# GERB

# Measuring the Earth's Energy Balance

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## 1. Background

Since December 2002, the Geostationary Earth Radiation Budget (GERB) instrument has been a 'science passenger' on the Meteosat Second Generation satellites. This broad-band radiometer makes accurate (up to 50 km nominal resolution) and rapid (every 15 minutes) geostationary measurements of the radiation coming from the Sun and outgoing Earth radiation to space.

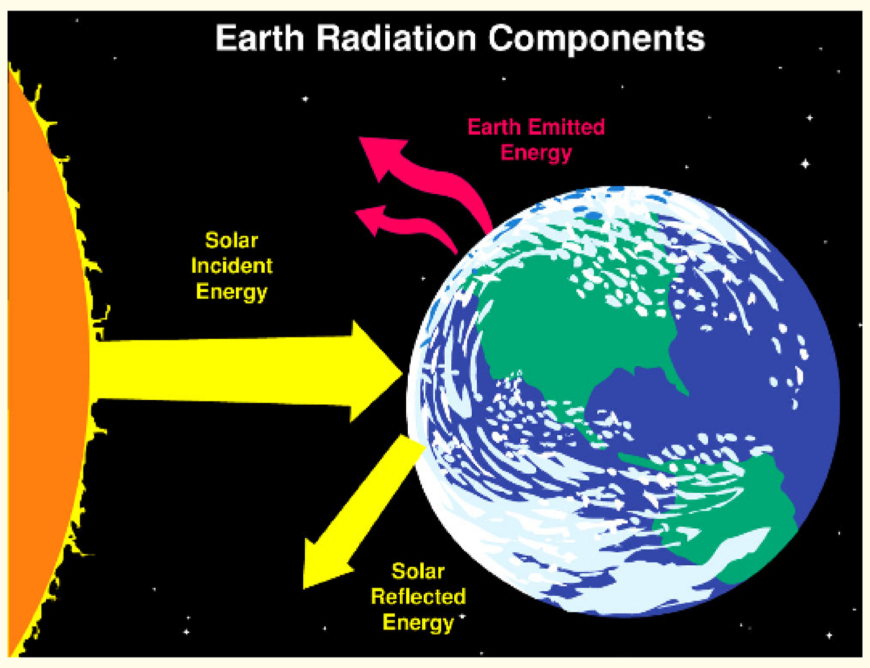


*Figure 1. Three components of the Earth radiation budget.*

The resulting energy balance allows a unique insight into the climate system, and is particularly important for understanding rapidly changing processes like clouds, aerosols and water vapour.

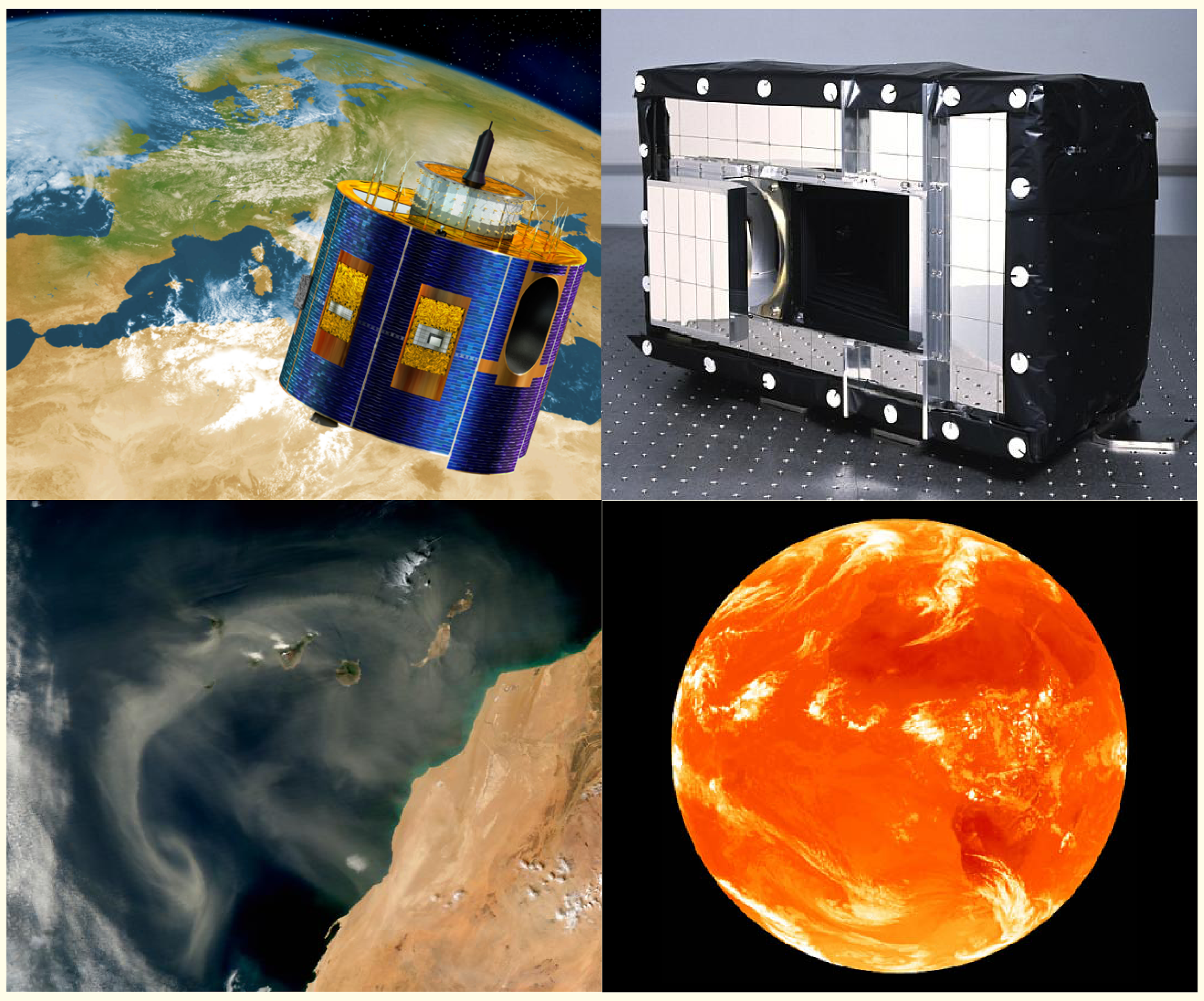

*Figure 3. Clockwise, starting from top left:*
*(1) Meteosat satellites has been improving the accuracy of weather forecasts for over 30 years*
*(2) the GERB instrument (Earth viewing port in the middle)*
*(3) The infrared channel provides images based on the heat emitted by clouds and the surface of the Earth and is used for day and night imagery*
*(4) Dust outbreak over the Atlantic Ocean: one of the many science cases (aerosol forcing)*

## 2. Image Processing

Main elements of the image processing are summarized in the table below:

| *Level* | *Data* | *Processing step* | *Auxiliary data* |
|---|---|---|---|
| L 0 | raw telemetry | - | - |
| L 1.5 | filtered radiances (total, short wave) | Count - radiance conversion | ground calibration |
| | | Geolocation | satellite position |
| | | Rectification | mirror timing |
| L 2 | unfiltered radiances (total, short, long wave) | Unfiltering | SEVIRI radiances |
| | | Long wave substraction | |
| | fluxes (long, short wave) | Scene identification | spectral top of atmosphere radation models |
| | | Radiance - flux conversion | |
| | | Resolution enhancement | |

The Royal Meteorological Institute of Belgium (RMIB) hosts a near real-time archive for *Level 2 radiance and flux products* (see **http://gerb.oma.be**).

The spatial resolution of these products is greatly improved by incorporating additional information from the other instrument onboard MSG - the Spinning Enhanced Visible and Infrared Imager (SEVIRI).

### *GERB Instrument Fact Sheet*

| | |
|---|---|
| Wave bands | 0.32 - 100.0 $\mu$m (total)<br>0.32 - 4.0 $\mu$m (short) |
| Spatial sampling | 256 x 282 pixels resolution<br>44.6 x 39.3 km pixel size |
| Temporal sampling | full Earth disk cycle time in 6 min or 564 satellite revolutions |
| SEVIRI Coregistration | 3 km spatial and 15 min temporal sampling |
| Instrument mass | 40 kg |
| Dimensions | 0.45 x 0.2 x 0.15 m |


*Figure 2. Calibration of the GERB sensor*

## 3. Results

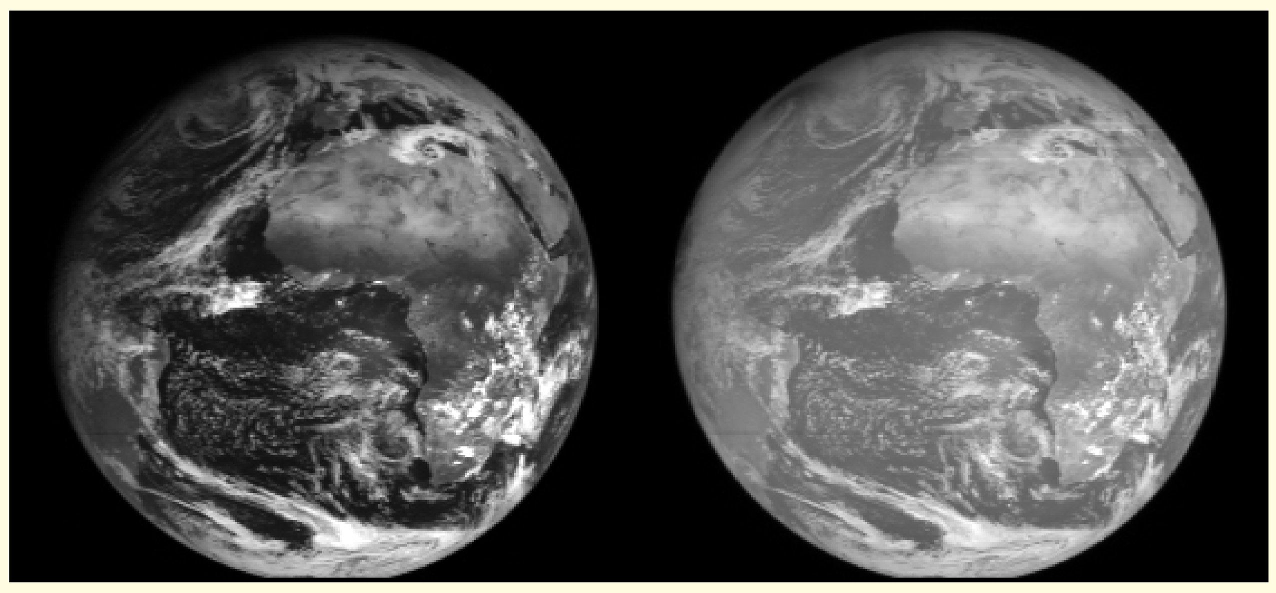

Figure 4. Some of the first GERB images (01/02/2006, 12:20 pm): the *short wave channel (left)* filters out the longer thermal wavelengths, while the *total wave channel (right)* measures both long- and shortwave radiation.

Currently, an official data release of the *second GERB instrument* is being validated. Improvements were made, mainly based on comparison studies with the first GERB and CERES instrument.

## 4. A glimpse into the future

The current GERB image processing still has room left for fine-tuning:

a) Defining *quality metrics for the geolocation process* would allows us to verify the performance and estimate the accuracy when matching raw GERB and SEVIRI data.

b) Better *synergetic use of SEVIRI data* could greatly improve the spatial resolution of the GERB products.

Besides these processing enhancements, demands for *an objective analysis system* to estimate near real-time top of atmosphere radiative fluxes are growing rapidly. The resulting products will need to be validated by comparing them with results from the Clouds and the Earth's Radiant Energy System (CERES) experiment.