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Detection of Saharan Dust with Ground-based Radiation Measurements

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The evaluation of the radiation data of the network of the German Meteorological Service (Deutscher Wetterdienst, DWD) and especially of the data of different broadband and spectral instruments of the Lindenberg Meteorological Observatory (MOL-RAO) on August 19th/20th 2012 show signals which are a result of a Saharan dust event. The origin is proved by analysing the backward trajectories of the GME weather forecast model.

The dust event is characterised by means of ground based measurements of broadband and spectral irradiation, derived aerosol properties and ceilometer backscatter profiles.

In this contribution as a start the daily course of global, diffuse and direct radiation at normal incidence of the Baseline Surface Radiation Network (BSRN) station at Lindenberg (φ=52°12' N; λ=12°07' E; h=126 m) is discussed. Synoptical observations by Lindenberg weather station as well as satellite observations indicate a cloudfree sky for the whole day. In the afternoon hours a remarkable reduction of the direct component and a simultaneous increase of the diffuse component of radiation were recorded, meanwhile global radiation remains almost undisturbed.

Spectral measurements of direct radiation with a Precision Filterradiometer (PFR) are used to derive spectral aerosol optical depth (AOD) as well as Angstroem turbidity parameters α and β. Both quantities undergo a large change within 3 hours, which is in good agreement to the changes in the broadband measurements. The results are interpreted as a shifting of particle fraction for the benefit of large particles.

Atmospheric aerosol transported from North Africa and Spain to Central Europe led to changes in global and diffuse spectral irradiance in the UV region. Model output values from an RTM to simulate its optical effect by absorption and scattering are in line with measured components of solar UV irradiance.

The advection of dust-contaminated air over parts of Germany can be monitored using data of ceilometer network. A maximum layer depth of 2.5 km is observed.

Calculations of broadband-AOD (Gueymard, 1998) for selected sites of the radiation network make up a view on dust advection on Aug 20, 2012.