Koninklijk Meteorologisch Instituut

Institut Royal Météorologique

Königliches Meteorologisches Institut

Royal Meteorological Institute

Geostationary Earth Radiation Budget (GERB): status update and user-friendly access to GERB data using Python

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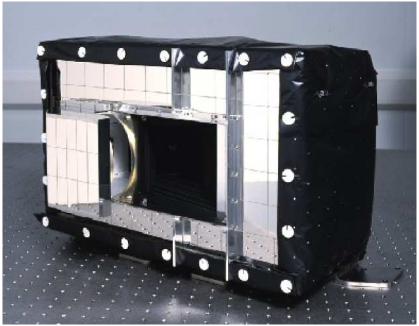
The GERB instrument

- Geostationary Earth Radiation Budget 2,1,3,4 aboard Meteosat Second Generation 1,2,3,4
- Broadband radiometer (0.32μm to 4μm and 0.32μm to 30μm)
- Field-of-view as SEVIRI
- 50km x 50km resolution at nadir
- 15 minutes refresh rate for “HR” product



The GERB project

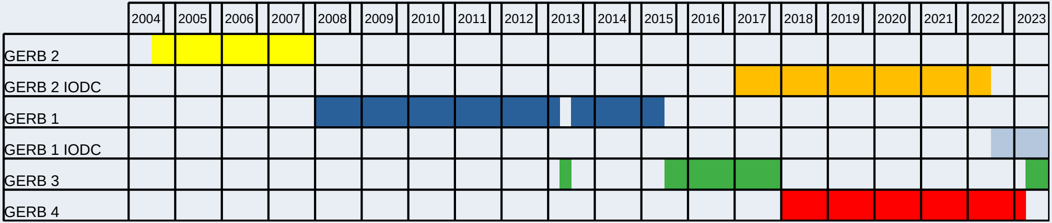
Consortium organization

Laboratory	Country	Role
Imperial College (IC)	UK	Science lead, calibration, aerosol
Rutherford Appleton Laboratory (RAL)	UK	Instrument operation, “GGSPS”[1], data up to L1
Royal Meteorological Institute of Belgium (RMIB)	BE	Geolocation and L2 products

[1] GERB Ground Segment Processing System

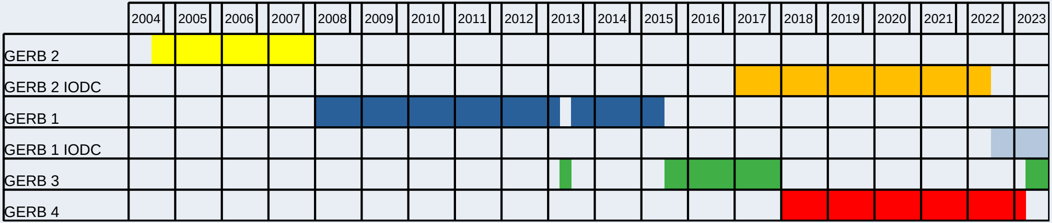
GERB instruments since 2004

Timeline



GERB instruments since 2004

Timeline



Current status

- GERB 1 operating over Indian Ocean
- GERB 3 operating at 0 degree
- GERB 4 off since february 2023

Data

Data availability

- GERB 2 - GERB 1: CEDA `https://data.ceda.ac.uk/badc/gerb/`
- Also in CM SAF: *TOA Radiation from GERB/SEVIRI ed. 2.0* `https://wui.cmsaf.eu/safira/action/viewDoiDetails?acronym=TOA_GERB_V002`
- Obs4MIPS `https://data.ceda.ac.uk/neodc/obs4MIPs/ImperialCollege/GERB-HR-ED01-1-0`
- 40 days of NRT data for GERB 3: `https://gerb.oma.be/`

Data products

GERB data products

NANRG	Non Averaged Non Rectified Geolocated (50km)
ARG	Average, Rectified, Geolocated
HR	High Resolution (9km)
BARG	Binned Averaged Rectified Geolocated

- Radiances from GERB / Cloud information from SEVIRI

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GERB-like data product

HR	High Resolution (9km)

- Radiances from SEVIRI

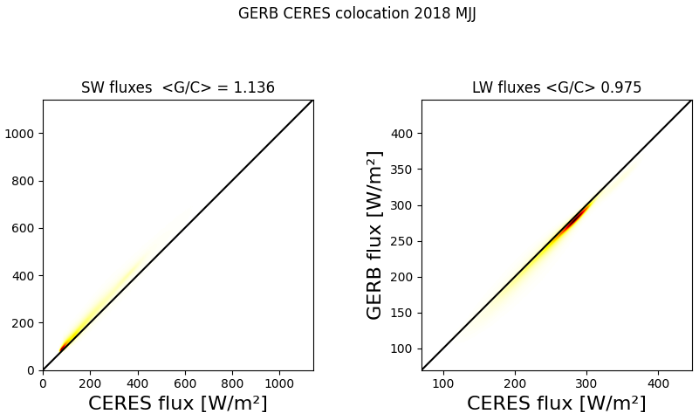
GERB CERES colocation

Method

- CERES Single Scanner Footprint (SSF) fluxes (Aqua - MODIS - FM3)
- Colocation with GERB HR product

GERB 2,1,3

	SW	LW
G2	1.05	0.97
G1	1.07	0.97
G3	1.01	0.98



GERB CERES colocation 2018 MJJ

SW fluxes <G/C> = 1.136

LW fluxes <G/C> 0.975

GERB CERES colocation

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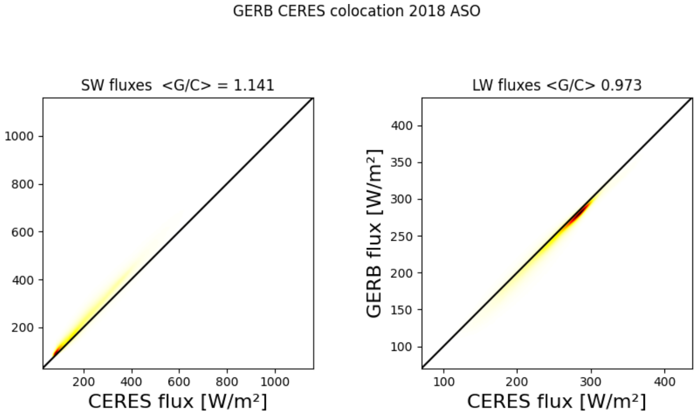

GERB L2 HDF5 files

- Flat structure
- Content
  - Radiometry: [Solar, Thermal] × [Radiance, Flux]
  - Scene Identification: Cloud, Scene Type, Angular model
  - Angles: Viewing Zenith Angle, Solar Zenith Angle, Relative Azimuth Angle
- Points of attention:
  - Floating point data is discretized: Need for multiplication by “quantization factor”.
  - “NaN” does not exist in HDF5 → check the “error value” in the documentation.

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Check the RMIB GERB Products User Guide

`https://gerb.oma.be/Documents/userguide.pdf`

RMI

Using Python

- Convenient solution: add a “reader” to the Satpy `https://satpy.readthedocs.io/` library
- Satpy supports, among others: MSG SEVIRI, MFG MVIRI, Himawari AHI, GOES ABI, AVHRR, MODIS, VIIRS
-
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Check the “Satpy reader” link `https://gerb.oma.be/`

Reading an image

Python code

```
import satpy
scene = satpy.Scene(reader="gerb_l2_hr_h5",\
filenames=["G1_SEV2_L20_HR_SOL_TH_20120621_101500_ED01.hdf"])

scene.load([’Thermal Flux’, ’Solar Flux’])
```

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Data

The data in this example is from the GERB 1 record available at `https://data.ceda.ac.uk/badc/gerb/`

Reading an image (...)

Python code for plotting

```
crs = scene[’Thermal Flux’].attrs[’area’].to_cartopy_crs()
ax = plt.axes(projection=crs); ax.coastlines();
ax.gridlines(); ax.set_global()
plt.imshow(local_scene[’Thermal Flux’], transform=crs,\
extent=crs.bounds, origin=’upper’, cmap=plt.cm.hot)
```

Reading an image (...)

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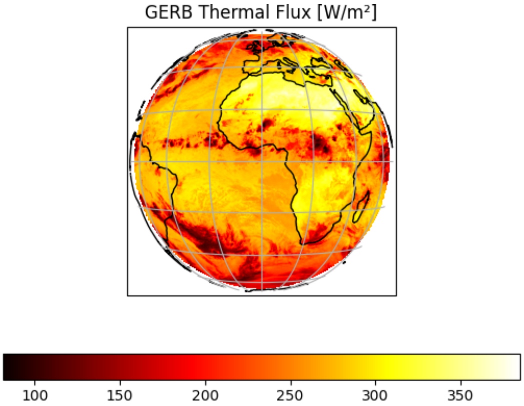
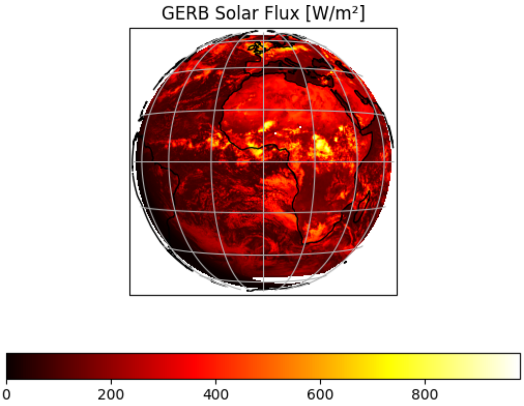
plt.imshow(local_scene[’Thermal Flux’], transform=crs,\
extent=crs.bounds, origin=’upper’, cmap=plt.cm.hot)
```

Python code to access the data array

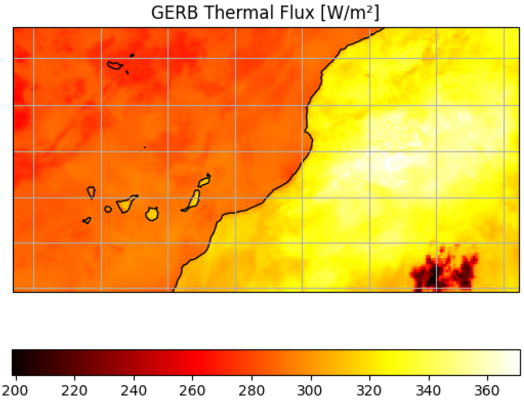
```
print(scene[’Solar Flux’].data.mean().compute(),\
scene[’Thermal Flux’].data.mean().compute())
```

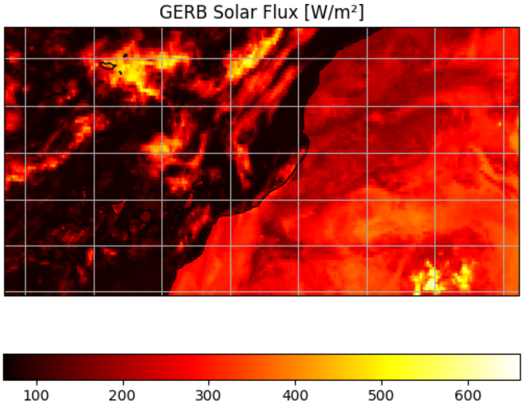
Example scene: 2012-06-21 10:15





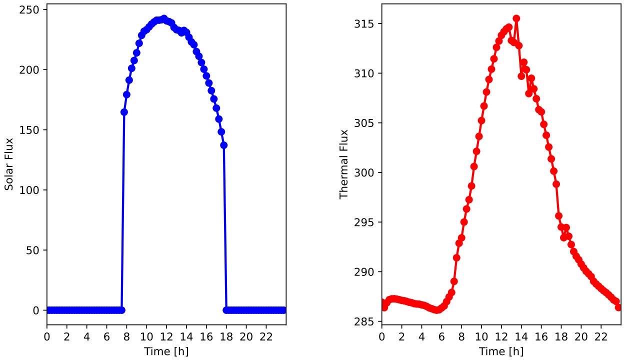
Example scene: region “maspalomas” 2012-06-21 10:15





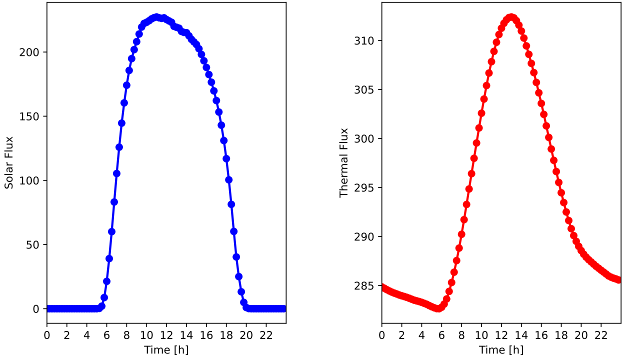
Example scene: region “maspalomas” 2023-08-01 – 2023-08-09

GERB HR product



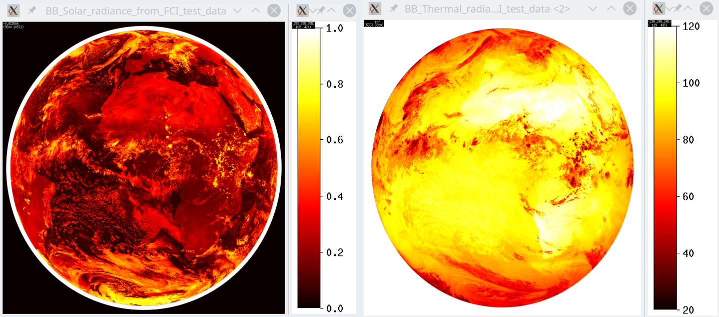
Example scene: region “maspalomas” 2023-08-01 – 2023-08-09

GERB-like HR product



MTG ?

Solar (SW) & Thermal (LW) Radiance


BB_Solar_radiance_from_FCI_test_data
1.0
0.8
0.6
0.4
0.2
0.0
BB_Thermal_radia...I_test_data <2>
120
100
80
60
40
20

Comments

- **Preliminary** based on simulated MTG data
- Same field of view as GERB → direct radiance comparison

GERB until 2030?

Outlook

- Postprocessing and QC of G4 dataset
- G3 mirror side calibration ongoing
- Hope for continuation beyond 2024 → concurrent operation with MTG-I1

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RMI

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- Thanks for your attention