QUALITY SUMMARY: GERB L2 Edition 1 products

GERB project team, last update March 2017

Collated by J E Russell

Please cite: Harries et al. 2005 when referencing GERB data.

This document contains important cautions and details of user applied adjustments required when using GERB data products. All users should read this document before using GERB data and ensure their use is appropriate.

Section 1 summarises the **recommended user applied revisions**

Section 2 summarises the different GERB Edition products available to users

Section 3 lists important **specific cautions and limitations** to bear in mind when using the GERB products.

Section 4 Lists sources of further information, including user-guides and validation documents

Contents

1. Recommended user applied revisions 1
2. GERB product overview 2
   Level 2 products........ 3
3. Specific cautions 4
   Absolute accuracy and calibration:........ 4
   Gridding and geolocation: 6
   Flux accuracy and limitations 7
   Missing data and data flags 8
4. Further information and user documents 9

1. Recommended user applied revisions

The GERB team now **recommends** the following combined correction be applied to the Edition 1 level 2 **reflected solar radiance and fluxes except those flagged as using the fixed twilight model**:

$$SW_{ED1\,SWcombcorr}(t) = k\left[\frac{SW(ED1)}{1-\varepsilon t}\right]$$

where t is the time in fractional years since the start of the operational record, i.e.1st May 2004 for GERB 2 and 1st May 2007 for GERB 1.

For GERB 2 k = 0.976, ε = 0.00655

For GERB 1: k = 1.055, ε = 0.00824

This correction incorporates three different things: a post launch calibration update for GERB2, adjustment of the GERB 1 record to the mean GERB 2 level and broad correction for the in-orbit aging of the GERB SW response.

All Edition 1 data to which the following correction is applied should be denoted as having the ED 1 SW combined adjustment when used in presentations, reports or publications.[1]

Exclusions: This correction is should not be applied to longwave / emitted thermal radiance and fluxes, only the shortwave / reflected solar. It should not be applied at solar zenith angles greater than 85° where the fixed twilight model is used[2].

2. GERB product overview

The GERB Edition 1 level 2 data products are determined from measurements obtained by the GERB instruments on METEOSAT 8 and METEOSAT 9. The operational data record from the GERB instrument on METEOSAT 8 (GERB-2) covers the period March 2004 to May 2007. From May 2007 to January 2013 the GERB on METEOSAT 9 (GERB-1) is the operational instrument.

The Edition 1 record from these two GERB instruments is processed with the same algorithms, however there are differences between the two instruments which is discussed in a separate validation document. Gross user applied post-processing adjustments are provided to adjust the reflected solar radiances and fluxes for instrumental differences and in-orbit aging of the GERB SW response.

From the GERB level 1.5 filtered radiance observations three varieties of GERB level 2 products are produced and made available to users. Each provide measured radiances and retrieved fluxes on a regular equal viewing angle grid at a temporal resolution of between 15 and 17 minutes but differ in the details of their spatial space and temporal averaging. A schematic illustrating the spatial and temporal characteristics of the GERB level 1.5 and level 2 products is shown in the figure 1.

Some issues with the data mean that the edition 1 GERB products do not meet all of their accuracy targets. Specific problems are known to exist with geolocation accuracy; detector spectral response information and radiance to flux conversion factors.

In orbit differences between the two GERB records and a gradual darkening of the SW response over the operating lifetime exists in the Edition 1 products as supplied. User applied adjustment factors are described here to provide a basic correction. More detailed observation specific correction will be incorporated into future Editions of the GERB products.

The original aims for absolute accuracy, defined as the accuracy after sufficient averaging to remove any random component of the error, of the SW and LW unfiltered radiances was 1% of the typical full scale signals which were considered to be 240 $Wm^{-2}sr^{-1}$ for the SW and 77 $Wm^{-2}sr^{-1}$ for the LW. For the Edition 1 GERB products we have determined the absolute accuracy as 2.25% for the SW and 0.96% for the LW unfiltered radiances. The primary

[1] It is a **requirement** for the GERB 2 calibration to be traceable to the all GERB 2 shortwave data be multiplied by the 0.976 constant contained in this equation as this pertains to an update to the calibration reference standard against which it was calibration if users only make this correction to GERB 2 and do not correct for aging they should denote the data at GERB 2 Edition 1 SWupdate. The GERB team strongly recommends that the aging adjustment be made to keep the full data record within specified accuracy. If using the GERB 1 data in isolation it is acceptable to only correct for again and not normalise to the GERB 2 level, by setting *k* for GERB 1 to 1.0. GERB 1 data that is treated in the manner should be denoted GERB 1 Edtion 1 SWagingcorrected.

[2] Strictly the SWupdate constant multiplier part of the correction should be applied to the GERB 2 twilight model data as well as the other solar fluxes. However this omission is a within the errors of the twilight model and for simplicity this is not required or recommended (see Processing and Accuracy document for more details).

causes of the reduced SW accuracy are uncertainties associated with the detector response measurements, and the possible impact on the unfiltering of SEVIRI inter-channel calibration. The issues with the spectral response are in the process of being resolved, and once known, further comparisons between different unfiltering methods will be used to reduce the uncertainty due to the SEVIRI channel calibration. A more detailed breakdown of the ground determined uncertainties is given in the Edition 1 processing document.

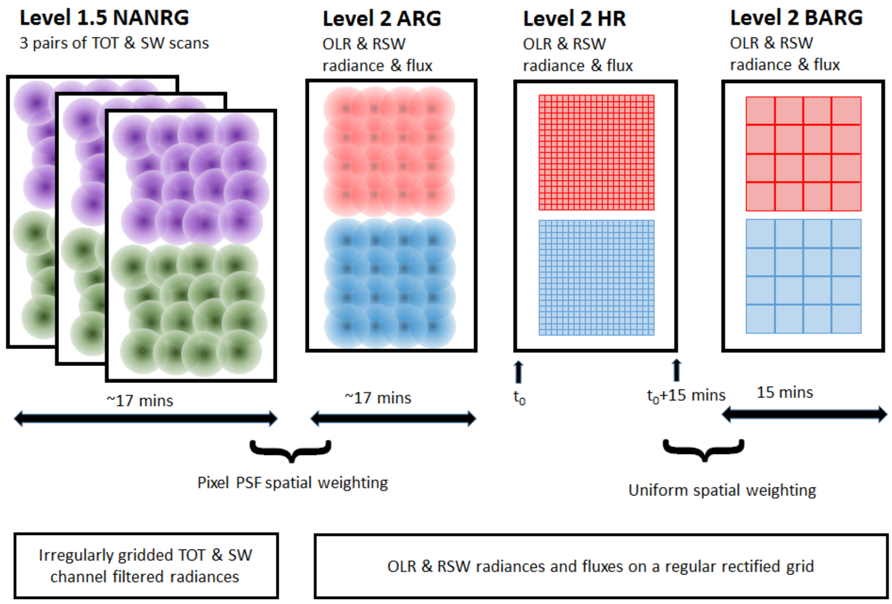

Figure 1. Schematic showing characteristics of the GERB level 1.5 and level 2 products.

Level 2 products

For all the GERB products RSW and OLR fluxes are determined from the GERB observed radiances according the scene characteristics (apart from the fill estimates described below), viewing geometry and, for RSW, also the solar illumination. For the OLR, radiance to flux conversions are based on regressions involving the SEVIRI narrow band observations. These regressions have been determined from simulations of narrow band and broadband radiance and flux for a wide variety of scene types. For the SW the conversions use the CERES TRMM empirical angular dependency models (ADMs). The appropriate TRMM model is chosen according the underlying surface type, which for the GERB Edition 1 products is based on a fixed surface type map, in addition to the cloud cover, optical depth and phase, retrieved from coincident SEVIRI shortwave channel radiances.

ARG: (Averaged, Rectified, Geolocated). ARG products are the **average of the radiances and fluxes associated with three interleaved SW and TOT GERB scans interpolated to a fixed rectified equal viewing angle grid** and averaged. This gives the product a temporal **resolution of just under 17 minutes**[3]. Times contained in the level 2 ARG product names indicate the nominal start of the integration period and are copied from the prime level 1.5 NANRG (Non-Averaged Non-Rectified Geolocated) product from which they are derived.

North-south and east-west grid spacing is around 0.07° in viewing angle giving a **spatial resolution of approximately 45 km at nadir**. Whilst the radiances and fluxes are corrected for the spectral imperfections of the instrument, **no correction is made for spatial non-**

[3] Data is interpolated to SW acquisition times to allow derivation of LW from subtraction of SW from TOTAL. The 3 SW scans are obtained over a period of 14.1 minutes. TOTAL channel data is interpolated from 4 TOTAL channel scans spanning a total period of 19.74 minutes.

uniformities in the instrument field of view response. Thus each ARG grid point is a weighted average of the observed scenes with the weighting determined by the instrument field of view response or Point Spread Function (PSF).

NOTE: **Separate ARG files are produced for the reflected solar (denoted by 'SOL' in the product name) and emitted thermal (denoted by 'TH') radiances and fluxes** resulting in twice as many files than for the NANRG or HR products. The **ARG grid is fixed with grid locations specified in the ARG geolocation file**. Only one geolocation file is required as the information is invariant over time.

HR: (High Resolution). A **resolution enhanced snapshot** of the **TOA radiances and fluxes every 15 minutes**. They are provided at the SEVIRI product acquisition time on a fixed equal viewing angle grid matched to 3x3 SEVIRI pixel grid-boxes, giving **a grid spacing of 9 km at the sub-satellite point**. The time in the product name is the same as the SEVIRI product name time. However, the actual time associated with a given point corresponds to the SEVIRI observation time of that point and thus varies according to the SEVIRI scan pattern. Instantaneous accuracy at the HR scale is expected to be lower than for the lower spatial resolution GERB products as additional noise is introduced by the resolution enhancement, particularly for very inhomogeneous scenes and extreme angles. **The HR product is recommended as the basis for users wishing to create custom averages over time and space** and its production ensures that after appropriate averaging its accuracy is commensurate with the other GERB products. Care should be taken if scene separation is to be made at the HR resolution before averaging as the resolution enhancement introduces some 'blurring' between scene types within the same or adjacent GERB pixels.

NOTE: Both **reflected solar and emitted thermal radiances are fluxes are contained within the same file**, resulting in fewer individual files than the for the BARG or ARG datasets. The **HR grid is fixed with grid locations specified in the HR geolocation file**. Only one geolocation file is required as the information is invariant over time.

BARG: (Binned, Averaged, Rectified, Geolocated). **A 15 minute average of the HR TOA radiances and fluxes**. The BARG products are provided to users **as a ready made average derived from the GERB HR radiances and fluxes**. BARG products are formed via a 5x5 spatial averaging and **trapezium rule integration** of the HR values. The resulting **spatial resolution of ~45km at the sub-satellite** point is similar to the GERB sampling. Each BARG product is a temporal average over an exact 15 minute time period with product name denoting the start of the averaging period.

NOTE: **Separate BARG files are produced for the reflected solar (denoted by 'SOL' in the product name) and emitted thermal (denoted by 'TH') radiances and fluxes** resulting in twice as many files than for the NANRG or HR products. The B**ARG grid is fixed with grid locations specified in the BARG geolocation file**. Only one geolocation file is required as the information is invariant over time.

3. Specific cautions

Absolute accuracy and calibration:

Recommended user applied "SW combined correction"

The following user applied adjustment to the GERB Edition 1 reflected solar radiances and fluxes is recommended. The correction addresses several distinct effects which are outlined in more detail below. For both GERB 1 and GERB 2 it provides a time varying gain correction to compensate for a spectral aging of the instrument optics. It also incorporates an additional time invariant gain correction to the SW level which adjusts the GERB 2 SW for updated calibration of a ground source reference and provides a level adjustment to the GERB 1 SW level to unify it with the GERB 2 record.

All Edition 1 data to which the following correction is applied should be denoted as having the ED 1 SW combined adjustment when used in presentations, reports or publications.

The combined correction should be applied to the GERB Edition 1 SW radiances and fluxes, SW(ED1), as follows

$$SW_{ED1\,SWcombcorr}(t) = k\left[\frac{SW(ED1)}{1-\varepsilon t}\right]$$

where t is the time in fractional years since the start of the operational record, i.e.1[st] May 2004 for GERB 2 and 1[st] May 2007 for GERB 1.

For GERB 1: *k* = 1.055, ε = 0.00824

For GERB 2 *k* = 0.976, ε = 0.00655

SW in orbit instrument ageing: In the Edition 1 data processing instrument gain is determined in orbit and updated every 5 minutes. However all calibration coefficients apart from the gain are kept static using ground measured values. Evidence of a drift in the SW spectral calibration has been found and will be addressed fully in an Edition 2 release. The drift due to a spectral darkening of the optics results in an apparent reduction over time in the reflected solar radiance and fluxes. The severity of the effect varies with the spectral properties of the scene, increasing in severity as the proportion of scene energy at shorter wavelengths increases (i.e. as scenes become "bluer"). Further information on the effect is discussed in the processing and calibration and in the validation documents. A gross level correction for the mean effect is incorporated into the SW combined correction described above. Users should be aware that whilst this corrects the mean effect there will remain a temporal trend in the errors associated with scenes that age more severly than the average (blue scenes) and in the opposite sense for scenes which age less severly than the average (red scenes). Very broadly speaking this means that the reflected solar fluxes from clear ocean will tend to reduce somewhat over the record whilst those from clear desert will tend to brighten slightly. AD4 and AD5 discuss this in more detail.

GERB 2 SW calibration update: A correction of around 2.4% to the calibration curve of the shortwave ground calibration source used for GERB 2 (on METEOSAT-8, operational record March 2004-May 2007) was advised by the UK National Physical Laboratory after production of the Edition 1 data. The correction implies the GERB 2 shortwave needs to be adjusted by the multiplicative factor 0.976. Users were previously advised of this correction and asked to denote corrected products as GERB 2 Edition 1 SWupdate. This correction is now incorporated into the SW combined correction described below, which is the only correction now required and should be applied *instead* of the SWupdate correction.

Instrument switch-over May 2007: The Edition 1 processing preserves the independence of the individual instrument calibrations. At the point of transition (May 2007) a step change in the Edition 1 data record is expected due to the differences between GERB 1 and GERB 2. This is described in the validation document. The step change in particularly large for the reflected solar and the k value included for GERB 1 in the SW combined correction described above provides a correction of the mean effect. Applying this makes the GERB 1 calibration traceable via GERB 2 rather than independent of it. Users should be aware that scene specific differences will still exisit between the GERB 1 and GERB 2 observations and are related to the independent uncertainties in the spectral response of the two instruments. More detail is provided in AD4 and AD5.

Pixel to pixel variation in shortwave response: GERB obtains measurements with 256 distinct detectors arranged approximately North-South with respect to the Earth. The shortwave and longwave gain of each pixel is independently determined, but the unfiltering of the radiances for the Edition 1 GERB products uses an average pixel spectral response. Whilst we do not expect significant differences in the spectral response of the pixels, there may be a variation in their response with a standard deviation of around 2% in the shortwave, which will result in subtle differences between the accuracy of the observations in different latitude regions.

Residual offsets and trends: The combined correction provides scene mean adjustments for SW spectral aging and SW differences between the two GERB instruments. It cannot address the spectral detail of these effects, thus for individual scenes trends over time and step changes at the transition between the GERB 2 and GERB 1 instrument records will remain. This is discussed in more detail in the Processing and Calibration document and the Validation document. Users should also be aware that slight differences in the viewing position of the METEOSAT-8 and METEOSAT-9 satellites and in the different SEVIRI instruments used for scene identification also introduce spatial and temporal variation into the differences between the two instruments which can manifest in the reflected solar or emitted thermal fluxes. Please refer to the validation document for GERB-1 and GERB-2 comparisons. ***Caution is advised if looking at long time series and trends in the data and when analysing the data prior to May 2007 and post May 2007 as a single record*.**

Gridding and geolocation:

ARG grid: For the ARG products GERB measurements have been interpolated to a regular grid, the spacing of which corresponds to the GERB sampling distance. However, the native resolution of the GERB products, which is larger than this sampling distance and a function of wavelength, is retained, and no correction for the spatial variation in the instrument response is made. Thus ***each measurement represents a non-uniform spatial average at the native GERB resolution*** centred on that grid point. The spatial variation of the weighting is determined by the average of the point spread functions (PSFs) of the pixels that contribute to that point. Pixel PSFs are available on request from the GERB team.

HR grid: For the HR products the GERB measurements are interpolated to a regular grid and exact 15 minute time points. Information on the spatial distribution of radiance within the GERB footprint inferred from SEVIRI NB observations along with information from the GERB pixel overlap and used to present the data at a higher spatial resolution. This is part of the process used to correct for the effect of the GERB point spread function. The HR products are designed to be averaged to a lower spatial resolution commensurate with the native GERB resolution.

BARG grid: The BARG product provides a ready-made temporally and spatially averaged output derived from the GERB HR data. It uses a trapezium rule average in time over exact 15 minute time periods and comprises a 5x5 HR grid point spatial average. Users should be aware that all quantities in the HR products (flux, radiance and incoming solar radiation) undergo the same averaging. Consideration of the systematic shape of temporal variation of the RSW and OLR curves would lead to the expectation that the trapezium rule temporal averaging employed would produce a slight low bias compared to an exact integration. As the average of a ratio will not be same as the ratio of the average for such an integration, users should also bear in mind that quantities such as average albedo cannot be accurately determined from the average reflected flux and incoming solar flux provided in the BARG product.

Geolocation. The mean geolocation accuracy should be sufficient for most scientific purposes, however the ***geolocation accuracy of an individual observations points is not guaranteed***. Edition 1 GERB geolocation is achieved by a statistical matching between the GERB and SEVIRI data which is subject to random error. In general ***the stability of the edition 1 geolocation is best for low viewing zenith angles, becoming worse for viewing angles above 40-50° and for extreme solar zenith angles***. Over the nominal GERB region (60°E to 60°W, 60°S to 60°N), we estimate the standard deviation of the geolocation to be around a quarter of a GERB pixel. Effects on the products are most significant at high contrast edges, such as cloud and coastline.

In addition to this statistical error, GERB measurements are obtained by means of a rapidly rotating mirror on the edge of the rotating MSG spacecraft. This mechanism is subject to occasional mispointing events which are normally identified and removed from the data if serious. However ***occasional mirror mispointing events may remain introducing a further source of geolocation error***. This issue is more significant for the METEOSAT-9 data record (from May 2007).

Users should note that although the geolocation error is random, it can produce systematic effects in average radiances or fluxes that have been separated according to scene type. For example, geolocation errors will occasionally cause GERB pixels identified as clear sky to actually be cloudy. For dark surfaces such as ocean, the occasional cloud contamination will elevate the radiance or flux determined for the scene, leading to a systematic bias in the inferred average quantity.

Flux accuracy and limitations

Aerosol: Edition 1 GERB data contains no special treatment of aerosol and does not use an aerosol specific radiance to flux conversion. Optically thin aerosol gets treated as clear sky and thicker aerosol can be identified and treated as cloud. Thus ***fluxes in the presence of aerosol are likely to be less accurate*** than for other scene types. LW flux errors are expected to be within 10 W m^{-2} but SW errors in the presence of significant aerosol loading may be subject to more significant errors. ***Extreme caution is therefore recommended before using the Edition 1 GERB shortwave fluxes to study the radiative effect of aerosol*** and it suggested that users wishing to use these data for such an application consult with the GERB project team.

An aerosol treatment is currently under development to address this issue. As a first step an estimation of aerosol optical depth has been included in the GERB ARG products (Brindley and Ignatov, 2006). Whilst experimental in nature and currently only available over ocean, this field can be used to identify significant aerosol contamination (optical depth >~0.4) which is likely to result in less accurate fluxes. As the problem with aerosol relates to the radiance to flux conversion, SW radiances in the presence of aerosol should still provide useful information on the broadband effect of the aerosol present.

Thin cloud: ***A problem is known to exist in the radiance to flux conversion for thin (0.5< optical depth at 0.55μm < 3) high (>6km) level cloud***. It is estimated from simulations that this can result in a relative error on the LW flux of up to 20% in the worst cases which occur for fluxes derived from nadir and grazing angle observations. Conversely errors become small for fluxes derived from observations at viewing zenith angles of about 52°. Therefore except for fluxes derived from observations over a small viewing zenith angle range [50°:55°], ***extreme caution is recommended before using the GERB Edition1 flux data to study cirrus cloud radiative effect in the LW***, and it is suggested that users wishing to use these data for such an application consult with the GERB project team.

It should be noted that both these problems relate to the radiance to flux conversion not the GERB SW and LW radiances. Thus GERB LW radiances may be used to for studying cirrus and the GERB team can provide support to help users to obtain the best estimate of LW flux and associated error from the GERB radiance in case of cirrus cloud, or similar semi-transparent atmospheric components such as desert dust.

GERB flux reference level: GERB fluxes are top of the atmosphere energy densities referenced at the Earth reference ellipsoid surface. Users are reminded that when comparing these fluxes to model or other measurements an adjustment to allow for different reference levels may be necessary.

Angular range of flux calculation: Fluxes are not determined for viewing zenith angles > 80° (applies to both reflected solar fluxes and emitted thermal fluxes).

Fluxes observed at viewing zenith angles > 70°: Users should be aware that whilst fluxes are calculated up to viewing zenith angles of 80°, values determined from data acquired at ***view zenith angles greater than 70° will be subject to increased errors***. For these higher viewing angles the three dimensional nature of clouds and the increased atmospheric path for Rayleigh scattering cause a growth in apparent cloudiness and increasing scene identification errors (Diekmann and Smith, 1988; Smith and Manalo-Smith, 1995). Thus, the wrong angular dependency model (ADM) is selected for computing flux from radiance. Also, the footprint of the pixel on the Earth grows rapidly beyond 70 degrees, so that scenes and ADMs are highly mixed.

It should also be noted that the large footprints associated with these larger view angles do not average well over Earth grids. GERB uses an instrument-oriented grid system, but when one maps the fluxes to Earth, the problem inevitably arises.

Other view angle dependent errors in radiance to flux conversion: Because GERB observes from a geostationary orbit the viewing geometry of each point of the surface is fixed with respect to the satellite and the relative solar angles are a function of time of day and year. This means that errors in the radiance to flux conversion due to a specific radiance viewing angle or solar angle occur systematically in the dataset and cannot be assumed to reduce with averaging. The results of the flux comparison with CERES shown in section **Error! Reference source not found.** provide an indication of the extent to which d ifferences remain after averaging. As discussed in the validation, specific biases are expected to exist in the scene identification in certain locations of viewing and solar geometry which can also introduce apparent biases into the flux.

Missing data and data flags

Eclipse operations and Stray light: ***For a few months centred on each equinox the amount of GERB data available is reduced*** by variable amounts. In all cases no science data can be collected from 23:00 to 02:30 UTC from approximately mid February to end of April and from mid September to end of November as the Sun is within the instrument FOV. Approaching these times ***as the Sun comes close to the edge of the GERB field of view, stray illumination can cause contamination of the data products***, which leads to flagging or removal of the products from the Edition record. In some instances (the whole METEOSAT-9 record) the performance of the GERB mirror makes the probability of accidental exposure to the Sun too great a risk to enable science observations at any time from mid February to end of April and from mid August to end of October.

Contamination of the data by stray light is a function of solar declination and time of day. Significant levels are limited to the hours around midnight and to a lesser extent midday. Severity of stray light contamination peaks at the spring and autumn equinoxes. Scans containing severe stray light contamination (above 3.5 $Wm^{-2}sr^{-1}$ in the filtered radiances, termed direct stray light) are excluded from the level 2 Edition products but exist in the level 1.5 data and any level 2 products that are obtained directly from the RMIB online archive (and not bearing the ED01 in their product names.). These scans occur during the hours 22:45 to 01:15 GMT from 03-Feb to 04-May and 09-Aug to 07-Nov. This contamination is identified by the level 1.5 flags, a summary of which is contained in the level 2 products.

Scans containing stray light contamination less than 3.5 $Wm^{-2}sr^{-1}$ but above the noise level (~0.3%, termed diffuse stray light) are flagged in the level 1.5 data and can be identified from the summary of the level 1.5 flags contained in the level 2 products. These flags occur in products between the hours of 23:00 and 01:00 GMT from 15-Jan to 23-May and 21-Jul to 26-Nov.

Scans affected by stray light contamination of the internal black body view, used to subtract the offset from each measurement, are also flagged in the level 1.5 data and can be identified from the summary of the level 1.5 flags contained in the level 2 products. These flags occur in products between the hours 10:05 to 12:30 GMT from 15-Jan to 23-May and

21-Jul to 26-Nov. Whilst normally a small effect, effects of stray light in the black body are visibly noticeable in the data for about three weeks centred on each equinox.

Twilight and Night-time SW data: The error flag is present to indicate all unavailable SW observations. In the ARG products both missing SW data and night-time SW observations are indicated by this flag. For the ARG products users should consider both the flag and the solar zenith angle to determine whether it is night-time or the SW data is missing. In the HR and BARG products, for solar zenith angles 85-100° a twilight model is used (based on the CERES empirical twilight model (Kato and Loeb, 2003)

Bad data flags: Users should be aware of the error values for each dataset and the calculation limits applied to the products. Users are also directed to the level 1.5 anomaly flags copied into the level 2 products which indicate GERB instrument anomalies affecting the data. Products affected by major anomalies are processed to level 2products but excluded from the Edition dataset. They will exists in the RMIB data archive and any users accessing GERB data products from this archive that do not contain the designation ED in the product name should be aware that observations subject to major instrument anomalies which seriously compromise the data will occasionally be present. Users may also wish to exclude products affected by some or all minor anomalies. A list of the anomalies flagged is included in the level 2 user guide (AD2) with further information in the level 1.5 user guide (AD1).

LW non-repeatability: The daytime longwave signal is determined by subtraction of SW from TOTAL observations. The sampling of TOTAL and SW data is not exactly repeatable and occasionally, interpolation of the TOTAL channel radiances to the shortwave locations results in significant errors.

High frequency variations in the GERB LW, for regions which SEVIRI observations indicate to be homogenous in the LW but highly variable in the SW, are considered to be the product of such errors. The spurious variability is corrected by using the GERB radiometric level in conjunction with the LW spatial variability estimated from SEVIRI. A difference between the longwave ratio and the longwave correction factors contained in the level 2 ARG product indicates where this technique has been applied to the GERB LW data.

Filled flux values: The level 2 ARG products do not contain fluxes when SZA > 80° or over ocean when the glint angle < 15°. The HR and BARG products contain fill estimates for these cases which are not intended to provide an accurate instantaneous flux but to enable temporal averages to be made with minimal bias. Fill values are indicated at an individual grid point level by a dataset flag "status flag word 1" which is included within the "rmib" group of the HDF file. All non-zero values of this flag indicate a fill flux value. See the processing and accuracy and validation release documents for further details (AD3,AD4 and AD5).

Clear ocean fluxes in near glint conditions When the glint angle is <25° and the scene has been identified to be clear ocean a climatological ocean flux is used instead of converting the radiance to flux using an understanding of the scene anisotropy. The climatological value is designed to enable temporal averages with low bias and is not expected to provide high instantaneous accuracy. For the HR and BARG products this is denoted as fill value and is identified by the dataset flag "status flag word 1" included within the "rmib" group of the HDF file. See the processing and validation document for further details.

4. References:

Harries, JE, Russell, JE, Hanafin, JA, Brindley H, Futyan J, Rufus J, Kellock S, Matthews G, Wrigley R, Last A, Mueller J, Mossavati R, Ashmall J, Sawyer E, Parker D, Caldwell M, Allan PM, Smith A, Bates MJ, Coan B, Stewart BC, Lepine DR, Cornwall LA, Corney DR, Ricketts MJ, Drummond D, Smart D, Cutler R, Dewitte S, Clerbaux N, Gonzalez L, Ipe A, Bertrand C, Joukoff A, Crommelynck D, Nelms N, Llewellyn-Jones DT, Butcher G, Smith GL, Szewczyk ZP, Mlynczak PE, Slingo A, Allan RP, Ringer MA, The geostationary Earth Radiation Budget Project, BULLETIN OF THE AMERICAN METEOROLOGICAL SOCIETY 86 (7): 945 JUL 2005.

5. Further information and user documents

The following applicable documents contain further relevant details and are available from the GERB edition data distribution archives:

Quality Summary: GERB level 2 Edition 1: [this document] Essential information for users of the GERB products, required reading.

Processing and accuracy summary: GERB level 2 Edition 1: Updated document describing the GERB processing and providing theoretical accuracy statements for the data fields. Recommended reading for all users of the GERB data. Includes sections of the aging and the treatment of fill fields of relevance to the latest release.

Level 2 ARG Edition 1 release validation report: Validation studies completed at the time of the ARG edition 1 release. Includes comparison with older CERES products (CERES SSF Ed 2). Incorporates the required user applied ground calibration update for GERB 2 comparisons, but does not include the latest recommended user revisions that unify and stabilise the GERB records.

Level 2 HR Edition 1 release validation supplement: Latest validation for the filled HR and BARG Edition 1 release. Comparisons with later versions of CERES data (CERES SSF Ed 3 and Ed 4). Consideration of the filled data and the latest user revisions for aging and unification of the record.

RMIB GERB products user guide: automatically generated document detailing every field contained in all the GERB level 2 products.

Quality Summary for GERB Edition 1 L1.5 NANRG and GEO products: NANRG release quality and validation document. As the level 1.5 products form the basis of the level 2, users of the level 2 may find the information useful background.

GGSPS products user guide: provides background information on product definitions relevant to all products and details of the parameters contained in the level 1.5 GERB data