Radiative fluxes over Indian Ocean from METEOSAT-8 data, validation report

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1. Presentation

The OSI SAF radiative fluxes products are the Surface Solar Irradiance (SSI) and the Downward Longwave Irradiance (DLI). The operational chain uses GOES-E and METEOSAT (at 0E) data, covering the Atlantic from 60S to 60N and from 100W to 45E. [1]. A new processing chain has been implemented at the Centre de Météorologie Spatiale (CMS) of Météo-France. This chain ingests data from METEOSAT-8 located at 41.5E and is very similar to the operational chain, but adapted to a different geographical area.

The METEOSAT-8 radiative fluxes are produced on the area 60S-60N–19.5W-101.5E, partially covering the Indian Ocean. The products have been validated against in situ data with the same method as for the operational products [2]. This validation is based on Match-up Data Bases (MDB) gathering coincident METEOSAT data and in situ measurements, from pyranometer or pyrgeometer.

The processing chain and validation of METEOSAT-8 radiative fluxes are not an OSI SAF commitment, they are done on best effort.

References :

[1] Geostationary Radiative Flux (Products OSI-303, 304, 305, 306) Product User Manual, Version 1.6, April 2017, SAF/OSI/CDOP/M-F/TEC/MA/182

[2] METEOSAT and GOES-E Radiative Fluxes Validation Report (products OSI-303, 304,305, 306) Version 1.2 June 2011. SAF/OSI/CDOP/M-F/TEC/MA/184

2. Validation stations

At present, the validation stations usable for METEOSAT-8 products are only stations that are also used for METEOSAT-10 (at 0E). The station positions are shown in figure 1, their satellite zenith angle values are presented below.

	METEOSAT-10	METEOSAT-8
Toravere (Finlande)	70.0	67.4
France (métropole)	49.2-57.2	58.6-67.5
Tamanrasset	27.4	48.2
Pamandzi (Mayotte)	53.7	15.7
Gillot (La Réunion)	66.0	29.2

The tropical moored buoys of the RAMA (Research Moored Array for African-Asian-Australian Monsoon Analysis) network have been taken into account: the corresponding satellite data are ingested into the MDB, but the buoy data are not presently available.

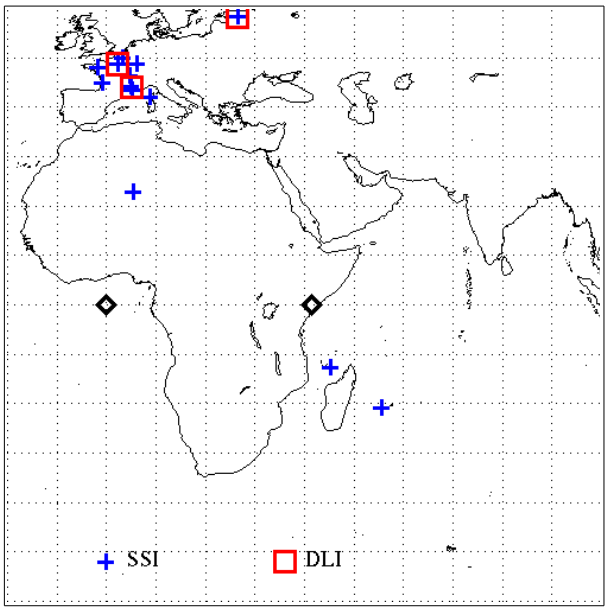

Figure 1: measurement stations used for METEOSAT-8 radiative fluxes validation. The black diamonds show the satellite positions, METEOSAT-10 at 0E and METEOSAT-8 at 41.5E.

3. Results

Validation statistics of METEOSAT-8 radiative fluxes have been calculated on a 4-month period, from February to May 2017.The SSI and DLI results on the whole period are presented in table 1 and 2, respectively, together with the operational results (GOES-13 & METEOSAT-10).

The METEOSAT-8 error statistics compare favorably with the operational ones. The DLI errors and the SSI mean errors (bias) are similar. The METEOSAT-8 standard deviations are lower than the operational ones, as METEOSAT-8 validation stations are fewer and have a smaller geographical distribution.

	bias	stdev	RMSE	mean	nbc	cor
hourly	7.7 1.9%	65.6 16.4%	66.0 16.6%	398.9	27208	0.967
daily	3.0 1.7%	15.2 8.7%	15.5 8.8%	175.3	1329	0.986
operational results						
hourly	4.9 1.2%	80.6 19.6%	80.7 19.6%	411.1	51743	0.954
daily	4.4 2.5%	19.9 11.0%	20.3 11.3%	180.7	2060	0.973

Table 1: METEOSAT-8 SSI validation statistics from February to May 2017. “mean” is the mean measure in Wm^{-2}. “bias” and “stdev” are the error mean and standard deviation, “RMSE” is the root mean square error, they are expressed in Wm^{-2} and in percentage of the mean measure. “nbc” is the number of cases and “cor” is the correlation coefficient. Operational results refer to GOES-13 and METEOSAT-10.

	bias	stdev	RMSE	mean	nbc	cor
hourly	-4.1 -1.4%	17.7 5.9%	18.2 6.1%	299.5	13993	0.894
daily	-3.7 -1.2%	10.7 3.6%	11.3 3.8%	298.5	317	0.944
operational results						
hourly	-4.3 -1.4%	18.7 6.1%	19.2 6.3%	304.6	43089	0.923
daily	-4.2 -1.4%	10.8 3.6%	11.6 3.8%	304.5	902	0.967

Table 2: METEOSAT-8 DLI validation statistics from February to May 2017. Similar to table 1.

Figure 2 shows the temporal variations of METEOSAT-8 validation statistics. From February to May, the SSI bias varies from 20 Wm^{-2} to 0, the DLI bias from -10 Wm^{-2} to 0. These variations are consistent with the seasonal variations observed on the operational products, see http://www.osi-saf.org.