

MTG Test Data Package Description - FCI L1C - 24h Test Data for Users

Doc.No. : EUM/MTG/TEN/19/1090563
Issue : v1A e-signed
Date : 24 June 2019
WBS/DBS :

EUMETSAT
Eumetsat-Allee 1, D-64295 Darmstadt, Germany
Tel: +49 6151 807-7
Fax: +49 6151 807 555
<http://www.eumetsat.int>

Document Change Record

<i>Issue / Revision</i>	<i>DCN. No</i>	<i>Date</i>	<i>Summary of Changes</i>
1		01/06/2019	Created from the release
1A		24/06/2019	Update for the delivery format being individual directory archives and not a single large archive file

Table of Contents

1	Test Package Description	4
1.1	Document Scope	4
1.2	Package Overview	4
1.3	Package Contents	4
1.3.1	CharLS Compression	5
1.4	Package Validity	5
1.5	Package Usage	5
1.6	Applicable and Reference Documents	5
1.6.1	Applicable Documents	5
1.6.2	Reference Documents	6
1.7	Acronyms	6
2	Test Data Description	7
2.1	Repeat Cycles	7
2.2	Radiance simulation	7
2.2.1	Temporal simulation	7
2.2.2	Spectral simulation	8
2.2.3	Interpolation of Count/Radiance	8
2.3	Body chunks populated variables/attributes	8
2.4	Trailer chunks populated variables/attributes	11
2.5	Production Software	12
3	Software	13
3.1	Library Versions	13
3.2	Decompression of Data Files	13
4	Known Limitations	14
4.1	Format Issues	14
4.1.1	Expected Format Evolution	14
4.1.2	Number of Body Chunks and Their Sizes (Rows and Columns)	14
4.1.3	CF Convention Conformance	14
4.1.4	FillValue attribute	15
4.1.5	Undefined Block of Data	15
4.1.6	Geolocation grid	16
4.2	Data Content Issues	17
4.2.1	repeat_cycle_counter	17
4.2.2	IR3.8	17
4.2.3	Conversion of radiance to brightness temperature	17
4.2.4	NetCDF Strings and MATLAB	18
4.2.5	Stray-light or sun-glint	19
4.2.6	Value of the last column is set to zero	21

1 TEST PACKAGE DESCRIPTION

1.1 Document Scope

This document is a test package description to be included with the delivery of the relevant test package. It details the contents of the test package and provides information about the limitations of the test package, the conformance to any relevant specifications and the intended use of the package.

1.2 Package Overview

This document is the test package description for the following test package:

- FCI_Level_1_Test_Data_for_Users_1.0

The data is under two sub-directories: COMPRESSED with the CHARLS internally compressed copies of the data and UNCOMPRESSED with uncompressed copies. Within each sub-directory, there is an archive file per repeat cycle which can be unpacked into a directory with the body and trailer chunks for that repeat cycle.

The term “test package” is indicated throughout this document as a generic term referring to both test package and the actual test data.

This test data contains a nominal 24 Hours (with 1 hour overlaps) of FCI level 1C FDHSI simulated Repeat Cycles to be used in support to Users data familiarisation and load testing.

The format for these test data is derived from:

- MTG Generic Format Specification, V4A
- MTG FCI Level 0 & 1 Format Specification, V4A

1.3 Package Contents

This package contains the following data:

Full Disk High Spectral Imagery (FDHSI) datasets

- Full images of the Earth.
- 16 channels
- Size: 5568x5568 or 11136x11136 pixels, depending on the channel.

The dataset is divided into a number of body chunk files and a trailer chunk file. There is more information in appendix A.

There are 156 repeat cycles, having 71 netCDF files per repeat cycle, being 11076 files in total for the uncompressed dataset, and the same numbers for the compressed set.

1.3.1 CharLS Compression

In order to fulfil bandwidth requirements, FCI level 1C data is compressed using the CharLS algorithm.

In practise, the compression plug-in would be downloaded from the EUMETSAT website, but for this package release, a copy of the decompressor package is provided.

1.4 Package Validity

In order to check the integrity of the data, there are checksums provided created using the sha256sum tool.

sha256sum_checksums_all_files.txt – contains the checksum for each directory archive in the unarchived package above. Each directory contains the product chunks for a single repeat cycle.

sha256sum_checksums_all_directory_zips.txt – contains the checksums for each individual file in the package

1.5 Package Usage

This package of test data is intended to support user familiarisation with the FCI 1C format and to enable simulation of operational loads.

It only contains representative data contents and is not generally suitable for scientific processing. The data is nominal data and not all fields are currently filled. A more representative but smaller test data set with missing data, simulated channels and other enhancements is expected to be available for users in Q3 2019.

This test data was originally developed to support L2PF development but has been made available to the Users for testing data throughput and simulating EUMETCast transmission.

1.6 Applicable and Reference Documents

1.6.1 Applicable Documents

Acronym	Title	Reference
---------	-------	-----------

MTG Test Data Package Description - FCI L1C - 24h Test Data for Users

[FCIL1PUG]	FCI L1 Product User Guide	EUM/MTG/USR/13/719113
[FCIL1FS]	MTG FCI Level 0 & 1 Format Specification, v4A	EUM/MTG/SPE/10/0447
[GFS]	MTG Generic Format Specification, v4A	EUM/MTG/SPE/11/0252
[SIG]	Software Installation Guide	EUM-COM-SIG-14-121-TS

1.6.2 Reference Documents

None

1.7 Acronyms

This is a list of acronyms used in this document.

CF	Climate and Forecast (metadata conventions)
FCI	Flexible Combiner Imager
FD	Full Disk
FDHSI	Full Disk High Spectral Imagery
HRFI	High Resolution Fast Imagery
LAC	Local Area Coverage
MSG	Meteosat Second Generation
MTG	Meteosat Third Generation
SEVIRI	Spinning Enhanced Visible and Infrared Imager
SSD	Spatial Sample Distance

2 TEST DATA DESCRIPTION

2.1 Repeat Cycles

The start date of the produced FCI FDHSI Level-1c Repeat Cycles are as follows:

- 09.04.2017 23:00:00
- 09.04.2017 23:10:00
- 09.04.2017 23:20:00
- ...
- 11.04.2017 00:40:00
- 11.04.2017 00:50:00

2.2 Radiance simulation

The FCI radiances have been synthesized from Level1.5 SEVIRI images only.

2.2.1 Temporal simulation

The data is referred as having “24 hours of data”, one day, as a meaningful way to describe the delivery. However, in order to avoid boundary problems, one extra hour is provided before, and another extra hour after the central 24 hours. Therefore, the actual delivery contains 26 hours of data.

Because the repeat cycle intervals are different for SEVIRI (15 min) and FCI (10 min), a specific correspondence was applied, as shown in Table 1. The SEVIRI Repeat Cycle with the closest start date is associated to each FCI Repeat Cycle. This obviously means that some SEVIRI Repeat Cycles are associated to two consecutive FCI Repeat Cycles.

FCI Repeat Cycle Start Date	SEVIRI Repeat Cycle Start Date
...	...
10.04.2017 16:00:00	10.04.2017 16:00:00
10.04.2017 16:10:00	10.04.2017 16:15:00
10.04.2017 16:20:00	10.04.2017 16:15:00
10.04.2017 16:30:00	10.04.2017 16:30:00
10.04.2017 16:40:00	10.04.2017 16:45:00
10.04.2017 16:50:00	10.04.2017 16:45:00
10.04.2017 17:00:00	10.04.2017 17:00:00
...	...

Table 1: temporal correspondence between FCI and SEVIRI input images

2.2.2 Spectral simulation

The FCI channels are constructed from the SEVIRI L1.5 radiances following the correspondence described in Table 2.

FCI L1c channel	SEVIRI Level1.5 channel no	SEVIRI channel name
VIS 0.4	1	VIS 0.6
VIS 0.5	1	VIS 0.6
VIS 0.6	1	VIS 0.6
VIS 0.8	2	VIS 0.8
VIS 0.9	2	VIS 0.8
NIR 1.3	3	NIR 1.6
NIR 1.6	3	NIR 1.6
NIR 2.2	3	NIR 1.6
IR 3.8	4	IR 3.9
WV 6.3	5	WV 6.2
WV 7.3	6	WV 7.3
IR 8.7	7	IR 8.7
IR 9.7	8	IR 9.7
IR 10.5	9	IR 10.8
IR 12.3	10	IR 12.0
IR 13.3	11	IR 13.4

Table 2: FCI to SEVIRI spectral correspondence

2.2.3 Interpolation of Count/Radiance

The SEVIRI L1.5 data is provided in counts 0 to 1023. The data was spatially interpolated to the FCI resolution using a nearest-neighbour interpolation. Although the FCI data is sampled in a count range 0 to 4095 (and 0 to 8191 for Fire (3.8) channel), the SEVIRI count dynamic range was maintained for this MTG FCI L1c dataset, and the slope and offsets (to convert to radiances) of SEVIRI were used in the FCI simulated data. This way the count/radiance information is preserved in the FCI L1c data.

2.3 Body chunks populated variables/attributes

The L1c is structured as shown in the following diagram (from [AD-01]).

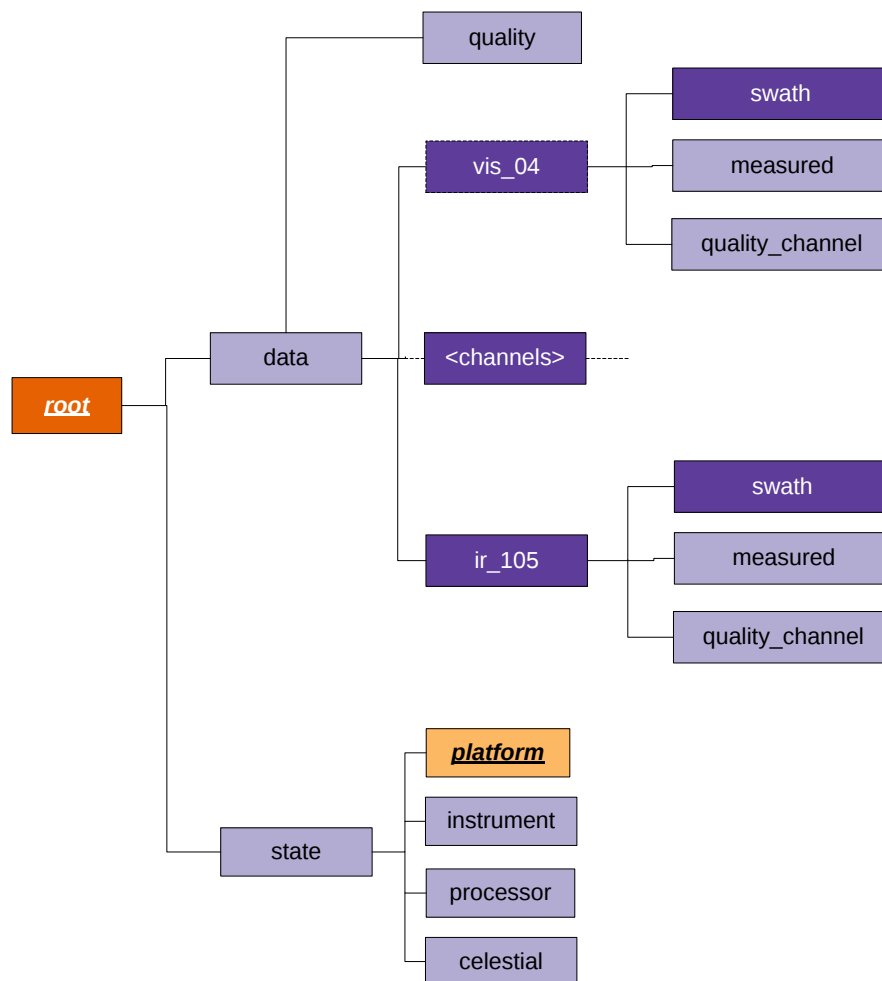


Figure 2-1 Overview of nesting in the FCI Level 1c Body data chunk groups (FDHSI example)

For the purposes of generating test data to support the L2PF development (the reason for which this test data was originally developed) , only a sub-set of data within a sub-set number of groups were required.

These are groups:

- root
- data
- data/channels/measured
- state/instrument
- state/processor
- state/platform
- state/celestial

Table 3 lists the FCI Level-1c netCDF variables simulated and populated in the Body chunks of this Test Dataset.

MTG Test Data Package Description - FCI L1C - 24h Test Data for Users

Group	Parameter Name	Comment
root	number_of_reference_grids	
	number_of_l1c_channels	
	l1c_channels_present	
	index	
	time	
data	mtg_geos_projection	
data/ channels	group VIS0.6{..}, group VIS0.8{..} with the following relevant variables in the next n rows	
	y	
	x	
	ssd_index	
data/ channels/ measured		
	start_position_row	
	end_position_row	
	start_position_column	
	end_position_column	
	x	
	y	
	effective_radiance	
	pixel_quality_flags	These are filled with zeros
	radiance_to_bt_conversion_ coefficients_a	
	radiance_to_bt_conversion_ coefficients_b	
	radiance_to_bt_conversion_ coefficients_wavenumber	
	radiance_to_bt_conversion_ constant_c1	
	radiance_to_bt_conversion_ constant_c2	
	channel_effective_solar_irra diance	See 2.2
state/ instrumen t	repeat_cycle_counter	
	repeat_cycle_start_time	
state/ processor	projection_origin_longitude	
	projection_origin_latitude	

	reference_altitude	
	reference_grid	
	reference_grid_spatial_sam pling_angle_ns	
	reference_grid_spatial_sam pling_angle_ew	
	earth_polar_radius	
	earth_equatorial_radius	
	reference_grid_number_of_c olumns	
	reference_grid_number_of_r ows	
	azimuth_angle_at_reference _grid_origin	
	elevation_angle_at_referenc e_grid_origin	
state/plat form	subsattellite _latitude	This is fixed to 0°
	subsattellite _longitude	This is fixed to 0°
	platform_altitude	This is fixed to the nominal altitude
state/cele stial	subsolar _latitude	This is approximated to 1 degree accuracy
	subsolar _longitude	This is approximated to 1 degree accuracy
	earth_sun_distance	This is fixed to the average earth to sun distance

Table 3: Body chunks populated variables

2.4 Trailer chunks populated variables/attributes

Table 4 lists the FCI Level-1c NetCDF variables simulated and populated in the Trailer chunks of this Test Dataset.

Group	Parameter Name	Comments
data/ channels/measured		
	radiance_to_bt_conversion_co efficients_a	
	radiance_to_bt_conversion_co efficients_b	
	radiance_to_bt_conversion_co efficients_wavenumber	
	radiance_to_bt_conversion_co nstant_c1	

	radiance_to_bt_conversion_constant_c2	
	channel_effective_solar_irradiance	
external_calibration_coefficients	external_calibration_coefficients_valid	
state/instrument	repeat_cycle_counter	
	repeat_cycle_start_time	
state/processor	projection_origin_longitude	
	projection_origin_latitude	
	reference_altitude	
	reference_grid	
	reference_grid_spatial_sampling_angle_ns	
	reference_grid_spatial_sampling_angle_ew	
	earth_polar_radius	
	earth_equatorial_radius	
	reference_grid_number_of_columns	
	reference_grid_number_of_rows	
	azimuth_angle_at_reference_grid_origin	
	elevation_angle_at_reference_grid_origin	

Table 4: Trailer chunks populated variables

2.5 Production Software

This test dataset was produced by EUMETSAT with the FCI Level-1 Reference Processor. The GitLab tag of the FCI Level-1 Reference Processor is [SAF TestData FCI L1c 24h 20181213 v7](#) .

3 SOFTWARE

3.1 Library Versions

These netCDF data files have been created considering the following library versions:

- netCDF 4.6.3 (released 5th March 2019)
- HDF5 1.10.5

It is advisable to use HDF5 v1.10.x libraries, because there could be issues when reading and writing this dataset with the HDF5 v1.8.x libraries.

3.2 Decompression of Data Files

In order to work with these compressed files, a usual first step is to remove the compression. This has to be done in two different ways, depending on the version of the libraries:

1. netCDF 4.3.2.ext and HDF5 1.8.14:

```
ncopy -d 0 input.nc output.nc
```

2. netCDF 4.6.2 and HDF5 1.8.21:

```
ncopy -F none input.nc output.nc
```

The “ncopy -F” parameter is documented in the [netCDF-4 Filter Support webpage](#).

4 KNOWN LIMITATIONS

We include here some known limitations in the provided dataset. There are two groups of limitations: about format, and about the data itself.

4.1 Format Issues

This test data release aims at providing a data format as close as possible to the data format of the future FCI data. However, the reasons below indicate when this objective could not be achieved.

4.1.1 Expected Format Evolution

The format and contents of the FCI L1C dataset is not finalised and may require modifications and additions as the MTG system evolves during development. However, it is expected that the overall format and philosophy of the format will not change and that future updates will be minor. As netCDF files are self-descriptive, the impact of these changes will be minor.

4.1.2 Number of Body Chunks and Their Sizes (Rows and Columns)

The datasets have been chunked from a complete repeat cycle dataset following a strategy that will be consolidated in the future. The chunks have been produced such that there are 70 of them per Repeat Cycle (plus the trailer chunk) and such that they all roughly cover the same solid angle portion of the Earth disk (note this means the number of rows in each chunk varies from chunk to chunk).

In addition, the number of body chunks could differ. There is a range of possible values: 70 body chunks per Full Disk is the approach in this delivery, but 40 body chunks is the most realistic figure.

4.1.3 CF Convention Conformance

The CF 1.6 and forthcoming CF 1.7 conventions do not cover the enhanced netCDF-4 constructs that are used in the MTG products such as groups, enumerated data types and unsigned data types. This means that the MTG products cannot currently conform to existing CF conventions. It is hoped that the creation of a CF 2.0 that is compatible with netCDF-4 will allow the products to be made CF compatible.

4.1.4 FillValue attribute

NetCDF-Java does not generate “FillValue” attributes for “ushort” data types. Other data types like “short” and “float” are implemented correctly. There is an issue raised to netCDF-Java developers. At the time of writing this document, the bug was reported to be fixed in the library, but it was not implemented in these datasets.¹

We have experienced that, depending on the reader used, there could be a default FillValue. For example: the “effective_radiance” variable read using Python assumes the correct FillValue by default.

4.1.5 Undefined Block of Data

The “offset_size_var” netCDF variable in the BODY chunks, at root level, is not defined in [FCIL1FS]. It should be ignored because it does not contain meaningful data, and operational files will not contain it.

It is a block of data in order to enlarge the size of the files. The aim is to have realistic file sizes. 23 MB is the estimated size after compression.

```
dimensions:
    [...]
    offset_size_dim1 = 10000 ;
    offset_size_dim2 = 1900 ;
variables:
    [...]
    ubyte offset_size_var(offset_size_dim1, offset_size_dim2) ;
```

¹ <https://github.com/Unidata/thredds/issues/923>

4.1.6 Geolocation grid

The “mtg_geos_projection” variable, as presented in the “/data” group is the following:

```
int mtg_geos_projection ;  
    mtg_geos_projection:long_name = "MTG geostationary projection" ;  
    mtg_geos_projection:grid_mapping_name = "geostationary" ;  
    mtg_geos_projection:perspective_point_height = "35786400" ;  
    mtg_geos_projection:semi_major_axis = "6378137" ;  
    mtg_geos_projection:semi_minor_axis = "6356752" ;  
    mtg_geos_projection:inverse_flattening = "298.257223563" ;  
    mtg_geos_projection:latitude_of_projection_origin = "0" ;  
    mtg_geos_projection:longitude_of_projection_origin = "0" ;  
    mtg_geos_projection:sweep_angle_axis = "x" ;  
    mtg_geos_projection:units = "m" ;  
    mtg_geos_projection:coordinates = "y x" ;
```

However, the “mtg_geos_projection” variable is defined with slightly different values in [GFS] v4A:

```
int mtg_geos_projection;  
    mtg_geos_projection:long_name="MTG geostationary projection";  
    mtg_geos_projection:long_name="geostationary";  
    mtg_geos_projection:perspective_point_height= "42164000"; //m - WGS84 configured value  
    mtg_geos_projection:semi_major_axis= "6378169.0" ; //m- WGS84 configured value  
    mtg_geos_projection:semi_minor_axis= "6356583.8" ; //m - WGS84 configured value  
    mtg_geos_projection:inverse_flattening = "298.2572221; // WGS84 configured value  
    mtg_geos_projection:latitude_of_projection_origin ="0"; // configured value  
    mtg_geos_projection:longitude_of_projection_origin="0"; // configured value  
    mtg_geos_projection:sweep_angle_axis= "y"; // configured value
```

The values in the L1c data are the correct ones.

4.2 Data Content Issues

This test data has been produced using MSG SEVIRI data; hence, many of the more detailed physical characteristics of an actual FCI L1C dataset may be absent or inaccurate.

Some of the known limitations are described below.

4.2.1 repeat_cycle_counter

The value of the “repeat_cycle_counter” variable, in the “/state/instrument” group, is not defined.

4.2.2 IR3.8

The FCI Earth scene data was generated from SEVIRI Level 1.5 images. No fire was simulated therefore the FCI extended range is not used (“warm_scale_factor” and “warm_add_offset” are not required to read the FCI radiances).

4.2.3 Conversion of radiance to brightness temperature

The two coefficients `data.<channel>.measured.radiance_to_bt_conversion_constant_c1` (1.1910428E-16) and `data.<channel>.measured.radiance_to_bt_conversion_constant_c2` (0.014387751) are not part of the current test data files. Both are the constants, i.e. they are the same for all the IR spectral channels.

4.2.4 NetCDF Strings and MATLAB

A well-known issue in the netCDF community is the lack of support of the “string” data type by the MATLAB programming language.

This test data has been generated using mostly MATLAB, except regarding the population of string netCDF variables. In this particular case, a specific Python script has been used instead.

Therefore: string variables are correct as long as users do not use MATLAB to read the data. For all the other information stored in these files (non-string variables, attributes, etc) MATLAB is ok. This is not a problem of this particular dataset, it is a general problem related to MATLAB. Although it is not a problem of this dataset, it is explained here for the sake of clarity.

For example, the usual way to dump the content of a netCDF file could be:

```
ncdump FILE.nc
```

Its output of a 4-channel dataset is, exactly as expected:

```
[...]
l1c_channels_present = "VIS0.4", "VIS0.5", "VIS0.6", "VIS0.8", "VIS0.9", "NIR1.3",
"NIR1.6", "NIR2.2", "IR3.8", "WV6.3", "WV7.3", "IR8.7", "IR9.7", "IR10.5", "IR12.3",
"IR13.3" ;
[...]
```

In addition, opening this file using Python:

```
from netCDF4 import Dataset
file = 'FILE.nc'
grp_root = Dataset( file, 'r', format='NETCDF4' )
grp_root.variables['l1c_channels_present'][:]
grp_root.close()
```

The output from script above is:

```
array([u'VIS0.4', u'VIS0.5', u'VIS0.6', u'VIS0.8', u'VIS0.9', u'NIR1.3',
       u'NIR1.6', u'NIR2.2', u'IR3.8', u'WV6.3', u'WV7.3', u'IR8.7',
       u'IR9.7', u'IR10.5', u'IR12.3', u'IR13.3'], dtype=object)
```

However, opening this file using MATLAB (note: MATLAB does not manage string data types):

```
filename='Python_saves_str.nc';
ncid = netcdf.open( filename, 'NETCDF4' );
varid = netcdf.inqVarID( ncid, 'l1c_channels_present' );
my_list_of_channels = netcdf.getVar( ncid, varid ); % This line gives an error
netcdf.close( ncid );
```

We get the following error:

Error using netcdf.getVar (line 133)
12 is not a recognized netCDF datatype.

Conclusion: String variables are not read properly using MATLAB. Any other data is correctly read using MATLAB. Use other programming languages (example: Python, C) to read string and non-string variables indistinctly.

4.2.5 Stray-light or sun-glint

The signal from some pixels is higher than expected. This is not an issue of this test data, this effect is already present in the SEVIRI data that has been used as input.

See this example from this netCDF file:

[20170410_RC1/W_XX-EUMETSAT-Darmstadt,IMG+SAT,MTI1+FCI-1C-RRAD-FDHSI-FD--CHK-BODY--L2P-NC4E_C_EUMT_20170410001500_GTT_DEV_20170410000951_20170410001000_N_C_0001_0070.nc](#)

Chunk characteristics:

- Date: 20170410
- Repeat cycle: 1st product of the day (about midnight)
- Chunk: 70 (northernmost chunk)

The effect is clear in the “ir_105” channel. See the red pixels around X=3500 and Y=120.

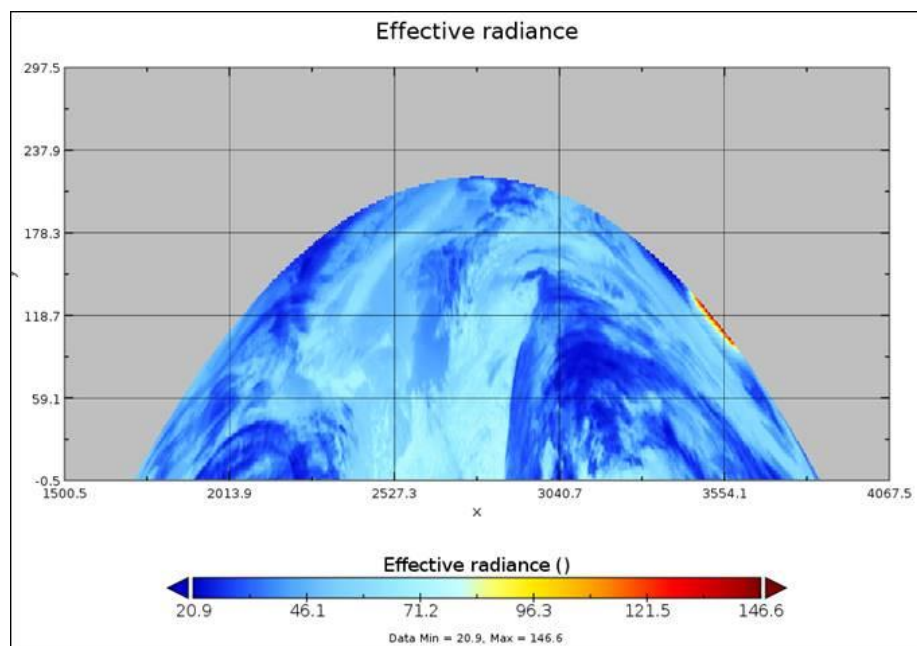


Figure 2: 20170410, repeat cycle 1, chunk 70, channel ir_105.

4.2.6 Value of the last column is set to zero

The value of the pixels of the last column in the “effective_radiance”, “pixel_quality”, and “index_map” variables, as saved in the netCDF file, is set to “0”.

This is an undesired effect due to the algorithm that generates the simulated FCI. The size of the FCI and SEVIRI pixels is different, and the algorithm did not assign the proper value to the simulated FCI pixel at the end of the row.

Therefore:

- Regarding the “effective_radiance” variable, the value as seen by the user equals the “add_offset” attribute. This is, “-10.5” in the table below.
- Regarding the “pixel_quality” and “index_map” variables, the value seen by the user equals “0”, because there is no “add_offset” attribute defined for them.

X-Axis: x										
5557.0	5558.0	5559.0	5560.0	5561.0	5562.0	5563.0	5564.0	5565.0	5566.0	5567.0
NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	-10.5
NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	-10.5
NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	-10.5
NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	-10.5
NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	-10.5
NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	-10.5
NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	-10.5
NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	-10.5
NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	-10.5
NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	-10.5
NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	-10.5
NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	-10.5
NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	-10.5

Figure 3: The value of the last column of the “effective_radiance” variable, as seen by Panoply. Same data as Figure

APPENDIX A TEST PACKAGE CONTENTS

This appendix provides the list of data files included in the delivered package. Data files are located folders according to their simulated date (format YYYYMMDD) and Repeat Cycle within that date. Example:

These are the first six Repeat Cycles (1h of data at the end of 9th April 2017):

- 20170409_RC139
- 20170409_RC140
- 20170409_RC141
- 20170409_RC142
- 20170409_RC143
- 20170409_RC144

These are the 144 Repeat Cycles (24h of data) during 10th April 2017:

- 20170410_RC1
- 20170410_RC2
- 20170410_RC3
- [...]
- 20170410_RC142
- 20170410_RC143
- 20170410_RC144

These are the last six Repeat Cycles (1h of data at the beginning of 11th April 2017):

- 20170411_RC1
- 20170411_RC2
- 20170411_RC3
- 20170411_RC4
- 20170411_RC5
- 20170411_RC6
- 20170411_RC7 (This folder is empty)

MTG Test Data Package Description - FCI L1C - 24h Test Data for Users

Within each of these folders, we find the following files. Note that:

- There are 71 files per Repeat Cycle: 70 body chunks and 1 trailer chunk. Note how the chunk number increase, from **0001** to **0071** (at the end of the file names, last numbers before the extension).
- The Repeat Cycles is the penultimate running number, from **0001** to **0144** (at the end of the file names, number before the chunk numbers).
- There are two consecutive dashes (“-”) in “[...]FD--CHK[...]” and “BODY--L2P[...]”. In previous releases, file names contained a “x” in between both dashes.

```
W_XX-EUMETSAT-Darmstadt,IMG+SAT,MTI1+FCI-1C-RRAD-FDHSI-FD--CHK-BODY--L2P-NC4E_C_EUMT_20170410160508_GTT_DEV_20170410160000_20170410160008_N_C_0096_0001.nc
W_XX-EUMETSAT-Darmstadt,IMG+SAT,MTI1+FCI-1C-RRAD-FDHSI-FD--CHK-BODY--L2P-NC4E_C_EUMT_20170410160517_GTT_DEV_20170410160008_20170410160017_N_C_0096_0002.nc
W_XX-EUMETSAT-Darmstadt,IMG+SAT,MTI1+FCI-1C-RRAD-FDHSI-FD--CHK-BODY--L2P-NC4E_C_EUMT_20170410160525_GTT_DEV_20170410160017_20170410160025_N_C_0096_0003.nc
W_XX-EUMETSAT-Darmstadt,IMG+SAT,MTI1+FCI-1C-RRAD-FDHSI-FD--CHK-BODY--L2P-NC4E_C_EUMT_20170410160534_GTT_DEV_20170410160025_20170410160034_N_C_0096_0004.nc
W_XX-EUMETSAT-Darmstadt,IMG+SAT,MTI1+FCI-1C-RRAD-FDHSI-FD--CHK-BODY--L2P-NC4E_C_EUMT_20170410160542_GTT_DEV_20170410160034_20170410160042_N_C_0096_0005.nc
[...]
W_XX-EUMETSAT-Darmstadt,IMG+SAT,MTI1+FCI-1C-RRAD-FDHSI-FD--CHK-BODY--L2P-NC4E_C_EUMT_20170410161434_GTT_DEV_20170410160925_20170410160934_N_C_0096_0067.nc
W_XX-EUMETSAT-Darmstadt,IMG+SAT,MTI1+FCI-1C-RRAD-FDHSI-FD--CHK-BODY--L2P-NC4E_C_EUMT_20170410161442_GTT_DEV_20170410160934_20170410160942_N_C_0096_0068.nc
W_XX-EUMETSAT-Darmstadt,IMG+SAT,MTI1+FCI-1C-RRAD-FDHSI-FD--CHK-BODY--L2P-NC4E_C_EUMT_20170410161451_GTT_DEV_20170410160942_20170410160951_N_C_0096_0069.nc
W_XX-EUMETSAT-Darmstadt,IMG+SAT,MTI1+FCI-1C-RRAD-FDHSI-FD--CHK-BODY--L2P-NC4E_C_EUMT_20170410161500_GTT_DEV_20170410160951_20170410161000_N_C_0096_0070.nc
W_XX-EUMETSAT-Darmstadt,IMG+SAT,MTI1+FCI-1C-RRAD-FDHSI-FD--CHK-TRAIL--L2P-NC4E_C_EUMT_20170410161600_GTT_DEV_20170410160000_20170410161000_N_C_0096_0071.nc
```

APPENDIX B SHORT FORMAT DESCRIPTION

The data format could be intimidating due to its size and complexity. The CDL description (as provided by “ncdump -h file.nc”) contains 3069 lines, as it defines attributes, dimensions, variables, data types, and groups.

The following comments try to clarify the format:

- The most important variable is “effective_radiance”, located in the “/data/[channel]/measured” groups. Note that “[channel]” refers to one of the FDHSI channels, one of the 16 possibilities (“vis_04”, “vis_05”, etc.).
- Other relevant contributors to the size of the files are the “pixel_quality” and “index_map” variables. In this delivery, they both are set to “0”. They all are located in the “/data/[channel]/measured” groups.
- Both “effective_radiance” and “index_map” indicate pixels in deep space with the value NC_FILL_USHORT. “pixel_quality” does not make any difference between Earth or space pixels.
- The size of a FCI level 1C product before compression corresponds roughly to 5 bytes/pixel. The contribution from other variables and attributes is small.
 - effective_radiance: 2 bytes/pixel (unsigned short integer)
 - pixel_quality: 1 byte/pixel (byte)
 - index_map: 2 bytes/pixel (unsigned short integer)
- CharLS compression is applied to the three variables “effective_radiance”, “pixel_quality”, and “index_map”. No other variable is compressed.
- The size of a FCI level 1C product after compression, is approximately the size of the “effective_radiance” variable after compression. Both “pixel_quality” and “index_map” are extremely well compressed; their size after compression is 100-1000 times smaller than before compression. This is applicable to this delivered test data, and it is expected to be applicable to the real data as well.

APPENDIX C EXAMPLE IMAGE

This is the outcome after combining all chunks in a typical repeat cycle and generating the corresponding full disk product.

It corresponds to:

Date: 10th April 2017

Time: from 11:35 to 11:45 UTC (repeat cycle 70)

Channel: vis_04

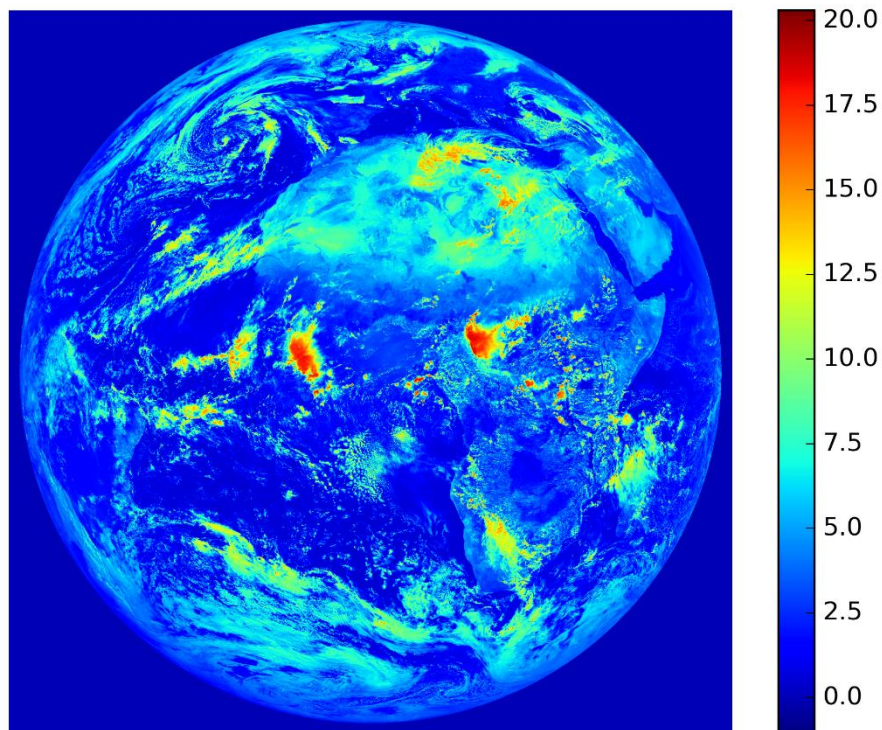


Figure 4: Full disk, FDHSI product, “vis_04” channel, 10th April 2017, midday.