DOWNWELLING SHORTWAVE RADIATION FROM MSG GEOSTATIONARY SATELLITE FOR LAND SAF: ACCURACY ASSESSMENT OF THE DIFFUSE COMPONENT USING SIRAMix METHOD AND INPUT AEROSOL LOAD AND TYPE

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Objectives and Rationale - Since 2005 data from Meteosat Second Generation (MSG) satellite are routinely processed in near real time by the LSA-SAF operational system in Lisbon. Particularly, the downwelling surface shortwave radiation (DSSF) is delivered operationally both on half-hourly and daily basis [1]. Only a global DSSF product is so far distributed in which clear sky and cloudy situations are distinguished. The objective of this study is to show the ongoing developments for a future dissemination of diffuse and direct DSSF components as diffuse is particularly meaningful for photosynthesis. The approach considers MACC-II aerosol and the SIRAMix (Surface Incident Radiation estimation using Aerosol Mixtures) method.

Principle of SIRAMix: Clear sky conditions, aerosol type and AOD products from MACC-II => diffuse & direct DSSF

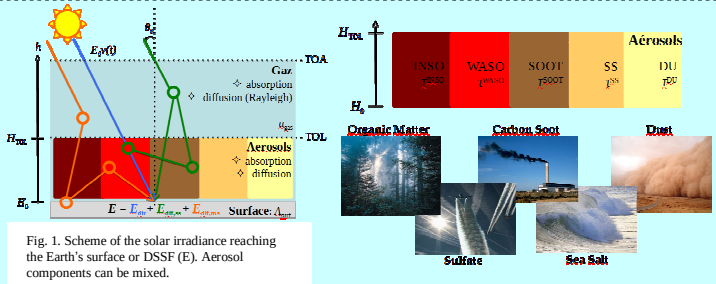


Fig. 1. Scheme of the solar irradiance reaching the Earth's surface or DSSF (E). Aerosol components can be mixed.

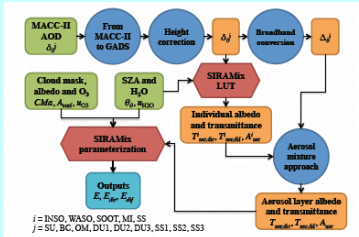


Fig. 2. Block scheme of the approach SIRAMix and the use of the inputs.

Look-Up Table (LUT):

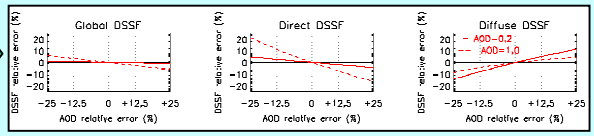
Transmittance (T_{aer}^{i}) and albedo (A_{aer}^{i}) are calculated for each aerosol type i

Radiative transfer code libRadtran + GADS

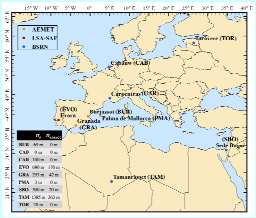
$$T_{aer} \approx \frac{1}{\tau_0} \sum_{i=1}^{n} \tau_0^i T_{aer}^i,$$

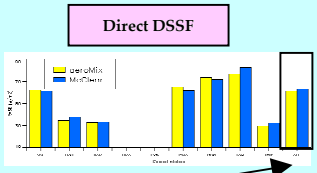
$$A_{aer} \approx \frac{1}{\tau_0} \sum_{i=1}^{n} \tau_0^i A_{aer}^i,$$

Sensitivity study on diffuse DSSF => Precision about 1%, quality of AOD is important

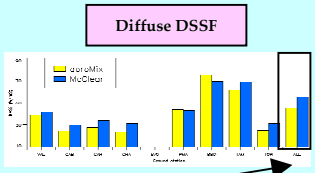


Validation with 9 ground stations (BSRN, AEMET, LSA SAF) and McClear

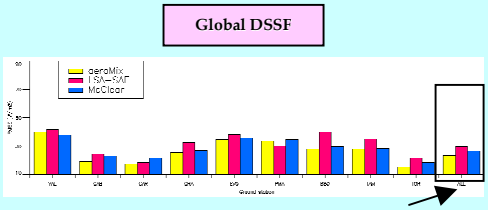




Reduction of 2.8 W/m²



Reduction of 10.3 W/m² due to aerosol mixing

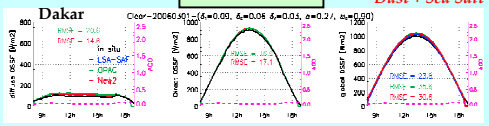


Reduction of 3.2 W/m² /McClear and 6.3 W/m² /LSA SAF due to dynamic properties of aerosol

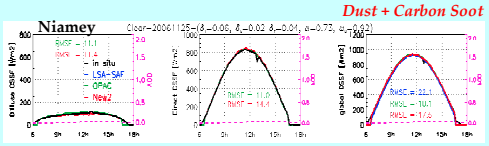
Impact study in West Africa

2 contrasted stations
Dakar (15°N, 17°W) & Niamey (14°N, 2°E)

Clear Day — *Dust + Sea Salt*

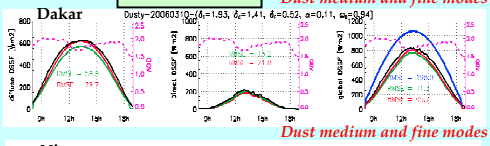


Dust + Carbon Soot

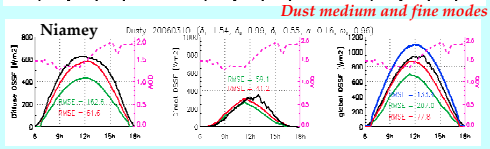


Diffuse *Direct* *Global*

Dust event — *Dust medium and fine modes*



Dust medium and fine modes



Diffuse *Direct* *Global*

- In situ - aeroMix + OPAC model - aeroMix + mixed model - LSA-SAF

Conclusion and Perspectives - SIRAMix method considers a mixing of aerosol types with intrinsic dynamic properties based on MACC-II information. This contributes to improve all DSSF components (direct, diffuse, global) between 3 W/m² and 10 W/m² when compared with McClear and actual DSSF operational products over 9 ground-based stations distributed over the MSG disk. The method uses pre-calculation of gas and aerosol transmittance and albedo terms plus DSSF quantities in LUTs that further serve to map operationally DSSF products in following the principle of an optimization. In West Africa, it appears that accounting for the mixing of aerosol (particularly various modes for dust) improves DSSF estimates. The method is computationally efficient and under implementation.

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