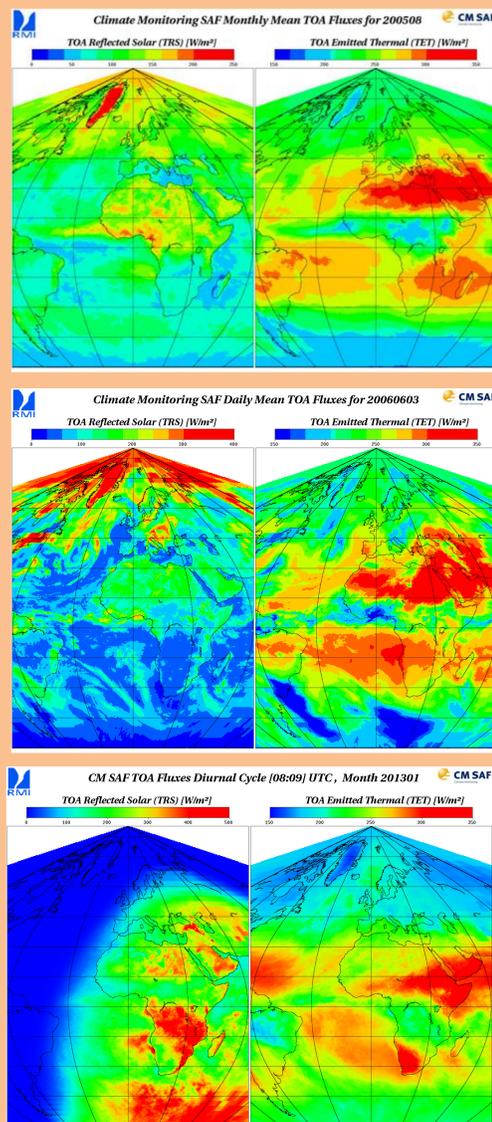# The CM SAF Top-Of-Atmosphere Radiation Products

Nicolas Clerbaux, Alessandro Ipe, Edward Baudrez, Stijn Nevens, Almudena Velazquez Blazquez, Ilse Decoster

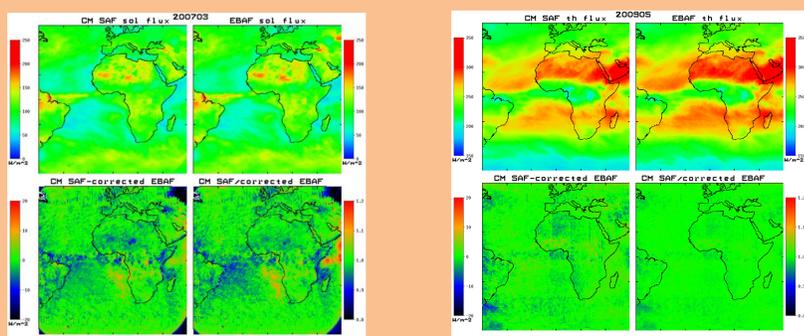Royal Meteorological Institute of Belgium (RMIB)

Existing products

1. An Environmental Data Record (EDR) is being generated since 2004 with the following features:

- based on the the Geostationary Earth Radiation Budget (GERB) instruments on the Meteosat Second Generation

- Use CERES for the Arctic region

- Sinusoidal Equal Area grid with resolution of (45km)²

- near real time (i.e. within 4 months)

- monthly mean, daily mean, and **monthly mean diurnal cycle**, in hourly intervals (see figues).

Climate Monitoring SAF Monthly Mean TOA Fluxes for 200508
TOA Reflected Solar (TRS) [W/m²]   TOA Emitted Thermal (TET) [W/m²]

Climate Monitoring SAF Daily Mean TOA Fluxes for 20060603
TOA Reflected Solar (TRS) [W/m²]   TOA Emitted Thermal (TET) [W/m²]

CM SAF TOA Fluxes Diurnal Cycle [08:09] UTC, Month 201301
TOA Reflected Solar (TRS) [W/m²]   TOA Emitted Thermal (TET) [W/m²]

2. A dataset has been released with the additional features:

- Coverage 2004 – 2011

- Homogenization of input data

- Extensive validation. The dataset shows good agreement with the Cloud and Earth Radiant Energy System (CERES) products, but provides a new dimension: **the diurnal cycle of the radiation**!

Error sources	Monthly Mean (MM)		Daily Mean (DM)		MM Diurnal Cycle (DC)	
	TRS	TET	TRS	TET	TRS	TET (daytime)
GERB instrument calibration uncertainty at 1 std. dev. (see [QGS], note 4). The accuracy given in percentage is converted in W/m² assuming TRS=100 W/m² and TET=239 W/m².	2.25% 2.3 W/m²	0.96% 2.4 W/m²	2.25% 2.2 W/m²	0.96% 2.4 W/m²	2.25% 4.5 W/m² (daytime TRS ~ 200 W/m²)	0.96% 2.4W/m²
Error due to processing (unfiltering, ADM, averaging) estimated by comparison with: CERES EBAF (MM), SYN1deg-day (DM), and SSF (DC). NB: these errors are estimated at 1x1° spatial resolution.	Bias 0.3 W/m² RMS 3W/m²	Bias 0.4W/m² RMS 2 W/m²	Bias 1.W/m² RMS 5.5 W/m²	Bias 0.5 W/m² RMS 3.6 W/m²	Bias 2.8W/m² RMS 12.8W/m²	Bias 0.9 W/m² RMS 3.1 W/m²
Additional error due to GERB-like This error is given for 100% use of GERB-like but could in practice be weighted with the actual fraction of GERB-like used in the product.	Bias 0.2W/m² RMS 1.2 W/m²	Bias 0.5W/m² RMS 1.2W/m²	Bias 0.3 W/m² RMS 1.85W/m²	Bias 0.5W/m² RMS 1.65W/m²	Bias 0.4W/m² RMS 2.3 W/m²	Bias 0.4W/m² RMS 1.3 W/m²
Additional error at 1 std. dev. due to missing MSG data (MSG failure, decontamination, colinearity, …).	Bias 0 RMS 0.4 W/m² /missing day	Bias 0 RMS 0.3W/m² /missing day	Bias 0.2 W/m² RMS 0.6 W/m²	Bias 0.1 W/m² RMS 0.2 W/m²	Bias 0.4 W/m² RMS 1.8 W/m² /missing day	Bias 0.1W/m² RMS 0.5 W/m² /missing day

CM SAF sol flux 200703   EBAF sol flux
CM SAF-corrected EBAF   CM SAF/corrected EBAF

CM SAF th flux 200905   EBAF th flux
CM SAF-corrected EBAF   CM SAF/corrected EBAF

CDOP-2 developments

1. Second edition of the TOA radiation « GERB » dataset whose main features are:

- Improved GERB fluxes as input

- Extended time period (2004-2014)

- All sky and clear sky fluxes. The new clearsky product will allow better model evaluation and estimation of the cloud radiative forcing.

- Dataset release foreseen Q2 2015

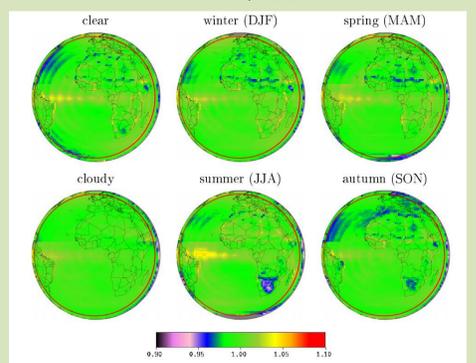*CM SAF clearsky monthly mean TRS for July 2010*
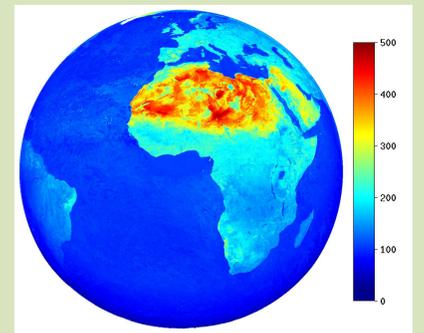
comparison with CERES EBAF
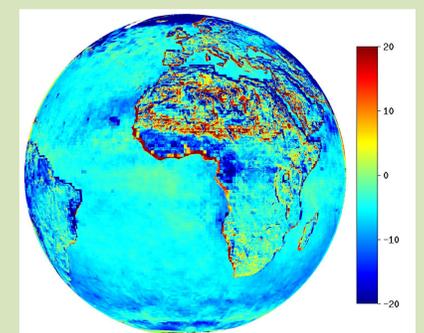
2. A long dataset combining MVIRI/SEVIRI/GERB with features:

- 1982 – 2012

- Downscaling of SEVIRI -> MVIRI (Cros et al, 2006)

- recalibration of the IR and WV channels following GSICS

- Calibration of VIS channel from SSCC or Decoster et al (2014) .

- GERB offline to tune empirical NB->BB regressions. See figures for examples of performances.

- Release foreseen Q2 2015

MVIRI GERB-like / GERB TRS ratio

clear   winter (DJF)   spring (MAM)
cloudy   summer (JJA)   autumn (SON)

MVIRI GERB-like / GERB TET ratio

Emp. Jan. 2005   Emp. Apr. 2006   Emp. July 2005   Emp. Oct. 2004

Meteosat-9
Meteosat-8
Meteosat-7
Meteosat-6
Meteosat-5
Meteosat-4
Meteosat-3
Meteosat-2

1980   1985   1990   1995   2000   2005   2010