Geophysical Research Abstracts, Vol. 8, 07961, 2006
SRef-ID: 1607-7962/gra/EGU06-A-07961

Aerosol radiative forcing at the Earth's surface derived from METEOSAT-7

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The Downwelling surface Shortwave Radiation flux (DSR) is the radiative forcing of Soil Vegetation Atmospheric Transfer schemes employed for climate modelling (Global Circulation Models and Numerical Weather Predictions). The GEOLAND Observatory on Natural Carbon Fluxes estimates the response of vegetation to the solar energy reaching the ground level through the DSR input delivered by the GEOLAND Core Service on Bio-Geophysical Parameters. Spatial sensors on geostationary platforms are most appropriate to estimate DSR with the GEOLAND requirements of hourly products and global coverage. Top Of the Atmosphere (TOA) radiance measurement processing is differentiated into the cloudy-sky processing line and the clear-sky processing line. The clear-sky algorithm combines statistical and physical methods to select DSR from a Look-Up-Table of DSR and TOA radiance values generated precisely with the 6S radiative transfer code, sweeping the input parameters representing more than 500 surface atmosphere system models. The advantage of the method is twofold: no ancillary information about the atmosphere and the surface properties is necessary, and the DSR retrieval is sensitive to the aerosol presence. The difference between the retrieved DSR and the simulation calculated with a radiative transfer code parametrised without aerosols provides the aerosol radiative forcing (ARF) at the surface level. The algorithm is applied to derive the variability of the aerosol radiative forcing at 07:20 (Greenwich Mean Time) during the aerosol episode coincident with the European heat wave of 2003 summer. ARF varies between 20 and 100 Wm-2 in Carpentras (44.0°N, 5.0°E), France, for the aerosol optical thickness (AOT), measured at 440 nm by the AErosol RObotic NETwork, varying between 0.1 and 0.6. Correlation between ARF and AOT is high, providing the sensitivity of ARF

on AOT, expressed by the normalised aerosol radiative forcing NARF, of 100 Wm-2 for a unity-variation of AOT. During the same time period, the sensitivity is similar in Palaiseau (48.7°N, 2.2°E), France, with NARF=80 Wm-2.