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The surface radiation budget from the CMSAF: Algorithms and validation

R. Hollmann, R. W. Müller, A. Gratzki and J.Schulz

Deutscher Wetterdienst, Offenbach, Germany (rainer.hollmann@dwd.de / Fax: +49 69 8062 4955 / Phone: +49 69 8062 4923)

Since January 2005, the SAF on Climate Monitoring (CM-SAF, http://www.cmsaf.dwd.de) derives operationally consistent cloud and radiation parameters in high spatial resolution for an area that covers Europe and part of the North Atlantic. The cloud and surface radiation products are based on data from the polar orbiting satellites NOAA (and in future METOP) for the northern latitudes. Later this year data from MSG (METEOSAT-8) for the mid latitudes will be used. The surface radiation product suite covers the short- and longwave fluxes as well as the independently derived surface albedo and its budgets.

The basic idea for the surface incoming shortwave flux (SIS) algorithm is that a relationship exists between the broadband (0.2-4.0 μm) atmospheric transmittance and the reflectance at the top of the atmosphere (TOA). Once the transmittance is determined from the TOA albedo, the surface irradiance can be computed from the incoming solar flux at TOA and the atmospheric transmittance. The actual computation of the surface irradiance involves two steps. First the broadband TOA albedo is determined from the satellite measurement. Then the atmospheric transmittance is determined from the TOA albedo together with information on the atmospheric and surface state with a time-efficient Modified Lambert Beer (MLB) approach.

The algorithm for the calculation of surface downward longwave flux is based on the assumption that there is a linear relationship between the clear sky flux and the flux in cloudy conditions multiplied with the fractional cloud cover. In this the clear-sky and cloudy sky downward longwave flux is parameterised as a function of the total water vapour content of the atmosphere, an effective emitting temperature and cloud base temperature. The required input data are derived from satellite data (AVHRR, MSG).

Profiles of temperature and humidity come from NWP model output.

This paper reports on validation results using AVHRR data for selected months and surface sites and will give first results of MSG-derived surface fluxes.