

Equivalence between the ARG, BARG and HR GERB formats

Nicolas Clerbaux

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Abstract

This technical note shows that the radiances and fluxes provided in the 3 main GERB level 2 formats (i.e. the ARG, BARG and HR formats) are consistent one to the others. That means that equivalent values are obtained when the GERB products are averaged over sufficiently large areas and time interval.

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1 Introduction

It can be proven that the GERB (Harries et al., 2005) level 2 radiances and fluxes provided in the ARG, BARG and HR formats are similar when averaged over sufficiently large areas and time interval. The 3 formats are defined in the GERB user's guide (Gonzalez and Ipe, 2006) The spatial averaging is needed to account for the differences in PSF, and the difference in time definition between the format. This equivalence allows the use of the not-released High Resolution (HR) GERB products to derive the monthly means TOA fluxes within the Climate Monitoring SAF.

This version of the technical note only deals with the shortwave radiation. There is no evidence of any differences between the formats for the longwave radiation.

2 Methodology

An area is defined as a rectangular box in latitude and longitude. The definition of the area should be done to avoid any contamination of the mean values with invalid data, such as due to dead detectors, sun glint, saturations. The average value in the area is computed as simple arithmetic mean of all the pixels having a geolocation that falls in the rectangular area.

The evaluation of the time t that corresponds to this area averaging is dependent on the format:

- for the BARG format, the time is simply set at the center of the BARG interval (H:07m30s, H:22m30s, ...)
- for the ARG format, the time for each pixel is first estimated at the center between "Start of Integration (per col)" and "End of Integration (per col)". Then, the time corresponding to the average is computed as the weighted time of the observations taken into account during the averaging process.
- for the HR format, the time is estimated as for the ARG, but the time for the pixel is here dependent on the row number instead of the column number.

So, for each format, each area, and type of products (radiance or flux), the time t and the mean values $v(t)$ are extract and stored as curve of $(t, v(t))$. As the times t are not the same for the different formats, the comparison is done on temporal integration of the curves over 1 hour intervals

$$\langle ARG \rangle = \frac{\int_H^{H+1} L_{ARG}(t) dt}{\int_H^{H+1} dt} \quad (1)$$

$$\langle BARG \rangle = \frac{\int_H^{H+1} L_{BARG}(t) dt}{\int_H^{H+1} dt} \quad (2)$$

$$\langle HR \rangle = \frac{\int_H^{H+1} L_{HR}(t) dt}{\int_H^{H+1} dt} \quad (3)$$

The curves $(t, v(t))$ are built for the 3 formats using all the data for a given day. The choice of the day should be done to have a complete as possible GERB data (no missing files).

3 Results

We have used the GERB V003 data (similar to ED01) for the 5th of May 2007. For this day there is no missing GERB data.

Two areas are defined, one in each hemisphere

$$NORTH = [17^{\circ}N : 60^{\circ}N] \text{ and } [20^{\circ}W : 19.75^{\circ}E] \quad (4)$$

$$SOUTH = [25^{\circ}S : 5^{\circ}S] \text{ and } [20^{\circ}W : 20^{\circ}E] \quad (5)$$

Figures 1 and 2 give the diurnal cycle of the regional averages for the 3 formats. The curves for the 3 formats are very close one to the other. They are indeed indistinguishable on the graphes.

Table 1 gives the numerical values of the ratio $\langle BARG \rangle / \langle ARG \rangle$ and $\langle HR \rangle / \langle ARG \rangle$ for hourly time intervals and daily averaging. The 3 formats agree always quite well, with an observed maximum difference of only 0.2% in the worse case.

4 Discussion

In this technical note a methodology is proposed to compare the shortwave radiances and fluxes provided in the 3 GERB level 2 formats. The methodology has been applied to a single day (05/05/2007) of GERB V003 (identical to ED01). It is shown that, in average, the radiances and fluxes in the 3 formats agree very well. There is no evidence of any systematic difference when the data is averaged over large areas. At smaller scale (less than 50km) systematic difference between the formats are expected to be introduced by the resolution enhancement process.

References

- Gonzalez, L. and A. Ipe, 2006: RMIB GERB products user guide. Technical Report MSG-RMIB-GE-UG, RMIB, <http://gerb.oma.be>.
- Harries, J., J. Russell, J. 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. Allan, A. Smith, M. Bates, B. Coan, B. Stewart, D. Lepine, L. Cornwall, D. Corney, M. Ricketts, D. Drummond, D. Smart, R. Cutler, , S. Dewitte, N. Clerbaux, L. Gonzalez, A. Ipe, C. Bertrand, A. Joukoff, D. Crommelynck, N. Nelms, D. Llewellyn-Jones, G. Butcher, G. Smith, Z. Szewczyk, P. Mlynczak, A. Slingo, R. Allan, and M. Ringer, 2005: The geostationary earth radiation budget project. *Bulletin of the American Meteorological Society*, **86(7)**, 945–960.

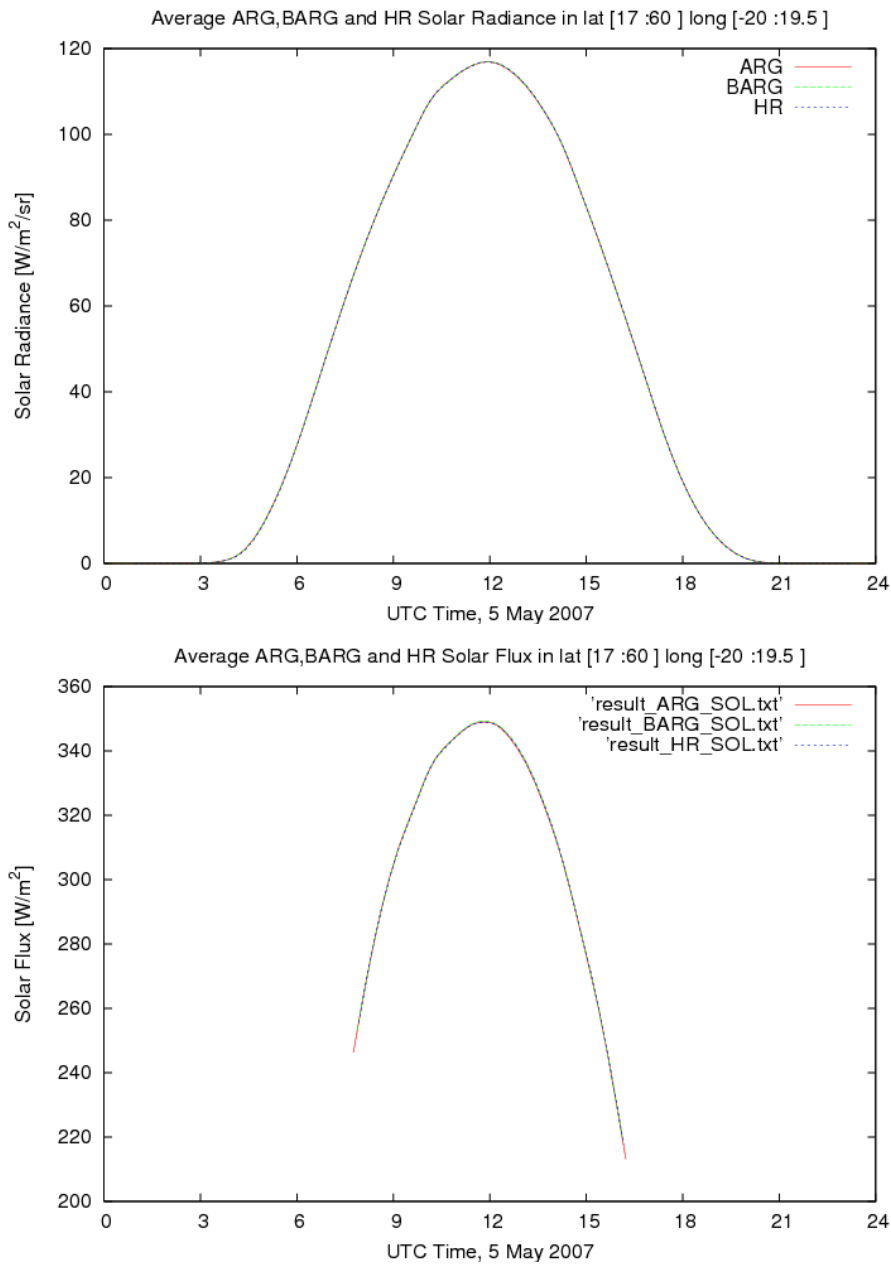


Figure 1: Regional averaging of the ARG, BARG and HR GERB-2 data over an area with zonal extension 17°N to 60°N and meridian extension 20°W to 19.75°E.

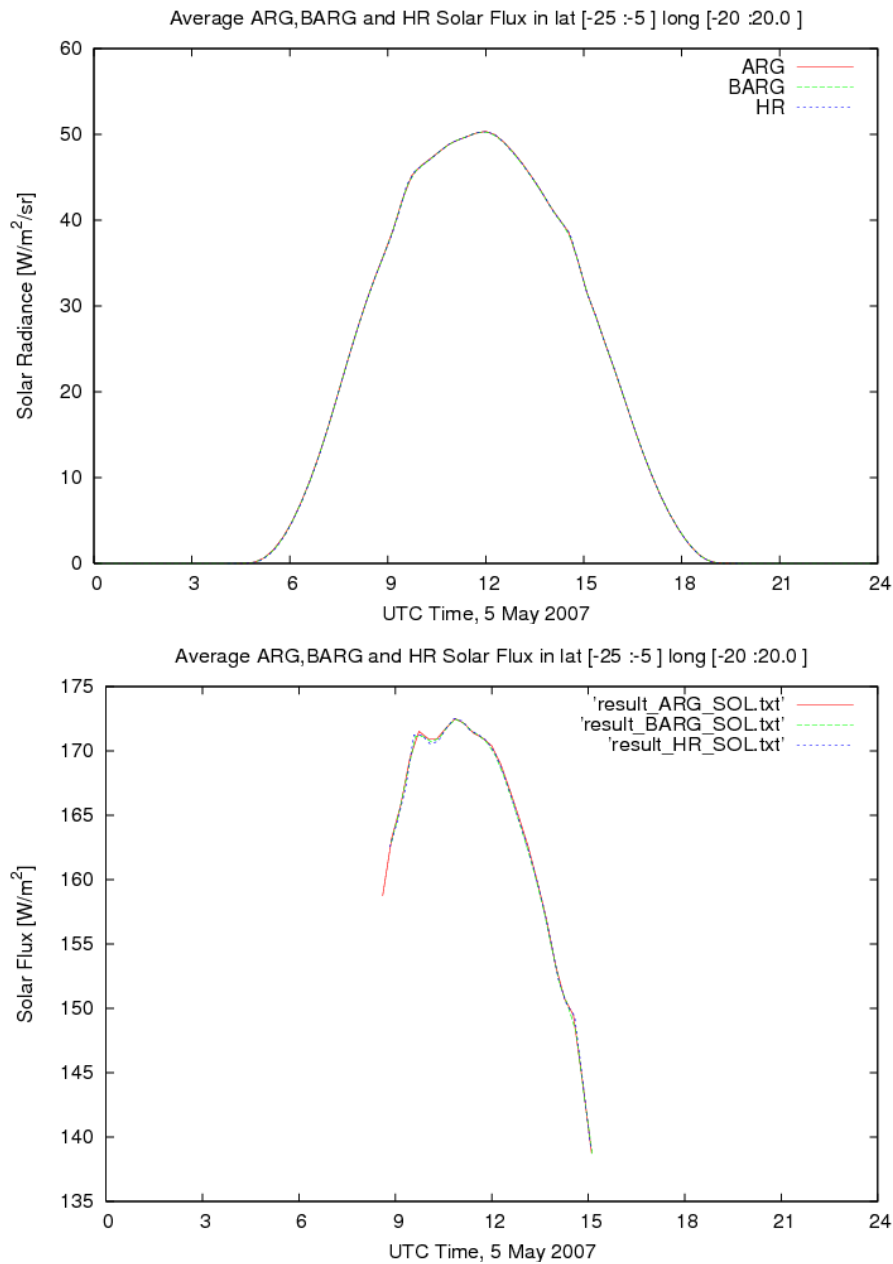


Figure 2: Regional averaging of the ARG, BARG and HR GERB-2 data over an area with zonal extension 25°S to 5°S and meridian extension 20°W to 20°E.

time	Radiance L			Flux F		
	<ARG>	<BARG>/<ARG>	<HR>/<ARG>	<ARG>	<BARG>/<ARG>	<HR>/<ARG>
[6 : 7]	38.81	1.0005	0.9968	-	-	-
[7 : 8]	61.43	1.0000	0.9986	-	-	-
[8 : 9]	81.55	1.0004	0.9995	284.17	1.0003	1.0000
[9 : 10]	] 98.36	1.0000	0.9993	318.64	0.9998	0.9992
[10 : 11]	] 110.66	1.0002	0.9999	339.44	1.0000	0.9996
[11 : 12]	] 115.94	1.0007	1.0001	347.86	1.0006	0.9999
[12 : 13]	] 115.21	1.0013	1.0007	344.88	1.0013	1.0004
[13 : 14]	] 107.31	1.0020	1.0017	327.28	1.0020	1.0015
[14 : 15]	] 92.77	1.0019	1.0017	296.24	1.0017	1.0013
[15 : 16]	] 72.78	1.0015	1.0020	253.17	1.0014	1.0020
[16 : 17]	] 50.84	1.0022	1.0039	-	-	-
[17 : 18]	] 28.75	1.0023	1.0040	-	-	-
<i>dayave.</i>	81.20	1.0010	1.0006	313.69	1.0009	1.0004

time	Radiance L			Flux F		
	<ARG>	<BARG>/<ARG>	<HR>/<ARG>	<ARG>	<BARG>/<ARG>	<HR>/<ARG>
[6 : 7]	-	-	-	-	-	-
[7 : 8]	20.14	0.9978	0.9973	-	-	-
[8 : 9]	32.08	0.9985	0.9984	-	-	-
[9 : 10]	42.47	0.9994	0.9999	168.96	0.9994	0.9993
[10 : 11]	47.74	0.9996	0.9995	171.61	0.9995	0.9992
[11 : 12]	49.82	0.9998	1.0002	171.36	0.9999	1.0001
[12 : 13]	49.11	0.9984	0.9993	167.26	0.9985	0.9991
[13 : 14]	44.48	0.9983	0.9991	158.77	0.9989	0.9998
[14 : 15]	38.11	0.9986	1.0008	148.34	0.9995	1.0006
[15 : 16]	27.39	0.9981	0.9992	-	-	-
[16 : 17]	16.39	1.0003	1.0011	-	-	-
[17 : 18]	-	-	-	-	-	-
<i>dayave.</i>	36.77	0.9989	0.9995	164.38	0.9993	0.9997

Table 1: Equivalence of averaged ARG, BARG and HR solar radiance and flux over 2 extended areas. Top Table is for the North area defined by Eq.(4) and bottom Table for the South area defined by Eq.(5). The Tables provide average ARG values and the ratio between BARG and HR with the ARG.