# Planned update of GERB Edition 1 TOA fluxes

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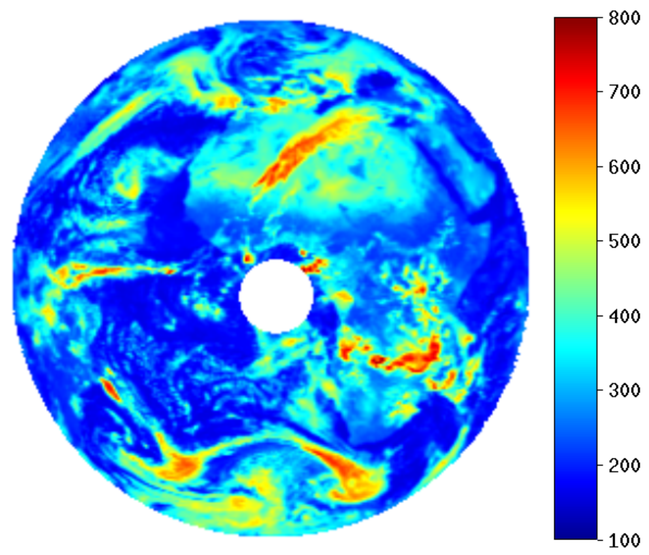
## 1 The GERB experiment

The Geostationary Earth Radiation Budget (GERB) experiment [5, 6] aims to deliver to the climate community TOA solar and thermal (unfiltered) instantaneous fluxes in near–realtime. Significant resources are also devoted to release climate–grade (homogeneous) datasets of these products as Editions for climate studies. This is achieved by flying the GERB broadband radiometers as co–passenger to the Spinning Enhanced Visible and InfraRed Imager (SEVIRI) on board of the Meteosat Second Generation (MSG) satellites.

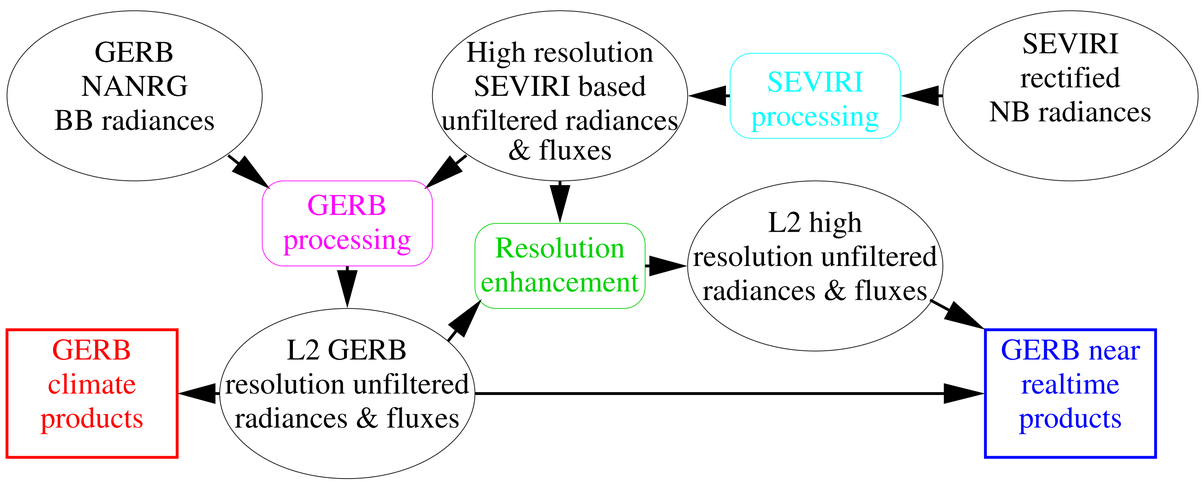
The GERB instruments are radiometers measuring TOA radiances into 2 filtered broadbands: a shortwave $(0.3-4)$ $\mu$m and a totalwave $(0.3-100)$ $\mu$m. The longwave channel is obtained by substraction of the former. These measurements are taken with a spatial resolution of about 45 km at a frequency of about 17 minutes. Special care was taken for an accurate calibration of the shortwave channel while an internal blackbody is used for the totalwave band.




## 2 The RMIB GERB processing

The RMIB GERB processing (RGP) is designed to synergetically use both the GERB broadband radiometer and the SEVIRI multispectral high resolution imager [3]. The strategy is threefold:

1. SEVIRI narrowband (filtered) radiances are solely used to derive high resolution (9 km) GERB-like TOA solar and thermal uncoupled radiances and fluxes. This is achieved by
   - a narrowband–to–broadband conversion to obtain solar and thermal (unfiltered) radiances [1, 2],
   - a radiance–to–flux conversion to estimate the solar fluxes from a scene identification and the application of associated anisotropic models while the thermal fluxes are computed from regressions of SEVIRI channels.
2. Combining the L15 Non–Averaged Non–Rectified Geolocated (NANRG) GERB (filtered) radiances with the previously estimated GERB–like filtered radiances and unfiltered radiances and fluxes convoluted by the GERB point spread function (PSF), we are able to compute the GERB unfiltered radiances and fluxes as the Averaged Rectified Geolocated (ARG) products.
3. Finally, a resolution enhancement is performed to estimate GERB high resolution unfiltered radiances and fluxes as the Binned Averaged Rectified Geolocated (BARG) and High Resolution (HR) products [4]. This is achieved by spatially interpolating the correction factors between GERB and GERB–like radiances on the high resolution rectified grid (9 km) in a way that the convolution of the high resolution corrected fluxes with the GERB PSF are still consistent at GERB native resolution (45 km).




## 3 Products description

As mentioned in the previous section, the RGP generates 3 types of products:

1. ARG contains unfiltered solar and thermal radiances and fluxes at 45 km on a fixed GERB geolocated grid at GERB measurements time which are convoluted with the GERB PSF. These products can be used for climatology and radiative feeback studies on large scale.
2. BARG consists of unfiltered solar and thermal radiances and fluxes at 45 km on the fixed SEVIRI geolocated grid at the nominal slot time. These products can be used for assimilation and validation of NWP and climate models.
3. HR contains unfiltered solar and thermal radiances and fluxes at 9 km on a fixed SEVIRI geolocated grid at SEVIRI measurements time. These products can be used for validation of NWP models as well as for regional radiative feeback studies.

## 4 Edition 1 release

Currently, only the ARG products have been released as Edition 1 dataset, i.e. generated with frozen RGP software. Nevertheless, the validation of this dataset raised concerns about a reduced accuracy of the solar fluxes within regions affected by the sunglint phenomenon. Indeed, such transient effect defeats the adopted strategy of the implemented scene identification. Therefore, the GERB Science Team decided to mask out the solar fluxes of these regions before the release.

## 5 Planned update to the RGP

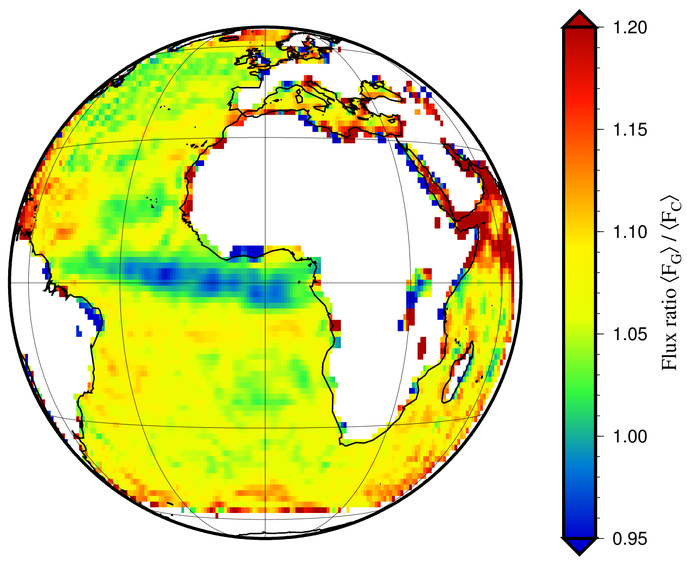
We propose to address 2 limitations in the RGP:

1. Missing solar fluxes within the sunglint regions due to the masking,
2. Missing solar fluxes around the terminator, i.e. the sunrise and sunset horizons.

Both will be adressed through postprocessing schemes running on the end–user products. They rely on the fact that, for a given region, previous unaffected scene identification results can be temporally extrapolated to replace the inaccurate scene identification. Therefore it allows to estimate and fill the missing solar fluxes within the BARG and HR products.

## 6 Validation of the sunglint filling

To validate the sunglint filling postprocessing, we have compared TOA solar fluxes from updated GERB BARG and CERES SSF Edition 3A spatially and temporally collocated footprints for June 2004 over ocean. The following figure shows the ratio of the monthly averaged GERB and CERES fluxes. Despite the adopted clearsky filling process in the sunglint area, it can be noted that a bias still exist between GERB and CERES fluxes in this region with the GERB fluxes being significantly lower than their surronding counterparts, resulting in a lower ratio (blue are on the equator). This issue is currently being investigated by the GERB team.




## 7 Conclusions

Edition 1 BARG and HR products are tentatively expected to be released in 2014 Q3. At that time, the reprocessing of the whole GERB dataset will be ongoing. These products will contain new fields allowing the users to know which solar fluxes were filled by the postprocessing schemes and which were only produced by the Edition 1 version of the RGP.

It is expected that the release of such datasets will ease comparisons and validations of NWP and general circulation models due to their formats as well as to their solar fluxes completeness.

**Acknowledgement**

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## References

[1] N. Clerbaux, S. Dewitte, C. Bertrand, D. Caprion, B. De Paepe, L. Gonzalez, A. Ipe, and J. Russell. Unfiltering of the Geostationary Earth Radiation Budget (GERB) data. Part I: Shortwave radiation. *J. Atmos. Ocean. Tech.*, 25(7):1087–1105, 2008.

[2] N. Clerbaux, S. Dewitte, C. Bertrand, D. Caprion, B. De Paepe, L. Gonzalez, A. Ipe, and J. Russell. Unfiltering of the Geostationary Earth Radiation Budget (GERB) data. Part II: Longwave radiation. *J. Atmos. Ocean. Tech.*, 25(7):1106–1117, 2008.

[3] S. Dewitte, L. Gonzalez, N. Clerbaux, A. Ipe, C. Bertrand, and B. De Paepe. The Geostationary Earth Radiation Budget Edition 1 data processing algorithms. *Adv. Space Res.*, 41(11):1906–1913, 2008.

[4] L. Gonzalez, A. Hermans, S. Dewitte, A. Ipe, G. Sadowski, and N. Clerbaux. Resolution enhancement of GERB data. In *Proc. EUMETSAT Meteorological Satellite Data Users' Conference*, volume P.29, Bologna, Italy, 2000.

[5] J.E. Harries and D. Crommelynck. The Geostationary Earth Radiation Budget Experiment on MSG–1 and its potential applications. *Adv. Space Res.*, 24(7):915–919, 1999.

[6] J.E. Harries, J.E. Russell, J.A. Hanafin, H. Brindley, J. Futyan, J. Rufus, S. Kellock, G. Matthews, R. Wrigley, A. Last, J. Mueller, R. Mossavati, J. Ashmall, E. Sawyer, D. Parker, M. Caldwell, P.M. Allan, A. Smith, M.J. Bates, B. Coan, B.C. Stewart, D.R. Lepine, L.A. Cornwall, D.R. Corney, M.J. Ricketts, D. Drummond, D. Smart, R. Cutler, S. Dewitte, N. Clerbaux, L. Gonzalez, A. Ipe, C. Bertrand, A. Joukoff, D. Crommelynck, N. Nelms, D.T. Llewellyn-Jones, G. Butcher, G.L. Smith, Z.P. Szewczyk, P.E. Mlynczak, A. Slingo, R.P. Allan, , and M.A. Ringer. The Geostationary Earth Radiation Budget Project. *B. Am. Meteorol. Soc.*, 86:945–960, 2005.