RMIB GERB Products

User Guide

Prepared by RMIB GERB team

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CHANGE RECORD

Issue	Date (DD-MM-YYYY)	Changed by	Reason for change
Version 1	07-6-2000		New document by S. Dewitte and G. Sadowski
Version 1.1	08-9-2000	G. Sadowski	Corrections and additions following the recommendations of the review board (δ Review 06-9-2000)
Version 1.2	03-6-2002	L. Gonzalez Sotelino	Radiance and flux on same file except for ARG
	25-11-2002	L. Gonzalez Sotelino	Rewriting of chapter "L2 RMIB GERB Products Data Acess" using HDF5 Lite API
	25-11-2002	L. Gonzalez Sotelino	introduction of MSG7 as possible imager
	25-11-2002	L. Gonzalez Sotelino	addition of "Summary Thermal Products Confidence", "Summary Solar Products Confidence", "/Radiometry/Longwave Correction/Minimum Correction Value", "/Radiometry/Shortwave Correction/Minimum Correction Value", "/Radiometry/Longwave Correction/Maximum Correction Value", "/Radiometry/Shortwave Correction/Maximum Correction Value"
	25-11-2002	L. Gonzalez Sotelino	"Mapped range" has been splitted on "Range" and "Offset"
	25-11-2002	L. Gonzalez Sotelino	"Surface Type" has been modified
Version 1.21	23-04-2003	L. Gonzalez Sotelino	L_{ov} changed by L_{thick} in 3.72
	23-04-2003	L. Gonzalez Sotelino	"Viewing Azimuth" in place of "Realtive Azimuth" for thermal files
Version 1.22	03-06-2002	L. Gonzalez Sotelino	XXM_50 changed to MXX_R50
	03-06-2002	L. Gonzalez Sotelino	longitude and latitude removed from archive
Version 2.0	03-05-2006	L. Gonzalez Sotelino	major revision for Edition 1 - only major changes are listed
	03-05-2006	L. Gonzalez Sotelino	file naming convention changed
	03-05-2006	L. Gonzalez Sotelino	L15 geolocation files added
Version 2.1	08-06-2006	L. Gonzalez Sotelino	Split of first chapter (Purpose of this document) in two chapters (Introduction added), warnings added about HDF and IDL version, chapter 4.2 moved to Introduction
Version 2.2	03-10-2006	L. Gonzalez Sotelino L. Gonzalez Sotelino	Added range in description of "Cloud Optical Depth (logarithm)" Definition of "Longwave Correction" corrected
Version 2.2.1	10-04-2008	L. Gonzalez Sotelino	Added "SEVIRI Radiance Definition Flag"
	12-08-2016	E. Baudrez	Updated URLs to websites
	31-08-2016	E. Baudrez	Added note that incoming solar flux is missing from HR products
	07-09-2016	E. Baudrez	Added note for attributes whose value may not correctly reflect the correct value in Edition-1: "File Name", "File Creation Time", "Software Identifier", "Product Version", and "Edition"
	07-09-2016	E. Baudrez	Added documentation for attributes and datasets that have been introduced with Edition-1: "Git Commit Identifier", "Pixel Algorithm", and "Status Flag Word 1"

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Issue	Date (DD-MM-YYYY)	Changed by	Reason for change
	07-09-2016	E. Baudrez	Added note to datasets whose accuracy may be affected when time extrapolation of the scene ID is in effect, or when a model has been used to calculate the flux: “Solar Flux”, “Cloud Optical Depth (logarithm)”, “Cloud Cover”, and “Cloud Phase”
	26-09-2016	E. Baudrez	Clarified the documentation of the time average in the Binned Averaged Rectified Geolocated (BARG) product, and the timing of the following datasets in the BARG product: “Incoming Solar Flux”, “Relative Azimuth Angle”, “Solar Zenith Angle”, “Viewing Azimuth Angle”, and “Viewing Zenith Angle”.
	03-10-2016	E. Baudrez	Dropped section “Resolution Enhancement Parameters”
	30-11-2017	E. Baudrez	Clarified the origin of the datasets “A Values (per GERB detector cell)”, and “C Values (per GERB detector cell)”
	30-11-2017	E. Baudrez	Updated overview of hierarchical structure of BARG and HR products to remove datasets that are not present in those products
	01-12-2017	E. Baudrez	Added link to the GGSPS Products User Guide for Level 1.5 products
	01-12-2017	E. Baudrez	Removed documentation for group “PSF Parameters”
	01-12-2017	E. Baudrez	Added note that group “Spectral Regression Parameters” and its datasets are only present in products for GERB-2
Version 2.3	01-12-2017	E. Baudrez	Removed documentation for dataset “Cloud Amount”

List of acronyms

ADM Angular Dependency Model

AOD Aerosol Optical Depth

API Application Programming Interface

ARG Averaged Rectified Geolocated

BARG Binned Averaged Rectified Geolocated

BRDF Bidirectional Reflectance Distribution Function

ED01 Edition 1

FTP File Transfer Protocol

GERB Geostationary Earth Radiation Budget

GGSPS GERB Ground Segment Processing System

HDF	Hierarchical Data Format
HTTP	Hypertext Transfer Protocol
L1.5	Level 1.5
L1.5G	Geolocation of Level 1.5
L2	Level 2
MSG	Meteosat Second Generation
NANRG	Non Averaged Non Rectified Geolocated
NCSA	National Center for Super-Computing Applications
NRT	Near Real Time
RAL	Rutherford-Appleton Laboratory
RGP	RMIB GERB Processing
RMIB	Royal Meteorological Institute of Belgium
ROLSS	RMIB On-Line Short-Term Services
SEVIRI	Spinning Enhanced Visible and InfraRed Imager
SHI	Snapshot High Resolution Image
WWW	World Wide Web

1 Purpose of this Document

This guide is intended to assist users of the Level 2 (L2) products derived from the Geostationary Earth Radiation Budget (GERB) instrument data. These L2 products are computed at the Royal Meteorological Institute of Belgium (RMIB). The L2 RMIB GERB Products consist of images of unfiltered radiances and radiative fluxes at the top of the atmosphere, together with some auxiliary information. Unfiltered radiances and radiative fluxes are available for reflected solar radiation and for emitted thermal radiation. In addition to the L2 products, this guide will also assist the user in the Level 1.5 geolocation (L1.5G) products derived at RMIB.

This document is organised as follows:

- Section 3 gives an overview of each of the various RMIB GERB Products.
- Section 4 provides a detailed description of the logical contents of the products.
- Section 5 describes how a user can write an application to read the RMIB GERB Products.
- Appendix A contains sample code that can help users devise their own reading programs for the RMIB GERB Products.

2 Introduction

2.1 Data Format

The data format chosen for the RMIB GERB Products is the Hierarchical Data Format (HDF) version 5. HDF is not a straightforward data file format in which data items are accessed from byte location. Instead data items in an HDF file format are accessed by name, using HDF library functions. See section 5.

2.2 How to obtain the RMIB GERB Products

A user who wishes to have access to the RMIB GERB Products must register at the RMIB GERB web site:

> http://gerb.oma.be/doku.php?id=data_access#data_access (click on *Register to the ROLSS mailing list*)

After the registration has been accepted, the user will be able to log on to the RMIB GERB File Transfer protocol (FTP) site with his or her registered email address as username and password:

> ftp://gerb.oma.be

where the HDF files of the RMIB GERB Products are stored.

2.3 How the Data has been generated

Documents detailing the scientific assumptions and algorithms used to derive the L2 RMIB GERB Products are available from our web site:

> http://gerb.oma.be

2.4 Warnings

- Before using GERB data you are required to read the data policy and the quality summary available at

  > http://gerb.oma.be/doku.php?id=data_access#data_access

- History changes to L2 data can be found at

  > http://gerb.oma.be/doku.php?id=product_version

  No processing changes will be made to affect the edition products, and changes listed are only of relevance to users of the Near Real Time (NRT) products.

- To have access to data you should use HDF5 library version 1.6.1 or higher (which is supported by IDL version 6.1 and above)

Any suggestion, information or correction can be sent to:

> gerb@meteo.be

3 RMIB GERB Products Files

3.1 Introduction

This section introduces the various RMIB GERB Products. There are 13 of them, differing in contents and/or resolution. Each product is stored in a separate HDF file.

The products are divided in three main types. A product type is defined by a given temporal sampling and spatial resolution.

- An *Averaged Rectified Geolocated* (ARG) product is defined as a 3 GERB scan average (approx. 15 min). The product has GERB spatial resolution and is geolocated on the Rectified Grid (256x256) computed by Rutherford-Appleton Laboratory (RAL) (cf. L1.5 ARG product). The spatial shape of one pixel is the average of the GERB footprints that have contributed to it.

- A *snapshot High Resolution image* (HR or SHI) product is defined as a snapshot at imager acquisition times. The product has 3x3 raw data pixels spatial resolution (1237x1237 for Spinning Enhanced Visible and InfraRed Imager (SEVIRI) and 833x833 for Meteosat).

- A *Binned Averaged Rectified Geolocated* (BARG) product is defined as an average over a time period. The period is an exact imager complete scan period [1]. The first average is computed centered on the midpoint between 00:00 UTC and 00:15 UTC. The product has roughly GERB spatial resolution, i.e. the pixels are geolocated on a rectified grid and are an average of HR pixels [2] from a high resolution image; the grid resolution is 247x247 for SEVIRI and 277x277 for Meteosat 7 imager. The spatial shape of one pixel is an exact square at nadir. The dimension of this square is the GERB sampling distance, i.e. close to 50 km.

- A *Non Averaged Non Rectified Geolocated* (NANRG) defines the Level 1.5 (L1.5) data from GERB instrument. We do not produce this data. RMIB products at L1.5 are limited to an alternate geolocation based on matching with SEVIRI of Non Averaged Non Rectified Geolocated (NANRG) L1.5 files available from RAL. There is one file by Earth view. For each NANRG L1.5 complete file there are six GEO files. The image size is the same as the size of the corresponding view from NANRG L1.5 file. The spatial and time resolution are the ones of the GERB instrument.

3.2 Name Convention

The file names of the RMIB GERB products are made up of several parts, separated by underscore characters, and an extension.
The name follows the convention:

<GERB>_<IMAGER>_<LEVEL>_<RES>_<DATA>_[<REGION>_][<SUBRES>_]<DATE>_<VERSION>.<SUFFIX>

where brackets stands for an optional field. The possible values for each field are summarize in Table 1.

Field Id	Possible values	Description
<GERB>	G1, G2, G3, G4	indicates which GERB instrument produced the original raw data. The GERB 1 instrument is identified by G1, etc...
<IMAGER>	MS7, SEV1, SEV2, SEV3, SEV4	indicates which imager instrument produced the original raw data. MS7 is for Meteosat 7 imager, SEV1 for SEVIRI imager on Meteosat 8, etc...

continued on next page

[1] 15' for SEVIRI and 30' for Meteosat 7
[2] 5x5 for SEVIRI and 3x3 Meteosat 7

		continued from previous page
<LEVEL>	L15, L20	L20 is for geolocated, calibrated and corrected raw data and L15 for geophysical parameters extracted from level L15.
<RES>	ARG, BARG, HR, NANRG	specifies the product spatial and temporal resolution. See Section 3.1.
<DATA>	SOL, TH, SOL_TH, GEO	indicates that the product is concerned with either solar radiation "SOL", thermal radiation "TH" or both "SOL_TH" or geolocation information "GEO"
<REGION>	EUROPE	indicates if the geographic region covered is different from the full Earth disk
<SUBRES>	M15_R50, M30_R50	specifies time and spatial resolution. "M15"("M30") stands for exact 15(30)-minute bins average, "R50" for GERB 50 km resolution,
<DATE>	<YYYYMMDD_HHMMSS>	reference time in format: four-digit year, two-digit month, two-digit day, an underscore character, two-digit hour, two-digit minute and two-digit second.
<VERSION>	V001, V002, ... ED01, ED02,...	indicates the data version or edition. Versions are intend for (unreleased) real-time data, editions are intend for released data
<SUFFIX>	hdf[.gz]	The file format is HDF 5 with optionnal gzip compression

Table 1: File name convention

3.3 Products Files

Table 2 lists the name and product type of the eleven L2 and the two L1.5G RMIB GERB products files (see section 3.2 about the file naming convention).

Page	File Name	Type
5	<GERB>_<IMAGER>_L20_ARG_TH_<DATE>_<VERSION>.hdf	ARG
7	<GERB>_<IMAGER>_L20_ARG_SOL_<DATE>_<VERSION>.hdf	ARG
9	<GERB>_<IMAGER>_L20_ARG_GEO_<DATE>_<VERSION>.hdf	ARG
10	<GERB>_<IMAGER>_L20_HR_TH_EUROPE_<DATE>_<VERSION>.hdf	HR
11	<GERB>_<IMAGER>_L20_HR_SOL_EUROPE_<DATE>_<VERSION>.hdf	HR
13	<GERB>_<IMAGER>_L20_HR_GEO_EUROPE_<DATE>_<VERSION>.hdf	HR
14	<GERB>_<IMAGER>_L20_BARG_TH_M15_R50_<DATE>_<VERSION>.hdf	BARG
15	<GERB>_<IMAGER>_L20_BARG_SOL_M15_R50_<DATE>_<VERSION>.hdf	BARG
17	<GERB>_<IMAGER>_L20_BARG_GEO_M15_R50_<DATE>_<VERSION>.hdf	BARG
18	<GERB>_<IMAGER>_L20_HR_SOL_TH_<DATE>_<VERSION>.hdf	HR
20	<GERB>_<IMAGER>_L20_HR_GEO_<DATE>_<VERSION>.hdf	HR
22	<GERB>_<IMAGER>_L15_GEO_TW_<DATE>_<VERSION>.hdf	NANRG
21	<GERB>_<IMAGER>_L15_GEO_SW_<DATE>_<VERSION>.hdf	NANRG

Table 2: RMIB GERB Products

Each of the following sections is devoted to one specific RMIB GERB product. The section title indicate the product file name as described in section 3.2. For each product, a table presents the logical structure of the data it contains. The number in the first column is the page of this document where the user can find a complete description of the data. The number in the second column is the section of this document where the user can find a complete description of the data. The third column of the table gives the name of the data (see section 5 on how to use that name to access the data).

3.3.1 "<GERB>_<IMAGER>_L20_ARG_TH_<DATE>_<VERSION>.hdf"

This is an Averaged Rectified Geolocated (ARG) product. This product contains thermal fluxes and unfiltered radiances for distribution by the GGSPS, defined to be compatible with the GERB filtered radiances derived by the GGSPS.

Table 3: Hierarchical structure of the product "L20_ARG_TH"

Page	Section	Access Path Name
28	4.1	/File Name
28	4.2	/File Creation Time
28	4.4	/RMIB/
30	4.7	/RMIB/Software Identifier
33	4.9	/RMIB/Product Version
34	4.10	/Edition (only for released data)
34	4.11	/GGSPS/
34	4.12	/GGSPS/L1.5 NANRG File Name
35	4.13	/GGSPS/L1.5 NANRG Product Version
35	4.16	/GERB/
36	4.17	/GERB/Instrument Identifier
36	4.18	/Imager/
36	4.19	/Imager/Type
36	4.20	/Imager/Instrument Identifier
37	4.23	/Summary Thermal Products Confidence
37	4.24	/Extra Thermal Product Confidence Information
38	4.25	/Extra Thermal Product Confidence Information/Data Fraction
38	4.26	/Extra Thermal Product Confidence Information/Data Quality
38	4.27	/Extra Thermal Product Confidence Information/Level 1.5 Anomaly Flags
39	4.28	/Extra Thermal Product Confidence Information/Level 2 Anomaly Flags
39	4.29	/Duplication Flag
40	4.30	/Radiation Type Identifier
40	4.31	/Radiometry/
40	4.32	/Radiometry/SEVIRI Radiance Definition Flag
42	4.35	/Radiometry/Thermal Radiance
69	4.115	/Radiometry/Thermal Radiance/Quantisation Factor
68	4.113	/Radiometry/Thermal Radiance/Unit
42	4.36	/Radiometry/Thermal Flux
69	4.115	/Radiometry/Thermal Flux/Quantisation Factor
68	4.113	/Radiometry/Thermal Flux/Unit
44	4.41	/Radiometry/Longwave Ratio
69	4.115	/Radiometry/Longwave Ratio/Quantisation Factor
68	4.114	/Radiometry/Longwave Ratio/Offset
44	4.42	/Radiometry/Longwave Correction
69	4.115	/Radiometry/Longwave Correction/Quantisation Factor
68	4.114	/Radiometry/Longwave Correction/Offset
44	4.43	/Radiometry/Longwave Correction/Minimum Correction Value
45	4.44	/Radiometry/Longwave Correction/Maximum Correction Value
58	4.84	/Radiometry/Spectral Regression Parameters
59	4.88	/Radiometry/Spectral Regression Parameters/Longwave Solar
60	4.89	/Radiometry/Spectral Regression Parameters/Longwave Thermal
60	4.90	/Radiometry/Spectral Regression Parameters/Thermal
60	4.91	/Radiometry/A Values (per GERB detector cell)/
61	4.92	/Radiometry/C Values (per GERB detector cell)/

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Hierarchical structure of the product "L20_ARG_TH"

Page	Section	Access Path Name
61	4.93	/Scene Identification/
65	4.104	/Scene Identification/Thermal Angular Dependency Models Set Version
48	4.51	/Geolocation/
48	4.52	/Geolocation/Geolocation File Name
49	4.53	/Geolocation/Nominal Satellite Longitude (degrees)
50	4.56	/Geolocation/Line of Sight North-South Speed
51	4.57	/Geolocation/Rectified Grid/
51	4.58	/Geolocation/Rectified Grid/Lap
51	4.59	/Geolocation/Rectified Grid/Lop
51	4.60	/Geolocation/Rectified Grid/Nr
52	4.61	/Geolocation/Rectified Grid/Nx
52	4.62	/Geolocation/Rectified Grid/Ny
52	4.63	/Geolocation/Rectified Grid/Xp
52	4.64	/Geolocation/Rectified Grid/Yp
53	4.65	/Geolocation/Rectified Grid/Grid Orientation
53	4.66	/Geolocation/Rectified Grid/dx
53	4.67	/Geolocation/Rectified Grid/dy
53	4.68	/Geolocation/Rectified Grid/Resolution Flags/
54	4.69	/Geolocation/Rectified Grid/Resolution Flags/East West
54	4.70	/Geolocation/Rectified Grid/Resolution Flags/North South
57	4.80	/Geolocation/Total Image 1/
57	4.81	/Geolocation/Total Image 1/Histogram of Line of Sight East-West Positions
58	4.83	/Geolocation/Total Image 1/Histogram of Line of Sight East-West Positions/Lowest Value
58	4.82	/Geolocation/Total Image 1/Histogram of Line of Sight East-West Positions/Interval Size
68	4.113	/Geolocation/Total Image 1/Histogram of Line of Sight East-West Positions/Unit
57	4.80	/Geolocation/Total Image 2/
57	4.81	/Geolocation/Total Image 2/Histogram of Line of Sight East-West Positions
58	4.83	/Geolocation/Total Image 2/Histogram of Line of Sight East-West Positions/Lowest Value
58	4.82	/Geolocation/Total Image 2/Histogram of Line of Sight East-West Positions/Interval Size
68	4.113	/Geolocation/Total Image 2/Histogram of Line of Sight East-West Positions/Unit
57	4.80	/Geolocation/Total Image 3/
57	4.81	/Geolocation/Total Image 3/Histogram of Line of Sight East-West Positions
58	4.83	/Geolocation/Total Image 3/Histogram of Line of Sight East-West Positions/Lowest Value
58	4.82	/Geolocation/Total Image 3/Histogram of Line of Sight East-West Positions/Interval Size
68	4.113	/Geolocation/Total Image 3/Histogram of Line of Sight East-West Positions/Unit
57	4.79	/Geolocation/Short Wave Image 1/
57	4.81	/Geolocation/Short Wave Image 1/Histogram of Line of Sight East-West Positions
58	4.83	/Geolocation/Short Wave Image 1/Histogram of Line of Sight East-West Positions/Lowest Value
58	4.82	/Geolocation/Short Wave Image 1/Histogram of Line of Sight East-West Positions/Interval Size
68	4.113	/Geolocation/Short Wave Image 1/Histogram of Line of Sight East-West Positions/Unit
57	4.79	/Geolocation/Short Wave Image 2/
57	4.81	/Geolocation/Short Wave Image 2/Histogram of Line of Sight East-West Positions
58	4.83	/Geolocation/Short Wave Image 2/Histogram of Line of Sight East-West Positions/Lowest Value
58	4.82	/Geolocation/Short Wave Image 2/Histogram of Line of Sight East-West Positions/Interval Size
68	4.113	/Geolocation/Short Wave Image 2/Histogram of Line of Sight East-West Positions/Unit
57	4.79	/Geolocation/Short Wave Image 3/
57	4.81	/Geolocation/Short Wave Image 3/Histogram of Line of Sight East-West Positions
58	4.83	/Geolocation/Short Wave Image 3/Histogram of Line of Sight East-West Positions/Lowest Value
58	4.82	/Geolocation/Short Wave Image 3/Histogram of Line of Sight East-West Positions/Interval Size
68	4.113	/Geolocation/Short Wave Image 3/Histogram of Line of Sight East-West Positions/Unit
66	4.105	/Times/

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Hierarchical structure of the product "L20_ARG_TH"

Page	Section	Access Path Name
66	4.106	/Times/First GERB Packet
66	4.107	/Times/Last GERB Packet
67	4.111	/Times/Start of Integration (per column)
68	4.112	/Times/End of Integration (per column)

3.3.2 "<GERB>_<IMAGER>_L20_ARG_SOL_<DATE>_<VERSION>.hdf"

This is an ARG product. This product contains solar fluxes and unfiltered radiances for distribution by the GGSPS, defined to be compatible with the GERB filtered radiances derived by the GGSPS.

Table 4: Hierarchical structure of the product "L20_ARG_SOL"

Page	Section	Access Path Name
28	4.1	/File Name
28	4.2	/File Creation Time
28	4.4	/RMIB/
30	4.7	/RMIB/Software Identifier
33	4.9	/RMIB/Product Version
34	4.10	/Edition (only for released data)
34	4.11	/GGSPS/
34	4.12	/GGSPS/L1.5 NANRG File Name
35	4.13	/GGSPS/L1.5 NANRG Product Version
35	4.16	/GERB/
36	4.17	/GERB/Instrument Identifier
36	4.18	/Imager/
36	4.19	/Imager/Type
36	4.20	/Imager/Instrument Identifier
37	4.22	/Summary Solar Products Confidence
37	4.24	/Extra Solar Product Confidence Information
38	4.25	/Extra Solar Product Confidence Information/Data Fraction
38	4.26	/Extra Solar Product Confidence Information/Data Quality
38	4.27	/Extra Solar Product Confidence Information/Level 1.5 Anomaly Flags
39	4.28	/Extra Solar Product Confidence Information/Level 2 Anomaly Flags
39	4.29	/Duplication Flag
40	4.30	/Radiation Type Identifier
40	4.31	/Radiometry/
40	4.32	/Radiometry/SEVIRI Radiance Definition Flag
41	4.33	/Radiometry/Solar Radiance
69	4.115	/Radiometry/Solar Radiance/Quantisation Factor
68	4.113	/Radiometry/Solar Radiance/Unit
41	4.34	/Radiometry/Solar Flux
69	4.115	/Radiometry/Solar Flux/Quantisation Factor
68	4.113	/Radiometry/Solar Flux/Unit
43	4.37	/Radiometry/Shortwave Ratio
69	4.115	/Radiometry/Shortwave Ratio/Quantisation Factor
68	4.114	/Radiometry/Shortwave Ratio/Offset
43	4.38	/Radiometry/Shortwave Correction
69	4.115	/Radiometry/Shortwave Correction/Quantisation Factor
68	4.114	/Radiometry/Shortwave Correction/Offset
43	4.39	/Radiometry/Shortwave Correction/Minimum Correction Value

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Hierarchical structure of the product "L20_ARG_SOL"

Page	Section	Access Path Name
43	4.40	/Radiometry/Shortwave Correction/Maximum Correction Value
58	4.84	/Radiometry/Spectral Regression Parameters
59	4.85	/Radiometry/Spectral Regression Parameters/Shortwave Solar
59	4.86	/Radiometry/Spectral Regression Parameters/Shortwave Thermal
59	4.87	/Radiometry/Spectral Regression Parameters/Solar
60	4.91	/Radiometry/A Values (per GERB detector cell)/
61	4.92	/Radiometry/C Values (per GERB detector cell)/
61	4.93	/Scene Identification/
64	4.100	/Scene Identification/Surface Type
65	4.103	/Scene Identification/Solar Angular Dependency Models Set Version
63	4.97	/Scene Identification/Aerosol Optical Depth Cover
69	4.115	/Scene Identification/Aerosol Optical Depth Cover/Quantisation Factor
68	4.113	/Scene Identification/Aerosol Optical Depth Cover/Unit
63	4.98	/Scene Identification/Aerosol Optical Depth IR 1.6
69	4.115	/Scene Identification/Aerosol Optical Depth IR 1.6/Quantisation Factor
63	4.98	/Scene Identification/Aerosol Optical Depth VIS 0.6
69	4.115	/Scene Identification/Aerosol Optical Depth VIS 0.6/Quantisation Factor
63	4.98	/Scene Identification/Aerosol Optical Depth VIS 0.8
69	4.115	/Scene Identification/Aerosol Optical Depth VIS 0.8/Quantisation Factor
62	4.95	/Scene Identification/Cloud Cover
69	4.115	/Scene Identification/Cloud Cover/Quantisation Factor
68	4.113	/Scene Identification/Cloud Cover/Unit
61	4.94	/Scene Identification/Cloud Optical Depth (logarithm)
69	4.115	/Scene Identification/Cloud Optical Depth (logarithm)/Quantisation Factor
62	4.96	/Scene Identification/Cloud Phase
69	4.115	/Scene Identification/Cloud Phase/Quantisation Factor
68	4.113	/Scene Identification/Cloud Phase/Unit
45	4.45	/Angles/
45	4.46	/Angles/Incoming Solar Flux
69	4.115	/Angles/Incoming Solar Flux/Quantisation Factor
68	4.113	/Angles/Incoming Solar Flux/Unit
48	4.51	/Geolocation/
48	4.52	/Geolocation/Geolocation File Name
49	4.53	/Geolocation/Nominal Satellite Longitude (degrees)
50	4.56	/Geolocation/Line of Sight North-South Speed
51	4.57	/Geolocation/Rectified Grid/
51	4.58	/Geolocation/Rectified Grid/Lap
51	4.59	/Geolocation/Rectified Grid/Lop
51	4.60	/Geolocation/Rectified Grid/Nr
52	4.61	/Geolocation/Rectified Grid/Nx
52	4.62	/Geolocation/Rectified Grid/Ny
52	4.63	/Geolocation/Rectified Grid/Xp
52	4.64	/Geolocation/Rectified Grid/Yp
53	4.65	/Geolocation/Rectified Grid/Grid Orientation
53	4.66	/Geolocation/Rectified Grid/dx
53	4.67	/Geolocation/Rectified Grid/dy
53	4.68	/Geolocation/Rectified Grid/Resolution Flags/
54	4.69	/Geolocation/Rectified Grid/Resolution Flags/East West
54	4.70	/Geolocation/Rectified Grid/Resolution Flags/North South
57	4.79	/Geolocation/Short Wave Image 1/
57	4.81	/Geolocation/Short Wave Image 1/Histogram of Line of Sight East-West Positions

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Hierarchical structure of the product "L20_ARG_SOL"

Page	Section	Access Path Name
58	4.83	/Geolocation/Short Wave Image 1/Histogram of Line of Sight East-West Positions/Lowest Value
58	4.82	/Geolocation/Short Wave Image 1/Histogram of Line of Sight East-West Positions/Interval Size
68	4.113	/Geolocation/Short Wave Image 1/Histogram of Line of Sight East-West Positions/Unit
57	4.79	/Geolocation/Short Wave Image 2/
57	4.81	/Geolocation/Short Wave Image 2/Histogram of Line of Sight East-West Positions
58	4.83	/Geolocation/Short Wave Image 2/Histogram of Line of Sight East-West Positions/Lowest Value
58	4.82	/Geolocation/Short Wave Image 2/Histogram of Line of Sight East-West Positions/Interval Size
68	4.113	/Geolocation/Short Wave Image 2/Histogram of Line of Sight East-West Positions/Unit
57	4.79	/Geolocation/Short Wave Image 3/
57	4.81	/Geolocation/Short Wave Image 3/Histogram of Line of Sight East-West Positions
58	4.83	/Geolocation/Short Wave Image 3/Histogram of Line of Sight East-West Positions/Lowest Value
58	4.82	/Geolocation/Short Wave Image 3/Histogram of Line of Sight East-West Positions/Interval Size
68	4.113	/Geolocation/Short Wave Image 3/Histogram of Line of Sight East-West Positions/Unit
66	4.105	/Times/
66	4.106	/Times/First GERB Packet
66	4.107	/Times/Last GERB Packet
67	4.111	/Times/Start of Integration (per column)
68	4.112	/Times/End of Integration (per column)

3.3.3 "<GERB>_<IMAGER>_L20_ARG_GEO_<DATE>_<VERSION>.hdf"

This product contains the geolocation (latitude, longitude) for the pixels of the "L20_ARG_TH" and "L20_ARG_SOL" products.

Table 5: Hierarchical structure of the product "L20_ARG_GEO"

Page	Section	Access Path Name
28	4.1	/File Name
28	4.2	/File Creation Time
28	4.4	/RMIB/
30	4.7	/RMIB/Software Identifier
34	4.10	/Edition (only for released data)
35	4.16	/GERB/
36	4.17	/GERB/Instrument Identifier
45	4.45	/Angles/
47	4.50	/Angles/Viewing Zenith
69	4.115	/Angles/Viewing Zenith/Quantisation Factor
68	4.113	/Angles/Viewing Zenith/Unit
48	4.51	/Geolocation/
49	4.54	/Geolocation/Latitude
69	4.115	/Geolocation/Latitude/Quantisation Factor
68	4.113	/Geolocation/Latitude/Unit
50	4.55	/Geolocation/Longitude
69	4.115	/Geolocation/Longitude/Quantisation Factor
68	4.113	/Geolocation/Longitude/Unit
51	4.57	/Geolocation/Rectified Grid/
51	4.58	/Geolocation/Rectified Grid/Lap
51	4.59	/Geolocation/Rectified Grid/Lop
51	4.60	/Geolocation/Rectified Grid/Nr
52	4.61	/Geolocation/Rectified Grid/Nx
52	4.62	/Geolocation/Rectified Grid/Ny
52	4.63	/Geolocation/Rectified Grid/Xp

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Hierarchical structure of the product "L20_ARG_GEO"

Page	Section	Access Path Name
52	4.64	/Geolocation/Rectified Grid/Yp
53	4.65	/Geolocation/Rectified Grid/Grid Orientation
53	4.66	/Geolocation/Rectified Grid/dx
53	4.67	/Geolocation/Rectified Grid/dy
53	4.68	/Geolocation/Rectified Grid/Resolution Flags/
54	4.69	/Geolocation/Rectified Grid/Resolution Flags/East West
54	4.70	/Geolocation/Rectified Grid/Resolution Flags/North South
66	4.105	/Times/
66	4.106	/Times/First GERB Packet

3.3.4 "<GERB>_<IMAGER>_L20_HR_TH_EUROPE_<DATE>_<VERSION>.hdf"

This is a SHI product, defined in a window over Europe. This product contains thermal radiances and fluxes, defined to be compatible with the SEVIRI radiance images. It can e.g. be used together with SEVIRI derived cloud products.

Table 6: Hierarchical structure of the product "L20_HR_TH_EUROPE"

Page	Section	Access Path Name
28	4.1	/File Name
28	4.2	/File Creation Time
28	4.4	/RMIB/
30	4.7	/RMIB/Software Identifier
33	4.9	/RMIB/Product Version
34	4.11	/GGSPS/
35	4.13	/GGSPS/L1.5 NANRG Product Version
35	4.16	/GERB/
36	4.17	/GERB/Instrument Identifier
36	4.18	/Imager/
36	4.19	/Imager/Type
36	4.20	/Imager/Instrument Identifier
37	4.23	/Summary Thermal Products Confidence
40	4.31	/Radiometry/
40	4.32	/Radiometry/SEVIRI Radiance Definition Flag
42	4.35	/Radiometry/Thermal Radiance
69	4.115	/Radiometry/Thermal Radiance/Quantisation Factor
68	4.113	/Radiometry/Thermal Radiance/Unit
42	4.36	/Radiometry/Thermal Flux
69	4.115	/Radiometry/Thermal Flux/Quantisation Factor
68	4.113	/Radiometry/Thermal Flux/Unit
44	4.42	/Radiometry/Longwave Correction
69	4.115	/Radiometry/Longwave Correction/Quantisation Factor
68	4.114	/Radiometry/Longwave Correction/Offset
58	4.84	/Radiometry/Spectral Regression Parameters
59	4.88	/Radiometry/Spectral Regression Parameters/Longwave Solar
60	4.89	/Radiometry/Spectral Regression Parameters/Longwave Thermal
60	4.90	/Radiometry/Spectral Regression Parameters/Thermal
60	4.91	/Radiometry/A Values (per GERB detector cell)/
61	4.92	/Radiometry/C Values (per GERB detector cell)/
61	4.93	/Scene Identification/
65	4.104	/Scene Identification/Thermal Angular Dependency Models Set Version

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Hierarchical structure of the product "L20_HR_TH_EUROPE"

Page	Section	Access Path Name
65	4.102	/Scene Identification/Thermal Angular Dependency Model
45	4.45	/Angles/
47	4.49	/Angles/Viewing Azimuth
69	4.115	/Angles/Viewing Azimuth/Quantisation Factor
68	4.113	/Angles/Viewing Azimuth/Unit
47	4.50	/Angles/Viewing Zenith
69	4.115	/Angles/Viewing Zenith/Quantisation Factor
68	4.113	/Angles/Viewing Zenith/Unit
48	4.51	/Geolocation/
48	4.52	/Geolocation/Geolocation File Name
49	4.53	/Geolocation/Nominal Satellite Longitude (degrees)
50	4.56	/Geolocation/Line of Sight North-South Speed
51	4.57	/Geolocation/Rectified Grid/
51	4.58	/Geolocation/Rectified Grid/Lap
51	4.59	/Geolocation/Rectified Grid/Lop
51	4.60	/Geolocation/Rectified Grid/Nr
52	4.61	/Geolocation/Rectified Grid/Nx
52	4.62	/Geolocation/Rectified Grid/Ny
52	4.63	/Geolocation/Rectified Grid/Xp
52	4.64	/Geolocation/Rectified Grid/Yp
53	4.65	/Geolocation/Rectified Grid/Grid Orientation
53	4.66	/Geolocation/Rectified Grid/dx
53	4.67	/Geolocation/Rectified Grid/dy
53	4.68	/Geolocation/Rectified Grid/Resolution Flags/
54	4.69	/Geolocation/Rectified Grid/Resolution Flags/East West
54	4.70	/Geolocation/Rectified Grid/Resolution Flags/North South
66	4.105	/Times/
67	4.110	/Times/Time (per row)

3.3.5 "<GERB>_<IMAGER>_L20_HR_SOL_EUROPE_<DATE>_<VERSION>.hdf"

This is a SHI product, defined in a window over Europe. This product contains solar radiances and fluxes, defined to be compatible with the SEVIRI radiance images. It can e.g. be used together with SEVIRI derived cloud products.

Table 7: Hierarchical structure of the product "L20_HR_SOL_EUROPE"

Page	Section	Access Path Name
28	4.1	/File Name
28	4.2	/File Creation Time
28	4.4	/RMIB/
30	4.7	/RMIB/Software Identifier
33	4.9	/RMIB/Product Version
34	4.11	/GGSPS/
35	4.13	/GGSPS/L1.5 NANRG Product Version
35	4.16	/GERB/
36	4.17	/GERB/Instrument Identifier
36	4.18	/Imager/
36	4.19	/Imager/Type
36	4.20	/Imager/Instrument Identifier
37	4.22	/Summary Solar Products Confidence
40	4.31	/Radiometry/

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Hierarchical structure of the product "L20_HR_SOL_EUROPE"

Page	Section	Access Path Name
40	4.32	/Radiometry/SEVIRI Radiance Definition Flag
41	4.33	/Radiometry/Solar Radiance
69	4.115	/Radiometry/Solar Radiance/Quantisation Factor
68	4.113	/Radiometry/Solar Radiance/Unit
41	4.34	/Radiometry/Solar Flux
69	4.115	/Radiometry/Solar Flux/Quantisation Factor
68	4.113	/Radiometry/Solar Flux/Unit
43	4.38	/Radiometry/Shortwave Correction
69	4.115	/Radiometry/Shortwave Correction/Quantisation Factor
68	4.114	/Radiometry/Shortwave Correction/Offset
58	4.84	/Radiometry/Spectral Regression Parameters
59	4.85	/Radiometry/Spectral Regression Parameters/Shortwave Solar
59	4.86	/Radiometry/Spectral Regression Parameters/Shortwave Thermal
59	4.87	/Radiometry/Spectral Regression Parameters/Solar
60	4.91	/Radiometry/A Values (per GERB detector cell)/
61	4.92	/Radiometry/C Values (per GERB detector cell)/
61	4.93	/Scene Identification/
64	4.100	/Scene Identification/Surface Type
65	4.103	/Scene Identification/Solar Angular Dependency Models Set Version
64	4.101	/Scene Identification/Solar Angular Dependency Model
63	4.98	/Scene Identification/Aerosol Optical Depth IR 1.6
69	4.115	/Scene Identification/Aerosol Optical Depth IR 1.6/Quantisation Factor
63	4.98	/Scene Identification/Aerosol Optical Depth VIS 0.6
69	4.115	/Scene Identification/Aerosol Optical Depth VIS 0.6/Quantisation Factor
63	4.98	/Scene Identification/Aerosol Optical Depth VIS 0.8
69	4.115	/Scene Identification/Aerosol Optical Depth VIS 0.8/Quantisation Factor
64	4.99	/Scene Identification/Dust Detection
69	4.115	/Scene Identification/Dust Detection/Quantisation Factor
62	4.95	/Scene Identification/Cloud Cover
69	4.115	/Scene Identification/Cloud Cover/Quantisation Factor
68	4.113	/Scene Identification/Cloud Cover/Unit
61	4.94	/Scene Identification/Cloud Optical Depth (logarithm)
69	4.115	/Scene Identification/Cloud Optical Depth (logarithm)/Quantisation Factor
62	4.96	/Scene Identification/Cloud Phase
69	4.115	/Scene Identification/Cloud Phase/Quantisation Factor
68	4.113	/Scene Identification/Cloud Phase/Unit
45	4.45	/Angles/
46	4.47	/Angles/Relative Azimuth
69	4.115	/Angles/Relative Azimuth/Quantisation Factor
68	4.113	/Angles/Relative Azimuth/Unit
46	4.48	/Angles/Solar Zenith
69	4.115	/Angles/Solar Zenith/Quantisation Factor
68	4.113	/Angles/Solar Zenith/Unit
47	4.49	/Angles/Viewing Azimuth
69	4.115	/Angles/Viewing Azimuth/Quantisation Factor
68	4.113	/Angles/Viewing Azimuth/Unit
47	4.50	/Angles/Viewing Zenith
69	4.115	/Angles/Viewing Zenith/Quantisation Factor
68	4.113	/Angles/Viewing Zenith/Unit
48	4.51	/Geolocation/
48	4.52	/Geolocation/Geolocation File Name

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		Hierarchical structure of the product "L20_HR_SOL_EUROPE"
Page	Section	Access Path Name
49	4.53	/Geolocation/Nominal Satellite Longitude (degrees)
50	4.56	/Geolocation/Line of Sight North-South Speed
51	4.57	/Geolocation/Rectified Grid/
51	4.58	/Geolocation/Rectified Grid/Lap
51	4.59	/Geolocation/Rectified Grid/Lop
51	4.60	/Geolocation/Rectified Grid/Nr
52	4.61	/Geolocation/Rectified Grid/Nx
52	4.62	/Geolocation/Rectified Grid/Ny
52	4.63	/Geolocation/Rectified Grid/Xp
52	4.64	/Geolocation/Rectified Grid/Yp
53	4.65	/Geolocation/Rectified Grid/Grid Orientation
53	4.66	/Geolocation/Rectified Grid/dx
53	4.67	/Geolocation/Rectified Grid/dy
53	4.68	/Geolocation/Rectified Grid/Resolution Flags/
54	4.69	/Geolocation/Rectified Grid/Resolution Flags/East West
54	4.70	/Geolocation/Rectified Grid/Resolution Flags/North South
66	4.105	/Times/
67	4.110	/Times/Time (per row)

3.3.6 "<GERB>_<IMAGER>_L20_HR_GEO_EUROPE_<DATE>_<VERSION>.hdf"

This product contains the geolocation (latitude, longitude) for the pixels of the "L20_HR_SOL_EUROPE" and "L20_HR_TH_EUROPE" products.

Table 8: Hierarchical structure of the product "L20_HR_GEO_EUROPE"

Page	Section	Access Path Name
28	4.1	/File Name
28	4.2	/File Creation Time
28	4.4	/RMIB/
30	4.7	/RMIB/Software Identifier
35	4.16	/GERB/
36	4.17	/GERB/Instrument Identifier
48	4.51	/Geolocation/
49	4.54	/Geolocation/Latitude
69	4.115	/Geolocation/Latitude/Quantisation Factor
68	4.113	/Geolocation/Latitude/Unit
50	4.55	/Geolocation/Longitude
69	4.115	/Geolocation/Longitude/Quantisation Factor
68	4.113	/Geolocation/Longitude/Unit
51	4.57	/Geolocation/Rectified Grid/
51	4.58	/Geolocation/Rectified Grid/Lap
51	4.59	/Geolocation/Rectified Grid/Lop
51	4.60	/Geolocation/Rectified Grid/Nr
52	4.61	/Geolocation/Rectified Grid/Nx
52	4.62	/Geolocation/Rectified Grid/Ny
52	4.63	/Geolocation/Rectified Grid/Xp
52	4.64	/Geolocation/Rectified Grid/Yp
53	4.65	/Geolocation/Rectified Grid/Grid Orientation
53	4.66	/Geolocation/Rectified Grid/dx
53	4.67	/Geolocation/Rectified Grid/dy
53	4.68	/Geolocation/Rectified Grid/Resolution Flags/
		continued on next page

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		Hierarchical structure of the product "L20_HR_GEO_EUROPE"
Page	Section	Access Path Name
54	4.69	/Geolocation/Rectified Grid/Resolution Flags/East West
54	4.70	/Geolocation/Rectified Grid/Resolution Flags/North South
66	4.105	/Times/
66	4.106	/Times/First GERB Packet

3.3.7 "<GERB>_<IMAGER>_L20_BARG_TH_M15_R50_<DATE>_<VERSION>.hdf"

This is a BARG product (see section 3.1 for a complete description). This product contains thermal radiances and fluxes, defined for easy comparison with model output.

Table 9: Hierarchical structure of the product "L20_BARG_TH_M15_R50"

Page	Section	Access Path Name
28	4.1	/File Name
28	4.2	/File Creation Time
28	4.4	/RMIB/
30	4.7	/RMIB/Software Identifier
33	4.9	/RMIB/Product Version
34	4.11	/GGSPS/
35	4.13	/GGSPS/L1.5 NANRG Product Version
35	4.16	/GERB/
36	4.17	/GERB/Instrument Identifier
36	4.18	/Imager/
36	4.19	/Imager/Type
36	4.20	/Imager/Instrument Identifier
37	4.23	/Summary Thermal Products Confidence
37	4.24	/Extra Thermal Product Confidence Information
38	4.25	/Extra Thermal Product Confidence Information/Data Fraction
38	4.26	/Extra Thermal Product Confidence Information/Data Quality
38	4.27	/Extra Thermal Product Confidence Information/Level 1.5 Anomaly Flags
39	4.28	/Extra Thermal Product Confidence Information/Level 2 Anomaly Flags
40	4.31	/Radiometry/
40	4.32	/Radiometry/SEVIRI Radiance Definition Flag
42	4.35	/Radiometry/Thermal Radiance
69	4.115	/Radiometry/Thermal Radiance/Quantisation Factor
68	4.113	/Radiometry/Thermal Radiance/Unit
42	4.36	/Radiometry/Thermal Flux
69	4.115	/Radiometry/Thermal Flux/Quantisation Factor
68	4.113	/Radiometry/Thermal Flux/Unit
44	4.42	/Radiometry/Longwave Correction
69	4.115	/Radiometry/Longwave Correction/Quantisation Factor
68	4.114	/Radiometry/Longwave Correction/Offset
44	4.43	/Radiometry/Longwave Correction/Minimum Correction Value
45	4.44	/Radiometry/Longwave Correction/Maximum Correction Value
58	4.84	/Radiometry/Spectral Regression Parameters
59	4.88	/Radiometry/Spectral Regression Parameters/Longwave Solar
60	4.89	/Radiometry/Spectral Regression Parameters/Longwave Thermal
60	4.90	/Radiometry/Spectral Regression Parameters/Thermal
60	4.91	/Radiometry/A Values (per GERB detector cell)/
61	4.92	/Radiometry/C Values (per GERB detector cell)/

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Hierarchical structure of the product "L20_BARG_TH_M15_R50"		
Page	Section	Access Path Name
61	4.93	/Scene Identification/
65	4.104	/Scene Identification/Thermal Angular Dependency Models Set Version
65	4.102	/Scene Identification/Thermal Angular Dependency Model
45	4.45	/Angles/
47	4.49	/Angles/Viewing Azimuth
69	4.115	/Angles/Viewing Azimuth/Quantisation Factor
68	4.113	/Angles/Viewing Azimuth/Unit
47	4.50	/Angles/Viewing Zenith
69	4.115	/Angles/Viewing Zenith/Quantisation Factor
68	4.113	/Angles/Viewing Zenith/Unit
48	4.51	/Geolocation/
48	4.52	/Geolocation/Geolocation File Name
49	4.53	/Geolocation/Nominal Satellite Longitude (degrees)
50	4.56	/Geolocation/Line of Sight North-South Speed
51	4.57	/Geolocation/Rectified Grid/
51	4.58	/Geolocation/Rectified Grid/Lap
51	4.59	/Geolocation/Rectified Grid/Lop
51	4.60	/Geolocation/Rectified Grid/Nr
52	4.61	/Geolocation/Rectified Grid/Nx
52	4.62	/Geolocation/Rectified Grid/Ny
52	4.63	/Geolocation/Rectified Grid/Xp
52	4.64	/Geolocation/Rectified Grid/Yp
53	4.65	/Geolocation/Rectified Grid/Grid Orientation
53	4.66	/Geolocation/Rectified Grid/dx
53	4.67	/Geolocation/Rectified Grid/dy
53	4.68	/Geolocation/Rectified Grid/Resolution Flags/
54	4.69	/Geolocation/Rectified Grid/Resolution Flags/East West
54	4.70	/Geolocation/Rectified Grid/Resolution Flags/North South
66	4.105	/Times/
67	4.108	/Times/Start of Integration
67	4.109	/Times/End of Integration

3.3.8 "<GERB>_<IMAGER>_L20_BARG_SOL_M15_R50_<DATE>_<VERSION>.hdf"

This is a BARG product (see section 3.1 for a complete description). This product contains solar radiances and fluxes, defined for easy comparison with model output.

Table 10: Hierarchical structure of the product "L20_BARG_SOL_M15_R50"

Page	Section	Access Path Name
28	4.1	/File Name
28	4.2	/File Creation Time
28	4.4	/RMIB/
29	4.5	/RMIB/Git Commit Identifier
29	4.6	/RMIB/Pixel Algorithm
69	4.115	/RMIB/Pixel Algorithm/Quantisation Factor
30	4.7	/RMIB/Software Identifier
30	4.8	/RMIB/Status Flag Word 1
33	4.9	/RMIB/Product Version
34	4.11	/GGSPS/
35	4.13	/GGSPS/L1.5 NANRG Product Version
35	4.16	/GERB/
36	4.17	/GERB/Instrument Identifier
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Hierarchical structure of the product "L20_BARG_SOL_M15_R50"

Page	Section	Access Path Name
36	4.18	/Imager/
36	4.19	/Imager/Type
36	4.20	/Imager/Instrument Identifier
37	4.22	/Summary Solar Products Confidence
37	4.24	/Extra Solar Product Confidence Information
38	4.25	/Extra Solar Product Confidence Information/Data Fraction
38	4.26	/Extra Solar Product Confidence Information/Data Quality
38	4.27	/Extra Solar Product Confidence Information/Level 1.5 Anomaly Flags
39	4.28	/Extra Solar Product Confidence Information/Level 2 Anomaly Flags
40	4.31	/Radiometry/
40	4.32	/Radiometry/SEVIRI Radiance Definition Flag
41	4.33	/Radiometry/Solar Radiance
69	4.115	/Radiometry/Solar Radiance/Quantisation Factor
68	4.113	/Radiometry/Solar Radiance/Unit
41	4.34	/Radiometry/Solar Flux
69	4.115	/Radiometry/Solar Flux/Quantisation Factor
68	4.113	/Radiometry/Solar Flux/Unit
43	4.38	/Radiometry/Shortwave Correction
69	4.115	/Radiometry/Shortwave Correction/Quantisation Factor
68	4.114	/Radiometry/Shortwave Correction/Offset
43	4.39	/Radiometry/Shortwave Correction/Minimum Correction Value
43	4.40	/Radiometry/Shortwave Correction/Maximum Correction Value
58	4.84	/Radiometry/Spectral Regression Parameters
59	4.85	/Radiometry/Spectral Regression Parameters/Shortwave Solar
59	4.86	/Radiometry/Spectral Regression Parameters/Shortwave Thermal
59	4.87	/Radiometry/Spectral Regression Parameters/Solar
60	4.91	/Radiometry/A Values (per GERB detector cell)/
61	4.92	/Radiometry/C Values (per GERB detector cell)/
61	4.93	/Scene Identification/
64	4.100	/Scene Identification/Surface Type
65	4.103	/Scene Identification/Solar Angular Dependency Models Set Version
63	4.97	/Scene Identification/Aerosol Optical Depth Cover
69	4.115	/Scene Identification/Aerosol Optical Depth Cover/Quantisation Factor
68	4.113	/Scene Identification/Aerosol Optical Depth Cover/Unit
63	4.98	/Scene Identification/Aerosol Optical Depth IR 1.6
69	4.115	/Scene Identification/Aerosol Optical Depth IR 1.6/Quantisation Factor
63	4.98	/Scene Identification/Aerosol Optical Depth VIS 0.6
69	4.115	/Scene Identification/Aerosol Optical Depth VIS 0.6/Quantisation Factor
63	4.98	/Scene Identification/Aerosol Optical Depth VIS 0.8
69	4.115	/Scene Identification/Aerosol Optical Depth VIS 0.8/Quantisation Factor
62	4.95	/Scene Identification/Cloud Cover
69	4.115	/Scene Identification/Cloud Cover/Quantisation Factor
68	4.113	/Scene Identification/Cloud Cover/Unit
61	4.94	/Scene Identification/Cloud Optical Depth (logarithm)
69	4.115	/Scene Identification/Cloud Optical Depth (logarithm)/Quantisation Factor
62	4.96	/Scene Identification/Cloud Phase
69	4.115	/Scene Identification/Cloud Phase/Quantisation Factor
68	4.113	/Scene Identification/Cloud Phase/Unit
45	4.45	/Angles/
45	4.46	/Angles/Incoming Solar Flux
69	4.115	/Angles/Incoming Solar Flux/Quantisation Factor

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Page	Section	Access Path Name
		Hierarchical structure of the product "L20_BARG_SOL_M15_R50"
68	4.113	/Angles/Incoming Solar Flux/Unit
46	4.47	/Angles/Relative Azimuth
69	4.115	/Angles/Relative Azimuth/Quantisation Factor
68	4.113	/Angles/Relative Azimuth/Unit
46	4.48	/Angles/Solar Zenith
69	4.115	/Angles/Solar Zenith/Quantisation Factor
68	4.113	/Angles/Solar Zenith/Unit
47	4.49	/Angles/Viewing Azimuth
69	4.115	/Angles/Viewing Azimuth/Quantisation Factor
68	4.113	/Angles/Viewing Azimuth/Unit
47	4.50	/Angles/Viewing Zenith
69	4.115	/Angles/Viewing Zenith/Quantisation Factor
68	4.113	/Angles/Viewing Zenith/Unit
48	4.51	/Geolocation/
48	4.52	/Geolocation/Geolocation File Name
49	4.53	/Geolocation/Nominal Satellite Longitude (degrees)
50	4.56	/Geolocation/Line of Sight North-South Speed
51	4.57	/Geolocation/Rectified Grid/
51	4.58	/Geolocation/Rectified Grid/Lap
51	4.59	/Geolocation/Rectified Grid/Lop
51	4.60	/Geolocation/Rectified Grid/Nr
52	4.61	/Geolocation/Rectified Grid/Nx
52	4.62	/Geolocation/Rectified Grid/Ny
52	4.63	/Geolocation/Rectified Grid/Xp
52	4.64	/Geolocation/Rectified Grid/Yp
53	4.65	/Geolocation/Rectified Grid/Grid Orientation
53	4.66	/Geolocation/Rectified Grid/dx
53	4.67	/Geolocation/Rectified Grid/dy
53	4.68	/Geolocation/Rectified Grid/Resolution Flags/
54	4.69	/Geolocation/Rectified Grid/Resolution Flags/East West
54	4.70	/Geolocation/Rectified Grid/Resolution Flags/North South
66	4.105	/Times/
67	4.108	/Times/Start of Integration
67	4.109	/Times/End of Integration

3.3.9 "<GERB>_<IMAGER>_L20_BARG_GEO_M15_R50_<DATE>_<VERSION>.hdf"

This product contains the geolocation (latitude, longitude) for the pixels of the "L20_BARG_SOL_M15_R50" and "L20_BARG_TH_M15_R50" products.

Table 11: Hierarchical structure of the product "L20_BARG_GEO_M15_R50"

Page	Section	Access Path Name
28	4.1	/File Name
28	4.2	/File Creation Time
28	4.4	/RMIB/
30	4.7	/RMIB/Software Identifier
35	4.16	/GERB/
36	4.17	/GERB/Instrument Identifier
48	4.51	/Geolocation/
49	4.54	/Geolocation/Latitude
69	4.115	/Geolocation/Latitude/Quantisation Factor
68	4.113	/Geolocation/Latitude/Unit

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Hierarchical structure of the product "L20_BARG_GEO_M15_R50"

Page	Section	Access Path Name
50	4.55	/Geolocation/Longitude
69	4.115	/Geolocation/Longitude/Quantisation Factor
68	4.113	/Geolocation/Longitude/Unit
51	4.57	/Geolocation/Rectified Grid/
51	4.58	/Geolocation/Rectified Grid/Lap
51	4.59	/Geolocation/Rectified Grid/Lop
51	4.60	/Geolocation/Rectified Grid/Nr
52	4.61	/Geolocation/Rectified Grid/Nx
52	4.62	/Geolocation/Rectified Grid/Ny
52	4.63	/Geolocation/Rectified Grid/Xp
52	4.64	/Geolocation/Rectified Grid/Yp
53	4.65	/Geolocation/Rectified Grid/Grid Orientation
53	4.66	/Geolocation/Rectified Grid/dx
53	4.67	/Geolocation/Rectified Grid/dy
53	4.68	/Geolocation/Rectified Grid/Resolution Flags/
54	4.69	/Geolocation/Rectified Grid/Resolution Flags/East West
54	4.70	/Geolocation/Rectified Grid/Resolution Flags/North South
66	4.105	/Times/
66	4.106	/Times/First GERB Packet

3.3.10 "<GERB>_<IMAGER>_L20_HR_SOL_TH_<DATE>_<VERSION>.hdf"

This is a SHI product (see section 3.1), defined over the full MSG disc.
It is not intended for routine distribution.

Table 12: Hierarchical structure of the product "L20_HR_SOL_TH"

Page	Section	Access Path Name
28	4.1	/File Name
28	4.2	/File Creation Time
28	4.4	/RMIB/
29	4.5	/RMIB/Git Commit Identifier
29	4.6	/RMIB/Pixel Algorithm
69	4.115	/RMIB/Pixel Algorithm/Quantisation Factor
30	4.7	/RMIB/Software Identifier
30	4.8	/RMIB/Status Flag Word 1
33	4.9	/RMIB/Product Version
34	4.11	/GGSPS/
35	4.13	/GGSPS/L1.5 NANRG Product Version
35	4.16	/GERB/
36	4.17	/GERB/Instrument Identifier
36	4.18	/Imager/
36	4.19	/Imager/Type
36	4.20	/Imager/Instrument Identifier
37	4.23	/Summary Thermal Products Confidence
37	4.22	/Summary Solar Products Confidence
40	4.31	/Radiometry/
40	4.32	/Radiometry/SEVIRI Radiance Definition Flag
42	4.35	/Radiometry/Thermal Radiance
69	4.115	/Radiometry/Thermal Radiance/Quantisation Factor
68	4.113	/Radiometry/Thermal Radiance/Unit
41	4.33	/Radiometry/Solar Radiance

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Hierarchical structure of the product "L20_HR_SOL_TH"

Page	Section	Access Path Name
69	4.115	/Radiometry/Solar Radiance/Quantisation Factor
68	4.113	/Radiometry/Solar Radiance/Unit
42	4.36	/Radiometry/Thermal Flux
69	4.115	/Radiometry/Thermal Flux/Quantisation Factor
68	4.113	/Radiometry/Thermal Flux/Unit
41	4.34	/Radiometry/Solar Flux
69	4.115	/Radiometry/Solar Flux/Quantisation Factor
68	4.113	/Radiometry/Solar Flux/Unit
44	4.42	/Radiometry/Longwave Correction
69	4.115	/Radiometry/Longwave Correction/Quantisation Factor
68	4.114	/Radiometry/Longwave Correction/Offset
43	4.38	/Radiometry/Shortwave Correction
69	4.115	/Radiometry/Shortwave Correction/Quantisation Factor
68	4.114	/Radiometry/Shortwave Correction/Offset
58	4.84	/Radiometry/Spectral Regression Parameters
59	4.88	/Radiometry/Spectral Regression Parameters/Longwave Solar
60	4.89	/Radiometry/Spectral Regression Parameters/Longwave Thermal
60	4.90	/Radiometry/Spectral Regression Parameters/Thermal
59	4.85	/Radiometry/Spectral Regression Parameters/Shortwave Solar
59	4.86	/Radiometry/Spectral Regression Parameters/Shortwave Thermal
59	4.87	/Radiometry/Spectral Regression Parameters/Solar
60	4.91	/Radiometry/A Values (per GERB detector cell)/
61	4.92	/Radiometry/C Values (per GERB detector cell)/
61	4.93	/Scene Identification/
64	4.100	/Scene Identification/Surface Type
65	4.104	/Scene Identification/Thermal Angular Dependency Models Set Version
65	4.102	/Scene Identification/Thermal Angular Dependency Model
65	4.103	/Scene Identification/Solar Angular Dependency Models Set Version
64	4.101	/Scene Identification/Solar Angular Dependency Model
63	4.98	/Scene Identification/Aerosol Optical Depth IR 1.6
69	4.115	/Scene Identification/Aerosol Optical Depth IR 1.6/Quantisation Factor
63	4.98	/Scene Identification/Aerosol Optical Depth VIS 0.6
69	4.115	/Scene Identification/Aerosol Optical Depth VIS 0.6/Quantisation Factor
63	4.98	/Scene Identification/Aerosol Optical Depth VIS 0.8
69	4.115	/Scene Identification/Aerosol Optical Depth VIS 0.8/Quantisation Factor
64	4.99	/Scene Identification/Dust Detection
69	4.115	/Scene Identification/Dust Detection/Quantisation Factor
62	4.95	/Scene Identification/Cloud Cover
69	4.115	/Scene Identification/Cloud Cover/Quantisation Factor
68	4.113	/Scene Identification/Cloud Cover/Unit
61	4.94	/Scene Identification/Cloud Optical Depth (logarithm)
69	4.115	/Scene Identification/Cloud Optical Depth (logarithm)/Quantisation Factor
62	4.96	/Scene Identification/Cloud Phase
69	4.115	/Scene Identification/Cloud Phase/Quantisation Factor
68	4.113	/Scene Identification/Cloud Phase/Unit
45	4.45	/Angles/
46	4.47	/Angles/Relative Azimuth
69	4.115	/Angles/Relative Azimuth/Quantisation Factor
68	4.113	/Angles/Relative Azimuth/Unit
46	4.48	/Angles/Solar Zenith
69	4.115	/Angles/Solar Zenith/Quantisation Factor

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Page	Section	Access Path Name
		Hierarchical structure of the product "L20_HR_SOL_TH"
68	4.113	/Angles/Solar Zenith/Unit
47	4.49	/Angles/Viewing Azimuth
69	4.115	/Angles/Viewing Azimuth/Quantisation Factor
68	4.113	/Angles/Viewing Azimuth/Unit
47	4.50	/Angles/Viewing Zenith
69	4.115	/Angles/Viewing Zenith/Quantisation Factor
68	4.113	/Angles/Viewing Zenith/Unit
48	4.51	/Geolocation/
48	4.52	/Geolocation/Geolocation File Name
49	4.53	/Geolocation/Nominal Satellite Longitude (degrees)
50	4.56	/Geolocation/Line of Sight North-South Speed
51	4.57	/Geolocation/Rectified Grid/
51	4.58	/Geolocation/Rectified Grid/Lap
51	4.59	/Geolocation/Rectified Grid/Lop
51	4.60	/Geolocation/Rectified Grid/Nr
52	4.61	/Geolocation/Rectified Grid/Nx
52	4.62	/Geolocation/Rectified Grid/Ny
52	4.63	/Geolocation/Rectified Grid/Xp
52	4.64	/Geolocation/Rectified Grid/Yp
53	4.65	/Geolocation/Rectified Grid/Grid Orientation
53	4.66	/Geolocation/Rectified Grid/dx
53	4.67	/Geolocation/Rectified Grid/dy
53	4.68	/Geolocation/Rectified Grid/Resolution Flags/
54	4.69	/Geolocation/Rectified Grid/Resolution Flags/East West
54	4.70	/Geolocation/Rectified Grid/Resolution Flags/North South
66	4.105	/Times/
67	4.110	/Times/Time (per row)

3.3.11 "<GERB>_<IMAGER>_L20_HR_GEO_<DATE>_<VERSION>.hdf"

This product contains the geolocation (latitude, longitude) for the pixels of the "L20_HR_SOL_TH" product.

Table 13: Hierarchical structure of the product "L20_HR_GEO"

Page	Section	Access Path Name
28	4.1	/File Name
28	4.2	/File Creation Time
28	4.4	/RMIB/
30	4.7	/RMIB/Software Identifier
35	4.16	/GERB/
36	4.17	/GERB/Instrument Identifier
48	4.51	/Geolocation/
49	4.54	/Geolocation/Latitude
69	4.115	/Geolocation/Latitude/Quantisation Factor
68	4.113	/Geolocation/Latitude/Unit
50	4.55	/Geolocation/Longitude
69	4.115	/Geolocation/Longitude/Quantisation Factor
68	4.113	/Geolocation/Longitude/Unit
51	4.57	/Geolocation/Rectified Grid/
51	4.58	/Geolocation/Rectified Grid/Lap
51	4.59	/Geolocation/Rectified Grid/Lop
51	4.60	/Geolocation/Rectified Grid/Nr

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Page	Section	Access Path Name
		continued from previous page
		Hierarchical structure of the product "L20_HR_GEO"
52	4.61	/Geolocation/Rectified Grid/Nx
52	4.62	/Geolocation/Rectified Grid/Ny
52	4.63	/Geolocation/Rectified Grid/Xp
52	4.64	/Geolocation/Rectified Grid/Yp
53	4.65	/Geolocation/Rectified Grid/Grid Orientation
53	4.66	/Geolocation/Rectified Grid/dx
53	4.67	/Geolocation/Rectified Grid/dy
53	4.68	/Geolocation/Rectified Grid/Resolution Flags/
54	4.69	/Geolocation/Rectified Grid/Resolution Flags/East West
54	4.70	/Geolocation/Rectified Grid/Resolution Flags/North South
66	4.105	/Times/
66	4.106	/Times/First GERB Packet

3.3.12 "<GERB>_<IMAGER>_L15_GEO_SW<DATE>_<VERSION>.hdf"

This product contains the geolocation (latitude, longitude) for the pixels of the "L15_NANRG" product. This "L15_NANRG" product is not produced at the RMIB but by RAL. The "L15_NANRG" files are composed of 3 SW Earth views and 3 TW Earth views. This file is the geolocation of one of this view. Information in the file or the date in the name allows to determine the Earth view of the NANRG file for which the geolocation applies.

Table 14: Hierarchical structure of the product "L15_GEO_SW"

Page	Section	Access Path Name
28	4.1	/File Name
28	4.2	/File Creation Time
28	4.3	/File Version
28	4.4	/RMIB/
30	4.7	/RMIB/Software Identifier
33	4.9	/RMIB/Product Version
35	4.16	/GERB/
36	4.17	/GERB/Instrument Identifier
36	4.18	/Imager/
36	4.19	/Imager/Type
36	4.20	/Imager/Instrument Identifier
37	4.21	/Imager/File Names
56	4.78	/RAL correlation
56	4.78	/RMIB correlation
34	4.10	/Edition (only for released data)
40	4.30	/Radiation Type Identifier
34	4.11	/GGSPS/
34	4.12	/GGSPS/L1.5 NANRG File Name
35	4.13	/GGSPS/L1.5 NANRG Product Version
35	4.14	/GGSPS/HDF View Index
35	4.15	/GGSPS/TW Flag
48	4.51	/Geolocation/
54	4.71	/Geolocation/Earth Flag
55	4.72	/Geolocation/Latitude (degrees)
55	4.73	/Geolocation/Longitude (degrees)
55	4.74	/Geolocation/Number of columns
55	4.75	/Geolocation/Number of detectors
		continued on next page

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Hierarchical structure of the product "L15_GEO_SW"		
Page	Section	Access Path Name
56	4.76	/Geolocation/Geolocation Arrays Flag
56	4.77	/Geolocation/Geolocation Parameters

3.3.13 "<GERB>_<IMAGER>_L15_GEO_TW<DATE>_<VERSION>.hdf"

This product contains the geolocation (latitude, longitude) for the pixels of the "L15_NANRG" product. This "L15_NANRG" product is not produced at the RMIB but by RAL. The "L15_NANRG" files are composed of 3 SW Earth views and 3 TW Earth views. This file is the geolocation of one of this view. Information in the file or the date in the name allows to determine the Earth view of the NANRG file for which the geolocation applies.

Table 15: Hierarchical structure of the product "L15_GEO_TW"

Page	Section	Access Path Name
28	4.1	/File Name
28	4.2	/File Creation Time
28	4.3	/File Version
28	4.4	/RMIB/
30	4.7	/RMIB/Software Identifier
33	4.9	/RMIB/Product Version
35	4.16	/GERB/
36	4.17	/GERB/Instrument Identifier
36	4.18	/Imager/
36	4.19	/Imager/Type
36	4.20	/Imager/Instrument Identifier
37	4.21	/Imager/File Names
56	4.78	/RAL correlation
56	4.78	/RMIB correlation
34	4.10	/Edition (only for released data)
40	4.30	/Radiation Type Identifier
34	4.11	/GGSPS/
34	4.12	/GGSPS/L1.5 NANRG File Name
35	4.13	/GGSPS/L1.5 NANRG Product Version
35	4.14	/GGSPS/HDF View Index
35	4.15	/GGSPS/TW Flag
48	4.51	/Geolocation/
54	4.71	/Geolocation/Earth Flag
55	4.72	/Geolocation/Latitude (degrees)
55	4.73	/Geolocation/Longitude (degrees)
55	4.74	/Geolocation/Number of columns
55	4.75	/Geolocation/Number of detectors
56	4.76	/Geolocation/Geolocation Arrays Flag
56	4.77	/Geolocation/Geolocation Parameters

4 RMIB GERB Products Contents

This section describes the contents of the fields from which the L2 products are composed. For each HDF field, the following information is provided:

- The field name.
- The HDF object type (see 5.3.1) is indicated between square brackets.
- A description of the field contents.
- The absolute name (see 5.3.2) of the field.
- If need be, some additional information: HDF data type, data quantisation, data offset, data error value, range

In the table 16, all the fields of the HDF files are listed in alphabetical order to ease reference to the complete description which is organised from a logical view.

Table 16: HDF Path by Alphabetical Order

Page	Section	Access Path Name
45	4.45	/Angles/
45	4.46	/Angles/Incoming Solar Flux
69	4.115	/Angles/Incoming Solar Flux/Quantisation Factor
68	4.113	/Angles/Incoming Solar Flux/Unit
46	4.47	/Angles/Relative Azimuth
69	4.115	/Angles/Relative Azimuth/Quantisation Factor
68	4.113	/Angles/Relative Azimuth/Unit
46	4.48	/Angles/Solar Zenith
69	4.115	/Angles/Solar Zenith/Quantisation Factor
68	4.113	/Angles/Solar Zenith/Unit
47	4.49	/Angles/Viewing Azimuth
69	4.115	/Angles/Viewing Azimuth/Quantisation Factor
68	4.113	/Angles/Viewing Azimuth/Unit
47	4.50	/Angles/Viewing Zenith
69	4.115	/Angles/Viewing Zenith/Quantisation Factor
68	4.113	/Angles/Viewing Zenith/Unit
39	4.29	/Duplication Flag
37	4.24	/Extra Solar Product Confidence Information
38	4.25	/Extra Solar Product Confidence Information/Data Fraction
38	4.26	/Extra Solar Product Confidence Information/Data Quality
38	4.27	/Extra Solar Product Confidence Information/Level 1.5 Anomaly Flags
39	4.28	/Extra Solar Product Confidence Information/Level 2 Anomaly Flags
37	4.24	/Extra Thermal Product Confidence Information
38	4.25	/Extra Thermal Product Confidence Information/Data Fraction
38	4.26	/Extra Thermal Product Confidence Information/Data Quality
38	4.27	/Extra Thermal Product Confidence Information/Level 1.5 Anomaly Flags
39	4.28	/Extra Thermal Product Confidence Information/Level 2 Anomaly Flags
28	4.2	/File Creation Time
28	4.1	/File Name
28	4.3	/File Version
48	4.51	/Geolocation/
54	4.71	/Geolocation/Earth Flag
48	4.52	/Geolocation/Geolocation File Name

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Page	Section	Access Path Name
56	4.76	/Geolocation/Geolocation Arrays Flag
49	4.54	/Geolocation/Latitude
69	4.115	/Geolocation/Latitude/Quantisation Factor
68	4.113	/Geolocation/Latitude/Unit
55	4.72	/Geolocation/Latitude (degrees)
50	4.56	/Geolocation/Line of Sight North-South Speed
50	4.55	/Geolocation/Longitude
69	4.115	/Geolocation/Longitude/Quantisation Factor
68	4.113	/Geolocation/Longitude/Unit
55	4.73	/Geolocation/Longitude (degrees)
49	4.53	/Geolocation/Nominal Satellite Longitude (degrees)
55	4.74	/Geolocation/Number of columns
55	4.75	/Geolocation/Number of detectors
56	4.77	/Geolocation/Geolocation Parameters
51	4.57	/Geolocation/Rectified Grid/
53	4.66	/Geolocation/Rectified Grid/dx
53	4.67	/Geolocation/Rectified Grid/dy
53	4.65	/Geolocation/Rectified Grid/Grid Orientation
51	4.58	/Geolocation/Rectified Grid/Lap
51	4.59	/Geolocation/Rectified Grid/Lop
51	4.60	/Geolocation/Rectified Grid/Nr
52	4.61	/Geolocation/Rectified Grid/Nx
52	4.62	/Geolocation/Rectified Grid/Ny
53	4.68	/Geolocation/Rectified Grid/Resolution Flags/
54	4.69	/Geolocation/Rectified Grid/Resolution Flags/East West
54	4.70	/Geolocation/Rectified Grid/Resolution Flags/North South
52	4.63	/Geolocation/Rectified Grid/Xp
52	4.64	/Geolocation/Rectified Grid/Yp
57	4.79	/Geolocation/Short Wave Image 1/
57	4.81	/Geolocation/Short Wave Image 1/Histogram of Line of Sight East-West Positions
58	4.82	/Geolocation/Short Wave Image 1/Histogram of Line of Sight East-West Positions/Interval Size
58	4.83	/Geolocation/Short Wave Image 1/Histogram of Line of Sight East-West Positions/Lowest Value
68	4.113	/Geolocation/Short Wave Image 1/Histogram of Line of Sight East-West Positions/Unit
57	4.79	/Geolocation/Short Wave Image 2/
57	4.81	/Geolocation/Short Wave Image 2/Histogram of Line of Sight East-West Positions
58	4.82	/Geolocation/Short Wave Image 2/Histogram of Line of Sight East-West Positions/Interval Size
58	4.83	/Geolocation/Short Wave Image 2/Histogram of Line of Sight East-West Positions/Lowest Value
68	4.113	/Geolocation/Short Wave Image 2/Histogram of Line of Sight East-West Positions/Unit
57	4.79	/Geolocation/Short Wave Image 3/
57	4.81	/Geolocation/Short Wave Image 3/Histogram of Line of Sight East-West Positions
58	4.82	/Geolocation/Short Wave Image 3/Histogram of Line of Sight East-West Positions/Interval Size
58	4.83	/Geolocation/Short Wave Image 3/Histogram of Line of Sight East-West Positions/Lowest Value
68	4.113	/Geolocation/Short Wave Image 3/Histogram of Line of Sight East-West Positions/Unit
57	4.80	/Geolocation/Total Image 1/
57	4.81	/Geolocation/Total Image 1/Histogram of Line of Sight East-West Positions
58	4.82	/Geolocation/Total Image 1/Histogram of Line of Sight East-West Positions/Interval Size
58	4.83	/Geolocation/Total Image 1/Histogram of Line of Sight East-West Positions/Lowest Value
68	4.113	/Geolocation/Total Image 1/Histogram of Line of Sight East-West Positions/Unit
57	4.80	/Geolocation/Total Image 2/
57	4.81	/Geolocation/Total Image 2/Histogram of Line of Sight East-West Positions
58	4.82	/Geolocation/Total Image 2/Histogram of Line of Sight East-West Positions/Interval Size

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Page	Section	Access Path Name
58	4.83	/Geolocation/Total Image 2/Histogram of Line of Sight East-West Positions/Lowest Value
68	4.113	/Geolocation/Total Image 2/Histogram of Line of Sight East-West Positions/Unit
57	4.80	/Geolocation/Total Image 3/
57	4.81	/Geolocation/Total Image 3/Histogram of Line of Sight East-West Positions
58	4.82	/Geolocation/Total Image 3/Histogram of Line of Sight East-West Positions/Interval Size
58	4.83	/Geolocation/Total Image 3/Histogram of Line of Sight East-West Positions/Lowest Value
68	4.113	/Geolocation/Total Image 3/Histogram of Line of Sight East-West Positions/Unit
35	4.16	/GERB/
36	4.17	/GERB/Instrument Identifier
34	4.11	/GGSPS/
35	4.14	/GGSPS/HDF View Index
34	4.12	/GGSPS/L1.5 NANRG File Name
35	4.13	/GGSPS/L1.5 NANRG Product Version
35	4.15	/GGSPS/TW Flag
36	4.18	/Imager/
37	4.21	/Imager/File Names
36	4.20	/Imager/Instrument Identifier
36	4.19	/Imager/Type
40	4.30	/Radiation Type Identifier
40	4.31	/Radiometry/
44	4.41	/Radiometry/Longwave Ratio
68	4.114	/Radiometry/Longwave Ratio/Offset
69	4.115	/Radiometry/Longwave Ratio/Quantisation Factor
44	4.42	/Radiometry/Longwave Correction
44	4.43	/Radiometry/Longwave Correction/Minimum Correction Value
45	4.44	/Radiometry/Longwave Correction/Maximum Correction Value
68	4.114	/Radiometry/Longwave Correction/Offset
69	4.115	/Radiometry/Longwave Correction/Quantisation Factor
40	4.32	/Radiometry/SEVIRI Radiance Definition Flag
43	4.37	/Radiometry/Shortwave Ratio
68	4.114	/Radiometry/Shortwave Ratio/Offset
69	4.115	/Radiometry/Shortwave Ratio/Quantisation Factor
43	4.38	/Radiometry/Shortwave Correction
43	4.39	/Radiometry/Shortwave Correction/Minimum Correction Value
43	4.40	/Radiometry/Shortwave Correction/Maximum Correction Value
68	4.114	/Radiometry/Shortwave Correction/Offset
69	4.115	/Radiometry/Shortwave Correction/Quantisation Factor
41	4.34	/Radiometry/Solar Flux
69	4.115	/Radiometry/Solar Flux/Quantisation Factor
68	4.113	/Radiometry/Solar Flux/Unit
41	4.33	/Radiometry/Solar Radiance
69	4.115	/Radiometry/Solar Radiance/Quantisation Factor
68	4.113	/Radiometry/Solar Radiance/Unit
58	4.84	/Radiometry/Spectral Regression Parameters
59	4.88	/Radiometry/Spectral Regression Parameters/Longwave Solar
60	4.89	/Radiometry/Spectral Regression Parameters/Longwave Thermal
60	4.90	/Radiometry/Spectral Regression Parameters/Thermal
59	4.85	/Radiometry/Spectral Regression Parameters/Shortwave Solar
59	4.86	/Radiometry/Spectral Regression Parameters/Shortwave Thermal
59	4.87	/Radiometry/Spectral Regression Parameters/Solar
42	4.36	/Radiometry/Thermal Flux

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Page	Section	Access Path Name
69	4.115	/Radiometry/Thermal Flux/Quantisation Factor
68	4.113	/Radiometry/Thermal Flux/Unit
42	4.35	/Radiometry/Thermal Radiance
69	4.115	/Radiometry/Thermal Radiance/Quantisation Factor
68	4.113	/Radiometry/Thermal Radiance/Unit
60	4.91	/Radiometry/A Values (per GERB detector cell)/
61	4.92	/Radiometry/C Values (per GERB detector cell)/
56	4.78	/RAL correlation
28	4.4	/RMIB/
29	4.5	/RMIB/Git Commit Identifier
29	4.6	/RMIB/Pixel Algorithm
69	4.115	/RMIB/Pixel Algorithm/Quantisation Factor
30	4.7	/RMIB/Software Identifier
30	4.8	/RMIB/Status Flag Word 1
33	4.9	/RMIB/Product Version
56	4.78	/RMIB correlation
61	4.93	/Scene Identification/
63	4.97	/Scene Identification/Aerosol Optical Depth Cover
69	4.115	/Scene Identification/Aerosol Optical Depth Cover/Quantisation Factor
68	4.113	/Scene Identification/Aerosol Optical Depth Cover/Unit
63	4.98	/Scene Identification/Aerosol Optical Depth IR 1.6
69	4.115	/Scene Identification/Aerosol Optical Depth IR 1.6/Quantisation Factor
63	4.98	/Scene Identification/Aerosol Optical Depth VIS 0.6
69	4.115	/Scene Identification/Aerosol Optical Depth VIS 0.6/Quantisation Factor
63	4.98	/Scene Identification/Aerosol Optical Depth VIS 0.8
69	4.115	/Scene Identification/Aerosol Optical Depth VIS 0.8/Quantisation Factor
62	4.95	/Scene Identification/Cloud Cover
69	4.115	/Scene Identification/Cloud Cover/Quantisation Factor
68	4.113	/Scene Identification/Cloud Cover/Unit
61	4.94	/Scene Identification/Cloud Optical Depth (logarithm)
69	4.115	/Scene Identification/Cloud Optical Depth (logarithm)/Quantisation Factor
62	4.96	/Scene Identification/Cloud Phase
69	4.115	/Scene Identification/Cloud Phase/Quantisation Factor
68	4.113	/Scene Identification/Cloud Phase/Unit
64	4.99	/Scene Identification/Dust Detection
69	4.115	/Scene Identification/Dust Detection/Quantisation Factor
64	4.101	/Scene Identification/Solar Angular Dependency Model
65	4.103	/Scene Identification/Solar Angular Dependency Models Set Version
64	4.100	/Scene Identification/Surface Type
65	4.102	/Scene Identification/Thermal Angular Dependency Model
65	4.104	/Scene Identification/Thermal Angular Dependency Models Set Version
37	4.22	/Summary Solar Products Confidence
37	4.23	/Summary Thermal Products Confidence
66	4.105	/Times/
67	4.109	/Times/End of Integration
68	4.112	/Times/End of Integration (per column)
66	4.106	/Times/First GERB Packet
66	4.107	/Times/Last GERB Packet
67	4.108	/Times/Start of Integration
67	4.111	/Times/Start of Integration (per column)
67	4.110	/Times/Time (per row)

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Page	Section	Access Path Name

4.1 File Name [Attribute]

Description

The name of the file.
Note that in Edition 1, the value of the File Name attribute inside the HDF file may not correctly reflect the actual file name.

HDF Path

"*/File Name*"

Additional Information

Data type: `H5T_STRING`.

4.2 File Creation Time [Attribute]

Description

The UTC time when the file was created.
Note that in Edition 1, the value of the File Creation Time attribute inside the HDF file may not correctly reflect the actual file creation time.

HDF Path

"*/File Creation Time*"

Additional Information

Data type: `H5T_STRING`.
The format is "YYYYMMDD HH:MM:SS".

4.3 File Version [Attribute]

Description

Version of the file.

HDF Path

"*/File Version*"

Additional Information

Data type: `H5T_STD_I32BE`.

4.4 RMIB [Group]

Description

This group contains information about the RMIB GERB processing software.

HDF Path

"*/RMIB/*"

Additional Information

None

4.5 Git Commit Identifier [Attribute]

Description

The SHA-1 digest that identifies the version of the RMIB GERB processing software that was last used to generate or modify this HDF file. This identifier is used to track changes in data format, processing and internal software management.

HDF Path

"*/RMIB/Git Commit Identifier*"

Additional Information

Data type: `H5T_STRING`.

4.6 Pixel Algorithm [Dataset]

Description

The dataset "Pixel Algorithm" is an image that, for every pixel in the field of view, indicates whether the Edition-1 radiance-to-flux conversion algorithm or a model has been used to calculate the pixel's solar flux values. It is meant to be a "summary" of the Status Flag Word 1 dataset described in section 4.8. The value of the Pixel Algorithm dataset is interpreted as follows:

- 0 (HR) – The solar flux has been calculated using the Edition-1 radiance-to-flux conversion algorithm. No twilight model or clear-ocean climatological model has been used to calculate the solar flux. No extrapolation of the scene identification was performed.
- 1 (HR) – The solar flux has been calculated using at least one of the following models/approximations: (i) the scene identification for this pixel has been extrapolated forward or backward in time, and is not current (the radiance-to-flux conversion algorithm may or may not have been applied to this pixel), (ii) the solar flux has been calculated from a monthly clear-ocean climatology instead of from the radiance-to-flux conversion, or (iii) the solar flux has been calculated from a twilight model instead of from the radiance-to-flux conversion. Inspect the value of the corresponding pixel from the Status Flag Word 1 dataset (see section 4.8) for more information.
- Any fractional number between 0 and 1 (only occurs in BARG) signify that a fraction of the HR pixels contributing to the value in the BARG pixel under consideration have been calculated using at least one of the models or approximations described above. The figure is meant to give an estimate how many of the contributing HR pixels are "pure" Edition-1 radiance-to-flux conversion, as opposed to calculated using a model or approximation.

HDF Path

"*/RMIB/Pixel Algorithm*"

Additional Information

Quantisation factor: 0.01.
Data type: `H5T_STD_U8BE`.
Error value: 255.
Range: [0,100].

4.7 Software Identifier [Attribute]

Description

Version number of the RMIB GERB processing software that has been used. The software identification follows a date format: "YYYYMMDD_HHMMSS". This identifier is used to track all changes in data format, processing and internal software management. (See http://gerb.oma.be/doku.php?id=product_version for history and last changes.)
Note that in Edition 1, the value of the Software Identifier attribute inside the HDF file may not unequivocally determine the actual software used to generate the file.

HDF Path

"*/RMIB/Software Identifier*"

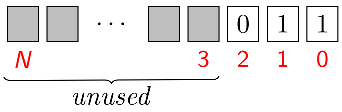
Additional Information

Data type: `H5T_STRING`.

4.8 Status Flag Word 1 [Dataset]

Description

The dataset "Status Flag Word 1" indicates, for every pixel in the field of view, whether any models or approximations have been used that could affect the quality of the resulting solar flux or of the scene identification. The status flag word is an assembly of bit flags that is interpreted as follows:



- Bit 2 is *set*: A twilight model has been applied to the solar flux; the radiance-to-flux conversion has not been applied to this pixel.
- Bit 1 is *set*: An clear-ocean climatological model has been applied to the solar flux; the radiance-to-flux conversion has not been applied to this pixel.
- Bit 0 is *set*: The scene identification has been extrapolated forwards or backwards in time. The radiance-to-flux conversion may or may not have been applied to this pixel, depending on the value of the other status flags.

Other bits are currently unused and reserved for future use. Note that not all combinations of status flags make sense; e.g., a pixel may not have both a twilight model and a clear-ocean climatological model applied to the solar flux at the same time.

Interpretation of the status flag word for the BARG resolution

The interpretation of the status flag word for the BARG resolution is somewhat different. As each BARG pixel is computed from the spatial and temporal average of multiple HR pixels, the status flag word for a BARG pixel is actually a combination of the status flag bits of the contributing HR pixels. The calculation of the status flag word is represented schematically in Figure 1.
To compute the status flag word at the BARG resolution, the status flag word at the HR resolution is split by bit number. The separated, binary, "bit images" are subjected to the BARG time and space averaging. This yields a floating-point value per pixel, which represents the fraction of input HR pixels that have the bit set. This floating-point value is converted to a binary (0/1) value by thresholding, i.e., considering any value larger than 0 to be 1. The thresholded, binary, bit flags are finally reassembled in a status word, in the same order as for the HR resolution.

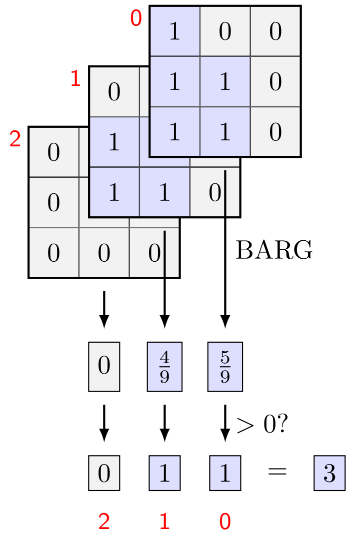


Figure 1: Schematic representation of the computation of the status flag word for the BARG resolution. Please note that this picture is included for illustration only. The actual BARG averaging is more complex than what the picture suggests, and may use more than nine HR pixels per BARG pixel.

The meaning of the status bits is therefore slightly different for BARG than for HR. If a BARG status bit is set, this means that at *least one of the HR pixels contributing to the BARG pixel under consideration has the corresponding status bit set*. If a BARG status bit is unset, none of the contributing HR status bits was set.
As a result of the thresholding and reassembly of HR status bits, certain combinations of status flags that are impossible in HR can appear in BARG. For example, while in HR the application of the twilight model and clear-ocean climatology can never occur together, this combination could appear to occur in BARG. What actually happens is that a distinct HR pixels with different status flags within the same BARG "footprint" get combined into seemingly impossible combinations.

Twilight model for solar flux

When the status bit for twilight model is set, the radiance-to-flux conversion is not applied. Rather, the solar flux is calculated from linear interpolation within a table of precalculated solar flux values tabulated as a function of solar zenith angle. The values used are shown in Table 17. When applied to GERB-2, however, the interpolated values are first divided by the SW calibration update factor before substituting them into the image. This ensures that when the entire solar flux image is multipied with the SW calibration update factor as recommended by the Quality Summary, the twilight flux will be correct.

Clear-ocean climatological model for solar flux

When the status bit for clear-ocean climatology is set, the radiance-to-flux conversion is not applied. Rather, the solar flux is calculated from a monthly climatology, as follows:

$$F_{\mathrm{GERB}} = \Gamma F_{\mathrm{model}}$$

where Γ represents climatological data, and F_{model} represents the model flux (described below) calculated with the current scene identification.
The model flux is calculated as follows:

$$F_{\mathrm{model}} = a \frac{F_{\mathrm{incoming}} \cos\theta}{\tilde{r}^2}$$

Solar Zenith Angle, °	flux, W m^{-2}
84.5	48.3428
85.5	39.7990
86.5	31.7399
87.5	24.9577
88.5	18.4358
89.5	12.4553
90.5	7.5284
91.5	5.0543
92.5	2.9716
93.5	1.5336
94.5	0.9251
95.5	0.6051
96.5	0.3768
97.6	0.3004
98.5	0.2401
99.5	0.1802

Table 17: Precalculated values used for the solar twilight flux model. Actual values are interpolated between the values shown. Solar flux values for solar zenith angles above 99.5° are set to zero. Note that the twilight model is never used for solar zenith angles below 85°. Also note that, for GERB-2, the resultant interpolated values are first divided by the SW calibration update factor (not shown) before substituting them into the solar flux image.

where

$$\begin{aligned} a &= \text{model albedo} \\ F_{\text{incoming}} &= \text{incoming solar flux, 1366 W m}^{-2} \\ \theta &= \text{solar zenith angle, radians} \\ \tilde{r} &= \text{normalized Sun–Earth distance, dimensionless} \end{aligned}$$

The model albedo a is calculated from the Bidirectional Reflectance Distribution Functions (BRDFs) with actual or extrapolated scene identification.
The climatological data Γ vary in space and time, and are computed by collecting actual GERB solar fluxes and model fluxes, and computing the monthly average ratio. The following criteria for inclusion are used:

- Only clear-sky, dust-free pixels outside of the geometric sun glint area (i.e., with a glint angle exceeding 25°) are retained.
- Pixels with high solar or viewing zenith angles are rejected.
- Additionally, each pixel needs to be surrounded by 8 other pixels meeting the above criteria.
- Lastly, only ocean/water points are retained.

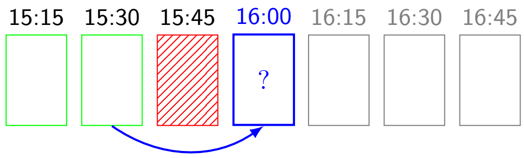
The monthly average ratio per pixel,

$$\Gamma = \left\langle \frac{F_{\text{GERB}}}{F_{\text{model}}} \right\rangle$$

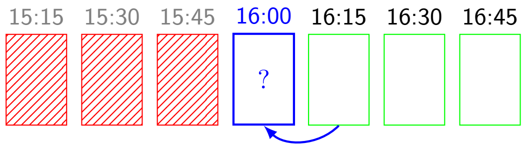
is then stored in an image, one per month, for further use.

Scene extrapolation in time

When the status bit for scene extrapolation is set, the scene identification has been obtained from forward or backward extrapolation of the scene identification of the same pixel in another point in time. The radiance-to-flux conversion may or may not have been applied, depending on the value of the other status flags.
The time extrapolation can be either forward or backward, and is performed pixel by pixel. The forward extrapolation is tried first; schematically, it works as follows for the 16:00 slot for a given pixel:



In this example, the 15:45 slot does not contain a valid scene identification *for the given pixel*, but the 15:30 slot does. The scene identification for the given pixel from the 15:30 slot is then copied to the 16:00 slot.
The backward extrapolation is tried next; schematically, it works as follows for the 16:00 slot:



In this example, the scene identification from the 16:15 slot (for the same pixel) is valid and will be copied to the 16:00 slot.
For any given pixel, the backward extrapolation is preferred to the forward extrapolation only if it yields a scene identification obtained from a slot *closer in time* to the destination slot. In case of a tie, the forward extrapolation is preferred.
The scene identification is never extrapolated beyond a duration of 2 hours and 30 minutes. If no valid scene identification is available for the given pixel at any given point in time within 2 hours and 30 minutes of the given time, the scene identification will be marked invalid. The scene identification is never extrapolated when the solar zenith angle exceeds 80°. Scene identification extrapolation is only applied inside the geometric area defined by sun glint angles of 15° or less, or in the geometric area defined by solar zenith angles between 80 and 85°.

HDF Path

"*/RMIB/Status Flag Word 1*"

Additional Information

Data type: `H5T_STD_I32BE`.
Error value: N/A.

4.9 Product Version [Attribute]

Description

Version number of the RMIB GERB processing products. This identifier is used to track major changes in data format and processing. (See http://gerb.oma.be/doku.php?id=product_version for history and last changes.)
Note that in Edition 1, the value of the Product Version attribute inside the HDF file may not correctly reflect the actual product version.

HDF Path

"*/RMIB/Product Version*"

Additional Information

Data type: `H5T_STD_I32BE`.

4.10 Edition [Attribute]

Description

The format is "EDXX" where XX is an increasing number with new release.
Note that in Edition 1, the actual Edition attribute may unfortunately be missing.

HDF Path

"*/Edition*"

Additional Information

Data type: `H5T_STD_I32BE`.

4.11 GGSPS [Group]

Description

This information in this group is copied from the level 1.5 Non Averaged Non Rectified Geolocated (NANRG) GERB radiance product that has been used as input file. It contains information about the GGSPS software that was used to produce the NANRG data used in this product.

HDF Path

"*/GGSPS/*"

Additional Information

See GGSPS documentation [1].

4.12 L1.5 NANRG File Name {[Dataset],[Attribute]}

Description

The name of the all the L1.5 NANRG files that have been used as input. If more than one file has been used, the name of the main file is the first item. The RAL NANRG files contain three SW Earth view and three TW views. GERB LW in RMIB GERB Processing (RGP) is generated as the difference between the TW and the SW at SW acquisition time. The TW at SW acquisition time is generated by interpolation of the TW acquired before and after the SW. This needs an extra Earth view which is taken from a second NANRG L1.5 files.
In L15 files (see section 3.3.12, 3.3.13), this field is an attribute.

HDF Path

"*/GGSPS/L1.5 NANRG File Name*"

Additional Information

Data type: `H5T_STRING`.

4.13 L1.5 NANRG Product Version [Dataset]

Description

The product version of the L1.5 NANRG files that have been used as input.

HDF Path

"*/GGSPS/L1.5 NANRG Product Version*"

Additional Information

Data type: `H5T_STD_I32BE`.
See the GGSPS information page at http://ggsps.rl.ac.uk/information.html, and in particular, the *Level 1.5 GGSPS Products User Guide* document, which can be found on the same page, for more information.

4.14 HDF View Index [Attribute]

Description

This attribute gives the index of the Earth view used. The index can be one of the three 1,2,3 values. Using this information with the "L1.5 NANRG File Name" (see section 4.12) attribute and the "Radiation Type Identifier" (see section 4.30), it is possible to determine which Earth view has been used.

HDF Path

"*/GGSPS/HDF View Index*"

Additional Information

Data type: `H5T_STD_I32BE`.

4.15 TW Flag [Attribute]

Description

The geolocation of GERB by matching with SEVIRI in SW is only possible for a pixel subset depending on time. To improve the geolocation stability, the missing pixels are replaced by a TW interpolation from the previous and next GERB Earth view. This flag indicates the use of TW data for geolocation.
This flag is always set to 0 because of software bug.

HDF Path

"*/GGSPS/TW Flag*"

Additional Information

Data type: `H5T_STD_I32BE`.

4.16 GERB [Group]

Description

This group contains information regarding the GERB instrument that was used.

HDF Path

"*/GERB/*"

Additional Information

None

4.17 Instrument Identifier [Attribute]

Description

This identifier indicates which GERB instrument is used.

HDF Path

"*/GERB/Instrument Identifier*"

Additional Information

Data type: `H5T_STRING`.
Allowed values: "G1", "G2", "G3", ...

4.18 Imager [Group]

Description

This group contains information about the imager (SEVIRI or METEOSAT) that has been used as auxiliary data in the processing of GERB data.

HDF Path

"*/Imager/*"

Additional Information

None

4.19 Type [Attribute]

Description

Indicates which one of two possible imager types has been used: SEVIRI or METEOSAT.

HDF Path

"*/Imager/Type*"

Additional Information

Data type: `H5T_STRING`.

4.20 Instrument Identifier [Attribute]

Description

This identifier indicates which imager of a particular type has been used. 1 is for SEVIRI 1 on MSG8, etc...

HDF Path

"*/Imager/Instrument Identifier*"

Additional Information

Data type: H5T_STD_I32BE.

4.21 File Names [Dataset]

Description

List of imager files used.

HDF Path

"*/Imager/File Names*"

Additional Information

Data type: H5T_STRING.

4.22 Summary Solar Products Confidence [Attribute]

Description

Product confidence summary value indicating overall usefulness of solar products. This is the ratio of pixels that are valid. A valid pixel is one that is in the range defined by "Minimum Correction Value"(see section 4.39) and "Maximum Correction Value"(see section 4.40). This value is always equal to 1 for ED01 ARG Solar data.

HDF Path

"*/Summary Solar Products Confidence*"

Additional Information

Data type: H5T_IEEE_F64BE.

4.23 Summary Thermal Products Confidence [Attribute]

Description

Product confidence summary value indicating overall usefulness of thermal products. This is the ratio of pixels for which the correction applied is equal to the ratio of GERB and SEVIRI data. Two reasons could avoid the equality between ratio and correction: first the pixel value has been corrupted by non-repeatability between total wave and short wave Earth view. Secondly, the pixel is too far from a "decent" correction value which is in the range defined by "Minimum Correction Value"(see section 4.43) and "Maximum Correction Value"(see section 4.44). Additional information can be found in [5].

HDF Path

"*/Summary Thermal Products Confidence*"

Additional Information

Data type: H5T_IEEE_F64BE

4.24 Extra {Thermal,Solar} Product Confidence Information [Group]

Description

This group contains information about data quality.

HDF Path

"*/Extra Thermal Product Confidence Information*"

"*/Extra Solar Product Confidence Information*"

Additional Information

None

4.25 Data Fraction [Attribute]

Description

The fraction of data that has been computed versus the maximum number of data that could have been computed. This percent is never equal to 1 because the simultaneous use of SEVIRI and GERB. In the Earth limb, it is not possible to correctly estimate the ration between SEVIRI and GERB. If it is not possible to determine this percent, the attribute is set to -1. This could happen during the night for solar/shortwave data.

HDF Path

"*/Extra Thermal Product Confidence Information/Data Fraction*"

"*/Extra Solar Product Confidence Information/Data Fraction*"

Additional Information

Data type: `H5T_IEEE_F64BE`
Error Value: -1.
Range: (0,1).

4.26 Data Quality [Attribute]

Description

This attribute is not used.

HDF Path

"*/Extra Thermal Product Confidence Information/Data Quality*"

"*/Extra Solar Product Confidence Information/Data Quality*"

Additional Information

Data type: `H5T_IEEE_I32BE`

4.27 Level 1.5 Anomaly Flags [Attribute]

Description

This attribute is the propagation trough the RGP of the L1.5 anomaly flags. More specifically, it is the bitwise 'OR' of the constituent flags from each of the NANRG scans used as input in deriving the product. All the input files are used to compute this flag and not only the main input file. Description of these flags can be found in [1]. For information, the L1.5 anomaly flags are:

Bit	Meaning	Severity
0	Quartz filter anomaly	Major
1	Direct stray light	Major
2	Direct stray light affecting gain calculation	Minor
3	Diffuse stray light	Minor
4	Stray light in black body	Minor
5-8	Unused	
9	Black body temperature anomaly	Minor
10	Detector temperature anomaly (”warning level”)	Minor
11	Detector temperature anomaly (”alarm level”)	Minor
12-13	Not currently used	Minor
14	There has been a satellite manoeuvre within the last 6 hours (i.e. geolocation less accurate)	Minor
15-17	Not currently used	
18	Old TSOL Jitter information used	Minor
19-31	Not currently used	

HDF Path

“*/Extra Thermal Product Confidence Information/Level 1.5 Anomaly Flags*”

“*/Extra Solar Product Confidence Information/Level 1.5 Anomaly Flags*”

Additional Information

Data type: `H5T_IEEE_I32BE`

4.28 Level 2 Anomaly Flags [Attribute]

Description

This attribute is not used.

HDF Path

“*/Extra Thermal Product Confidence Information/Level 2 Anomaly Flags*”

“*/Extra Solar Product Confidence Information/Level 2 Anomaly Flags*”

Additional Information

Data type: `H5T_IEEE_I32BE`

4.29 Duplication Flag [Attribute]

Description

This flag is copied from the level 1.5 Non Averaged Non Rectified Geolocated (NANRG) GERB radiance product that has been used as main input file. It indicates whether this NANRG product appears in two fifteen minute slots, and if so if it is the first or second duplication.
This flag is obsolete.

HDF Path

"*/Duplication Flag*"

Additional Information

Data type: `H5T_STD_I32BE`.
Allowed values: 0 = no duplication, 1 = nominal file, 2 = duplicated file See level 1.5 NANRG documentation for complete information.

4.30 Radiation Type Identifier [Attribute]

Description

This identifier indicates on of the two possible radiation types: emitted thermal radiation or reflected solar radiation.

HDF Path

"*/Radiation Type Identifier*"

Additional Information

Data type: `H5T_STRING`.
Allowed values: "SOL" for solar, "TH" for thermal

4.31 Radiometry [Group]

Description

This group contains information about the radiometric measurements of GERB.

HDF Path

"*/Radiometry/*"

Additional Information

None

4.32 SEVIRI Radiance Definition Flag [Attribute]

Description

This attribute is set to the definition of radiance provided by EUMETSAT for SEVIRI. More information about the EUMETSAT radiance definition can be found in [4]. The values should be interpreted according to the following table:

Value	Meaning	Comment
-1	Mismatch	Data has been generated with SEVIRI data having different radiance definition
0	Undefined	Information on SEVIRI radiance definition is not available.
1	Spectral Radiance	
2	Effective Radiance	

This flag has been added after ED01 version.

HDF Path

"*/Radiometry/SEVIRI Radiance Definition Flag*"

Additional Information

Data type: `H5T_STD_I32BE`.

4.33 Solar Radiance [Dataset]

Description

This dataset contains the GERB measured radiance of reflected solar energy at the top of the atmosphere. The radiance has been derived by combining GERB and SEVIRI data and by averaging three consecutive solar radiance images at GERB acquisition time.

HDF Path

"*/Radiometry/Solar Radiance*"

Additional Information

Quantisation factor: 0.05 $W/(m^2 sr)$.
Data type: `H5T_STD_I16BE`.
Error value: -32767.
Expected Range: [0,500] $W/(m^2 sr)$

4.34 Solar Flux [Dataset]

Description

This dataset contains the surface density of the radiative flux of reflected solar energy at the top of the atmosphere, referenced at the Earth reference ellipsoid surface. The flux has been derived by combining GERB and SEVIRI data and by averaging three consecutive solar images at GERB acquisition time.
The accuracy of the solar flux may be affected by the use of various approximations and/or models. The status flag word described in section 4.8 indicates, per pixel, which approximations and/or models, if any, have been applied in calculating the solar flux.

Version

- V007, Edition 1 (ED01): The flux is set to error value if the viewing zenith angle (see section 4.50) is higher than 80 degrees. The flux is set to zero if the solar zenith angle (see section 4.48) is higher than 100 degrees.

HDF Path

"*/Radiometry/Solar Flux*"

Additional Information

The Earth surface can be calculated at different heights above the Earth reference ellipsoid. Because the surface increases with height above the reference ellipsoid, the flux surface density decreases with height, by a factor $R^2/(R+h)^2$, with R the local radius of the reference ellipsoid and h the height above the reference ellipsoid.

Quantisation factor: 0.25 W/m^2.

Data type: `H5T_STD_I16BE`.
Error value: -32767.
Expected range: [0,1500] W/m^2

4.35 Thermal Radiance [Dataset]

Description

This dataset contains the GERB measured radiance of emitted energy at the top of the atmosphere. The flux has been derived by combining GERB and SEVIRI data and by averaging three consecutive thermal images at GERB acquisition time.

HDF Path

"*/Radiometry/Thermal Radiance*"

Additional Information

Quantisation factor: 0.05 W/m^2sr.
Data type: `H5T_STD_I16BE`.
Error value: -32767.
Expected range: [50, 150] W/m^2

4.36 Thermal Flux [Dataset]

Description

This dataset contains the surface density of the radiative flux of emitted thermal energy at the top of the atmosphere, referenced at the Earth reference ellipsoid surface. The flux has been derived by combining GERB and SEVIRI data and by averaging three consecutive thermal images at GERB acquisition time.

Version

- V007, ED01: The flux is set to error value if the viewing zenith angle (see section 4.50) is higher than 80 degrees.

HDF Path

"*/Radiometry/Thermal Flux*"

Additional Information

The Earth surface can be calculated at different heights above the Earth reference ellipsoid. Because the surface increases with height above the reference ellipsoid, the flux surface density decreases with height, by a factor $R^2/(R+h)^2$, with R the local radius of the reference ellipsoid and h the height above the reference ellipsoid.

Quantisation factor: 0.25 W/m^2.
Data type: `H5T_STD_I16BE`.
Error value: -32767.
Expected range: [150, 450] W/m^2
Unit: W/m^2.

4.37 Shortwave Ratio [Dataset]

Description

The shortwave ratio factor is the ratio between the GERB measured shortwave filtered radiance, and the estimation of the same quantity from the imager data.

HDF Path

"*/Radiometry/Shortwave Ratio*"

Additional Information

Quantisation factor: 0.005
Offset: 1.
Data type: `H5T_STD_I16BE`.
Range: (0,2).

4.38 Shortwave Correction [Dataset]

Description

The shortwave correction factor is the correction applied to the SEVIRI unfiltered solar radiance and solar flux. If this ratio is outside a defined range, the limit of the range is applied (see section 4.39 and 4.40). As for ED01 release, both correction values are not used in shortwave.

HDF Path

"*/Radiometry/Shortwave Correction*"

Additional Information

Quantisation factor: 0.005
Offset: 1.
Data type: `H5T_STD_I16BE`.
Range: (0,2).

4.39 Shortwave Minimum Correction Value[Attribute]

Description

If the correction ratio between GERB and SEVIRI is lower than this value, this value has been applied as correction. As for ED01 release, this minimum correction value is not used in shortwave.

HDF Path

"*/Radiometry/Shortwave Correction/Minimum Correction Value*"

Additional Information

Data type: `H5T_IEEE_F64BE`
If no lower limit has been used, this value is -1.

4.40 Shortwave Maximum Correction Value [Attribute]

Description

If the correction ratio between GERB and SEVIRI is higher than this value, this value has been applied as correction. As for ED01 release, this maximum correction value is not used in shortwave.

HDF Path

"*/Radiometry/Shortwave Correction/Maximum Correction Value*"

Additional Information

Data type: `H5T_IEEE_F64BE`
If no upper limit has been used, this value is -1.

4.41 Longwave Ratio [Dataset]

Description

The longwave ratio factor is the ratio between the GERB measured synthetic longwave filtered radiance, and the estimation of the same quantity from the imager data.

HDF Path

"*/Radiometry/Longwave Ratio*"

Additional Information

Unit: None
Quantisation factor: 0.005
Offset: 1.
Data type: `H5T_STD_I16BE`.
Range: (0,2).

4.42 Longwave Correction [Dataset]

Description

The longwave correction factor is the correction applied to the SEVIRI unfiltered thermal radiance and thermal flux. The correction factor is the longwave ratio (see 4.41) with, as for ED01 release, a non-repeatibility correction and if this value is outside a defined range, the limit of the range is applied (see section 4.43 and 4.44 and [5] for explanation how this limits are estimated).

HDF Path

"*/Radiometry/Longwave Correction*"

Additional Information

Unit: None
Quantisation factor: 0.005
Offset: 1.
Data type: `H5T_STD_I16BE`.
Range: (0,2).

4.43 Longwave Minimum Correction Value[Attribute]

Description

If the longwave correction between GERB and SEVIRI is lower than this value, this value has been applied as correction.

HDF Path

"*/Radiometry/Longwave Correction/Minimum Correction Value*"

Additional Information

Data type: `H5T_IEEE_F64BE`
If no lower limit has been used, this value is -1.

4.44 Longwave Maximum Correction Value[Attribute]

Description

If the longwave ratio between GERB and SEVIRI is higher than this value, this value has been applied as correction.

HDF Path

"*/Radiometry/Longwave Correction/Maximum Correction Value*"

Additional Information

Data type: `H5T_IEEE_F64BE`
If no upper limit has been used, this value is -1.

4.45 Angles [Group]

Description

This group contains the angles that describe the viewing and solar geometry for each GERB observation. It contains also the incoming Solar flux.

HDF Path

"*/Angles/*"

Additional Information

The possible viewing and solar angles are illustrated in figure 2.

4.46 Incoming Solar Flux [Dataset]

Description

This dataset contains the incoming solar flux at the top of the atmosphere. It can be used to determine if the reflected solar flux can safely set to null according to the user's needs.
In the BARG product, the value for incoming solar flux is a 15-minute average, centred on the midpoint of the time integration interval.
Please note that the incoming solar flux dataset is only present for products containing solar flux and/or radiance, and that the dataset is missing from the high-resolution products.

HDF Path

"*/Angles/Incoming Solar Flux*"

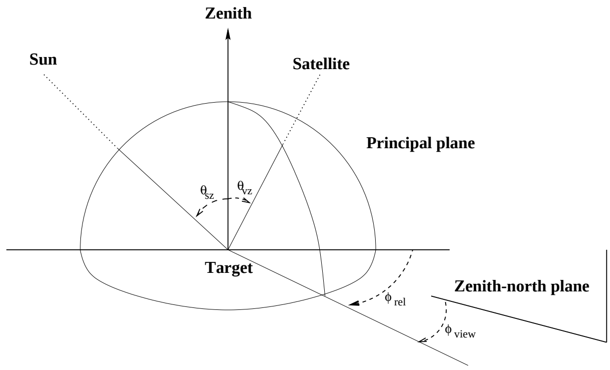


Figure 2: Sun-target-satellite geometry. Principal plane = plane which contains the sun and the zenith direction. Zenith-north plane = plane which contains the local northern direction and the zenith direction. θ_{sz} = solar zenith angle. θ_{vz} = viewing zenith angle. ϕ_{rel} = relative azimuth angle. ϕ_{view} = viewing azimuth angle.

Additional Information

Quantisation factor: 0.25.
Data type: `H5T_STD_I16BE`.
Error value: -32767.
Unit: W/m^2.

4.47 Relative Azimuth [Dataset]

Description

See figure 2. The relative azimuth angle ϕ_{rel} is the angle of the satellite observation plane relative to the principal plane. The target is the observed scene on the surface of the Earth, characterised by its geodetic geolocation parameters. The zenith direction is the local geodetic vertical direction. The satellite observation plane contains the zenith and the satellite. The principal plane contains the zenith and the sun.
In the BARG product, the value for the relative azimuth angle is an instantaneous value calculated at the BARG resolution and at the midpoint of the time integration interval.

HDF Path

"*/Angles/Relative Azimuth*"

Additional Information

Quantisation factor: 0.1 degree.
Data type: `H5T_STD_I16BE`.
Error value: -32767.
Range: (-180,180).

4.48 Solar Zenith [Dataset]

Description

See figure 2. The solar zenith angle θ_{sz} is the angle from the zenith direction towards the target-solar direction. The target is the observed scene on the surface of the Earth, characterised by its geodetic geolocation parameters. The zenith direction is the local geodetic vertical direction.

In the BARG product, the value for the solar zenith angle is an instantaneous value calculated at the BARG resolution and at the midpoint of the time integration interval.

HDF Path

"*/Angles/Solar Zenith*"

Additional Information

Quantisation factor: 0.1 degree.
Data type: `H5T_STD_I8BE`.
Error value: 255.
Range: (0,180) degree.

4.49 Viewing Azimuth [Dataset]

Description

See figure 2. The viewing azimuth angle ϕ_{view} is the angle of the satellite observation plane relative to the zenith-north plane. The target is the observed scene on the surface of the Earth, characterised by its geodetic geolocation parameters. The zenith direction is the local geodetic vertical direction. The satellite observation plane contains the zenith and the satellite. The zenith plane contains the zenith and the local north direction.
In the BARG product, the value for the viewing azimuth angle is an instantaneous value calculated at the BARG resolution and at the midpoint of the time integration interval.

HDF Path

"*/Angles/Viewing Azimuth*"

Additional Information

Quantisation factor: 0.1 degree.
Data type: `H5T_STD_I16BE`.
Error value: -32767.
Range: (0,360).

4.50 Viewing Zenith [Dataset]

Description

See figure 2. The viewing zenith angle θ_{vz} is the angle from the zenith direction towards the target-satellite direction. The target is the observed scene on the surface of the Earth, characterised by its geodetic geolocation parameters. The zenith direction is the local geodetic vertical direction.
In the BARG product, the value for the viewing zenith angle is an instantaneous value calculated at the BARG resolution and at the midpoint of the time integration interval.

HDF Path

"*/Angles/Viewing Zenith*"

Additional Information

Quantisation factor: 0.1 degree.
Data type: `H5T_STD_I8BE`.
Error value: 255.
Range: (0,90) degree.

4.51 Geolocation [Group]

Description

This group contains the parameters that describe the location on Earth for the GERB observations. The location is given in geodetic coordinates, relative to the Earth reference ellipsoid.

HDF Path

"*/Geolocation/*"

Additional Information

The geolocation parameters for a geostationary satellite viewing the Earth in an equi-angular projection are illustrated in figure 3. The Earth reference ellipsoid is defined by a polar radius R_P and an equatorial radius R_E.

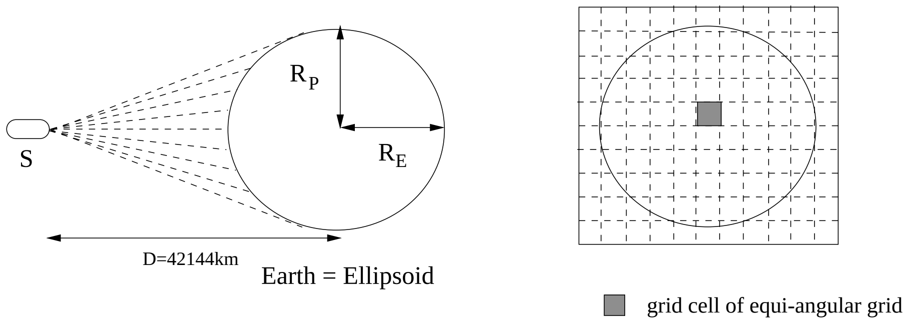


Figure 3: Geolocation parameters. Left = intersection of the lines of sight of a geostationary satellite with the Earth reference ellipsoid. Right = the corresponding equi-angular grid projection of the Earth as viewed from the satellite.

Consider the right hand axis system where the origin is the centre of the Earth, the XY-plane is the equatorial plane, the YZ-plane is the Greenwhich meridian plane and the Z-axis points northwards (see figure 4). A point P on the Earth reference ellipsoid with longitude ϕ and geocentric latitude θ_c has the Cartesian coordinates

$$\begin{aligned} X &= R_E \cos(\phi)\cos(\theta_c) \\ Y &= R_E \sin(\phi)\cos(\theta_c) \quad with\ R_P = 6356583.8\ and\ R_E = 6378169.0\ in\ meters \\ Z &= R_P \sin(\theta_c) \end{aligned} \tag{1}$$

The geodetic vertical in the point P is defined as the outer normal to the Earth reference ellipsoid in P. The geodetic latitude of the point P is the angle from the equatorial plane towards the geodetic vertical in P. The relationship between the geocentric latitude θ_c and the geodetic latitude θ_d is given by $\tan(\theta_d) = (R_E/R_P)^2 \tan(\theta_c)$.

4.52 Geolocation File Name [Attribute]

Description

Name of the geolocation file which contains the latitude and longitude for each pixel.

HDF Path

"*/Geolocation/Geolocation File Name*"

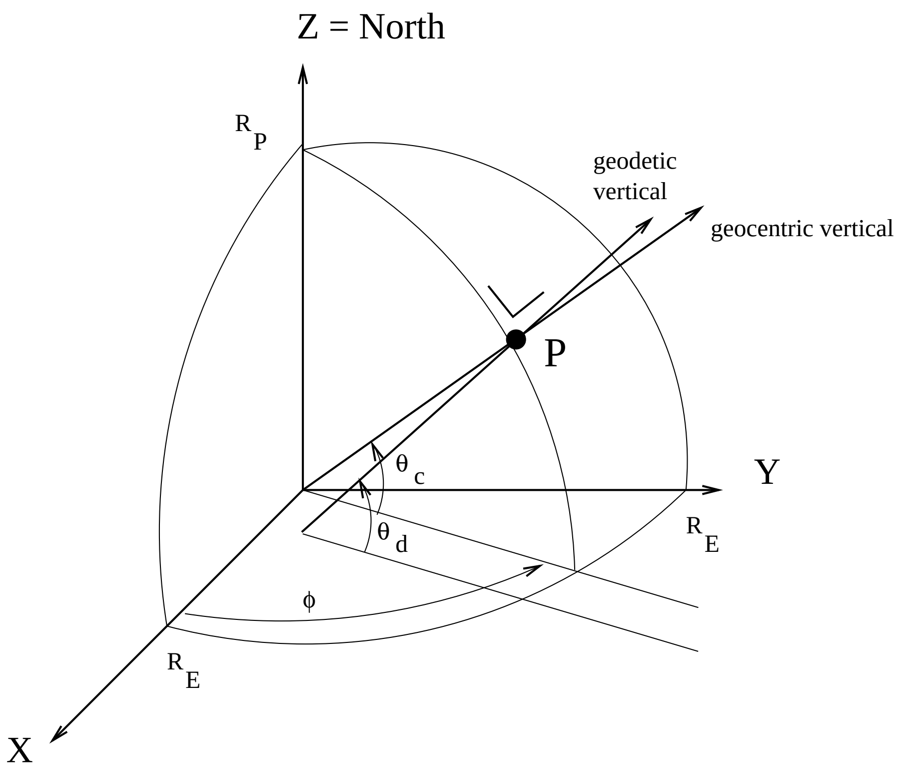


Figure 4: Geodetic versus geocentric geolocation. θ_c = geocentric latitude. θ_d = geodetic latitude. ϕ = (geodetic or geocentric) longitude.

Additional Information

Data type: `H5T_STRING`.
see also section 4.106 for additional information about geolocation date span

4.53 Nominal Satellite Longitude (degrees) [Attribute]

Description

The nominal satellite longitude. The real satellite position can slightly differs from the nominal satellite position.

HDF Path

"*/Geolocation/Nominal Satellite Longitude (degrees)*"

Additional Information

Units: Degree.
Data type: `H5T_IEEE_F64BE`.

4.54 Latitude [Dataset]

Description

See figures 3 and 4. The geodetic latitude is given for every GERB observation point. The GERB observation point is the intersection of the GERB line of sight and the Earth reference ellipsoid. The

geodetic latitude of the point P is the angle from the equatorial plane towards the geodetic vertical in P. The geodetic vertical in the point P is defined as the outer normal to the Earth reference ellipsoid in P.
See also section 4.72

HDF Path

"*/Geolocation/Latitude*"

Additional Information

Quantisation factor: $\frac{1}{128}$ degree.
Data type: `H5T_STD_I16BE`.
Error value: -32767.
Range: (-90,+90) degree.

4.55 Longitude [Dataset]

Description

See figures 3 and 4. The longitude is given for every GERB observation point. The GERB observation point is the intersection of the GERB line of sight and the Earth reference ellipsoid. The longitude of the point P is the angle from the Greenwhich meridian plane towards P, positive in eastward direction.
See also section 4.73

HDF Path

"*/Geolocation/Longitude*"

Additional Information

Quantisation factor: $\frac{1}{128}$ degree.
Data type: `H5T_STD_I16BE`.
Error value: -32767.
Range: (-180,+180) degree.

4.56 Line of Sight North-South Speed [Attribute]

Description

The angular speed in north-south direction of the GERB line of sight during the Earth view.

HDF Path

"*/Geolocation/Line of Sight North-South Speed*"

Additional Information

Units: Degree per second.
Data type: `H5T_IEEE_F64BE`.

This line of sight speed influences the dynamic point spread function of the GERB instrument.

4.57 Rectified Grid [Group]

Description

This group contains the parameters that describe the rectified grid on which the GERB observation points are located. The rectified grid is the grid obtained by an equi-angular projection from a geostationary satellite as shown in figure 3.

HDF Path

"*/Geolocation/Rectified Grid/*"

Additional Information

None

4.58 Lap [Attribute]

Description

Latitude of sub-satellite point.

HDF Path

"*/Geolocation/Rectified Grid/Lap*"

Additional Information

Units: Degree.
Data type: `H5T_IEEE_F64BE`.

4.59 Lop [Attribute]

Description

Longitude of sub-satellite point.

HDF Path

"*/Geolocation/Rectified Grid/Lop*"

Additional Information

Units: Degree.
Data type: `H5T_IEEE_F64BE`.

4.60 Nr [Attribute]

Description

The altitude of the imaging device from the Earth's center, measured in units of the Earth's (equatorial) radius.

HDF Path

"*/Geolocation/Rectified Grid/Nr*"

Additional Information

Units: Earth radius.
Data type: `H5T_IEEE_F64BE`.

4.61 Nx [Attribute]

Description

Number of points along x axis = number of columns = width image.

HDF Path

"*/Geolocation/Rectified Grid/Nx*"

Additional Information

Data type: `H5T_STD_I32BE`.

4.62 Ny [Attribute]

Description

Number of points along y axis = number of rows = height image.

HDF Path

"*/Geolocation/Rectified Grid/Ny*"

Additional Information

Data type: `H5T_STD_I32BE`.

4.63 Xp [Attribute]

Description

X-coordinate of sub satellite point.

HDF Path

"*/Geolocation/Rectified Grid/Xp*"

Additional Information

Units: Grid length.
Data type: `H5T_IEEE_F64BE`.

4.64 Yp [Attribute]

Description

Y-coordinate of sub-satellite point.

HDF Path

"*/Geolocation/Rectified Grid/Yp*"

Additional Information

Units: Grid length.
Data type: `H5T_IEEE_F64BE`.

4.65 Grid Orientation [Attribute]

Description

The angle between the increasing y axis and the meridian of the sub-satellite point in the direction of increasing latitude.

HDF Path

"*/Geolocation/Rectified Grid/Grid Orientation*"

Additional Information

Units: Millidegree.
Data type: `H5T_IEEE_F64BE`.

4.66 dx [Attribute]

Description

Apparent diameter of Earth in grid lengths, in x direction.

HDF Path

"*/Geolocation/Rectified Grid/dx*"

Additional Information

Units: Grid length.
Data type: `H5T_IEEE_F64BE`.

4.67 dy [Attribute]

Description

Apparent diameter of Earth in grid lengths, in y direction.

HDF Path

"*/Geolocation/Rectified Grid/dy*"

Additional Information

Units: Grid length.
Data type: `H5T_IEEE_F64BE`.

4.68 Resolution Flags [Group]

Description

This group contains the north-south and the east-west resolution at nadir (subsatellite point) of the used rectified grid.

HDF Path

"*/Geolocation/Rectified Grid/Resolution Flags/*"

Additional Information

None

4.69 East West [Attribute]

Description

The east-west resolution at nadir (subsatellite point) of the used rectified grid.

HDF Path

"*/Geolocation/Rectified Grid/Resolution Flags/East West*"

Additional Information

Units: Degree.
Data type: `H5T_IEEE_F64BE`.

4.70 North South [Attribute]

Description

The north-south resolution at nadir (subsatellite point) of the used rectified grid.

HDF Path

"*/Geolocation/Rectified Grid/Resolution Flags/North South*"

Additional Information

Units: Degree.
Data type: `H5T_IEEE_F64BE`.

4.71 Earth Flag[Dataset]

Description

This dataset is a flag for the intersection of the pixel line of sight with the reference ellipsoid. When there is an intersection, the value is 255, when there is no intersection the value is 0.

HDF Path

"*/Geolocation/Earth Flag*"

Additional Information

Data type: `H5T_STD_U8BE`.
Error value: 1.
Values: 0=deep space, 255=on Earth, 1=Error Value

4.72 Latitude (degrees) [Dataset]

Description

This dataset contains the latitude geolocation of L1.5 NANRG data estimated by image matching with SEVIRI. The longitude is given in geocentric coordinates.

HDF Path

"*/Geolocation/Latitude (degrees)*"

Additional Information

Data type: `H5T_IEEE_F64BE`.
Error value: -32767.
Range: (-90,+90) degree.

4.73 Longitude (degrees) [Dataset]

Description

This dataset contains the longitude geolocation of L1.5 NANRG data estimated by image matching with SEVIRI. The longitude is given in geocentric coordinates.

HDF Path

"*/Geolocation/Longitude (degrees)*"

Additional Information

Data type: `H5T_IEEE_F64BE`.
Error value: -32767.
Range: (-90,+90) degree.

4.74 Number of columns [Attribute]

Description

This attribute is the number of columns of the geolocation of one GERB Earth View.

HDF Path

"*/Geolocation/Number of columns*"

Additional Information

Data type: `H5T_STD_I32BE`.

4.75 Number of detectors [Attribute]

Description

This attribute is the number of detectors (lines) of the geolocation of one GERB Earth View.

HDF Path

"*/Geolocation/Number of detectors*"

Additional Information

Data type: `H5T_STD_I32BE`.

4.76 Geolocation Arrays Flag [Attribute]

Description

This attribute is set to 1 if the longitude, latitude and Earth flag is present in the HDF file else it is set to 0.

HDF Path

"*/Geolocation/Geolocation Arrays Flag*"

Additional Information

Data type: `H5T_STD_I32BE`.

4.77 Geolocation Parameters [Group]

Description

This group is for internal usage only.

HDF Path

"*/Geolocation/Geolocation Parameters*"

Additional Information

4.78 {RAL,RMIB} Correlation [Attribute]

Description

This parameters gives a rough estimation of geolocation quality. It is computed as the mean over the Earth disc of the relative difference between the GERB L1.5 radiance value and the estimation of this value computed from SEVIRI data.

$$R = \sqrt{\frac{1}{N}\sum_{i,j}\left(\frac{(L_{ij}^{GERB}-\tilde{L}_{ij}^{SEVIRI})}{\frac{(L_{ij}^{GERB}+\tilde{L}_{ij}^{SEVIRI})}{2}}\right)^2}$$

where R is the correlation value, N is the number of pixels considered, L_{ij}^{GERB} is the radiance value from GERB and $\tilde{L}_{ij}^{SEVIRI}$ is the estimation of the GERB value from SEVIRI data.
This value depends on the geolocation. The RAL Correlation is computed with the geolocation found in the L1.5 NANRG files. The RMIB Correlation is computed with the geolocation found by minimisation of R.

HDF Path

"*/RAL Correlation*"
"*/RMIB Correlation*"

Additional Information

Data type: `H5T_IEEE_F64BE`.

4.79 Short Wave Image {1,2,3} [Group]

Description

This group contains geolocation information for the Nth of the three GERB short wave images that have been used as input.

HDF Path

"*/Geolocation/Short Wave Image 1/*"
"*/Geolocation/Short Wave Image 2/*"
"*/Geolocation/Short Wave Image 3/*"

Additional Information

None

4.80 Total Image {1,2,3} [Group]

Description

This group contains geolocation information for the Nth of the GERB total images that have been used as input. Only information coming from the total images of the main L1.5 NANRG file is considered.

HDF Path

"*/Geolocation/Total Image 1/*"
"*/Geolocation/Total Image 2/*"
"*/Geolocation/Total Image 3/*"

Additional Information

None

4.81 Histogram of Line of Sight East-West Positions [Dataset]

Description

This information is copied from the level 1.5 Non Averaged Non Rectified Geolocated (NANRG) GERB radiance product that has been used as main input file. This dataset contains the histogram of the measured east-west deviations of the GERB line of sight from its nominal position. One histogram is given for every image column of the Nth GERB image (total or short wave according to the HDF path).

HDF Path

"*/Geolocation/Short Image 1/Histogram of Line of Sight East-West Positions*"
"*/Geolocation/Short Image 2/Histogram of Line of Sight East-West Positions*"
"*/Geolocation/Short Image 3/Histogram of Line of Sight East-West Positions*"
"*/Geolocation/Total Image 1/Histogram of Line of Sight East-West Positions*"
"*/Geolocation/Total Image 2/Histogram of Line of Sight East-West Positions*"
"*/Geolocation/Total Image 3/Histogram of Line of Sight East-West Positions*"

Additional Information

Unit: Pixel.
Quantisation factor: 1.
Offset: 0.
Data type: `H5T_STD_U8BE`.

Range: (0,255).

4.82 Interval Size [Attribute]

Description

The interval between two bins for the histogram defined at section 4.81.

HDF Path

"*/Geolocation/Short Image 1/Histogram of Line of Sight East-West Positions/Interval Size*"
"*/Geolocation/Short Image 2/Histogram of Line of Sight East-West Positions/Interval Size*"
"*/Geolocation/Short Image 3/Histogram of Line of Sight East-West Positions/Interval Size*"
"*/Geolocation/Total Image 1/Histogram of Line of Sight East-West Positions/Interval Size*"
"*/Geolocation/Total Image 2/Histogram of Line of Sight East-West Positions/Interval Size*"
"*/Geolocation/Total Image 3/Histogram of Line of Sight East-West Positions/Interval Size*"

Additional Information

Data type: `H5T_STD_F64BE`.

4.83 Lowest Value [Attribute]

Description

The first value of the first bin for the histogram defined at section 4.81.

HDF Path

"*/Geolocation/Short Image 1/Histogram of Line of Sight East-West Positions/Lowest Value*"
"*/Geolocation/Short Image 2/Histogram of Line of Sight East-West Positions/Lowest Value*"
"*/Geolocation/Short Image 3/Histogram of Line of Sight East-West Positions/Lowest Value*"

"*/Geolocation/Total Image 1/Histogram of Line of Sight East-West Positions/Lowest Value*"
"*/Geolocation/Total Image 2/Histogram of Line of Sight East-West Positions/Lowest Value*"
"*/Geolocation/Total Image 3/Histogram of Line of Sight East-West Positions/Lowest Value*"

Additional Information

Data type: `H5T_STD_F64BE`.

4.84 Spectral Regression Parameters [Group]

Description

This group contains the spectral regression parameters that have been used to estimate unfiltered radiances and GERB filtered radiances from the imager data.

HDF Path

"*/Radiometry/Spectral Regression Parameters*"

Additional Information

The information under this group is not intended for users, but for internal usage. This group and its datasets are only present for GERB-2.

4.85 Shortwave Solar [Dataset]

Description

Spectral regression parameters that have been used to estimate the solar contribution to the GERB shortwave filtered radiances from the imager data.

HDF Path

"*/Radiometry/Spectral Regression Parameters/Shortwave Solar*"

Additional Information

This dataset is not intended for users, but for internal usage. This dataset is only present for GERB-2.

4.86 Shortwave Thermal [Dataset]

Description

Spectral regression parameters that have been used to estimate the thermal contribution to the GERB shortwave filtered radiances from the imager data.

HDF Path

"*/Radiometry/Spectral Regression Parameters/Shortwave Thermal*"

Additional Information

This dataset is not intended for users, but for internal usage. This dataset is only present for GERB-2.

4.87 Solar [Dataset]

Description

Spectral regression parameters that have been used to estimate the solar unfiltered radiances from the imager data.

HDF Path

"*/Radiometry/Spectral Regression Parameters/Solar*"

Additional Information

This dataset is not intended for users, but for internal usage. This dataset is only present for GERB-2.

4.88 Longwave Solar [Dataset]

Description

Spectral regression parameters that have been used to estimate the solar contribution to the GERB filtered radiances from the imager data.

HDF Path

"*/Radiometry/Spectral Regression Parameters/Longwave Solar*"

Additional Information

This dataset is not intended for users, but for internal usage. This dataset is only present for GERB-2.

4.89 Longwave Thermal [Dataset]

Description

Spectral regression parameters that have been used to estimate the thermal contribution to the GERB filtered radiances from the imager data.

HDF Path

"*/Radiometry/Spectral Regression Parameters/Longwave Thermal*"

Additional Information

This dataset is not intended for users, but for internal usage. This dataset is only present for GERB-2.

4.90 Thermal [Dataset]

Description

Spectral regression parameters that have been used to estimate the thermal unfiltered radiances from the imager data.

HDF Path

"*/Radiometry/Spectral Regression Parameters/Thermal*"

Additional Information

This dataset is not intended for users, but for internal usage. This dataset is only present for GERB-2.

4.91 A Values (per GERB detector cell) [Dataset]

Description

The A-value is used for the definition of the GERB synthetic longwave filtered radiance. A is defined as the ratio between the GERB filtered total radiance and the GERB filtered short wave radiance for a 5800 K black body. The A-values are copied from the level 1.5 Non Averaged Non Rectified Geolocated (NANRG) GERB radiance product that has been used as main input file. They are measured with the sunlit onboard solar diffuser sphere.
There is one value for each detector. If more than one NANRG file has been used, the A-values reported are the ones of first level 1.5 NANRG short wave input file in time used for the generation of this output file.

HDF Path

"*/Radiometry/A Values (per GERB detector cell)/*"

Additional Information

Data type: `H5T_IEEE_64BE`.
This dataset is not intended for users, but for internal usage.

4.92 C Values (per GERB detector cell) [Dataset]

Description

The C-value is used to monitor the longwave leakage of the GERB quartz filter. C is defined as the ratio between the GERB filtered shortwave radiance and the GERB filtered total radiance for a 300 K black body. The given C-values are copied from the level 1.5 Non Averaged Non Rectified Geolocated (NANRG) GERB radiance product that has been used as main input file. They are measured with the onboard black body.
If more than one NANRG file has been used, the C-values reported are the ones of the first level 1.5 NANRG short wave input file in time used for the generation of this output file.

HDF Path

"*/Radiometry/C Values (per GERB detector cell)/*"

Additional Information

Data type: `H5T_IEEE_64BE`.
This dataset is not intended for users, but for internal usage.

4.93 Scene Identification [Group]

Description

This group contains auxiliary scene identification information given with the GERB measurements. Some of the identification information is only available during daytime and/or in shortwave/solar data files. The given scene identification is the most accurate for the high resolution and for the binned 50 km resolution products. It is only indicative for the GERB footprint product.

HDF Path

"*/Scene Identification/*"

Additional Information

None

4.94 Cloud Optical Depth (logarithm)[Dataset]

Description

This dataset contains the natural logarithmic average of the cloud optical depths at 0.55 μm over the cloudy part of the footprint. The error value is used for clearsky footprints.
As the cloud optical depth values for the footprint are bound to the range [$\tau_{thres} = 0.6$, 128] where τ_{thres} corresponds to thinnest cloudy conditions while 128 is associated to an infinitely thick cloud, the values of this dataset are bound to the range [log(τ_{thres})=-0.51, 4.852]. See [3] for more information.
The accuracy of the cloud optical depth may be affected by the extrapolation of the scene identification from earlier or later slots. If such extrapolation has taken place for a given pixel, the status bit for scene identification extrapolation will be set in the status flag word (refer to section 4.8 for more information).

HDF Path

"*/Scene Identification/Cloud Optical Depth (logarithm)*"

Additional Information

Data type: `H5T_STD_I16BE`.
Error value: -32767.
Range: [log(τ_{thres})=-0.51, 4.852]
Quantisation factor: $2.5\,10^{-4}$.

4.95 Cloud Cover [Dataset]

Description

The cloud cover is the relative number of cloudy imager pixels in the GERB footprint or grid cell. A cloud cover of 0 corresponds to a clear sky footprint. A cloud cover of 1 corresponds to an overcast footprint. The RMIB cloud retrieval scheme uses for input estimated composite TOA clearsky visible reflectances. By comparing the latters with the measured reflectances, cloud optical thickness is inferred by means of look-up tables built from 1D radiative transfer computations. Finally, the cloud flag results by thresholding the cloud optical thickness (cloudy if >= 0.6).
The accuracy of the cloud cover may be affected by the extrapolation of the scene identification from earlier or later slots. If such extrapolation has taken place for a given pixel, the status bit for scene identification extrapolation will be set in the status flag word (refer to section 4.8 for more information).

HDF Path

"*/Scene Identification/Cloud Cover*"

Additional Information

Data type: `H5T_STD_U8BE`.
Error Value: 255.
Range: [0,100].
Quantisation factor: 0.01.

4.96 Cloud Phase [Dataset]

Description

This dataset contains the mean cloud phase (water or ice cloud) over the footprint. A cloud phase of 0 corresponds to a pure water cloud. A cloud phase of 1 corresponds to a pure ice cloud. And between this limits, mixed water-ice cloud.
The cloud thermodynamic phase is estimated according to the 10.8 µm brightness temperature (water if > 265 Kelvin, ice if < 245 Kelvin, mixed phases otherwise) (see section 4.95 for additional information).
The accuracy of the cloud phase may be affected by the extrapolation of the scene identification from earlier or later slots. If such extrapolation has taken place for a given pixel, the status bit for scene identification extrapolation will be set in the status flag word (refer to section 4.8 for more information).

HDF Path

"*/Scene Identification/Cloud Phase*"

Additional Information

Data type: `H5T_STD_U8BE`.
Error Value: 255.
Range: [0,100] (water=0, mixed, ice=100).
Quantisation factor: 0.01.

4.97 Aerosol Optical Depth Cover [Dataset]

Description

The aerosol optical depth cover is the relative number of imager pixels in the GERB footprint or grid cell for which an aerosol optical depth cover has been computed. An aerosol optical depth value is computed for a SEVIRI pixel if:

- the pixel is cloud free
- the pixel has been identified as ocean
- the viewing zenith angle (see section 4.45) is lower than 60 degrees
- the solar zenith angle (see section 4.45) is lower than 60 degrees
- the tilt angle is lower than 40 degrees

HDF Path

"*/Scene Identification/Aerosol Optical Depth Cover*"

Additional Information

Data type: `H5T_STD_U8BE`.
Error Value: 255
Range: [0,100]
Quantisation factor: 0.01
Unit: Percent

4.98 Aerosol Optical Depth {IR 1.6,VIS 0.6,VIS 0.8} [Dataset]

Description

The aerosol optical depth mean over the GERB footprint or grid cell. First, the AOD is computed at the full SEVIRI resolution for a limited number of pixels (see section 4.97). Then, the mean over the GERB footprint or grid cell is done and includes only the pixels for which an AOD has been computed. The method is based on [6]. Three independent Aerosol Optical Depth (AOD) are computed for three different SEVIRI spectral bands.

HDF Path

"*/Scene Identification/Aerosol Optical Depth IR 1.6*" for the near-infrared band centered on 1.6 μm

"*/Scene Identification/Aerosol Optical Depth VIS 0.6*" for the visible band centered on 0.6 μm

"*/Scene Identification/Aerosol Optical Depth VIS 0.8*" for the visible band centered on 0.8 μm

Additional Information

Data type: `H5T_STD_U8BE`.
Error Value: 255
Expected Range: [0,1]
Quantisation factor: 0.04
Unit: None

4.99 Dust Detection [Dataset]

Description

The dust detection is the relative number of imager pixels in the GERB footprint or grid cell for which a dust detection has been computed. A dust detection is computed for a 3x3 SEVIRI pixel if:

- the pixel has been identified as ocean
- the viewing zenith angle (see section 4.45) is lower than 70 degrees

The method used is described in [2].

HDF Path

"*/Scene Identification/Dust Detection*"

Additional Information

Data type: `H5T_STD_U8BE`.
Error Value: 255
Range: [0,1]
Quantisation factor: 0.01

4.100 Surface Type [Dataset]

Description

This dataset contains the surface type within the GERB footprint or grid cell. The defined types are : 0=undefined, 1=ocean, dark vegetation, bright vegetation, dark desert, bright desert, snow.

HDF Path

"*/Scene Identification/Surface Type*"

Additional Information

Data type: `H5T_STD_U8BE`.
Allowed values:

Surface type	Value
Undefined	0
Ocean	1
Dark Vegetation	2
Bright Vegetation	3
Dark Desert	4
Bright Desert	5
Snow	6

Error Value: 255

4.101 Solar Angular Dependency Model [Dataset]

Description

This dataset contains the identifier of the scene-type-dependent Angular Dependency Model (ADM) that has been used to convert the reflected solar radiance in the reflected solar flux.
Note that if the scene identification has been extrapolated (indicated by the corresponding status bit in the status flag word discussed in section 4.8), the identifier of the ADM has been adjusted to correspond to the extrapolated scene type.

HDF Path

"*/Scene Identification/Solar Angular Dependency Model*"

Additional Information

Data type: `H5T_STD_U8BE`.
Error Value: -32367.
Range: 0,1024.

4.102 Thermal Angular Dependency Model [Dataset]

Description

It contains the identifier of the scene type dependent Angular Dependency Model that has been used to convert the emitted thermal radiance in the emitted thermal flux.

HDF Path

"*/Scene Identification/Thermal Angular Dependency Model*"

Additional Information

Data type: `H5T_STD_U8BE`.
Valid values range from 0 to 254. 255 indicates an error.

4.103 Solar Angular Dependency Models Set Version [Attribute]

Description

Indicates which set of solar angular dependency models has been used to determine fluxes from radiances.

HDF Path

"*/Scene Identification/Solar Angular Dependency Models Set Version*"

Additional Information

Data type: : `H5T_STRING`.

4.104 Thermal Angular Dependency Models Set Version [Attribute]

Description

Indicates which set of thermal angular dependency models has been used to determine fluxes from radiances.

HDF Path

"*/Scene Identification/Thermal Angular Dependency Models Set Version*"

Additional Information

Data type: : `H5T_STRING`.

4.105 Times [Group]

Description

This group gives information about the sampling time of the GERB products. For the three types of products a different time sampling strategy is used, and hence different time parameters are given:

- The high resolution product is a 15(30) minute snapshot at SEVIRI (Meteosat7) acquisition times. A time per row is given.
- The GERB footprint product is an average of three consecutive GERB measurements. An integration start and end time per column is given.
- The binned 50 km product (BARG) is a fixed 15(30) minute average. An overall integration start and end time is given.

HDF Path

"*/Times/*"

Additional Information

4.106 First GERB Packet [Attribute]

Description

In the radiance and flux files, this is the acquisition time of the first GERB packet that has been used. In the geolocation files, the value of this field indicates the UTC time for which the data first applies. Because the GERB project is a NRT project, the more recent files are processed before older files. This implies that in some case the geolocation file corresponding to a data file has a date in the name and in the First GERB Packet attribute that is later than the date in the file name of the data file.

HDF Path

"*/Times/First GERB Packet*"

Additional Information

Data type: `H5T_STRING`.
The format is "YYYYMMDD HH:MM:SS".

4.107 Last GERB Packet [Attribute]

Description

This is the acquisition time of the last GERB packet that has been used.

HDF Path

"*/Times/Last GERB Packet*"

Additional Information

Data type: `H5T_STRING`.
The format is "YYYYMMDD HH:MM:SS".

4.108 Start of Integration [Attribute]

Description

Start time of integration for the complete image.

HDF Path

"*/Times/Start of Integration*"

Additional Information

Data type: `H5T_STRING`.
The format is "YYYYMMDD HH:MM:SS".

4.109 End of Integration [Attribute]

Description

End time of integration for the complete image.

HDF Path

"*/Times/End of Integration*"

Additional Information

Data type: `H5T_STRING`.
The format is "YYYYMMDD HH:MM:SS".

4.110 Time (per row) [Dataset]

Description

This dataset contains the acquisition time for every image row.

HDF Path

"*/Times/Time (per row)*"

Additional Information

Data type: `H5T_STRING`.
The format is "YYYYMMDD HH:MM:SS.MMM".

4.111 Start of Integration (per column) [Dataset]

Description

The start of integration parameter gives the time of start of integration for every image column. The imager data is not considered: only time of GERB data used for column data generation is taken into account.

HDF Path

"*/Times/Start of Integration (per column)*"

Additional Information

Data type: `H5T_STRING`.
The format is "YYYYMMDD HH:MM:SS.MMM".

4.112 End of Integration (per column) [Dataset]

Description

The end of integration parameter gives the time of end of integration for each image column. The imager data is not considered: only time of GERB data used for column data generation is taken into account.

HDF Path

"*/Times/End of Integration (per column)*"

Additional Information

Data type: `H5T_STRING`.
The format is "YYYYMMDD HH:MM:SS.MMM".

4.113 Unit [Attribute]

Description

Unit in string format. This attribute is associated with datasets. Datasets without unit attribute are unitless.

HDF Path

"*/Dataset HDF Path/Unit*"

Additional Information

Data type: `H5T_STRING`.

4.114 Offset [Attribute]

Description

Offset to apply to dataset values. This attribute is associated with datasets. Datasets without offset attribute do not have an offset.
A dataset value v is retrieved as:

$$v = q * h + o$$

where q is the quantisation factor (see section 4.115), h is the value read from the HDF file and o is the offset (see section 4.114).

HDF Path

"*/Dataset HDF Path/Offset*"

Additional Information

Data type: `H5T_IEEE_64BE`

4.115 Quantisation Factor [Attribute]

Description

Quantisation factor to apply to dataset values. This attribute is associated with datasets. Datasets without quantisation factor attribute have a default quantisation factor value of 1.
A dataset value v is retrieved as:

$$v = q * h + o$$

where q is the quantisation factor (see section 4.115), h is the value read from the HDF file and o is the offset (see section 4.114).

HDF Path

"*/Dataset HDF Path/Quantisation Factor*"

Additional Information

Data type: `H5T_IEEE_64BE`

5 RMIB GERB Products Data Access

5.1 Introduction

The RMIB GERB flux products are stored using a file format designed by the National Center for Super-Computing Applications (NCSA): the Hierarchical Data Format version 5 (HDF5). This document describes how to retrieve the RMIB GERB scientific data, from the perspective of a user who wants to use these data in his or her own programming applications.
We assume that the user's programs will be written in the C (or C++) programming language. Access to files in format is through an Application Programming Interface (API) written in C. This API is provided by the HDF library. A simplified version called High Level API is also available. This interface is sufficient to retrieve data from RMIB HDF files.
As RMIB GERB HDF files were generated using the HDF5 library version 1.6.5, limitations on HDF restrict the use of library version 1.6.1 or above to be able to read them. More specifically, IDL users will only be able to access these files with IDL version 6.1 or above. A non-exhaustive list of programs using HDF5 is available at the address `http://www.hdfgroup.org/tools5desc.html`.

5.2 How to Obtain the HDF5 Library

Pre-compiled binaries of the latest version of the HDF5 libraries for various platforms are available for download at the following URL:

`http://www.hdfgroup.org/HDF5/release/obtain5.html#obtain`

Older releases can be found at

`http://www.hdfgroup.org/ftp/HDF5/releases/`

This guide is certainly not a complete HDF5 reference guide. For more advanced use of the HDF5 Library, please refer to the full documentation set, also available from the same site:

`http://www.hdfgroup.org/HDF5/doc/index.html`

5.3 Overview of HDF5

5.3.1 Objects

- *File* objects represent the HDF file.
- *Dataset* objects are used for storing multi-dimensional arrays of data.
- *Group* objects serve as containers for other HDF5 objects.
- *Attribute* objects are used for single-valued data that characterise another object (either a group or a dataset).

5.3.2 Hierarchical Layout

At the API level, the layout of an HDF5 file takes the form of a hierarchical structure. In fact, the data organisation closely resembles that of the UNIX file system. An object in an HDF5 file takes on the role of a file in the UNIX file system.
At creation time, an HDF5 object must be given a name (i.e. a string of characters). The name can be either *absolute* (i.e. starting with a '/' character) or *relative* (i.e. *not* starting with a '/' character). The '/' serves as a delimiter and indicates that the object whose name starts at the next character, stands one level deeper in the HDF5 hierarchy.
At the top of the hierarchy stands the *root group* object whose name is "/" (a single slash). The root group is automatically created at the file creation, even if the HDF file is otherwise empty (i.e. it does not contain any user data).

Each data structure within the HDF5 file is unequivocally identified by its absolute name. A *base name* is a relative name that does not contain any '/' character (except maybe as the last character of a group name).
For example, if

- "*First Group*" is the base name of a group object,
- "*My Dataset*" is the base name of a dataset object located in the group above,
- "*Some Attribute*" is the base name of an attribute object of the preceding dataset,

then the absolute name of "*Some Attribute*" is

"*/First Group/My Dataset/Some Attribute*".

5.3.3 API

The HDF5 library API is a set of C functions that manipulates the contents of HDF files. The creation, writing, reading and deletion of all HDF5 objects is done through this API.
The functions names are composed from the concatenation of the following parts:

1. The library identifier prefix: "`H5`",
2. A letter specifying which type of object the function is concerned with ("`F`" for a file object, "`G`" for a group, "`D`" for a dataset, "`A`" for an attribute, "`S`" for a data space object, and "`T`" for a data type object),
3. A string referring to type of action the function performs.

For example, `H5Dread` names a function that is concerned with the reading of data stored in a dataset object.
The library references an HDF5 object through a unique identifier the data type of which is `hid_t`. This identifier is supplied by an "open" function, specific to each type of HDF5 object, which is given the name of the object (see 5.3.2) as one of its arguments.
The necessary functions for retrieving data from an existing HDF file are explained in section 5.4. Note that we only present the subset of the API needed to extract the information stored in the RMIB GERB flux products files. For a complete coverage of the HDF5 library, please refer to the full NCSA documentation (see 5.2). From HDF5 version 1.6.0, it is bundled within the API.

5.3.4 High Level API

The HDF5 High Level API consists of higher-level functions which do more operations per call than the basic HDF5 interface. The purpose is to wrap intuitive functions around certain sets of features in the existing APIss. This version of the API has two sets of functions: dataset and attribute related functions. These functions hide most of the API complexity.

5.4 How to Retrieve HDF Data

In order to retrieve the data stored in an HDF file, a program needs to gain access to the object containing these data. The basic usage scheme corresponds to the execution of the following steps:

1. Open the file.
2. Read the value(s) stored in the object
3. Close the file.

The functions that perform these operations are explained in the following sections.

5.4.1 File Access

To access the content of an existing file, the file must first be opened with a call to the function `H5Fopen()`:

```
hid_t H5Fopen(  const char *name,
                unsigned flag,
                hid_t access_properties   ) ;
```

where ***name*** is the name of the file to open and ***flag*** describes the type of access (`H5F_ACC_RDONLY` for read-only access). ***access_properties*** can be set to `H5P_DEFAULT` for the default access parameters.
The return value is an object ID for the open file. A negative return value indicates failure. This ID should be closed when the file is no longer needed, by calling `H5Fclose()`:

```
herr_t H5Fclose(  hid_t file_id   ) ;
```

The return value of `H5Fclose()` is zero for success and negative for failure.

5.4.2 Dataset Access

In order to retrieve the data, the contents of the dataset must be read into memory. This is achieved by a call to the function `H5LTread_dataset_[type]()`.

```
herr_t H5LTread_dataset_[type](  hid_t loc_id,
                                 hid_t dset_name,
                                 [type] *buffer    ) ;
```

where ***[type]*** can take one of the following values {char, short, int, long, float, double}, ***loc_id*** is the file ID, ***dset_name*** is the name of the dataset, ***buffer*** is the location in memory where the data values will be written to. A negative return value indicates failure.
When calling `H5LTread_dataset_[type]()`, it is assumed that ***buffer*** is a memory location big enough to contain all the data to be read. Otherwise, a memory fault will likely result. To be safe, we have to query the dataset for the number of data it contains and afterwards dynamically allocate enough memory with the standard function `malloc()` (see 5.4.5).
Two functions are needed to determine the number of data points stored in a dataset,
`H5LTget_dataset_ndims()` and `H5LTget_dataset_info()` .
The first returns the dimensionality of a dataset.

```
herr_t H5LTget_dataset_ndims (  hid_t loc_id,
                                const char dset_name,
                                int *rank              ) ;
```

where ***loc_id*** is the file ID, ***dset_name*** is the datset name, ***rank*** is filled with the dimensionality of the dataset. A negative return value indicates failure.
The second returns the size of each dimension, the data class and the data size.

```
herr_t H5LTget_dataset_info (  hid_t loc_id,
                               const char dset_name,
                               hsize_t *dims,
                               H5T_class_t *class_id,
                               size_t *type_size       ) ;
```

where ***loc_id*** is the file ID, ***dset_name*** is the dataset name, ***dims*** is filled with the size of each dimension, ***class_id*** is filled with the data class identifier, ***type_size*** is filled with the size of the datatype in bytes. A negative return value indicates failure. ***dims*** must point to previously allocated memory of sufficient size (sizeof(size_t)*rank) where rank has been determined by a call to `H5LTget_dataset_ndims()` .

5.4.3 Attribute Access

An attribute is primarily used to provide single-valued metadata information to another HDF5 object (group or dataset). The value of the attribute is retrieved by a call to the function `H5LTget_attribute_[type]()`:

```
herr_t H5LTget_attribute_[type]( hid_t loc_id,
                                 const char *obj_name,
                                 const char *attr_name,
                                 [type] *data          ) ;
```

where *[type]* can take one of the following values {string,char, short, int, long, float, double}, ***loc_id*** is the file ID, ***obj_name*** is the name of the object that the attribute is attached to, ***dset_name*** is the name of the attribute, ***buffer*** is the location in memory where the attribute value will be written to. A negative return value indicates failure.

5.4.4 Data Types

One of the aims of HDF is portability, meaning that files can be created on one computer, and read on another. This is not obvious for binary files, if the memory layout of multi-byte data differ in the two machines (little-endian vs big-endian format). But the HDF library takes care of the conversion. Nevertheless, when reading values from an HDF file, the memory data type must be supplied as one of the arguments to `H5Dread()` or `H5Aread()`. This is so because the memory data type must be compatible with the data type stored in the HDF file for the library to be able to perform the conversion. For example, the library will automatically convert from signed big-endian two-byte integer (as stored in the HDF file) to a signed four-byte little-endian memory type; but, trying to retrieve float data (as stored in the HDF file) into an integer memory data type will generate an error.

Number Data The following table indicates memory data type ID (the value of argument ***mem_type_id*** in the "read" functions) compatible with the given stored data type; the third column indicates the corresponding C types (the type of argument ***buffer***).

Data Type Stored in HDF File	Memory Data Type	C Type
`H5T_IEEE_F64BE`	`H5T_NATIVE_DOUBLE`	`double`
`H5T_STD_I16BE`	`H5T_NATIVE_SHORT`	`short`
`H5T_STD_U8BE`	`H5T_NATIVE_UCHAR`	`unsigned char`
`H5T_STD_I8BE`	`H5T_NATIVE_CHAR`	`char`

Character String Attributes The C language uses the term `char` to represent one-byte numeric data and does not make character strings a first-class datatype. HDF5 makes a distinction between integer and character data and maps the C signed char (`H5T_NATIVE_CHAR`) and unsigned char (`H5T_NATIVE_UCHAR`) datatypes to the HDF5 integer type class.
When the value of an attribute is a character string, to be able to allocate memory to fit the whole string, we must know its length. Actually the string length is stored by the library as a part of the type information. The size of a string can be retrieve using the following function `H5LTget_attribute_info()`:

```
herr_t H5LTget_attribute_info( hid_t loc_id,
                               const char *obj_name,
                               const char *attr_name,
                               hsize_t *dims,
                               H5T_class_t *type_class,
                               size_t *type_size       ) ;
```

where ***loc_id*** is the file ID, ***obj_name*** is the name of the object that the attribute is attached to, ***attr_name*** is the name of the attribute, ***dims*** is `NULL`, ***type_class*** is the location in memory where the class identifier will be written to (should be `H5T_STRING` for a string), ***type_size*** is the location in memory where the size of the string will be written to.

Character String Dataset The character string dataset are not completely handled by the High Level API. This paragraph briefly introduces some concepts to understand how to retrieve these datasets. The information of a character string dataset can be retrieved using the same functions as for datasets

H5LTget_dataset_ndims() and H5LTget_dataset_info() (see 5.4.2). The size of one data is the number of characters including the terminating "
0" of each string of the dataset. A dataset is just like a string array in C: the strings have the same length and are null terminated. To retrieve a character string dataset, the size of each string must be given as argument. This is done through the definition of a type. This type should belong to the class of null terminated strings (which is H5T_C_S1) and have the adequate size. This is done through the follwing functions:

```
hid_t H5Tcopy (   hid_t type_id   ) ;
```

where *type_id* is the datatype to copy (H5T_C_S1 for null terminated strings). A negative return value indicates failure.

```
herr_t H5Tset_size(   hid_t type_id,
                      size_t size     ) ;
```

where *type_id* is the identifier of datatype to change size, ***size*** size in bytes to modify datatype. A negative return value indicates failure.
The datatype identifier returned should be released with H5Tclose or resource leaks will occur.

```
herr_t H5Tclose(   hid_t type_id   ) ;
```

where *type_id* is the identifier of the datatype to release. A negative return value indicates failure.

5.4.5 Example

This section presents the listing of an example C program that will read the HDF file *"demo.hdf"* provided with this guide. The code shows how to use the functions of the HDF5 API discussed in the preceding sections. Namely, it demonstrates how an application can open an HDF file, and access its groups, datasets and attributes.
The file *"read_demo_file.c"* contains the source code of the example. To compile it, you should have the HDF5 Library installed (see section 5.2). Please refer also to appendix A for additional examples. There are two versions of the same data extraction in this file: one using dynamic allocation of memory and the other using static arrays. Using only static arrays can lead to memory availability problems.

```c
#include <stdio.h>
#include <stdlib.h>
#include <string.h>

/* HDF5 Library header files */
#include <hdf5.h>
#include <H5LT.h>

/* The 'assert' macro is used to exit from the program in case
 * something went wrong. */
#include <assert.h>

#define DIM_0  20
#define DIM_1  10

int
main(void)
{
    /* Name of the HDF file. */
    char *file_name = "demo.hdf";

    /* IDs for accessing HDF5 objects. */
    hid_t f_id;

    /* Will contain information about the dataset (number of dimensions,
```

```
   number of data points, dimensions sizes). */
int num_dims;
hsize_t num_points, *dims;

/* Will contain the size in bytes of one datasat data */
size_t type_size;

/* Will contain the data from ``/First Group/My Dataset''. */
int *data = NULL, data_stat[DIM_0][DIM_1];
/* Will contain the class identifier of the dataset
   Outside the scope of this simple demo */
H5T_class_t class_id;

/* Will contain the value of attribute
   ``/First Group/My Dataset/Some Attribute''. */
double attr_double;

/* Will contain number of characters in attribute
   ``/First Group/My Dataset/Some Other Attribute''. */
size_t attr_string_size;

/* Will contain the value of attribute
   ``/First Group/My Dataset/Some Other Attribute''. */
char *attr_string_dyn = NULL, attr_string_stat[256];

/* Error reporting. */
herr_t error;

/* Will contain the data type of attribute
   ``/First Group/My Dataset/Some Other Attribute''. */
H5T_class_t type_class;

int n, i, j;

/* Open the file. */
f_id = H5Fopen(file_name, H5F_ACC_RDONLY, H5P_DEFAULT);
assert(f_id > 0);

/*** Reading Dataset ***/
/* dynamic allocation */
/*------------------*/

/* Retrieve the number of dimensions. */
error =
    H5LTget_dataset_ndims(f_id, "/First Group/My Dataset", &num_dims);
assert(!(error < 0));
assert(num_dims == 2);

/* Allocate array to contain the size of each dimension. */
dims = (hsize_t *) malloc(num_dims * sizeof(hsize_t));

/* Retrieve the dimension sizes. */
error =
    H5LTget_dataset_info(f_id, "/First Group/My Dataset", dims,
                         &class_id, &type_size);
assert(!(error < 0));

/* Check that the dataset is of type integer 4 bytes. */
assert(class_id == H5T_INTEGER);
assert(type_size == sizeof(int));

/* Compute number of data points stored in the dataset. */
num_points = dims[0] * dims[1];

/* Allocate enough memory to contain all the data in the dataset. */
data = (int *) malloc(num_points * sizeof(int));

/* Read the data from the dataset. */
```

```
error = H5LTread_dataset_int(f_id, "/First Group/My Dataset", data);
assert(!(error < 0));

/*** Reading Dataset ***/
/* static allocation */
/*——————————*/

error =
    H5LTread_dataset_int(f_id, "/First Group/My Dataset",
                         &(data_stat[0][0]));
assert(!(error < 0));

/*** Reading Attribute "Some Attribute" ***/
/*—————————————————-*/

/* Read contents of the attribute "Some Attribute". */
error =
    H5LTget_attribute_double(f_id, "/First Group/My Dataset",
                             "Some Attribute", &attr_double);
assert(!(error < 0));

/*** Reading Attribute "Some Other Attribute" ***/
/* dynamic allocation                          */
/*—————————————————————-*/

/* Check that it is a string and obtain the number of characters in the
 * attribute value. */
error =
    H5LTget_attribute_info(f_id, "/First Group/My Dataset",
                           "Some Other Attribute", NULL, &type_class,
                           &attr_string_size);
assert(!(error < 0) && (type_class == H5T_STRING));

/* Allocate enough memory to contain the string. */
attr_string_dyn = (char *) malloc(attr_string_size * sizeof(char));

/* Obtain the value of the "Some Other Attribute" attribute. */
error =
    H5LTget_attribute_string(f_id, "/First Group/My Dataset",
                             "Some Other Attribute", attr_string_dyn);
assert(!(error < 0));

/*** Reading Attribute "Some Other Attribute" ***/
/* static allocation                           */
/*—————————————————————-*/

/* Obtain the value of the "Some Other Attribute" attribute. */
error =
    H5LTget_attribute_string(f_id, "/First Group/My Dataset",
                             "Some Other Attribute", attr_string_stat);
assert(!(error < 0));

/* Do whatever with the data retrieved from the HDF file ...
 * Here we just print it. */
printf("--- dynamic version ---\n");

for (n = 0; n < num_dims; n++)
    printf("Size of dimension %d is %d\n", n, (int) dims[n]);

for (i = 0; i < dims[0]; i++) {
    for (j = 0; j < dims[1]; j++)
        printf("%d\t", data[i * dims[1] + j]);
    printf("\n");
}

printf("%.16f\n", attr_double);
printf("%s\n", attr_string_dyn);
```

```
    printf("--- static version ---\n");

    for (i = 0; i < dims[0]; i++) {
        for (j = 0; j < dims[1]; j++)
            printf("%d\t", data_stat[i][j]);
        printf("\n");
    }

    printf("%.16f\n", attr_double);
    printf("%s\n", attr_string_stat);

    /* Clean up. */
    free(data);
    free(dims);
    free(attr_string_dyn);

    return 0;
}
```

When this program has been compiled, it should produce the following output

```
--- dynamic version ---
Size of dimension 0 is 20
Size of dimension 1 is 10
1	2	3	4	5	6	7	8	9	10
2	4	6	8	10	12	14	16	18	20
3	6	9	12	15	18	21	24	27	30
4	8	12	16	20	24	28	32	36	40
5	10	15	20	25	30	35	40	45	50
6	12	18	24	30	36	42	48	54	60
7	14	21	28	35	42	49	56	63	70
8	16	24	32	40	48	56	64	72	80
9	18	27	36	45	54	63	72	81	90
10	20	30	40	50	60	70	80	90	100
11	22	33	44	55	66	77	88	99	110
12	24	36	48	60	72	84	96	108	120
13	26	39	52	65	78	91	104	117	130
14	28	42	56	70	84	98	112	126	140
15	30	45	60	75	90	105	120	135	150
16	32	48	64	80	96	112	128	144	160
17	34	51	68	85	102	119	136	153	170
18	36	54	72	90	108	126	144	162	180
19	38	57	76	95	114	133	152	171	190
20	40	60	80	100	120	140	160	180	200
3.1415926535897931
This string is the value of the attribute.
--- static version ---
1	2	3	4	5	6	7	8	9	10
2	4	6	8	10	12	14	16	18	20
3	6	9	12	15	18	21	24	27	30
4	8	12	16	20	24	28	32	36	40
5	10	15	20	25	30	35	40	45	50
6	12	18	24	30	36	42	48	54	60
7	14	21	28	35	42	49	56	63	70
8	16	24	32	40	48	56	64	72	80
9	18	27	36	45	54	63	72	81	90
10	20	30	40	50	60	70	80	90	100
11	22	33	44	55	66	77	88	99	110
12	24	36	48	60	72	84	96	108	120
13	26	39	52	65	78	91	104	117	130
14	28	42	56	70	84	98	112	126	140
```

```
15      30      45      60      75      90      105     120     135     150
16      32      48      64      80      96      112     128     144     160
17      34      51      68      85      102     119     136     153     170
18      36      54      72      90      108     126     144     162     180
19      38      57      76      95      114     133     152     171     190
20      40      60      80      100     120     140     160     180     200
3.1415926535897931
This string is the value of the attribute.
```

5.5 HDF Tools Provided by NCSA

Several utility programs are bundled with the HDF5 library. Among them, "`h5ls`" and "`h5dump`" are particularly useful for examining the contents of an HDF5 file. The following shows the output of these two programs on the HDF file *"demo.hdf"* provided with this document.

`> h5ls -r demo.hdf`

should produce

```
/demo.hdf/First\ Group   Group
/demo.hdf/First\ Group/My\ Dataset Dataset {20, 10}
```

`> h5dump demo.hdf`

should produce

```
HDF5 "../../demo.hdf" {
GROUP "/" {
   GROUP "First Group" {
      DATASET "My Dataset" {
         DATATYPE  H5T_STD_I32BE
         DATASPACE  SIMPLE { ( 20, 10 ) / ( 20, 10 ) }
         DATA {
         (0,0): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10,
         (1,0): 2, 4, 6, 8, 10, 12, 14, 16, 18, 20,
         (2,0): 3, 6, 9, 12, 15, 18, 21, 24, 27, 30,
         (3,0): 4, 8, 12, 16, 20, 24, 28, 32, 36, 40,
         (4,0): 5, 10, 15, 20, 25, 30, 35, 40, 45, 50,
         (5,0): 6, 12, 18, 24, 30, 36, 42, 48, 54, 60,
         (6,0): 7, 14, 21, 28, 35, 42, 49, 56, 63, 70,
         (7,0): 8, 16, 24, 32, 40, 48, 56, 64, 72, 80,
         (8,0): 9, 18, 27, 36, 45, 54, 63, 72, 81, 90,
         (9,0): 10, 20, 30, 40, 50, 60, 70, 80, 90, 100,
         (10,0): 11, 22, 33, 44, 55, 66, 77, 88, 99, 110,
         (11,0): 12, 24, 36, 48, 60, 72, 84, 96, 108, 120,
         (12,0): 13, 26, 39, 52, 65, 78, 91, 104, 117, 130,
         (13,0): 14, 28, 42, 56, 70, 84, 98, 112, 126, 140,
         (14,0): 15, 30, 45, 60, 75, 90, 105, 120, 135, 150,
         (15,0): 16, 32, 48, 64, 80, 96, 112, 128, 144, 160,
         (16,0): 17, 34, 51, 68, 85, 102, 119, 136, 153, 170,
         (17,0): 18, 36, 54, 72, 90, 108, 126, 144, 162, 180,
         (18,0): 19, 38, 57, 76, 95, 114, 133, 152, 171, 190,
         (19,0): 20, 40, 60, 80, 100, 120, 140, 160, 180, 200
         }
         ATTRIBUTE "Some Attribute" {
            DATATYPE  H5T_IEEE_F64BE
            DATASPACE  SCALAR
            DATA {
            (0): 3.14159
            }
         }
         ATTRIBUTE "Some Other Attribute" {
            DATATYPE  H5T_STRING {
                  STRSIZE 43;
```

```
                STRPAD H5T_STR_NULLTERM;
                CSET H5T_CSET_ASCII;
                CTYPE H5T_C_S1;
             }
          DATASPACE  SCALAR
          DATA {
          (0): "This string is the value of the attribute."
          }
       }
    }
 }
}
}
```

A Sample Code

Before being able to use the scientific data produced at RMIB, users must retrieve them from the HDF file, and format them according to their needs. This appendix presents sample code to help users of the L2 RMIB GERB Products develop their own reading applications. Each example is self-contained (except for the HDF5 Library, which must be separately installed) and its compilation produces an executable program. Each code snippet is meant to illustrate a simple way to access a given HDF data structure and retrieve its data.

Note: The programs produced out of these source codes must be given a single command line argument which is the name of an L2 RMIB GERB Product HDF file. This file must obviously contain the HDF structure that the program wants to read (see comments embedded in the code) or an error will occur.

A.1 Float Image

The following code illustrates how to extract a float image from quantised data stored in a 2-dimensional dataset. The quantisation factor is stored as a dataset attribute of type `double`. This is the factor by which each element from the dataset must be multiplied to obtain a meaningful value. In the example below, this means that, to obtain the physical value of the solar flux (in $W \cdot m^{-2}$), one must multiply the dataset data (count value) by the value of the quantisation factor. The source code file name is *"read_rgp_float_dataset.c"*.

```
#include <stdio.h>
#include <stdlib.h>

/* HDF5 Library header files */
#include <hdf5.h>
#include <H5LT.h>

/* The 'assert' macro is used to detect any error and exit from the program
 * in case something went wrong. */
#include <assert.h>

#define XDIM 256
#define YDIM 256

int
main(int argc, char *argv[])
{
    char *file_name;
    hid_t file_id;
    herr_t error;
    int i, j;
    int solar_flux_int16[YDIM][XDIM];
    float solar_flux[YDIM][XDIM];
    double quantisation_factor;

    /* The argument on the command line is the name of an HDF file. The file
     * must contain a "/Radiometry/Solar Flux" dataset of size 256 x 256. The
     * dataset values are integers. Each value results from the quantisation of
     * float values representing solar fluxes (in watts per meter square). The
     * quantisation factor is stored as an attribute of the dataset. */
    assert(argc == 2);
    file_name = argv[1];

    /* Open the HDF file. */
    file_id = H5Fopen(file_name, H5F_ACC_RDONLY, H5P_DEFAULT);
    assert(!(file_id < 0));

    /* Obtain the data stored in the "/Radiometry/Solar Flux" dataset. */
    error =
        H5LTread_dataset_int(file_id, "/Radiometry/Solar Flux",
                             solar_flux_int16[0]);
    assert(!(error < 0));

    /* Obtain the value of the "Quantisation Factor" attribute inside the
     * dataset. */
```

```
    error =
        H5LTget_attribute_double(file_id, "/Radiometry/Solar Flux",
                                 "Quantisation Factor",
                                 &quantisation_factor);
    assert(!(error < 0));

    /* Close the HDF file. */
    error = H5Fclose(file_id);
    assert(!(error < 0));

    /* Compute the float values of the solar flux and print them to standard
     * output. */
    for (i = 0; i < YDIM; i++) {
        for (j = 0; j < XDIM; j++) {
            solar_flux[i][j] =
                quantisation_factor * solar_flux_int16[i][j];
            printf("%.2f ", solar_flux[i][j]);
        }

        printf("\n");
    }

    return 0;
}
```

A.2 Integer Image

This code also extracts an image but does not perform integer to float conversion. The source code file name is *"read_rgp_integer_dataset.c"*.

```
#include <stdio.h>
#include <stdlib.h>

/* HDF5 Library header files */
#include <hdf5.h>
#include <H5LT.h>

/* The 'assert' macro is used to detect any error and exit from the program
 * in case something went wrong. */
#include <assert.h>

#define XDIM 256
#define YDIM 256

herr_t H5LTread_dataset_uchar(hid_t loc_id, const char *dset_name, char *data);

int
main(int argc, char *argv[])
{
    char *file_name;
    hid_t file_id;
    herr_t error;
    int i, j;
    unsigned char surface_type[YDIM][XDIM];

    /* The argument on the command line is the name of an HDF file which
     * must contain a "/Scene Identification/Surface Type" dataset of size
     * 256 x 256. The dataset values are integers. Each value is an index
     * representing a surface type {0=undefined, 1=ocean, 2=dark vegetation,
     * 3=bright vegetation, 4=dark desert, 5=bright desert, 6=snow, 255=error}.
     */
    assert(argc == 2);
    file_name = argv[1];

    /* Open the HDF file. */
    file_id = H5Fopen(file_name, H5F_ACC_RDONLY, H5P_DEFAULT);
```

```
    assert(file_id > 0);

    /* Obtain the data stored in the "/Scene Identification/Surface Type"
     * dataset. */
    error =
        H5LTread_dataset_uchar(file_id,
                               "/Scene Identification/Surface Type",
                               surface_type[0]);
    assert(!(error < 0));

    /* Print the surface type indices to standard output. */
    for (i = 0; i < YDIM; i++) {
        for (j = 0; j < XDIM; j++)
            printf("%d ", surface_type[i][j]);
        printf("\n");
    }

    return 0;
}

herr_t
H5LTread_dataset_uchar(hid_t loc_id, const char *dset_name, char *data)
{
    hid_t dataset_id;

    /* Open the dataset. */
    if ((dataset_id = H5Dopen(loc_id, dset_name)) < 0)
        return -1;

    /* Read */
    if (H5Dread(dataset_id, H5T_NATIVE_UCHAR, H5S_ALL, H5S_ALL, H5P_DEFAULT,
                data) < 0)
        goto out;

    /* End access to the dataset and release resources used by it. */
    if (H5Dclose(dataset_id))
        return -1;

    return 0;

out:
    H5Dclose(dataset_id);
    return -1;
}
```

A.3 String Data

The following code shows how to retrieve the value of a string attribute. The source code file name is *"read_rgp_string.c"*.

```
#include <stdio.h>
#include <stdlib.h>

/* HDF5 Library header files */
#include <hdf5.h>
#include <H5LT.h>

/* The 'assert' macro is used to detect any error and exit from the program
 * in case something went wrong. */
#include <assert.h>

int
main(int argc, char *argv[])
{
    char *file_name;
    hid_t file_id;
    herr_t error;
```

```
    char *attr_string_value = NULL;
    size_t attr_string_size;
    H5T_class_t type_class;

    /* The argument on the command line is the name of an HDF file which must
     * contain a "/File Creation Time" string attribute. */
    assert(argc == 2);
    file_name = argv[1];

    /* Open the HDF file. */
    file_id = H5Fopen(file_name, H5F_ACC_RDONLY, H5P_DEFAULT);
    assert(file_id > 0);

    /* Check that it is a string and obtain the number of characters in the
     * attribute value. */
    error =
        H5LTget_attribute_info(file_id, "/", "File Creation Time", NULL,
                               &type_class, &attr_string_size);
    assert(!(error < 0) && (type_class == H5T_STRING));

    /* Allocate enough memory to contain the string. */
    attr_string_value = (char *) malloc(attr_string_size * sizeof(char));

    /* Obtain the value of the "/File Creation Time" attribute. */
    error =
        H5LTget_attribute_string(file_id, "/", "File Creation Time",
                                 attr_string_value);
    assert(!(error < 0));

    /* Close the HDF file. */
    error = H5Fclose(file_id);
    assert(error == 0);

    /* Print the attribute string to standard output. */
    printf("The file '%s' was created on --%s-- UTC time.\n",
           file_name, attr_string_value);

    /* Release memory. */
    free(attr_string_value);

    return 0;
}
```

A.4 String List

The following code retrieves a series of string attributes whose names are strings representing numbers. The source code file name is *"read_rgp_string_list.c"*.

```
#include <stdio.h>
#include <stdlib.h>

/* HDF5 Library header files */
#include <hdf5.h>
#include <H5LT.h>

/* The 'assert' macro is used to detect any error and exit from the program
 * in case something went wrong. */
#include <assert.h>

#define NUMCOLUMNS 256

int
main(int argc, char *argv[])
{
    char *file_name;
    hid_t file_id;
```

```
    herr_t error;
    hsize_t dim, i;
    hid_t atype;
    int rank;
    char *buffer = NULL;
    size_t type_size;
    H5T_class_t class_id;

    /* The argument on the command line is the name of an HDF file which must
     * contain a "/Times/Start of Integration (per column)" group which itself
     * contains a list of 256 string attributes. The names of these attributes
     * are the string representation (in base 10) of the numbers between 0 and
     * 255 inclusive. */
    assert(argc == 2);
    file_name = argv[1];

    /* open the HDF file */
    file_id = H5Fopen(file_name, H5F_ACC_RDONLY, H5P_DEFAULT);
    assert(file_id > 0);

    /* obtain the dimensions of the dataset */
    error =
        H5LTget_dataset_ndims(file_id,
                              "/Times/Start of Integration (per column)",
                              &rank);
    assert(!(error < 0) && (rank == 1));

    /* obtain information about the dataset */
    error =
        H5LTget_dataset_info(file_id,
                             "/Times/Start of Integration (per column)",
                             &dim, &class_id, &type_size);
    assert(!(error < 0) && (class_id == H5T_STRING));

    /* allocate the buffer */
    buffer = (char *) malloc(sizeof(char) * dim * type_size);

    /* create a data type according to the dataset type: strings (null
     * terminated) of size type_size */
    atype = H5Tcopy(H5T_C_S1);
    assert(!(atype < 0));
    error = H5Tset_size(atype, type_size);
    assert(!(error < 0));

    /* read the dataset */
    error =
        H5LTread_dataset(file_id,
                         "/Times/Start of Integration (per column)", atype,
                         buffer);
    assert(!(error < 0));

    printf("Start of Integration (UTC Time):\n");
    for (i = 0; i < dim; i++) {
        printf("%d:\t--%s--\n", (int) i, buffer + (i * type_size));
    }

    /* Release memory. */
    free(buffer);
    H5Tclose(atype);

    return 0;
}
```

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