cloud enhances "surface albedo"; potentially large positive forcing, i.e. WARMING

Indirect rather than direct effect through modification of cloud properties

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Application to spatial data shows absorption effects of both biomass burning aerosol (seasonality !) from SW Africa, as well as dust aerosol from N Africa !

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