The CM SAF Top-Of-Atmosphere Radiation Data Record from GERB and SEVIRI (ed02)

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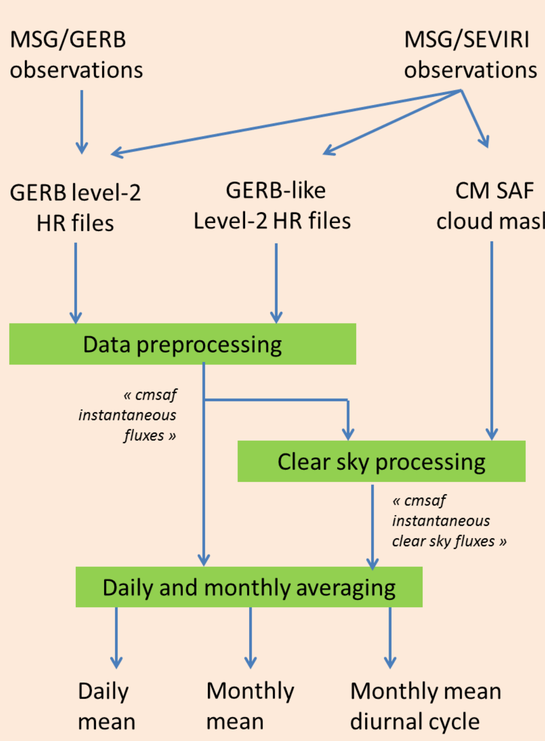
Introduction

- **A data record of TOA Radiation from GERB and SEVIRI instrument is developed within the EUMETSAT Climate Monitoring Satellite Application Facility (CM SAF).**
- **The data record complements other data records already released by CM SAF e.g. cloud products, surface radiation, water vapour, …**
- **A Delivery Readiness Review will be held on 25 Nov. 2016 to check the data record and associate documents (Product User manual, ATBD, Scientific Validation report) before official release.**

Processing flowchart

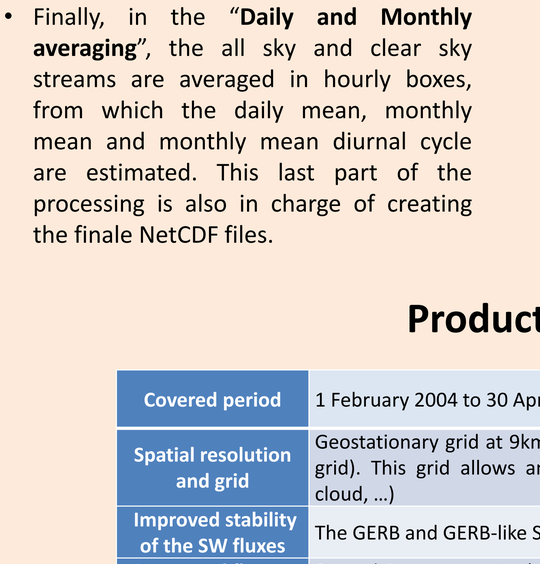
- The "**Data preprocessing**" subsystem performs several corrections of the input GERB and GERB-like data such as recalibration, homogenization, aging correction … In this step, the gaps in the GERB data record are filled with the GERB-like (a substitute based on SEVIRI). The output of the preprocessing is a stream of homogenized 15' instantaneous level 2 High Resolution (HR) data, called here "cmsaf instantaneous fluxes".
- In the "**Clear sky processing**", the fluxes are combined with the CM SAF MSG/SEVIRI cloud mask (CM-21012) to derive the 15' "cm saf instantaneous clear sky fluxes".
- Finally, in the "**Daily and Monthly averaging**", the all sky and clear sky streams are averaged in hourly boxes, from which the daily mean, monthly mean and monthly mean diurnal cycle are estimated. This last part of the processing is also in charge of creating the finale NetCDF files.



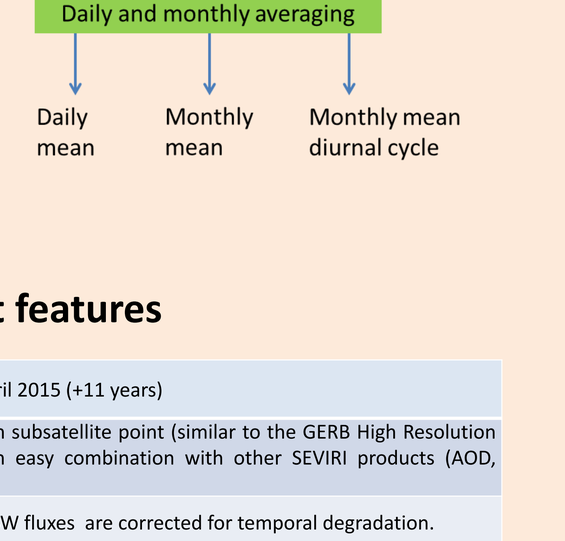
Product features

Covered period	1 February 2004 to 30 April 2015 (+11 years)
Spatial resolution and grid	Geostationary grid at 9km subsatellite point (similar to the GERB High Resolution grid). This grid allows an easy combination with other SEVIRI products (AOD, cloud, …)
Improved stability of the SW fluxes	The GERB and GERB-like SW fluxes are corrected for temporal degradation.
Improved fluxes processing	Several improvements (wrt GERB ED01) are applied to the solar and thermal fluxes processings.
Use of backup satellite data	Using data from backup satellite allows reducing the number and the length of the input data gaps.
Output quantities	SW and LW fluxes in provided for "all sky" and "clear sky" conditions .
Temporal characteristics	Fluxes provided as daily mean, monthly mean and monthly mean of the hourly values (diurnal cycle) in the data record.
Validation	Validation performed at lower resolution (1°x1°) by inter-comparison with CERES and HIRS OLR CDR data records.
Format	A NetCDF file format following the CF convention.

Illustrations – monthly mean and daily mean

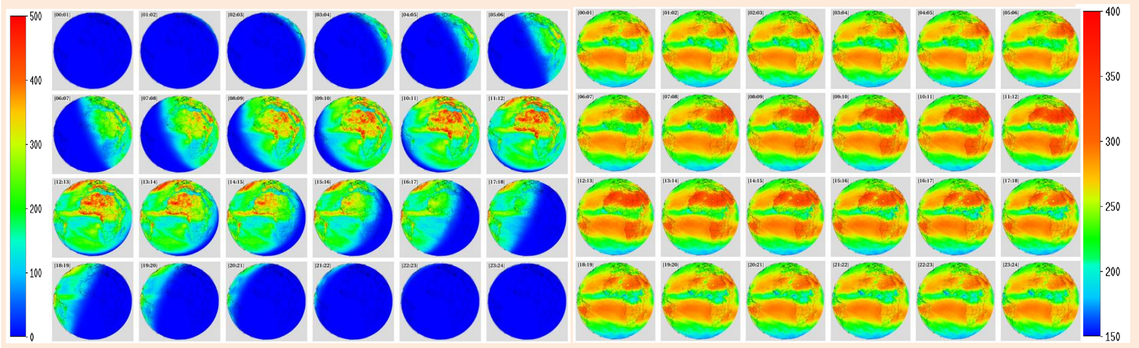


Monthly mean products for June 2010. The upper panels are TRS, lower are TET. Left are allsky fluxes and right is clear sky fluxes. All fluxes are in W/m².



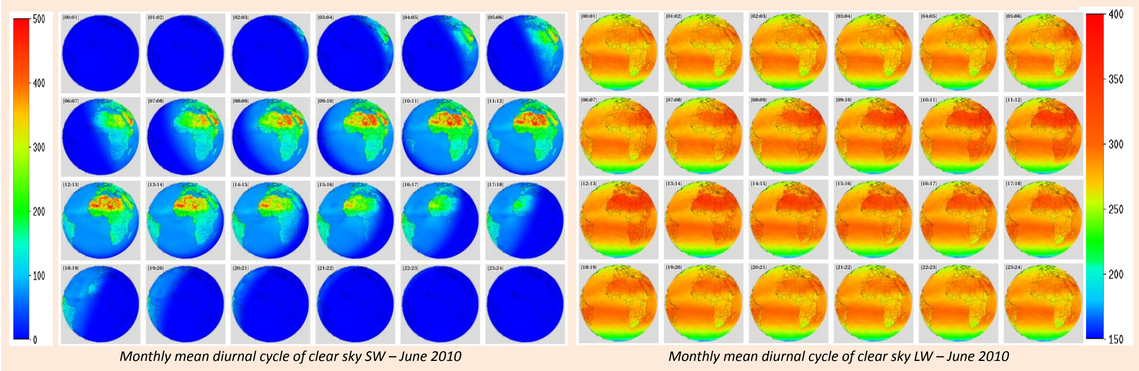
Daily mean products for 1st June 2010. The upper panels are TRS, lower are TET. Left are allsky fluxes and right is clear sky fluxes. All fluxes are in W/m².

Illustrations - monthly mean diurnal cycle



Monthly mean diurnal cycle of all sky SW – June 2010

Monthly mean diurnal cycle of all sky LW – June 2010



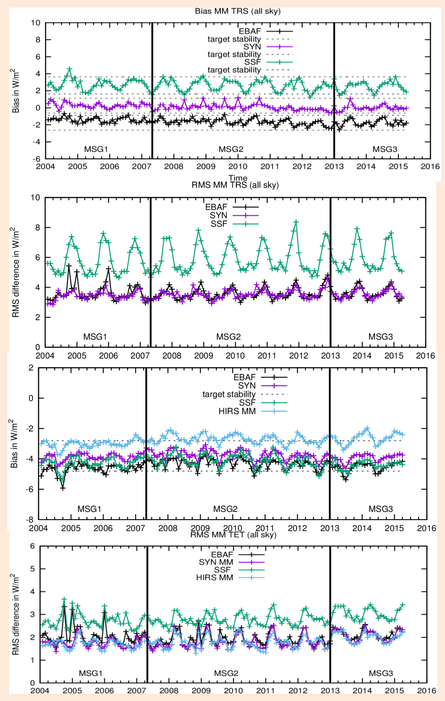
Monthly mean diurnal cycle of clear sky SW – June 2010

Monthly mean diurnal cycle of clear sky LW – June 2010

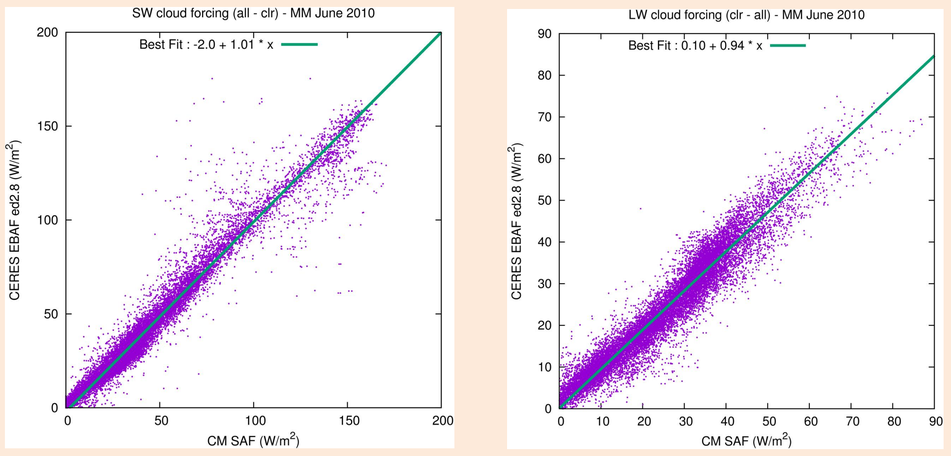
Intercomparison with CERES and HIRS OLR CDR

- The full data record is compared with CERES EBAF ed2.8, SYN1deg Edition 3A(month, daily, 3HM) and SSF Edition 3A (month, day).
- The all sky thermal flux is compared with HIRS OLR CDR daily v1.2.
- Biases wrt CERES and HIRS are stable (< 2 W/m²)
- RMS differences are stable over the data record and agree with the targeted accuracies (users req.).

Product		Requirement (threshold / target optimum)	RMS difference with CERES	
			all sky	clear sky
Monthly Mean	TRS	8/4/2 W/m²	3.5 W/m²	4.6 W/m²
	TET	4/2/1 W/m²	1.8 W/m²	3.0 W/m²
Daily Mean	TRS	16/8/4 W/m²	6.6 W/m²	6.1 W/m²
	TET	8/4/2 W/m²	4.5 W/m²	6.9 W/m²
Monthly Mean Diurnal Cycle	TRS	16/8/4 W/m²	10.9 W/m²	12.6 W/m²
	TET	8/4/2 W/m²	3.7 W/m²	5.6 W/m²



Example of applications : cloud forcing



SW (left) and LW (right) cloud radiative effect in June 2010 (monthly mean). Each dot is a 1°x1° area. The CM SAF cloud effects agree well with CERES EBAF ed2.8.

Summary

+ New ERB data record to be released soon via http://www.cmsaf.eu

+ Good agreement with the CERES and HIRS OLR products

+ fine spatial resolution (9km subsatellite point)

+ diurnal cycle at 1 hour resolution

+ accurate daily mean products

- Limited to Meteosat FOV

- Monthly averaging less efficient to reduce ADM errors due to constant direction of observation.

More info and access to CM SAF data : www.cmsaf.eu