MTG FCI L1 Product User Guide
[FCIL1PUG]
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## Document Change Record

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**Dimensions**

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**User Types**

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Appendix C

Appendix B

Appendix C
1 INTRODUCTION

1.1 Scope

This document is a User Guide for FCI Level 1C products.

This release is a preliminary version published to accompany the release of FCI Level 1c test data packages. Although the document represents our current best knowledge of the FCI instrument functionality and characteristics, data processing, and output format, it is likely that there will be evolutions in this knowledge in the years up to the launch of the first MTG Imaging platform which will lead to updates in future releases of this document.

In addition, some areas of the document are currently incomplete and these will be detailed and expanded in subsequent releases.

1.2 Acronyms and Definitions

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<th>Meaning</th>
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<td>AU</td>
<td>Astronomical Unit</td>
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<tr>
<td>CDL</td>
<td>Common Data Form Language</td>
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<td>FCI</td>
<td>Flexible Combined Imager</td>
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<tr>
<td>FD</td>
<td>Full Disc</td>
</tr>
<tr>
<td>FDHSI</td>
<td>Full Disc High Spectral Resolution Imagery</td>
</tr>
<tr>
<td>FDSS</td>
<td>Full Disc Scanning Service</td>
</tr>
<tr>
<td>HDF</td>
<td>Hierarchical Data Format</td>
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<td>IR</td>
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<td>Infrared Sounder</td>
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<td>LAC</td>
<td>Local Area Coverage</td>
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<td>LI</td>
<td>Lightning Imager</td>
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<td>MSG</td>
<td>Meteosat Second Generation</td>
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<td>MTG</td>
<td>Meteosat Third Generation</td>
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<tr>
<td>NcML</td>
<td>NetCDF Markup Language</td>
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<tr>
<td>NEdT</td>
<td>Noise Equivalent delta Temperature</td>
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<td>Network Common Data Format</td>
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<td>Repeat Cycle</td>
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<td>RSS</td>
<td>Rapid Scanning Service</td>
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<td>SEVIRI</td>
<td>Spinning Enhanced Visible and Infrared Imager</td>
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<td>SNR</td>
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<td>Spectral Response Function</td>
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<td>SSD</td>
<td>Spatial Sample Distance</td>
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<td>TAS</td>
<td>Thales Alenia Space</td>
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<td>UTC</td>
<td>Coordinated Universal Time</td>
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1.3 Applicable and Reference Documents

1.3.1 Applicable Documents

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1.4 Document Structure

The sections of this document present the following information:

Section 1 – An overview of the document.

Section Error! Reference source not found. – A brief introduction to the MTG programme, the MTG platform and the on-board instruments.

Section 3 – The Flexible Combined Imager (FCI) instrument hardware and functionality.

Section 4 – The core algorithms used to process data from the Level 0 data to Level 1c.

Section 5 – The characteristics of the Level 1c data including the use of reference grids, grouping of spectral channels, and use of quality indicators.

Section 6 – The file naming convention.

Section 7 – Characteristics of the netCDF dataset and the division of the product into chunks.

Section 8 – How to read and extract data from the FCI L1c netCDF files.

Appendix A – A detailed look at the netCDF formats including complete CDL descriptions.

Appendix B – Discussion of applicable netCDF standards and conventions

Appendix C – Identification of freely available tools for processing, manipulating or displaying these datasets.

1.5 Open Issues

1.5.1 Look Up Table Encoding Accuracy

The radiometric noise and precision look-up tables are made available in the trailer chunk (see Section 8.11). Radiance values are stored as encoded integers using the standard netCDF practise of applying a scale factor and offset as stored in the variable’s attributes, scaling_factor and add_offset, respectively. These same scale factor and offset are used to encode the radiance values for the look up tables to allow easier cross-referencing to radiance values. However, the noise and precision values are currently also encoded with the same scale facor and offset although these values are smaller than the radiance values. This results in a loss of accuracy due the quantisation effect of the scale facor when these values are encoded in the dataset. It is expected that using the same scale factor and offset does not bring significant ease-of-use advantages and that maintaining the accuracy of the data will be prioritised in the future release of the dataset.
1.5.2 Delivery of final Spectral Response Function
The Spectral Response Functions (SRF) given in Section 3.2.2 capture the best knowledge of
the MTG-I1 FCI at the date of December 2016. They were estimated from a combination of
theoretical modelling and measurements. The final characterized SRFs are likely to be slightly
different from this intermediate delivery. The details of how to provide the measured SRF
profiles needs to be added in a later issue of this document. An update is expected with the next
SCCDB delivery.

1.5.3 Delivery of CharLS decompression algorithm
A future version should address how the CharLS decompression algorithm will be provided to
the users.

1.5.4 Use of PyTroll to display FCI Level 1c data
Add a section about the usage of PyTroll to display FCI Level 1c data in Appendix C.

1.5.5 Delivery of NcML descriptions
A future version should address how the format description of the body and trailer files in the
NetCDF Markup Language (NcML) format (mentioned in Appendix A) are provided to the
users.

2 METEOSAT THIRD GENERATION (MTG)

2.1 The MTG Programme
The Meteosat Third Generation (MTG) programme provides meteorological imagery over
Europe and Africa and maintains continuity of the Meteosat programme, continuing and
expanding the service provide by Meteosat Second Generation (MSG).

2.2 The MTG Platform
MTG is a twin satellite concept based on 3-axis stabilised platforms. The twin satellites
comprise an imaging satellite, MTG-I, and a sounding satellite, MTG-S. Four imaging and two
sounding satellites are planned.

The MTG-I payload comprises:

1. The Flexible Combined Imager (FCI)
2. The Lightning Imager (LI)
3. The Data Collection System (DCS)
4. Search and Rescue (GEOSAR)

The MTG-S payload comprises:

1. The Infrared Sounder (IRS)
2. The Sentinel-4 Ultra-violet, Visible and Near-infrared Sounder (UVN)
3 FLEXIBLE COMBINED IMAGER (FCI)

3.1 The FCI Mission

The FCI will provide follow-on services to the Full Disc Scanning Service (FDSS) and Rapid Scanning Service (RSS) currently provided by the Meteosat Second Generation (MSG) Spinning Enhanced Visible and Infrared Imager (SEVIRI). Two imagery missions are defined that are combined in the FCI instrument design capabilities: The Full Disc Scanning Service (FDSS) provides samples in all of the 16 spectral channels at the nominal spatial resolution (1-2km) and the High Resolution Fast Imagery (HRFI) mission which measures at 4 out of the 16 channels with a better spatial resolution of 0.5-1km. The nominal operational mode is based on two imager satellites. One MTG-I satellite performs the full Earth-disc scanning in a 10 minutes repeat cycle and the second one covers the northern quarter of the full disc, i.e. LAC4_4 (Figure 1), over Europe in 2.5 minutes.

![Figure 1 FCI coverage nomenclature for the full disk (FDC) and the different Local Area Coverages (LAC)](image)

3.2 Instrument Characteristics

3.2.1 Spectral Channels

The FCI has channels over 16 spectral ranges covering visible to infrared wavelengths (Table I).

<table>
<thead>
<tr>
<th>Spectral Channel</th>
<th>Central Wavelength, $\lambda_0$</th>
<th>Spectral Width, $\Delta \lambda_0$</th>
<th>Spatial Sampling Distance (SSD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIS 0.4</td>
<td>0.444 $\mu$m</td>
<td>0.060 $\mu$m</td>
<td>1.0 km</td>
</tr>
<tr>
<td>VIS 0.5</td>
<td>0.510 $\mu$m</td>
<td>0.040 $\mu$m</td>
<td>1.0 km</td>
</tr>
<tr>
<td>VIS 0.6</td>
<td>0.640 $\mu$m</td>
<td>0.050 $\mu$m</td>
<td>1.0 km</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.5 km (HR)</td>
</tr>
<tr>
<td>Spectral Channel</td>
<td>Central Wavelength, $\lambda_0$</td>
<td>Spectral Width, $\Delta\lambda_0$</td>
<td>Spatial Sampling Distance (SSD)</td>
</tr>
<tr>
<td>------------------</td>
<td>---------------------------------</td>
<td>----------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>VIS 0.8</td>
<td>0.865 µm</td>
<td>0.050 µm</td>
<td>1.0 km</td>
</tr>
<tr>
<td>VIS 0.9</td>
<td>0.914 µm</td>
<td>0.020 µm</td>
<td>1.0 km</td>
</tr>
<tr>
<td>NIR 1.3</td>
<td>1.380 µm</td>
<td>0.030 µm</td>
<td>1.0 km</td>
</tr>
<tr>
<td>NIR 1.6</td>
<td>1.610 µm</td>
<td>0.050 µm</td>
<td>1.0 km</td>
</tr>
<tr>
<td>NIR 2.2</td>
<td>2.250 µm</td>
<td>0.050 µm</td>
<td>1.0 km</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.5 km (HR)</td>
</tr>
<tr>
<td>IR 3.8</td>
<td>3.800 µm</td>
<td>0.400 µm</td>
<td>2.0 km</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.0 km (HR)</td>
</tr>
<tr>
<td>WV 6.3</td>
<td>6.300 µm</td>
<td>1.000 µm</td>
<td>2.0 km</td>
</tr>
<tr>
<td>WV 7.3</td>
<td>7.350 µm</td>
<td>0.500 µm</td>
<td>2.0 km</td>
</tr>
<tr>
<td>IR 8.7</td>
<td>8.700 µm</td>
<td>0.400 µm</td>
<td>2.0 km</td>
</tr>
<tr>
<td>IR 9.7</td>
<td>9.660 µm</td>
<td>0.300 µm</td>
<td>2.0 km</td>
</tr>
<tr>
<td>IR 10.5</td>
<td>10.500 µm</td>
<td>0.700 µm</td>
<td>2.0 km</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.0 km (HR)</td>
</tr>
<tr>
<td>IR 12.3</td>
<td>12.300 µm</td>
<td>0.500 µm</td>
<td>2.0 km</td>
</tr>
<tr>
<td>IR 13.3</td>
<td>13.300 µm</td>
<td>0.600 µm</td>
<td>2.0 km</td>
</tr>
</tbody>
</table>

**Table 1 FCI Spectral Channel Spectral and Spatial Requirements.**
The spectral channels VIS 0.6, NIR 2.2, IR 3.8 and IR 10.5 are delivered in both FDHSI and HRFI spatial sampling configurations. The latter is indicated by (HR) in the table.
The FCI Spectral Channel Radiometric Requirements are given in Table 2.

<table>
<thead>
<tr>
<th>Spectral Channel</th>
<th>Min. Signal, $\alpha_{\text{min}}$</th>
<th>Max. Signal, $\alpha_{\text{max}}$</th>
<th>Ref. Signal, $\alpha_{\text{ref}}$</th>
<th>SNR</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIS 0.4</td>
<td>0.01</td>
<td>1.20</td>
<td>0.01</td>
<td>&gt;25</td>
</tr>
<tr>
<td>VIS 0.5</td>
<td>0.01</td>
<td>1.20</td>
<td>0.01</td>
<td>&gt;25</td>
</tr>
<tr>
<td>VIS 0.6</td>
<td>0.01</td>
<td>1.20</td>
<td>0.01</td>
<td>&gt;30</td>
</tr>
<tr>
<td>VIS 0.8</td>
<td>0.01</td>
<td>1.20</td>
<td>0.01</td>
<td>&gt;21</td>
</tr>
<tr>
<td>VIS 0.9</td>
<td>0.01</td>
<td>0.80</td>
<td>0.01</td>
<td>&gt;12</td>
</tr>
<tr>
<td>NIR 1.3</td>
<td>0.01</td>
<td>0.80</td>
<td>0.01</td>
<td>&gt;40</td>
</tr>
<tr>
<td>NIR 1.6</td>
<td>0.01</td>
<td>1.00</td>
<td>0.01</td>
<td>&gt;30</td>
</tr>
<tr>
<td>NIR 2.2</td>
<td>0.01</td>
<td>1.00</td>
<td>0.01</td>
<td>&gt;25</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Spectral Channel</th>
<th>Min. Signal, $T_{\text{min}}$</th>
<th>Max. Signal, $T_{\text{max}}$</th>
<th>Ref. Signal, $T_{\text{ref}}$</th>
<th>NEdT</th>
</tr>
</thead>
<tbody>
<tr>
<td>IR 3.8</td>
<td>200K</td>
<td>350K</td>
<td>300K</td>
<td>$&lt;$0.1K</td>
</tr>
<tr>
<td></td>
<td>350K</td>
<td>Fire range#2</td>
<td>350-Fire range#2</td>
<td>$&lt;$0.2K</td>
</tr>
<tr>
<td></td>
<td>&lt;1K</td>
<td>FIRE</td>
<td>FIRE</td>
<td>$&lt;$1K</td>
</tr>
<tr>
<td>WV 6.3</td>
<td>165K</td>
<td>270K</td>
<td>250K</td>
<td>$&lt;$0.3K</td>
</tr>
<tr>
<td>WV 7.3</td>
<td>165K</td>
<td>285K</td>
<td>250K</td>
<td>$&lt;$0.3K</td>
</tr>
<tr>
<td>IR 8.7</td>
<td>165K</td>
<td>330K</td>
<td>300K</td>
<td>$&lt;$0.1K</td>
</tr>
<tr>
<td>IR 9.7</td>
<td>165K</td>
<td>310K</td>
<td>250K</td>
<td>$&lt;$0.3K</td>
</tr>
<tr>
<td>IR 10.5</td>
<td>165K</td>
<td>340K</td>
<td>300K</td>
<td>$&lt;$0.1K</td>
</tr>
<tr>
<td></td>
<td>&lt;0.2K</td>
<td>HR</td>
<td>HR</td>
<td>$&lt;$0.2K</td>
</tr>
<tr>
<td>IR 12.3</td>
<td>165K</td>
<td>340K</td>
<td>300K</td>
<td>$&lt;$0.2K</td>
</tr>
<tr>
<td>IR 13.3</td>
<td>165K</td>
<td>300K</td>
<td>270K</td>
<td>$&lt;$0.2K</td>
</tr>
</tbody>
</table>

**Table 2 FCI Spectral Channel Radiometric Requirements**

Notes:
1. The channels VIS 0.6, NIR 2.2, IR 3.8 and IR 10.5 are delivered in FDHSI sampling and HRFI sampling configurations. The radiometric requirements for the HRFI sampling configuration are indicated by the superscript HR in the table.
2. For the IR 3.8 spectral channel the radiometric measurement range has been extended to the “Fire range” with reduced radiometric requirements for active fire monitoring indicated by the superscript FIRE in the table. The fire range is specified to meet the needs for a fire line of temperature 900K, at least 3 km in length and 30m in width on a back ground of 320K.
3. For the FCI, the value $\alpha$ represents the reflectance at the top of atmosphere (TOA) multiplied by the cosine of the solar zenith angle, i.e. $\alpha = \rho \cos(\theta_s)$ allowing minimum, maximum and reference signals in terms of spectral radiance at the top of atmosphere to be derived for the VNIR spectral channels.
4. Radiometric noise is provided as Signal to Noise Ratio (SNR) for Visible and Near Infrared (VNIR) spectral channels and Noise Equivalent delta Temperature (NEdT) for Infrared spectral channels.
3.2.2 Spectral Response Function (SRF)

Figure 2 shows the SRFs for each of the FCI spectral channels as obtained from a combination of theoretical modelling and measurements by industry. These plots do not represent the final SRFs which are still to be measured.

![Spectral Response Functions](image)

*Figure 2 Averaged FCI Spectral Response Functions of each spectral channel as a function of wavelength.*

3.2.3 Image Acquisition Principle
The FCI data is acquired by scanning the Earth across the detector arrays in an alternating east to west (E-W) and west to east (W-E) direction, with a south to north (S-N) movement between the alternating scans. The band of data collected in a single scan is referred to as a swath. The swaths are numbered from south to north starting from 1. The Earth full disk is imaged by 70 swaths in approximately 9 minutes and 30 seconds. Subsequently, the scan mirror is repositioned to the first acquisition position. This movement is called retrace. Due to the nature of the scan the level 1b swaths are inclined with respect to the level 1c grid, see Figure 3.

Each swath is 180 km wide (excluding the required overlap) and the time between points at either side of the swath boundary varies between 0 to 20 seconds maximum at the equator. The duration of a swath is approximately 3 seconds duration at the pole and 10 seconds at the equator. The spacecraft performs a yaw flip between summer and winter observation modes, which reverses the detector, but the scan pattern is programmed to remain almost the same no matter the yaw flip orientation.

![Figure 3 FCI Winter Full Disk Swath Pattern: The swaths are displayed as blue lines. The red circle indicates the Earth radius, i.e. deep space is observed at the beginning/end of each scan line.](image)

In nominal operational use, two coverage missions are defined: the full disk coverage (designated in the dataset name as FD) or quarter disk local area coverage (LAC) for Europe (designated as Q4). Each FD or Q4 dataset corresponds to a single FCI repeat cycle.
As noted previously, two imagery missions are defined that are combined in the FCI instrument design capabilities: the Full Disc High Spectral resolution Imagery (FDHSI) mission which has all 16 channels at a 1km SSD for visible and near-infrared channels and 2 km SSD for infrared channels, and the High spatial Resolution Fast Imagery (HRFI) mission which has 4 channels at high-resolution, namely VIS 0.6 and NIR 2.2 at 0.5km SSD and IR 3.8 and IR 10.5 at 1 km SSD.

### 3.2.4 Focal Plane Arrangement

[Information to be added in a later issue]

### 3.2.5 On-board Calibration Principle

Calibration activities are necessary to update some parameters needed for the Level 1 processing. Different methods are used for the VIS and NIR channels on one hand and the IR channels on the other hand. In-flight VIS/NIR calibration is done in two steps. Observations of the deep space at the end of each scan are used to update the offset calibration coefficients. Every six months during the 1.5 months of the equinox period the instrument looks at the sun (through a dedicated filter) to allow an update of the gain coefficients. The determination of the IR offset calibration coefficients is similar to the VIS/NIR one, i.e. using the deep space measurements during each swath. The IR gain calibration coefficients are determined during the retrace period between two consecutive repeat cycles through the measurement of an internal blackbody with known temperature which is inserted into the instrument’s optical path.

### 3.2.6 Detection Chain

[Information to be added in a later issue]
4 FCI LEVEL 1 PROCESSING ALGORITHMS

4.1 Overview

This Section will describe the core processing steps for generating FCI L1c datasets and detail the possible configurations for these steps.

[Information to be added in a later issue]

[Figure of overall processing to be added in a later issue]

Different data levels names are used to describe the conditions of the science data at various points in the data processing.

<table>
<thead>
<tr>
<th>Definition</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 0</td>
<td>Raw data</td>
</tr>
<tr>
<td>Level 1a</td>
<td>Level 0 science data in counts after removal from the packets, whilst maintaining the spatio-temporal sequencing of the data</td>
</tr>
<tr>
<td>Level 1b</td>
<td>Level 1a science data radiometrically calibrated and geolocated</td>
</tr>
<tr>
<td>Level 1c</td>
<td>Level 1b science data rectified to a reference grid</td>
</tr>
</tbody>
</table>
| Level 2    | Level 1b or Level 1c science data converted to geophysical values (temperature, humidity, radiative flux…)

4.2 Level 0 to Level 1a Processing

[Information to be added in a later issue]

4.3 Level 1a to Level 1b Processing

[Information to be added in a later issue]

4.4 Level 1b to Level 1c Processing

[Information to be added in a later issue]
4.5 Stray-Light Correction

[Information to be added in a later issue]

4.6 INR

[Information to be added in a later issue]

4.7 GSICS

[Information to be added in a later issue]
5 CHARACTERISTICS OF THE LEVEL 1C REGISTERED RADIANCE DATASET

5.1 Row and Column Numbering

A row is defined as a line of spatial samples or pixels running in a (nominal) East to West and West to East direction. The rows are numbered from the south to north starting from 1.

Figure 4: Illustration of row numbering within a swath used for Level 1b data.

Figure 5: Illustration of row numbering within a Level 1c rectified image.
A column is defined a line of *spatial samples* or *pixels* running in a (nominal) South to North direction. The columns are numbered from the west to east starting from 1.

*Figure 6: Illustration of column numbering within a swath used for Level 1b data.*

*Figure 7: Illustration of column numbering within a Level 1c rectified image*
5.2 Level 1c Reference Grid

The reference grid defines the geo-referenced position of the image pixel centroids at level 1c in a normalized geostationary projection. The normalized geostationary projection describes the view from a virtual satellite to an idealized Earth. The virtual satellite is in a geostationary orbit, perfectly located in the Equator plane at the given longitude, $\lambda_D$ (normally 0 deg). This point on the equator is the origin of the projection. The distance between virtual satellite and centre of Earth (the geostationary radius) is given by the geostationary altitude above the surface and the equatorial radius of the Earth’s reference ellipsoid. The level 1c Reference Grid steps are equiangular both in the virtual satellite azimuth and elevation and equal to the spatial sampling angle of the considered channel. The corresponding projected distance at the sub-satellite point is the spatial sampling distance (SSD).

![Diagram illustrating the spatial coordination of the three L1c reference grids, starting with the SW corner origin](image-url)
Figure 8 illustrates how the reference grids for the 3 SSD values are aligned, with the origin pixel at position (1,1) located in the SW corner. Information to generate the FDSS reference grid in the GEOS “Normalized Geostationary Projection” is provided in the dataset, but not the co-ordinates of the points (Section 8.1). Other reduced scans (e.g. for RSS) are defined as fixed subsets of the FDSS grid. Additional information about the Meteosat grids is provided in [Meteosat-Grids].

The normalized geostationary projection defines the line of sight of each pixel centre $P$ as a vector representing the view from the virtual satellite. This vector is expressed as a function of the two angles elevation ($\phi_S$) and azimuth ($\lambda_S$) and defined as follows:

$$\lambda_S = \arctan \left( \frac{r_2}{r_1} \right)$$

$$\phi_S = \arcsin \left( \frac{r_3}{\sqrt{r_1^2 + r_2^2 + r_3^2}} \right)$$

**Figure 9: Angular Definition of the Reference Grid**

Figure 9 shows the angular definition of the reference grid where:

1. the frame $(s1,s2,s3)$ has its origin at the satellite position, $(s3)$ points northwards, and $(s1)$ directs to the centre of the Earth
2. the vector $r$ of coordinates $(r_1, r_2, r_3)$ in the frame $(s1,s2,s3)$ is a pixel line of sight vector with $r = XP/norm(XP)$
In order to geolocate the radiances, the user must first calculate the corresponding azimuth, elevation coordinate for each row and column pixel, and then calculate the corresponding latitude, longitude coordinate from the azimuth, elevation information.

Let \((r,c)\) be the coordinates (row and column) of any pixel of the L1c image. Row and columns are counted increasingly when going from bottom to up (south to north) and left to right (west to east) and beginning at 1. Therefore, the South-West corner of a L1c image has coordinates \((1,1)\). For each channel, the correspondence between the row and column position \((r,c)\) and the azimuth and elevation position \((\lambda, \phi)\) of the pixel centre is written:

\[
\begin{align*}
\lambda &= \lambda_0 - (c - 1) \cdot \text{Azimuth\_Grid\_Sampling} \\
\phi &= \phi_0 + (r - 1) \cdot \text{Elevation\_Grid\_Sampling}
\end{align*}
\]

where:

1. Azimuth\_Grid\_Sampling and Elevation\_Grid\_Sampling are the reference grid spatial sampling angles, representing viewing angle increments between pixels in the W-E and S-N directions, respectively. The corresponding values are given in Table 3.

2. \(\lambda_0\) and \(\phi_0\) are the angles from the centre of the projection to the centre of the pixel in the first row and first column of the reference grid, respectively. Note that the first row, column of the reference grid is indexed \((1,1)\) (Figure 8). The values correspond to Azimuth\_Grid\_Sampling * (columns –1)/2 or Elevation\_Grid\_Sampling * (rows – 1)/2, respectively, and are given in Table 3, too.

Note that the E-W viewing angle \((\lambda_0)\) does not correspond to the standard definition of azimuth, for an observation from the instrument perspective, which runs from negative to positive from West to East. Instead, it runs from negative to positive from East to West.

The N-S viewing angle corresponds to the standard definition of elevation, for an observation from the instrument perspective.

<table>
<thead>
<tr>
<th>SSD (km)</th>
<th>(\lambda_0)</th>
<th>(\phi_0)</th>
<th>Grid Sampling</th>
<th>Columns in Full Disk</th>
<th>Rows in Full Disk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>degrees</td>
<td>radians</td>
<td>degrees</td>
<td>radians</td>
<td></td>
</tr>
<tr>
<td>0.5</td>
<td>8.9142405037</td>
<td>-0.1555828471</td>
<td>-8.9142405037</td>
<td>-0.1555828471</td>
<td>0.000860524494</td>
</tr>
<tr>
<td>1</td>
<td>8.9138402398</td>
<td>-0.1555758612</td>
<td>-8.9138402398</td>
<td>-0.1555758612</td>
<td>0.001601048988</td>
</tr>
<tr>
<td>2</td>
<td>8.9130397083</td>
<td>-0.1555618893</td>
<td>-8.9130397083</td>
<td>-0.1555618893</td>
<td>0.003202097973</td>
</tr>
</tbody>
</table>

**Table 3 Values per SSD for the three corresponding reference grids used for FCI L1c**

With these values, the coordinates of the Earth centre (origin of the projection) in the Full Disk image are \((11136.5, 11136.5)\), \((5568.5, 5568.5)\) and \((2784.5, 2784.5)\) for the 0.5, 1, and 2 km channels, respectively.

The following definitions are currently envisaged (this may evolve in the future) for the L1c LAC products (the row numbers correspond to the full disk row numbering):
Table 4 Offset positions and extents of the 4 LAC coverage areas (cf. Figure 1) in the 3 full disk reference grids

The Level 1c LACs cover the full West-East range, i.e. all of the Full Disk columns.

5.3 Normalized Geostationary Projection

The transformation from satellite viewing angles ($\lambda_s$, $\phi_s$) to geographical coordinates (lon, lat) is given by the inverse projection function:

$$\begin{pmatrix} \text{lon} \\ \text{lat} \end{pmatrix} = \begin{pmatrix} \arctan\left(\frac{S_2}{S_1}\right) + \lambda_D \\ \arctan\left(\frac{S_3}{S_{xy}}\right) \end{pmatrix}$$

where:

$$S_1 = h - s_n \cdot \cos(\lambda_s) \cdot \cos(\phi_s)$$

$$S_2 = -s_n \cdot \sin(\lambda_s) \cdot \cos(\phi_s)$$

$$S_3 = s_n \cdot \sin(\phi_s)$$

$$S_4 = \frac{r_{eq}^2}{r_{pol}^2}$$

$$S_5 = \left(h^2 - r_{eq}^2\right)$$

$$S_{xy} = \sqrt{s_1^2 + s_2^2}$$

$$s_n = \frac{h \cdot \cos(\lambda_s) \cdot \cos(\phi_s) - s_d}{\cos^2(\phi_s) + S_4 \cdot \sin^2(\phi_s)}$$

$$s_d = \sqrt{(h \cdot \cos(\lambda_s) \cdot \cos(\phi_s))^2 - (\cos^2(\phi_s) + S_4 \cdot \sin^2(\phi_s)) \cdot S_5}$$
The shape of the Earth is described by an oblate ellipsoid with a single flattening parameter \( f \)

\[
f = \frac{r_{eq} - r_{pol}}{r_{eq}}
\]

where \( r_{eq} \) and \( r_{pol} \) denote the equatorial and polar radius of the Earth, respectively. The appropriate values for the Earth are \( f = 1/298.257223563 \) and \( r_{eq} = 6378.137 \) km. The parameter \( h \) in the equations above refers to the geostationary radius. The geostationary radius is the distance from the Earth’s centre to the satellite in geostationary orbit and can be calculated from the sum of the geostationary altitude (35786.4 km) and the equatorial Earth radius \( r_{eq} \).

### 5.4 Spectral Channels

The FCI instrument consists of 16 imaging spectral channels ranging from 0.4 \( \mu \)m to 13.3 \( \mu \)m plus an additional Fire Application channel at 3.8 \( \mu \)m (FAIR3.8) with an extended dynamic range dedicated to fire monitoring. Section Error! Reference source not found. summaries the main characteristics of the FCI spectral channels.

### 5.5 Repeat Cycle Coverage and Duration

### 5.6 Timeliness and Availability

### 5.7 Image Size and Masking

A masking algorithm is applied during the processing. The masks are set such that they give a radiance measurement within the same extent on Earth, for all channels, on the level 1c grid. Operationally, this extent is always covered by the Level 1c data if the spacecraft orbit and pointing are within their tolerances. The user will therefore expect to have a radiance measurement everywhere in the un-masked area all the time, i.e. from one repeat cycle to the next. An exception being that the orbit longitude or maximum inclination is changed but in that case the masks will be regenerated.

### 5.8 Radiometric Quality

### 5.9 Geometric Quality

### 5.10 Restricted Operations

Restricted operations do not have any consequences on the product format itself. More details about restricted operations will be added in a later issue.
6 NAMING CONVENTION

All MTG Level 1 products have a WMO-compatible name, following the WMO file naming convention [WMO-386] (cf Attachment II-15 p25 2009 edition)

The filename will consist of the dataset (or product) name with a file_type and a compression field:

(dataset_name) . (file_type) (compression)

Where:

**dataset_name** is composed of the following fields, separated by underscore symbols, “_”:

(pflag)_(productidentifier)_ (oflag)(originator)_(yyyyMMddhhmmss)_(freeformat)

**productidentifier** is composed of the following fields, separated by commas:

(locationindicator),(datadesignator),(freedescription)

**freedescription** is composed of the following fields with plus symbol or dash symbol separators:

(spacecraftid)-(data_source)_ -(processing_level)_ -(type)_ -(subtype)_ -(coverage)_ -(subsetting)_ -(component1) -(component2) -(component3) -(purpose) -(format)

**freeformat** is composed of the following fields, separated by underscore symbols, “_”:

(facility_or_tool)_(environment)_(start_time)_(end_time)_
(processing_mode)_(special_compression)_(disposition_mode)_
(repeat_cycle_in_day)_(count_in_repeat_cycle)

The order of the fields is mandatory.

**NOTE: If there is no relevant value within the freeformat section, the field is left out. This can lead to the allowable repetition of underscores.**

The following table shows the fully expanded set of name fields in the correct order, with values described for FCI L1c datasets. Following the main table, subsequent subsections describes the allowed values for the selected fields in greater detail. Where a field has “no value” as a setting this implies no character is present in the file name.

<table>
<thead>
<tr>
<th>Name Field</th>
<th>Description</th>
<th>FCI-1C-RAD Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>pflag</td>
<td>WMO mandated</td>
<td>“W”</td>
</tr>
<tr>
<td>locationindicator</td>
<td>WMO mandated</td>
<td>“XX-EUMETSAT-Darmstadt”</td>
</tr>
<tr>
<td>datadesignator</td>
<td>The type of data with respect to the categories and subcategories defined in [WMO-386],</td>
<td>“IMG+SAT”</td>
</tr>
<tr>
<td>Name Field</td>
<td>Description</td>
<td>FCI-1C-RAD Values</td>
</tr>
<tr>
<td>---------------</td>
<td>------------------------------------------------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>spacecraftid</td>
<td>Spacecraft indicator</td>
<td>“MTIn” for MTG Imager n where n = 1, 2, 3 or 4</td>
</tr>
<tr>
<td>data_source</td>
<td>Instrument, platform or SAF</td>
<td>“FCI”</td>
</tr>
<tr>
<td>processing_level</td>
<td>Processing Level</td>
<td>“1C”</td>
</tr>
<tr>
<td>type</td>
<td>Identifies the type of data</td>
<td>“RRAD” for rectified radiances</td>
</tr>
<tr>
<td>subtype</td>
<td>Identifies a sub-type for the type.</td>
<td>“FDHSI” for FDHSI data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“HRFI” for HRFI data</td>
</tr>
<tr>
<td>coverage</td>
<td>Coverage of the full accumulation interval</td>
<td>“FD” for full disk, “Q4” for LAC4</td>
</tr>
<tr>
<td>subsetting</td>
<td>Identification of the type of subsetting performed</td>
<td>No value</td>
</tr>
<tr>
<td>component1</td>
<td>Identifies a first level component of the product</td>
<td>“CHK” for chunk</td>
</tr>
<tr>
<td>component2</td>
<td>Identifies a second level component of the product</td>
<td>“BODY” for a body chunk</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“TRAIL” for a trailer chunk</td>
</tr>
<tr>
<td>component3</td>
<td>Identifies a third level component of the product</td>
<td>No Value</td>
</tr>
<tr>
<td>purpose</td>
<td>The intended purpose of the dataset. This normally refers to the intended final recipient.</td>
<td>“DIS” for a dissemination dataset (has CharLS compression)</td>
</tr>
<tr>
<td>format</td>
<td>The intended encoding format of the dataset.</td>
<td>“NC4E” for netCDF-4 enhanced model</td>
</tr>
<tr>
<td>oflag</td>
<td>WMO mandated</td>
<td>“C”</td>
</tr>
<tr>
<td>originator</td>
<td>WMO mandated</td>
<td>“EUMT”</td>
</tr>
<tr>
<td>yyyyMMDdhhmmss</td>
<td>Is the UTC time of the processing, defined as the time of the formatting of the dataset/product by the processor [TBC-EUMETSAT], formatted in Abbreviated Generalised Time format e.g. yyyy = year MM = month dd = day of month hh = hour of day mm = minute of hour ss = second of minute</td>
<td>“IDPFI” = Instrument Data Processing Facility for MTG-I “GTT” = Generic Test Tool</td>
</tr>
<tr>
<td>facility_or_tool</td>
<td>Facility or tool producing the dataset</td>
<td>“OPE” - Operational</td>
</tr>
<tr>
<td>environment</td>
<td>Ground Segment Environment producing the dataset</td>
<td></td>
</tr>
<tr>
<td>start_time</td>
<td>UTC Time of start of Sensing Data formatted in Abbreviated Generalised Time format (see above).</td>
<td>For the body chunk, this will be the time of the first measurement in the chunk. For a trailer chunk this is the start time of the first body chunk in the repeat cycle.</td>
</tr>
<tr>
<td>end_time</td>
<td>UTC Time of end of Sensing Data formatted in Abbreviated Generalised Time format (see above).</td>
<td>For the body chunk, this will be the time of the last measurement in the chunk. For a trailer chunk this is the end time of the last body chunk in the repeat cycle.</td>
</tr>
<tr>
<td>processing_mode</td>
<td>Identification of the mode of processing</td>
<td>“N” = nominal</td>
</tr>
<tr>
<td>Name Field</td>
<td>Description</td>
<td>FCI-1C-RAD Values</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>special_compression</td>
<td>This field provides identification of a special compression technique that has been applied to one or more variables in the dataset. Special compression does not include the standard netCDF data compression or “deflation” using in-built zlib support which is transparent to the user.</td>
<td>“JLS” = JPEG-LS. Lossless JPEG compression has been applied internally. No Value – no special compression</td>
</tr>
<tr>
<td>disposition_mode</td>
<td>Shows disposition of the dataset from the perspective of an end-user’s needs.</td>
<td>“O” = operational “T” = testing</td>
</tr>
<tr>
<td>repeat_cycle_in_day</td>
<td>4-digit number (right-justified, zero-filled) indicating the expected current repeat cycle or group accumulation interval in the day for this particular dataset. The counter starts at 0001 for the first repeat cycle at or after midnight and resets for the next repeat cycle at or after the following midnight.</td>
<td>Variable</td>
</tr>
<tr>
<td>count_in_repeat_cycle</td>
<td>4-digit number (right-justified, zero-filled) indicating the expected count value of the dataset chunk in the repeat cycle. The counter will have discontinuities when chunks are not produced. The counter starts from 1 and resets when the repeat_cycle_in_day value changes. The counter increments for each chunk in a repeat cycle or accumulation interval (whether header, body or trailer). A value of 0 is used for datasets for which the counter is not applicable (e.g. datasets which are not chunk-able).</td>
<td>Variable</td>
</tr>
<tr>
<td>file_type</td>
<td>Indicator of the encoding format of the data, according to WMO conventions.</td>
<td>“.nc” – netCDF</td>
</tr>
<tr>
<td>compression</td>
<td>Indicator of compression applied to the dataset as a whole according to WMO conventions (as opposed to the internal compression of variable indicated by the “special_compression” name field).</td>
<td>No value</td>
</tr>
</tbody>
</table>

*Table 5 Breakdown of the fields in the FCI L1c dataset naming convention*
7 STRUCTURE AND PRESENTATION OF THE LEVEL 1C REGISTERED RADIANCE DATASETS

7.1 Overview

An FCI Level 1c rectified radiance dataset consists of a set of files that contain the level 1c science data rectified to a reference grid together with the auxiliary data associated with the processing configuration and the quality assessment of the dataset. The FCI L1c datasets are netCDF-4 files and use the enhanced data model. More details on the netCDF-format are given in Appendix B.

7.2 Coverage Mission and Imagery Mission Datasets

A format ID defined as

```
<Data_Source>-<Processing_Level>-<Type>-<Subtype>-<Component1>-<Component2>-<Format>
```

is used to identify the different datasets (Table 6). All datasets will have the same format specification as below.

<table>
<thead>
<tr>
<th>Format ID</th>
<th>#/RC</th>
</tr>
</thead>
<tbody>
<tr>
<td>FCI-1C-RRAD-FDHSI-CHK-BODY-NC4E</td>
<td>multiple</td>
</tr>
<tr>
<td>FCI-1C-RRAD-FDHSI-CHK-TRAIL-NC4E</td>
<td>1</td>
</tr>
<tr>
<td>FCI-1C-RRAD-HRFI-CHK-BODY-NC4E</td>
<td>multiple</td>
</tr>
<tr>
<td>FCI-1C-RRAD-HRFI-CHK-TRAIL-NC4E</td>
<td>1</td>
</tr>
</tbody>
</table>

*Table 6 FCI Level 1c datasets for routine operations*

7.3 Format

7.3.1 Data Chunks

An FCI-1C-RRAD dataset covers the full repeat cycle and is divided into a series individual files or “chunks” for timely dissemination. These same chunks are sent to the Archive for storage and can be retrieved in this form. The main bulk of the dataset are a series of body chunks that contain the observational data for the repeat cycle. There is also a trailer chunk that contains information applicable to or derived from the complete repeat cycle.

The division of the dataset in this way provides benefits for timely and efficient transfer rates for near real-time dissemination. It also provides a rapid method for retrieving geographically subsetted data from the archive by returning only those chunks that intersect the region of interest.
The body chunks correspond approximately to the size of a FCI swath. Each body chunk will contain about the same number of rows from the reference grid, but the time duration will vary from 4 to 10 seconds in line with the varying duration of the swaths. This will produce circa 40 body chunks for a full disk repeat cycle and up to 13 body chunks for a LAC4 repeat cycle.

Note: Level 1b swaths appear tilted when projected onto the reference grid due to the fan shaped scan pattern and may contribute to a number of level 1c body chunks (see Figure 3).

7.4 FCI L1c Rectified Radiance (FCI-1C-RRAD) Dataset

The FCI Level 1c rectified radiance dataset contains the level 1c science data together with the auxiliary data associated with the processing configuration and the quality assessment of the dataset.

The dataset is represented by different format IDs that can be found as a string in the filename as described in Table 5:

FCI-1C-RRAD-FDHSI-CHK-BODY-NC4E  
FCI-1C-RRAD-HRFI-CHK-BODY-NC4E  
The Level 1c full repeat cycle science data, for the FDHSI or HRFI spectral channels, is divided into a number of L1c body data chunks for dissemination and storage in the data archive. The division of the dataset in this way provides benefits for timely and efficient transfer rates to other environments and for geographically subset retrieval from the archive. See Section 7.5 for details.

FCI-1C-RRAD-FDHSI-CHK-TRAIL-NC4E  
FCI-1C-RRAD-HRFI-CHK-TRAIL-NC4E  
The Level 1c trailer, for the FDHSI or HRFI spectral channels, is used to contain information that is calculated at the end of the repeat cycle, e.g. repeat cycle quality metrics, and information that help in the interpretation of the data but would present too large an overhead if transmitted for every L1c Body data chunk, e.g. radiometric noise estimates. See Section 7.10 for details.
7.5 FCI-1C-RRAD Body Chunk

The groups available, to the FDHSI and HRFI subtypes, in the FCI level 1c Body data chunk are given in Table 7, with the nesting applied given in Figure 10.

![Diagram of netCDF groups in the FCI L1c body chunk file for an FDHSI dataset](image)

*Figure 10 Overview of netCDF groups in the FCI L1c body chunk file for an FDHSI dataset*
7.6 Group Overview

<table>
<thead>
<tr>
<th>Group Type</th>
<th>netCDF Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generic Type</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>root</td>
<td>Root level metadata</td>
<td></td>
</tr>
<tr>
<td>data</td>
<td>Information common to all channels</td>
<td></td>
</tr>
<tr>
<td>“channel” groups</td>
<td>FDHSI</td>
<td>All “channel” groups share a common generic format and contain information specific to that channel. FDHSI channel groups are found in the FDHSI dataset.</td>
</tr>
<tr>
<td></td>
<td>vis_04</td>
<td></td>
</tr>
<tr>
<td></td>
<td>vis_05</td>
<td></td>
</tr>
<tr>
<td></td>
<td>vis_06</td>
<td></td>
</tr>
<tr>
<td></td>
<td>vis_08</td>
<td></td>
</tr>
<tr>
<td></td>
<td>vis_09</td>
<td></td>
</tr>
<tr>
<td></td>
<td>nir_13</td>
<td></td>
</tr>
<tr>
<td></td>
<td>nir_16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>nir_22</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ir_38</td>
<td></td>
</tr>
<tr>
<td></td>
<td>wv_63</td>
<td></td>
</tr>
<tr>
<td></td>
<td>wv_73</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ir_87</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ir_97</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ir_105</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ir_123</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ir_133</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HRFI</td>
<td>HRFI channel groups are found in the HRFI dataset.</td>
</tr>
<tr>
<td></td>
<td>vis_06_hr</td>
<td></td>
</tr>
<tr>
<td></td>
<td>nir_22_hr</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ir_38_hr</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ir_105_hr</td>
<td></td>
</tr>
<tr>
<td></td>
<td>swath</td>
<td>Swath information</td>
</tr>
<tr>
<td></td>
<td>measured</td>
<td>Measured radiances</td>
</tr>
<tr>
<td></td>
<td>quality_channel</td>
<td>Associated quality information specific to a channel</td>
</tr>
<tr>
<td></td>
<td>state</td>
<td>State information</td>
</tr>
<tr>
<td></td>
<td>platform</td>
<td>Satellite state information</td>
</tr>
<tr>
<td></td>
<td>instrument</td>
<td>Instrument state information</td>
</tr>
<tr>
<td></td>
<td>processor</td>
<td>Processor state information</td>
</tr>
<tr>
<td></td>
<td>celestial</td>
<td>Celestial state information</td>
</tr>
</tbody>
</table>

Table 7 Description of the groups in an FCI L1c body chunk

7.7 Channel Subsetting

Channel subsetting may be achieved by selecting which channel groups are delivered in the dataset. As each channel group contains only information specific to that channel, they may be removed from the dataset without affecting its integrity.
7.8 Swath Information

Dependent upon the rectification method used, a given Level 1c grid pixel may have contributions from a number of Level 1b samples. However, the overlapping nature of the swaths allows the processing to ensure that a given pixel in the Level 1c dataset only has contributions from level 1b samples from a single swath. In order to preserve the related to the time at which a pixel’s data has been derived a “swath” group for each providing the ideal location of the swath boundary and the direction in which the swath scanned is included within the FCI level 1c data. Within the swath group the variable swath_boundary indicates which swath has contributed to a given pixel by recording the northernmost row per column of the last pixel in this chunk to have been created from a particular swath. The column number takes the valid_range of 1 to number_of_columns.

Figure 11 the northernmost pixels in the level 1c data constructed from samples from swaths are indicated by dashed blue boxes, thus the row indexing associated with the swath_boundary is as given in Table 8.

The number of the row and column are such that:
1. The column and row refer to the position in the level 1c reference grid, thus the position relative to the data chunk for a swath_boundary value is given by [EQ01].

\[
\text{row\_chunk}(a,b) = \frac{\text{data.<channel>.swath.swath\_boundary}(a,b) - \text{data.<channel>.measured.start\_position\_row}}{1}
\]  

[EQ01]
column_chunk(a,b) = b - data.<channel>.measured.start_position_column + 1

Where

row_chunk and column_chunk are the indices (not appearing in the dataset) in the chunk data array giving the location of the swath boundary (starting at 1,1)

a is the swath number
b is the column number in the swath_boundary array (running from 1 to number_of_columns)

2. For pixels where the swath boundary lies outside of the area of data to be generated given by the mask the swath_boundary is set to _FillValue.
3. For swaths lying completely within the masked out region of the data then no swath boundary information is generated.

Figure 11 Swath boundary (dashed lines) appearing in the level 1c grid indicated by the horizontal and vertical solid lines. Note that the swath edge can take a positive or negative slope when projected in the level 1c grid.

<table>
<thead>
<tr>
<th>Column</th>
<th>Row</th>
</tr>
</thead>
<tbody>
<tr>
<td>i</td>
<td>j+3</td>
</tr>
</tbody>
</table>
Table 8 Values of swath_boundary for the example

The swath_boundary for the lowermost and uppermost swaths contributing to the FCI level 1c body data chunk may run outside the coverage area contained in the chunk when moving from west to east or east to west. The means of identifying the values for swath_boundary for the upper and lower swath boundaries are illustrated in Figure 12. The following cases are considered:

a) For a given chunk, where a swath_boundary occurs North of the northernmost row in the chunk, its value is ceiled to the index of this northernmost row in the chunk (i.e. data.<channel>.measured.end_position_row). See Figure 12 (top panel).

b) For a given chunk, where a swath_boundary occurs South of the southernmost row in the chunk, its value is set to _FillValue See Figure 12 (centre panel).

c) In the case of the full dataset the two sets of swath_boundary information given with chunk n and n+1 for the boundary between swaths s to s+1 needs to be combined to create a single set of values. This information is not provided in the trailer and if needed can be reconstructed by the user.

Recorded with the swath_boundary in the “data” group is the parameter swath_direction indicating the direction of the scan mirror movement during the swath data acquisition.
In instances where a packet of data is missing from the telemetry downlinked from the satellite an area of effective_radiance values will be generated that are set to the_FillValue. In areas
where there is a swath overlap with the next/previous swath, and in case the next/previous swath data is not missing, the missing data will be replaced with data measured from the next/previous swath, as illustrated in Figure 13.

![Figure 13 Swath boundary appearing in the level 1e grid including filling of missing data](image)

**7.8.1 Index Mapping**

Within the “measurement” group for each channel an array, the *index_map*, is introduced in which an index is recorded per pixel. The index represents an integer number of time intervals from the start of the repeat cycle. The default time interval is 0.1s, but can be modified within the range 0.01 to 1s.

A collection of geometric parameters is included within the data and is applicable to all channel data groups. The geometric parameters are `data.swath_direction`, `data.swath_number`, `time` (of acquisition), `state.platform.subsatellite_latitude`, `state.platform.subsatellite_longitude`, `state.platform.platform_altitude` (of the satellite), `state.celestial.subsolar_latitude`, `state.celestial.subsolar_longitude` and `state.celestial.earth_sun_distance`. They all have the dimension index. The geometric parameters are calculated for each of the time intervals covered during the repeat cycle. Using the index value from the *index_map* for a particular pixel the geometrical parameters applicable at the time of acquisition of that pixel can be
established, as indicated in Figure 14. The values of `data.swath_number` and `data.swath_direction` are taken from the reference scan law. During u-turns and retrace `data.swath_direction` is set to _FillValue. Attention is paid to ensure no _FillValue index is referenced by an Earth pixel in the `index_map`, except in the case of missing data.

![Pixel index mapping relationship to the geometric parameters table](image)

**Figure 14** Pixel index mapping relationship to the geometric parameters table

### 7.8.2 Radiance Encoding

The “measured” group includes the level 1c science data. The 12 (resp. 13 for IR3.8) bits of the netCDF 16-bit integer are used to encode and compress the effective radiance for all spectral channels except the IR 3.8 channel. Attributes `scale_factor` and `add_offset` are used to rescale the 12-bit counts to an effective radiance in units of $\text{mWm}^{-2}\text{sr}^{-1}(\text{cm}^{-1})^{-1}$:

$$\text{radiance} = (\text{counts} \times \text{scale_factor}) + \text{add_offset}$$

The attributes `scale_factor` and `add_offset` are standard for netCDF files. If present for a variable, `add_offset` is to be added to the data after it is read by the application that accesses the data. If both `scale_factor` and `add_offset` attributes are present, the data are first scaled before the offset is added.

The IR 3.8 channel is a special case. Instead of 12 bit as for the other spectral channels, 13 bit are used to store the data. For IR3.8 the additional attributes `valid_cold_range`,...
warm_scale_factor and warm_add_offset are used to encode and compress the counts above $2^{12}$ (4096) to cover the extended radiometric range. For counts below 4096, the same conversion as for the other channels is used (Figure 15).

$$\text{radiance} = (\text{counts} \times \text{scale\_factor}) + \text{add\_offset} \quad \text{for counts below or equal to 4096}$$

$$\text{radiance} = (\text{counts} \times \text{warm\_scale\_factor}) + \text{warm\_add\_offset} \quad \text{for counts above 4096}$$

*Figure 15 Illustration of the encoding of the combined IR 3.8m channel with offsets and scale factors for the “cold” (green) and “warm” (red) measurements*

_FillValue_ will be used for data that cannot be produced due to missing level 0 data. The conversion from effective radiance into brightness temperatures and reflectances is described in Sections 8.4 and 8.5, respectively.

### 7.8.3 Pixel Quality

An 8 bit _pixel_quality_ variable, associated with each effective_radiance, is provided in the measurement group. The possible values are given in Table 9.

<table>
<thead>
<tr>
<th>Bit</th>
<th>Name</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>missing_warning</td>
<td>Pixel has a contribution from missing samples following rectification.</td>
</tr>
<tr>
<td>1</td>
<td>radiometric_warning</td>
<td>Pixel may have radiometric errors due to a contribution from samples with radiometric errors following rectification.</td>
</tr>
</tbody>
</table>
Radiometric errors in this sense arise from calibration processes occurring during the repeat cycle that do not impact the calibration of the complete repeat cycle.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>noise_warning</td>
</tr>
<tr>
<td></td>
<td>Pixel may be noisy (have a non-nominal noise level) due to a contribution from noisy samples following rectification.</td>
</tr>
<tr>
<td>3</td>
<td>geolocation_warning</td>
</tr>
<tr>
<td></td>
<td>Pixel may not have a very accurate geolocation since missing geometric data have been interpolated to compute it.</td>
</tr>
<tr>
<td>4</td>
<td>saturation_warning</td>
</tr>
<tr>
<td></td>
<td>Pixel has a contribution from saturated samples following rectification.</td>
</tr>
<tr>
<td>5</td>
<td>straylight_correction_warning</td>
</tr>
<tr>
<td></td>
<td>Pixel has a contribution from samples corrected for solar stray light contamination</td>
</tr>
<tr>
<td>6</td>
<td>extended_dynamic_range_warning</td>
</tr>
<tr>
<td></td>
<td>For the IR3.8 channel only: Pixel has a contribution from samples selected from the FAIR3.8 detector measurements (cf. Section 5.4)</td>
</tr>
<tr>
<td>7</td>
<td>encoding_saturation_warning</td>
</tr>
<tr>
<td></td>
<td>Pixel is saturated from the process of encoding into 12-bits (13-bits for FAIR3.8).</td>
</tr>
</tbody>
</table>

**Table 9 Description of the quality flags in the pixel_quality variable**

### 7.9 Special Compression

In order to reduce the size of the FCI-1C-RRAD dataset, a compression is applied by default to the variables `effective_radiance`, `pixel_quality` and `index_map`. In order to achieve greater compression than allowed by the default netCDF zipping algorithms, disseminated L1c datasets will use lossless Jpeg compression implemented at the HDF layer. Once the relevant decompression module is installed at the user side, decompression will be transparent to the user. See Section 8.10.
7.10 FCI-1C-RRAD Trailer Chunk
The groups available, to the FDHSI and HRFI subtypes, in the FCI level 1c Trailer data chunk are given in Table 10, with the nesting applied given in Figure 16.

Figure 16 Overview of netCDF groups in the FCI L1c trailer chunk file for an FDHSI dataset

<table>
<thead>
<tr>
<th>Group</th>
<th>netCDF Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generic Type</td>
<td>netCDF Name</td>
<td>Description</td>
</tr>
<tr>
<td>root</td>
<td></td>
<td>Root level metadata</td>
</tr>
<tr>
<td>data</td>
<td></td>
<td>Information common to all channels</td>
</tr>
<tr>
<td>“channel” groups</td>
<td>FDHSI</td>
<td>All “channel” groups share a common generic format and contain information specific to that channel.</td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
<td>vis_05</td>
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<td></td>
</tr>
<tr>
<td>vis_06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>vis_08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>vis_09</td>
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<td></td>
</tr>
</tbody>
</table>
FDHSI channel groups are found in the FDHSI dataset.

HRFI channel groups are found in the HRFI dataset.

<table>
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<th>Channel Group</th>
<th>Description</th>
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<tr>
<td>nir_16</td>
<td></td>
</tr>
<tr>
<td>nir_22</td>
<td></td>
</tr>
<tr>
<td>ir_38</td>
<td></td>
</tr>
<tr>
<td>wv_63</td>
<td></td>
</tr>
<tr>
<td>wv_73</td>
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<td>ir_87</td>
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<td>ir_97</td>
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<td>ir_105</td>
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<td>ir_123</td>
<td></td>
</tr>
<tr>
<td>ir_133</td>
<td></td>
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<td>vis_06_hr</td>
<td></td>
</tr>
<tr>
<td>nir_22_hr</td>
<td></td>
</tr>
<tr>
<td>ir_38_hr</td>
<td></td>
</tr>
<tr>
<td>ir_105_hr</td>
<td></td>
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<table>
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<th>Attribute</th>
<th>Description</th>
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<td>swath</td>
<td>Swath information for the repeat cycle</td>
</tr>
<tr>
<td>measured</td>
<td>Metadata about the measured radiances</td>
</tr>
<tr>
<td>quality</td>
<td>Associated repeat cycle quality information</td>
</tr>
<tr>
<td>quality_channel</td>
<td>Information common to all channels</td>
</tr>
<tr>
<td>external_calibration_coefficients</td>
<td>GSICS radiance corrections</td>
</tr>
<tr>
<td>state</td>
<td>State information</td>
</tr>
<tr>
<td>platform</td>
<td>Satellite state information</td>
</tr>
<tr>
<td>instrument</td>
<td>Instrument state information</td>
</tr>
<tr>
<td>processor</td>
<td>Processor state information</td>
</tr>
<tr>
<td>celestial</td>
<td>Celestial state information</td>
</tr>
</tbody>
</table>

**Table 10 Description of the groups in an FCI L1c trailer chunk**

### 7.11 Example file names

As mentioned above, the FCI-1C-RRAD dataset covers the full repeat cycle and is divided into a series of individual files or “chunks” for timely dissemination. Table 11 shows an example of FCI Level 1c RRAD files names for one swath assuming a total number of 40 body chunks. The 40 body chunk files are numbered from 1 to 40 and the single trailer chunk file has the number 41.

<table>
<thead>
<tr>
<th>File Name</th>
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<tbody>
<tr>
<td>W_XX-<em>IMG+SAT,MTI1+FCI-1C-RRAD-FDHSI-FD--CHK-BODY--</em>.0001.nc</td>
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<tr>
<td>W_XX-<em>IMG+SAT,MTI1+FCI-1C-RRAD-FDHSI-FD--CHK-BODY--</em>.0002.nc</td>
</tr>
<tr>
<td>W_XX-<em>IMG+SAT,MTI1+FCI-1C-RRAD-FDHSI-FD--CHK-BODY--</em>.0003.nc</td>
</tr>
<tr>
<td>........</td>
</tr>
<tr>
<td>W_XX-<em>IMG+SAT,MTI1+FCI-1C-RRAD-FDHSI-FD--CHK-BODY--</em>.0040.nc</td>
</tr>
<tr>
<td>W_XX-<em>IMG+SAT,MTI1+FCI-1C-RRAD-FDHSI-FD--CHK-TRAIL--</em>_0041.nc</td>
</tr>
</tbody>
</table>

*Table 11 Example FCI Level 1c datasets file names*
8 FCI L1 DATASET USAGE

8.1 Reconstructing Reference Grids

Pixel-related data (radiances and pixel quality flags) do not have associated geolocation coordinate variables included in the product in order to reduce the size of the product.

A CF-convention grid_mapping variables for the geostationary projection are included in the product to allow CF-Convention-aware tools to geolocate the grid_mapping associated variables (cf. variable data.mtg_geos_projection). In addition, the pixel positions are provided as coordinate variables data.<channel>.measured.x (X coordinate in mtg_geos_projection) and data.<channel>.measured.y (Y coordinate in mtg_geos_projection).

Alternatively, the geolocation grids may be calculated and associated to the variables using the equations given in Section 5.2 and the relevant parameters included in the product. E.g. the variables reference_grid.spatial_sampling_angle_ns and reference_grid.spatial_sampling_angle_ew contain the value for Azimuth_Grid_Sampling and Elevation_Grid_Sampling in radians units, respectively. Note that the equations assume pixel positions start at (1,1) and not (0,0) so the array indexing of the particular language used for constructing the grids should be taken into account if the coordinate variable values are not used.

8.2 Unpacking Coded Radiances

Radiances are stored in a compressed form as integer values with associated offsets and scale factors as per the standard (see CF conventions [CF]). However, the extended 3.8 channel has an additional set of offset and scale factors that have been used to compress the data into 13 bits. These need to be unpacked as per the explanation in Section 7.8.2.

8.3 Effective Radiance Unit Conversion

Radiances in the FCI L1c dataset (variable effective_radiance) have units of mW.m-2.sr-1.cm-1-1. If these radiances are multiplied with the variable data.<channel>.measured.radiance_unit_conversion_coefficient, the effective radiances in units W.m-2.sr-1.µm-1 are obtained.

8.4 Converting to Effective Radiance to Brightness Temperature for IR Channels

The effective brightness temperature of a surface is the temperature of a spatially uniform blackbody that emits the equivalent amount of radiant energy as the surface within a spectral band characterized by the spectral response function of the instrument. Given the band-average spectral radiance per wavenumber $L_{\nu}$, i.e. the effective radiance determined in Section 7.8.2,

the effective brightness temperature $T_{\text{eff}}$ can be approximated as follows:
The set of coefficients \{\nu_c, a, b\}, corresponding to a given spectral response function, are found by regression over the required range of temperatures. Constants \(c_1 = 2hc^2\) and \(c_2 = hc/k\) are radiation constants where \(c\), \(h\), and \(k\) are the speed of light, Planck, and Boltzmann constant, respectively.

The variable `data.<channel>.central_wavelength_actual` contains the wavelength corresponding to the representative wavenumber, \(\nu_c\).

The variables `data.<channel>.measured.radiance_to_bt_conversion_coefficient_a` and `data.<channel>.measured.radiance_to_bt_conversion_coefficient_b` contain the conversion coefficients \(a\) and \(b\) for IR channels, respectively. They are set to the `_FillValue` for VNIR channels.

The variables `data.<channel>.measured.radiance_to_bt_conversion_constant_c1` and `data.<channel>.measured.radiance_to_bt_conversion_constant_c2` contain the constants \(c_1\) and \(c_2\) for IR channels. Note that the values given in the dataset are \(c_1 = 2 \cdot 10^{11} \cdot hc^2 = 1.19104282E-05\) and \(c_2 = 100 \cdot hc/k = 1.43877513\) due to unit conversions. They are set to the `_FillValue` for visible and near-infrared channels.

### 8.5 Converting to Effective Radiance to Reflectance for VNIR Channels

The variable `data.<channel>.measured.channel_effective_solar_irradiance` contains the channel effective solar irradiance at 1 AU to be used in the derivation of the reflectance for VNIR spectral channels. The variable is set to `_FillValue` for IR spectral channels.

### 8.6 Solar Zenith Angle Calculation

The FCI Level 1c body chunks files, for the FDHSI or HRFI spectral channels, contain the two variables `state.celestial.solar_elevation` and `state.celestial.solar_azimuth`. Both have the dimension index, i.e. using the index given by the variable `index_map` (Section 7.8.1), the solar elevation and solar azimuth angles can be computed for each pixel. Since the solar zenith angle and the solar azimuth angle are complementary, the solar zenith angle can be determined from the azimuth angle.

### 8.7 Radiometric Noise Assessment

[Information to be added in a later issue]

### 8.8 Radiometric Accuracy Assessment

[Information to be added in a later issue]
8.9 Recombining Chunks

As noted in Section 7, each FCI Level 1 repeat cycle dataset (either FDHSI or HRFI) is distributed as a set of multiple netCDF files referred to as chunks. There are 2 types of chunks: “body” and “trailer”. Typically, a FDHSI product will consist of circa 40 body chunks, and a HRFI product up to 13 body chunks. Both products have final trailer chunk containing repeat cycle-based information.

The start_position_column, start_position_row, end_position_column and end_position_row variables within the data.<channel>.measured group may be used to locate the pixel-based data (radiances and pixel-quality flags) in each chunk with the correct position in the Level 1c reference grid (see Section 5.2 and Figure 17).

Figure 17 Illustration of the location of a typical body chunk within a LAC 4 repeat cycle dataset. The scan direction is from West to East.

In addition, each of pixel-based variables are linked to row and column 2D coordinate variables (as per the CF conventions [CF]) that contain the position of the pixel in the reference grid. These coordinate variables can also be used to locate the chunk within the reference grid and should allow CF-aware tools to combine the chunks into a complete repeat cycle image. However, at the time of this issue, this functionality appears to be available only for geolocated datasets.
The user currently has three paths to recombine the chunks into a complete repeat cycle image for each channel:

1. Create arrays based on the correct-sized reference grid for each channel and copy the pixel data into the correct area of the grid based upon either the associated corner coordinate variables or the linked 2D coordinate variable in the coordinate attribute.

2. Extend the method of option (1) by also geolocating the reference grid by calculating the relevant latitude and longitude variables and associating them as 2D coordinate variables with the pixel data. This may require the creation of a new netCDF file on disk or, if supported by the netCDF libraries, a netCDF object in memory.

8.10 Special Compression of Radiances, Index Map and Quality Flags

If the special_compression field in the filename (see Table 5) is set to “JLS”, then the effective_radiance, index_map and pixel_quality variables in the dataset have been compressed using the CharLS algorithm, a fast lossless JPEG compression. The user is required to download and install the HDF-5 dynamically loaded filter for CharLS decompression (noting that the netCDF-4 datasets use HDF-5 as their storage layer). This is currently available via the EUMETSAT website and comes with an installation guide. More information about the decompression can be found in Appendix C.2.3.

8.11 Radiometric Noise and Accuracy Look-Up Tables

The trailer chunk contains radiometric noise look-up tables for each channel presented as pairs of arrays, where their elements represent (x,y):

1. The estimated noise for a given radiance is represented by the arrays 
   
   data.<channel>.measured.radiometric_noise_lut_radiance (x-axis) and the 
   
   data.<channel>.measured.radiometric_noise_lut_noise (y-axis).

   The radiance values are packed in the same way as the radiances (see Section 8.2) and also use the same values for the add_offset and scaling_factor for each channel.

8.12 Timing Information

The Coordinated Universal Time (UTC) associated to each pixel is given by the global variable time using the index provided by the variable index_map (Section 7.8.1) provide in the FCI L1c body chunks.
APPENDIX A  FORMAT DESCRIPTIONS

This Appendix shows the content of the body (A.1) and trailer (A.1) files following the structure of Figure 10 and Figure 16. Additionally, NcML xml files describing the content of the body and trailer files in the NetCDF Markup Language (NcML) format using XML syntax can be provided.

A.1  Common Definitions

A.1.1  Enumerated Types

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<th>Type</th>
<th>Description</th>
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<th>String</th>
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<td>Indicates type of manoeuvre</td>
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<td></td>
</tr>
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<td>No manoeuvre</td>
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</tr>
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<td></td>
<td>Station Relocation</td>
<td>3</td>
<td>SR</td>
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<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Bit</th>
<th>String</th>
<th>Description</th>
<th>Meaning</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>swath_direction_type</td>
<td>ubYTE</td>
<td>0</td>
<td></td>
<td></td>
<td>forward_scan</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td>retrace</td>
<td></td>
</tr>
<tr>
<td>ssd_type</td>
<td>ubYTE</td>
<td>0</td>
<td></td>
<td></td>
<td>0.5km</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td>1km</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td>2km</td>
<td></td>
</tr>
<tr>
<td>yaw_flip_type</td>
<td>ubYTE</td>
<td>0</td>
<td></td>
<td></td>
<td>winter</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td>summer</td>
<td></td>
</tr>
<tr>
<td>mnd_type</td>
<td>ubYTE</td>
<td>0</td>
<td></td>
<td></td>
<td>no MND</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td>nominal MND</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td>reference MND</td>
<td></td>
</tr>
</tbody>
</table>

### A.1.2 Bit Masks

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Bit</th>
<th>String</th>
<th>Description</th>
<th>Meaning</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>pixel_quality</td>
<td>ubyte</td>
<td>0</td>
<td>missing_warning</td>
<td>Pixel has a contribution from missing samples following rectification.</td>
<td>missing_warning missing_warning (L1B) propagated at L1C. At L1B: flag missingSCI_grid in FCI geoloc grid</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rank</td>
<td>Code</td>
<td>Description</td>
<td>Note</td>
<td>Page</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>---------------</td>
<td>-------------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>radiometric_warning</td>
<td>Pixel may have radiometric errors due to a contribution from samples with radiometric errors following rectification. Radiometric errors in this sense arise from calibration activities occurring during the repeat cycle that do not impact the calibration of the complete repeat cycle, e.g. offset computation: deep space skipped due to Sun light pollution or Moon intrusion, insufficient number of valid deep space samples.</td>
<td>radiometric_warning: radiometric_warning (L1B) propagated at L1C. At L1B: flag missingRAD_grid in FCI geoloc grid</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>noise_warning</td>
<td>Pixel may be noisy (have a non-nominal noise level) due to a contribution from noisy samples following rectification.</td>
<td>noise_warning: noise_warning (L1B) propagated at L1C. At L1B: from [IDPFI-FCI-SPS-1.0.3.6] output FLAG_NOISE_WARNING_L1PROD[i] (same value for all samples acquired with a detector[i])</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>geolocation_warning</td>
<td>Pixel may not have a very accurate geolocation since it has been computed using interpolated data.</td>
<td>geolocation_warning: flag missingGEOLOC in FCI geoloc grid propagated at L1C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---------------------</td>
<td>------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>saturation_warning</td>
<td>Pixel has a contribution from saturated samples following rectification.</td>
<td>saturation_warning: under_saturated_warning (L1B) + over_saturated_warning(L1B) propagated at L1C. At L1B: flags underSaturated_grid and overSaturated_grid in FCI geoloc grid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>straylight_correction_warning</td>
<td>Pixel has a contribution from samples that have been corrected for solar stray light contamination (above a set threshold).</td>
<td>straylight_correction_warning: straylight_correction_warning (L1B) propagated at L1C. At L1B: flag_correct_SSL_L1B in SSL correction algorithm (TAF-FCI-L1PP-CAL-015)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>extended_dynamic_range_warning</td>
<td>For the IR3.8 channel only: Pixel has a contribution from samples selected from the FAIR3.8 detector measurements</td>
<td>extended_dynamic_range_warning: pixel has a contribution from samples selected from the FAIR3.8 detector measurements (for merged IR3.8 only)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>encoding_saturation_warning</td>
<td>Pixel is saturated from the process of encoding into 12-bits</td>
<td>encoding_saturation_warning: pixel is saturated from the process of encoding into 12-bits (13-bits for FAIR3.8)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
(13-bits for FAIR3.8).
### A.2 FCI-1C-RRAD-BODY

#### A.2.1 Group:root (/)

**Dimensions**

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>auxiliary_dataset</td>
<td>Number of auxiliary datasets involved in processing the dataset</td>
<td></td>
<td>&lt;runtime_value&gt;</td>
<td></td>
</tr>
<tr>
<td>index</td>
<td>Length of geometric data vectors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>number_of_l0_channels</td>
<td>Number of data channels delivered by the FCI instrument used to create the level 1c data [17 if all channels are present, otherwise set at according to the channels available from the instrument]</td>
<td></td>
<td>configured_value</td>
<td></td>
</tr>
<tr>
<td>number_of_l1c_channels</td>
<td>Number of spectral channels present in the originally generated dataset [16 if all FDHSI channels are present, 4 if all HRFI channels are present, otherwise set at according to the</td>
<td></td>
<td>configured_value</td>
<td></td>
</tr>
<tr>
<td>number_of_reference_grids</td>
<td>Number of reference grid used by the channels [default 2]. Note although 3 different grid exist for the FCI there are only 2 per mission (FDHSI/HRFI)</td>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**User Types**

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>auxiliary_dataset_status_type</td>
<td>See Enum types</td>
<td>enum ubyte</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ssd_type</td>
<td>Index based on the SSD size to select SSD-related data from arrays e.f. reference grid info</td>
<td>ubyte enum</td>
<td>see Enums table</td>
<td></td>
</tr>
<tr>
<td>swath_direction_type</td>
<td>Identified the direction of swath acquisition from East to West or West to East.</td>
<td>ubyte enum</td>
<td>see Enums table</td>
<td></td>
</tr>
</tbody>
</table>

**Global Attributes**

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventions</td>
<td>Conventions that the product conforms to. This could be a future version of the CF Conventions that is applicable to netCDF4.</td>
<td>string</td>
<td>e.g.&quot;CF-1.7&quot;</td>
<td></td>
</tr>
<tr>
<td>title</td>
<td>Dataset/product name</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field</td>
<td>Description</td>
<td>Type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>-------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>summary</td>
<td>As defined in the relevant dataset/product format specification.</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>keywords</td>
<td>As defined in the relevant dataset/product format specification.</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>keywords_vocabulary</td>
<td>As defined in the relevant dataset/product format specification.</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>history</td>
<td>As per [CF]</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>institution</td>
<td>This field may be extended with other values should datasets/products be generated in other locations.</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>location_indicator</td>
<td>As per the dataset name field “location_indicator” in dataset name</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>data_designator</td>
<td>As per the dataset name field “data_designator” in dataset name</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>platform</td>
<td>As per the dataset name field “spacecraft” in dataset name. Renamed in line with Attribute Convention for Dataset Discovery</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>data_source</td>
<td>As per the dataset name field “data_source” in dataset name</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>processing_level</td>
<td>As per the dataset name field “level” in dataset name</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>coverage</td>
<td>As per the dataset name field “coverage” in dataset name</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>type</td>
<td>As per the dataset name field “type” in dataset name</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>subtype</td>
<td>As per the dataset name field “subtype” in dataset name</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>component1</td>
<td>As per the dataset name field “component1” in dataset name</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Component</td>
<td>Description</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>component2</td>
<td>As per the dataset name field “component2” in dataset name</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>component3</td>
<td>As per the dataset name field “component3” in dataset name</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>product_id</td>
<td>The identifying product_id as used in the SIP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>baseline_version</td>
<td>Baseline version. The baseline version will reference of all other version numbers. Assumes processor_version is not sufficient for this.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>release_version</td>
<td>Release version. Used to tag datasets that can be considered to have a contiguous consistency sufficient for example, for consideration as a climate set.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>processor_version</td>
<td>Processor version. Currently assumes a single processor version number suffices for the relevant IDPF or L2PP. Currently undefined if processor version also includes configuration of static auxiliary data and processor switch configuration, etc.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>algorithm_version</td>
<td>Algorithm version. Currently unclear how this would be used and it may be redundant with processor_version.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>format_version</td>
<td>Format version of the dataset/product.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>time_coverage_start</td>
<td>As per the dataset name field “start_time” in dataset name. Renamed in line with Attribute Convention for Dataset Discovery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>time_coverage_end</td>
<td>As per the dataset name field “end_time” in dataset name. Renamed in line with Attribute Convention for Dataset Discovery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>processing_mode</td>
<td>As per the dataset name field “processing_mode” in dataset name</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>special_compression</td>
<td>As per the dataset name field “special_compression” in dataset name</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>subsetting</td>
<td>If this field is empty then no further strings follow. If this value is a single specified internal compression method as listed in the “special_compression” field in dataset name then it is followed by two strings: (1) human-readable parameters describing the exact internal compression performed</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
(2) either a URL providing a description of the internal compression method or the words “NO URL”. If the value is “MULTI”, then this is followed by sets of triplets of strings (one per internal compression applied) A triplet consists of:
(1) an internal compression code as listed in the “special_compression” field dataset name ;
(2) human-readable parameters describing the exact internal compression performed;
(3) either a URL providing a description of the internal compression method or the words “NO URL”.

<table>
<thead>
<tr>
<th><strong>disposition_mode</strong></th>
<th>As per the dataset/product name field “disposition_mode” in dataset name</th>
<th>string</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>source</strong></td>
<td>Characterisation of the type of data as per [CF].</td>
<td>string</td>
</tr>
<tr>
<td><strong>runtime_data</strong></td>
<td>Space-separated string array of the SIP names of all nonproduct input datasets used in the creation of the dataset (auxiliary data, configuration file, DPP files, etc.) (Was part of &lt;source&gt; field)</td>
<td>string</td>
</tr>
<tr>
<td><strong>parent_data</strong></td>
<td>Space-separated string array of the SIP names of all parent products/datasets used in the creation of the dataset (Was part of &lt;source&gt; field)</td>
<td>string</td>
</tr>
<tr>
<td><strong>linked_data</strong></td>
<td>Space-separated string array of the SIP names of all datasets to be linked with this dataset in the archive (e.g. for a Level 0 dataset this would be all additional datasets required to create the virtual L0+ dataset in the archive). (Was part of &lt;source&gt; field)</td>
<td>string</td>
</tr>
<tr>
<td><strong>facility_or_tool</strong></td>
<td>As per the dataset name field “facility_or_tool” in dataset name</td>
<td>string</td>
</tr>
<tr>
<td>environment</td>
<td>As per the dataset name field “environment” in dataset name</td>
<td>string</td>
</tr>
<tr>
<td>-------------------</td>
<td>-------------------------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>references</td>
<td>“www.eumetsat.int”</td>
<td>string</td>
</tr>
<tr>
<td>comment</td>
<td>Unless otherwise specified in the relevant dataset/product format specification, “None.”</td>
<td>string</td>
</tr>
<tr>
<td>date_created</td>
<td>UTC time of processing formatted in Abbreviated Generalised Time format and defined as the time of the formatting of the dataset/product by the processor. Renamed in line with Attribute Convention for Dataset Discovery</td>
<td>string</td>
</tr>
<tr>
<td>group_tag</td>
<td>String that represents a grouping of datasets that allows chunks and quick-looks to be linked together. The string has the format: <code>&lt;platform&gt;_&lt;datasource&gt;_&lt;processing_level&gt;_&lt;type&gt;_&lt;subtype&gt;_YYYY_DDD_NNNN_&lt;release_version&gt;</code>, where: &lt;&gt; indicates the same value as the named global metadata field in the brackets (as described in this table), YYYY = the year value of the “repeat_cycle_time_position” field, DDD = day in year value derived from the “repeat_cycle_time_position” field, left padded with zeroes: 001 = Jan 1st, etc, NNNN = copy of the “repeat_cycle_in_day” field</td>
<td>string</td>
</tr>
<tr>
<td>repeat_cycle_in_day</td>
<td>4-digit number (right-justified, zero-filled) indicating the expected current repeat cycle or group accumulation interval in the day for this particular dataset. For details on how to determine the expected repeat cycle see [EXPRC]. The counter starts at 0001 for the first repeat cycle at or after midnight (based on the time_position value) and resets for the next repeat cycle at or after the following midnight. Datasets/products that have no repeat cycle or group accumulation interval (e.g. certain DPP files) should use a fixed value of 0000 to indicate the field is not applicable.</td>
<td>string</td>
</tr>
<tr>
<td>processed_count_in_repeat_cycle</td>
<td>Cumulative count of the dataset chunk in the repeat cycle or group accumulation interval. Resets when the repeat_cycle_in_day value changes. The counter increments for each created chunk in a repeat cycle or accumulation interval. It does not increment when a chunk is not created due to missing parent data.</td>
<td>string</td>
</tr>
<tr>
<td>count_in_repeat_cycle</td>
<td>4-digit number (right-justified, zero-filled) indicating the expected count value of the dataset chunk in the repeat cycle or group accumulation interval based on the scan pattern or equivalent information. The counter will have discontinuities when chunks are not produced. The counter starts from 1 and resets when the repeat_cycle_in_day value changes. The counter increments for each chunk in a repeat cycle or accumulation interval (whether header, body or trailer). A value of 0 is used for datasets for which the counter is not applicable (e.g. datasets which are not chunk-able).</td>
<td>string</td>
</tr>
<tr>
<td>instrument_configuration_id</td>
<td>List of space-separated values of the “instrument configuration identifier” from the level 0 data ICU-I auxiliary data. Each unique ICID/ICID Version combination produces an entry in the list e.g. an ICID 100 that exists in the product with ICID Versions 1 and 2 will produce two “100” entries in the list.</td>
<td>string</td>
</tr>
<tr>
<td>instrument_configuration_id_version</td>
<td>List of space-separated values of the “instrument configuration identifier version” from the level 0 data ICU-I auxiliary data. Each ICID in the instrument_configuration_id field should have a matching ICID Version entry in the same position in this list.</td>
<td>string</td>
</tr>
<tr>
<td>subsettable_groups</td>
<td>Space separated list of paths to groups that have the subsettable=&quot;yes&quot; group attribute.</td>
<td>string</td>
</tr>
<tr>
<td>subsettable_groups_present</td>
<td>Space separated list of paths to groups that are present in the product. Will be the same as subsettable_groups for unsubsetted products.</td>
<td>string</td>
</tr>
<tr>
<td>mtg_name</td>
<td>String field containing the MTG WMO-convention name for the file</td>
<td>string</td>
</tr>
<tr>
<td>alternative_name</td>
<td>String field containing a possible alternative name for the file (e.g. Sentinel-4 naming convention)</td>
<td>string</td>
</tr>
<tr>
<td>purpose</td>
<td>As per the dataset/product name field “purpose” in dataset name</td>
<td>string</td>
</tr>
<tr>
<td>---------</td>
<td>---------------------------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>format</td>
<td>As per the dataset/product name field “format” in dataset name</td>
<td>string</td>
</tr>
<tr>
<td>id</td>
<td>Can contain a DOI for reprocessed climate datasets (configuration file). Otherwise set to an empty string.</td>
<td>string</td>
</tr>
<tr>
<td>naming authority</td>
<td>Will contain the DOI issuing authority for reprocessed climate datasets (configuration file) if id attribute is used. Otherwise set to an empty string.</td>
<td>string</td>
</tr>
<tr>
<td>creator_type</td>
<td>Specifies type of creator with one of the following: 'person', 'group', 'institution', or 'position'.</td>
<td>string</td>
</tr>
<tr>
<td>creator_institution</td>
<td>The institution of the creator; should uniquely identify the creator's institution.</td>
<td>string</td>
</tr>
<tr>
<td>creator_name</td>
<td>The name of the person (or other creator type specified by the creator_type attribute) principally responsible for creating this data.</td>
<td>string</td>
</tr>
<tr>
<td>creator_email</td>
<td>The email address of the person (or other creator type specified by the creator_type attribute) principally responsible for creating this data.</td>
<td>string</td>
</tr>
<tr>
<td>creator_url</td>
<td>The URL of the person (or other creator type specified by the creator_type attribute) principally responsible for creating this data.</td>
<td>string</td>
</tr>
<tr>
<td>license</td>
<td>URL to a standard or specific license, enter &quot;Freely Distributed&quot; or &quot;None&quot;, or describe any restrictions to data access and distribution in free text.</td>
<td>string</td>
</tr>
<tr>
<td>standard_name_vocabulary</td>
<td>The name and version of the controlled vocabulary from which variable standard names are taken. (Values for any standard_name attribute must come from the CF Standard Names vocabulary for the data file or product to comply with CF.) Example: 'CF Standard Name Table v27'.</td>
<td>string</td>
</tr>
<tr>
<td>project</td>
<td>The name of the project(s) principally responsible for originating this data. Multiple projects can be separated by commas</td>
<td>string</td>
</tr>
<tr>
<td>time_coverage_duration</td>
<td>Describes the duration of the data set.</td>
<td>string</td>
</tr>
<tr>
<td>time_coverage_resolution</td>
<td>Describes the targeted time period between each value in the data set</td>
<td>string</td>
</tr>
<tr>
<td>cdm_datatype</td>
<td>The data type, as derived from Unidata's Common Data Model Scientific Data types and understood by THREDDS [THREDDS]</td>
<td>string</td>
</tr>
<tr>
<td>comment</td>
<td>Miscellaneous information about the data, not captured elsewhere. (See [CF])</td>
<td>string</td>
</tr>
<tr>
<td>date_time_position</td>
<td>This is the start time of the repeat cycle (accumulation interval) shifted forwards or backwards to the nearest 30 seconds bin counting from 00:00:00. This removes minor variations and offsets in the actual observation start time of the repeat cycle. Repeat cycle Observations starting at 11:59:58, 12:00:00 and 12:00:05 would all have a date_time_position value with a time of 12:00:00. An observation starting at 23:59:45 would have value of 00:00:00 and be the first repeat cycle of the next day.</td>
<td>string</td>
</tr>
<tr>
<td>time_position</td>
<td>This is the time string taken from date/time string in date_time_position.</td>
<td>string</td>
</tr>
<tr>
<td>geospatial_lat_min</td>
<td>Geospatial_lat_min specifies the southernmost latitude covered by the dataset.</td>
<td>double</td>
</tr>
<tr>
<td>geospatial_lat_max</td>
<td>Geospatial_lat_max specifies the northernmost latitude covered by the dataset.</td>
<td>double</td>
</tr>
<tr>
<td>geospatial_lon_min</td>
<td>Geospatial_lon_min specifies the westernmost longitude covered by the dataset.</td>
<td>double</td>
</tr>
<tr>
<td>geospatial_lon_max</td>
<td>Geospatial_lon_max specifies the easternmost longitude covered by the dataset.</td>
<td>double</td>
</tr>
</tbody>
</table>

**Variables**

<table>
<thead>
<tr>
<th>Name</th>
<th>Attribute</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>auxiliary_dataset_identifier</td>
<td></td>
<td>Unique identifier for the auxiliary dataset. If available, the filename should be used.</td>
<td>string</td>
<td></td>
<td>auxiliary_dataset</td>
</tr>
</tbody>
</table>
If the auxiliary file was not available, the file name template should be stated, with unknown values such as times set to the correct length of lower case x characters.

<table>
<thead>
<tr>
<th>auxiliary_dataset_status</th>
<th>See Enum types auxiliary_dataset_status_type</th>
<th>auxiliary_dataset</th>
</tr>
</thead>
<tbody>
<tr>
<td>index</td>
<td>Coordinate variable with indices of data vectors segments extracted for chunk from the complete repeat cycle data vectors.</td>
<td>ushort</td>
</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;Coordinate variable of indices driven from repeat cycle data vectors&quot;</td>
</tr>
<tr>
<td>index_offset</td>
<td>Offset index of data vectors in this dataset. If</td>
<td>ushort</td>
</tr>
</tbody>
</table>
not using the coordinate variable index, then data vector data should be extracted from array position indexed_position - index_offset.

<table>
<thead>
<tr>
<th>long_name</th>
<th>string</th>
<th>&quot;Offset index for data vectors&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>time</td>
<td>double</td>
<td>&quot;UTC Time for geometric data vectors, i.e. time at which the geometric metadata are calculated.&quot;</td>
</tr>
<tr>
<td>title</td>
<td>string</td>
<td>&quot;UTC Time for geometric data vectors&quot;</td>
</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;UTC time at which the geometric metadata are calculated.&quot;</td>
</tr>
<tr>
<td>standard_name</td>
<td>string</td>
<td>&quot;time&quot;</td>
</tr>
<tr>
<td>units</td>
<td>string</td>
<td>&quot;seconds since 2000-01-01 00:00:00.0&quot;</td>
</tr>
</tbody>
</table>
### A.2.2 Group:/data

#### Dimensions

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>_FillValue</td>
<td></td>
<td>double</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### User Types

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Group Attributes

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Variables

<table>
<thead>
<tr>
<th>Name</th>
<th>Attribute</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
</table>

| Number of Level 1c spectral channels present in dataset | double | NC_FILL_DOUBLE |

| long_name | string | “Level 1c spectral channels present in dataset” |
mtg_geos_projection | Defines the MTG Geos Projection to use as a grid_mapping variable according to [CF] | int |

| long_name | string | "MTG geostationary projection" |
| grid_mapping_name | string | "geostationary" |
| perspective_point_height | 35786400 | string | <configured_value> |
| semi_major_axis | 6378137 | string | <configured_value> |
| semi_minor_axis | 6356752 | string | <configured_value> |
| inverse_flattening | string | <configured_value> |
| latitude_of_projection_origin | string | <configured_value> |
| longitude_of_projection_origin | string | <configured_value> |
| sweep_angle_axis | string | "x" |
| swath_direction | string | "Swath direction" |
| swath_number | Number of the swath | ushort | index |

A.2.3 Group:/data/<channel>

**Dimensions**

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>The number of columns in the Level</td>
<td>int</td>
<td>configured_value(5568,11136,22272)</td>
<td></td>
</tr>
</tbody>
</table>
1c Body data chunk this will equal either 5568, 11136 or 22272 data points depending on the channel.

| y  | The number of rows in the Level 1c Body data chunk. | configured_value(5568,11136,22272) |

### User Types

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>None defined</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Group Attributes

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>long_name</td>
<td>A string uniquely identifying the channel wavelength and resolution e.g. “FCI HRFI Visible 0.6 micron channel”</td>
<td>string</td>
<td>“FCI &lt;target&gt; channel”</td>
<td></td>
</tr>
<tr>
<td>subsettable</td>
<td>Group can be included or excluded from the dataset according to configured selection</td>
<td>string</td>
<td>&quot;yes&quot;</td>
<td></td>
</tr>
</tbody>
</table>

### Variables

<table>
<thead>
<tr>
<th>Name</th>
<th>Attribute</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>channel_srf_identifier</strong></td>
<td>Identifier for the SRF for this channel.</td>
<td>string</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td>-----------------------------------------</td>
<td>--------</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>long_name</strong></td>
<td>string</td>
<td>&quot;Channel Spectral Response Function identifier&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>channel_mtf_identifier</strong></td>
<td>Identifier for the MTF for this channel.</td>
<td>string</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>long_name</strong></td>
<td>string</td>
<td>&quot;Channel Modulation Transfer Function identifier&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>channel_srf_version</strong></td>
<td>Version number of the SRF for this channel.</td>
<td>ushort</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>long_name</strong></td>
<td>string</td>
<td>&quot;Channel Spectral Response Function identifier version&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>channel_mtf_version</strong></td>
<td>Version number of the MTF for this channel.</td>
<td>ushort</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>long_name</strong></td>
<td>string</td>
<td>&quot;Channel Modulation Transfer Function identifier version&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>central_wavelength_specified</strong></td>
<td>Specified central wavelength</td>
<td>float</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>long_name</strong></td>
<td>string</td>
<td>&quot;Specified central wavelength of channel&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variable</td>
<td>Type</td>
<td>Units</td>
<td>Description</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------------</td>
<td>----------</td>
<td>-------------------</td>
<td>------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>spectral_width_specified</td>
<td>float</td>
<td>&quot;um&quot;</td>
<td>Specified spectral width</td>
<td></td>
<td></td>
</tr>
<tr>
<td>_FillValue</td>
<td>float</td>
<td>NC_FILL_FLOAT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td></td>
<td>&quot;Specified spectral width of channel&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>units</td>
<td>string</td>
<td>&quot;um&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>_FillValue</td>
<td>float</td>
<td>NC_FILL_FLOAT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>central_wavelength_actual</td>
<td>float</td>
<td>&quot;um&quot;</td>
<td>Actual (measured) central wavelength</td>
<td></td>
<td></td>
</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td></td>
<td>&quot;Actual central wavelength of channel&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>units</td>
<td>string</td>
<td>&quot;um&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>_FillValue</td>
<td>float</td>
<td>NC_FILL_FLOAT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>spectral_width_actual</td>
<td>float</td>
<td>&quot;um&quot;</td>
<td>Actual (measured) spectral width</td>
<td></td>
<td></td>
</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td></td>
<td>&quot;Actual spectral width of channel&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>units</td>
<td>string</td>
<td>&quot;um&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>_FillValue</td>
<td>float</td>
<td>NC_FILL_FLOAT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ssd_index</td>
<td>float</td>
<td></td>
<td>SSD-based index for this channel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ssd_type</td>
<td>string</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td></td>
<td>&quot;Index selector for this channel based on SSD&quot;</td>
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<tr>
<td>ssd</td>
<td>float</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;Spatial sampling distance for this channel&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>-----------------</td>
<td>-----------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>units</td>
<td>string</td>
<td>&quot;m&quot;</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

### A.2.4 Group:/data/<channel>/measured

#### Dimensions

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
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</thead>
<tbody>
<tr>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>None defined</td>
</tr>
</tbody>
</table>

#### User Types

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>None defined</td>
</tr>
</tbody>
</table>

#### Group Attributes

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
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<tbody>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>None defined</td>
</tr>
</tbody>
</table>

#### Variables

<table>
<thead>
<tr>
<th>Name</th>
<th>Attribute</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>start_position_row</td>
<td></td>
<td>Row index of the first position in the reference grid</td>
<td>ushort</td>
<td></td>
<td></td>
</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;Row index of the pixel closest to the origin of the reference grid&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------</td>
<td>-----------------------------</td>
<td>---------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>_FillValue</td>
<td>float</td>
<td>NC_FILL_USHORT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>start_position_column</td>
<td></td>
<td>Column index of the first position in the reference grid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ushort</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>end_position_row</td>
<td></td>
<td>Row index of the last position in the reference grid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ushort</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>_FillValue</td>
<td>float</td>
<td>NC_FILL_USHORT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>end_position_column</td>
<td></td>
<td>Column index of the last position in the reference grid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ushort</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>_FillValue</td>
<td>float</td>
<td>NC_FILL_USHORT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>x</td>
<td></td>
<td>x coordinate variable for grid_mapping. Content is short</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;X coordinate in mtg_geos_projection&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>--------</td>
<td>--------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>standard_name</td>
<td>string</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>unit</td>
<td>string</td>
<td>&quot;radian&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>axis</td>
<td>string</td>
<td>&quot;X&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>valid_range</td>
<td>short</td>
<td>&lt;configured_value&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>scale_factor</td>
<td>float</td>
<td>&lt;configured_value&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>add_offset</td>
<td>float</td>
<td>&lt;configured_value&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>y</th>
<th>y coordinate variable for grid_mapping. Content is row value scaled to become radians</th>
</tr>
</thead>
<tbody>
<tr>
<td>long_name</td>
<td>string</td>
</tr>
<tr>
<td>standard_name</td>
<td>string</td>
</tr>
<tr>
<td>unit</td>
<td>string</td>
</tr>
<tr>
<td>axis</td>
<td>string</td>
</tr>
<tr>
<td>valid_range</td>
<td>short</td>
</tr>
<tr>
<td>scale_factor</td>
<td>float</td>
</tr>
<tr>
<td>add_offset</td>
<td>float</td>
</tr>
</tbody>
</table>

| effective_radiance | The effective radiance at each pixel. NOTE: | ushort | y, x |
For the IR_3.8 and IR_3.8_HR channels, the effective radiance is stored in a 16 bit integer but the merging of the extended radiometric range observations, aimed at fire radiance measurements, requires a different offset and gain to be applied to the data above the upper value in valid_cold_range.

<table>
<thead>
<tr>
<th>long_name</th>
<th>string</th>
<th>&quot;Effective radiance&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>units</td>
<td>string</td>
<td>&quot;mW.m-2.sr-1.(cm-1)-1&quot;</td>
</tr>
<tr>
<td>_FillValue</td>
<td>ushort</td>
<td>NC_FILL_USHORT</td>
</tr>
<tr>
<td>valid_range</td>
<td>ushort</td>
<td>&lt;configured_value&gt;</td>
</tr>
<tr>
<td>valid_cold_range</td>
<td>ushort</td>
<td>&lt;configured_value&gt;</td>
</tr>
<tr>
<td>scale_factor</td>
<td>ushort</td>
<td>&lt;configured_value&gt;</td>
</tr>
<tr>
<td>add_offset</td>
<td>ushort</td>
<td>&lt;configured_value&gt;</td>
</tr>
<tr>
<td>warm_scale_factor</td>
<td>ushort</td>
<td>&lt;configured_value&gt;</td>
</tr>
<tr>
<td>------------------</td>
<td>--------</td>
<td>-------------------</td>
</tr>
<tr>
<td>warm_add_offset</td>
<td>ushort</td>
<td>&lt;configured_value&gt;</td>
</tr>
<tr>
<td>ancillary_variables</td>
<td>string</td>
<td>&quot;pixel_quality&quot;</td>
</tr>
<tr>
<td>coordinates</td>
<td>string</td>
<td>&quot;y x&quot;</td>
</tr>
<tr>
<td>grid_mapping</td>
<td>string</td>
<td>&quot;mtg_geos_projection&quot;</td>
</tr>
</tbody>
</table>

**pixel_quality**
- **Variables:** Bitmask
- **Values:**
  - `y`, `x`
- **Definition:** Pixel quality flags
- **Flag masks:**
  - `0ub`, `255ub`
- **Flag meanings:**
  - `missing_warning`
  - `radiometric_warning`
  - `noise_warning`
  - `geolocation_warning`
  - `saturation_warning`
  - `straylight_correction_warning`
  - `extended_dynamic_range_warning`
  - `encoding_saturation_warning`
- **Coordinates:**
  - `y x`
- **Grid mapping:** `mtg_geos_projection`

**radiance_unit_conversion_coefficient**
- **Conversion coefficients to convert radiance units from float**
<table>
<thead>
<tr>
<th>long_name</th>
<th>string</th>
<th>comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>_FillValue</td>
<td>float</td>
<td>&quot;Radiance to brightness temperature conversion constant C1&quot;</td>
</tr>
<tr>
<td>radiance_to_bt_conversion_constant_c1</td>
<td>Conversion constant C1 (in mW/[m2.sr.(cm-1)4]) to convert radiance to</td>
<td>Only for IR channels. Set to _FillValue for VNIR channels.</td>
</tr>
<tr>
<td></td>
<td>brightness temperature to be used in the calculation of brightness</td>
<td></td>
</tr>
<tr>
<td></td>
<td>temperature for IR spectral channels.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>units</td>
<td>string</td>
<td>units</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-------------------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>_FillValue</td>
<td>&quot;mW/(m²2.sr.(cm^-1)^4)&quot;</td>
<td>ushort</td>
</tr>
</tbody>
</table>

**radiance_to_bt_conversion_constant_c2**
- Conversion constant C2 (in cm.K) to convert radiance to brightness temperature to be used in the calculation of brightness temperature for IR spectral channels. Variable is set to _FillValue for VNIR spectral channels.
- Conversion coefficient A (unitless) to convert radiance to brightness temperature to float.
<table>
<thead>
<tr>
<th><strong>long_name</strong></th>
<th><strong>string</strong></th>
<th>&quot;Radiance to brightness temperature conversion coefficient A&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>comment</strong></td>
<td><strong>string</strong></td>
<td>&quot;Only for IR channels. Set to _FillValue for VNIR channels&quot;</td>
</tr>
<tr>
<td><strong>units</strong></td>
<td><strong>string</strong></td>
<td>&quot;1&quot;</td>
</tr>
<tr>
<td>_FillValue</td>
<td><strong>ushort</strong></td>
<td>NC_FILL_FLOAT</td>
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</table>

- **radiance_to_bt_conversion_coefficient_b**
  - **Conversion coefficient B** (in K) to convert radiance to brightness temperature to be used in the calculation of brightness temperature for IR spectral channels. Variable is set to _FillValue for VNIR spectral channels.
<table>
<thead>
<tr>
<th>long_name</th>
<th>VNIR spectral channels.</th>
<th><strong>string</strong></th>
<th>&quot;Radiance to brightness temperature conversion coefficient B&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>comment</td>
<td></td>
<td><strong>string</strong></td>
<td>&quot;Only for IR channels. Set to _FillValue for VNIR channels&quot;</td>
</tr>
<tr>
<td>units</td>
<td></td>
<td><strong>string</strong></td>
<td>&quot;1&quot;</td>
</tr>
<tr>
<td>_FillValue</td>
<td></td>
<td><strong>ushort</strong></td>
<td>NC_FILL_FLOAT</td>
</tr>
<tr>
<td>radiance_to_bt_conversion_coefficient_wavenumber</td>
<td>Conversion coefficient NU (in cm⁻¹) to convert radiance to brightness temperature to be used in the calculation of brightness temperature for IR spectral channels. Variable is set to _FillValue for VNIR spectral channels.</td>
<td><strong>float</strong></td>
<td></td>
</tr>
<tr>
<td>long_name</td>
<td></td>
<td><strong>string</strong></td>
<td>&quot;Radiance to brightness temperature conversion coefficient wavenumber&quot;</td>
</tr>
<tr>
<td>comment</td>
<td></td>
<td><strong>string</strong></td>
<td>&quot;Only for IR channels. Set to _FillValue for VNIR channels&quot;</td>
</tr>
<tr>
<td>units</td>
<td></td>
<td><strong>string</strong></td>
<td>&quot;cm&lt;sup&gt;-1&lt;/sup&gt;&quot;</td>
</tr>
<tr>
<td>_FillValue</td>
<td>ushort</td>
<td>NC_FILL_FLOAT</td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>--------------</td>
<td>----------------</td>
<td></td>
</tr>
<tr>
<td>channel_effective_solar_irradiance</td>
<td>Channel effective solar irradiance at 1 AU (in mW/[m^2.(cm-1)]) to be used in the derivation of the reflectance for VNIR spectral channels. Variable is set to _FillValue for IR spectral channels.</td>
<td>float</td>
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<table>
<thead>
<tr>
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<th>string</th>
<th>Channel effective solar irradiance at 1 AU</th>
</tr>
</thead>
<tbody>
<tr>
<td>comment</td>
<td>string</td>
<td>&quot;For he derivation of reflectance for VNIR spectral channels. Set to _FillValue for IR channels&quot;</td>
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<tr>
<td>units</td>
<td>string</td>
<td>&quot;mW/(m^2.(cm^-1))&quot;</td>
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<td>ushort</td>
<td>NC_FILL_FLOAT</td>
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<td>index_map</td>
<td>string</td>
<td>Map associating pixel to indexed geometric parameters</td>
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<tr>
<td>coordinates</td>
<td>string</td>
<td>&quot;y x&quot;</td>
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</table>

<table>
<thead>
<tr>
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<th>&quot;Map associating pixel to indexed geometric parameters&quot;</th>
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<td>ushort</td>
<td>NC_FILL_USHORT</td>
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<tr>
<td>coordinates</td>
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### A.2.5 Group:/data/<channel>/swath

**Dimensions**

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<th>Shape</th>
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<tbody>
<tr>
<td>number_of_columns</td>
<td></td>
<td></td>
<td>configured_value(5568,11136,22272)</td>
<td></td>
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<tr>
<td>number_of_swath_boundaries</td>
<td>Number of swaths boundaries in the dataset (equal to number_of_swaths – 1)</td>
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<td>runtime_value</td>
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**User Types**

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**Group Attributes**

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<th>Values</th>
<th>Shape</th>
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</thead>
<tbody>
<tr>
<td>long_name</td>
<td>Group description &quot;Swath related information&quot;</td>
<td>string</td>
<td>Swath related information</td>
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**Variables**

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<th>Values</th>
<th>Shape</th>
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<tbody>
<tr>
<td>swath_boundary</td>
<td></td>
<td>The northern most row per column of the last pixel to have been created</td>
<td>ushort</td>
<td></td>
<td>number_of_swath_boundaries, number_of_columns</td>
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### from a particular swath.

<table>
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<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>long_name</td>
<td>&quot;Swath northern edge boundary&quot;</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>comment</td>
<td>&quot;The northern most row per column of the last pixel to have been created from a particular swath&quot;</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>_FillValue</td>
<td>NC_FILL_USHORT</td>
<td>ushort</td>
<td></td>
<td></td>
</tr>
<tr>
<td>valid_range</td>
<td>1 to configured_value for the channel</td>
<td>ushort</td>
<td>&lt;configured_value&gt;</td>
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#### A.2.6 Group:/data/<channel>/quality_channel

**Dimensions**

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**User Types**

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**Group Attributes**

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<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>long_name</td>
<td>&quot;Quality indicators applicable to a&quot;</td>
<td>string</td>
<td>Quality indicators</td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>Attribute</td>
<td>Description</td>
<td>Type</td>
<td>Values</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>-----------</td>
<td>-----------------------------------------------------------------------------</td>
<td>--------</td>
<td>---------------------</td>
</tr>
<tr>
<td>number_of_expected_earth_pixels</td>
<td></td>
<td>Number of earth pixels that are expected be in the nominal dataset</td>
<td>uint</td>
<td></td>
</tr>
<tr>
<td></td>
<td>long_name</td>
<td></td>
<td>string</td>
<td>Number of expected Earth pixels in nominal chunk&quot;</td>
</tr>
<tr>
<td></td>
<td>units</td>
<td></td>
<td>string</td>
<td>&quot;pixel&quot;</td>
</tr>
<tr>
<td></td>
<td>_FillValue</td>
<td></td>
<td>ushore</td>
<td>NC_FILL_UINT</td>
</tr>
<tr>
<td>number_of_masked_pixels</td>
<td></td>
<td>Number of space pixels that have been masked.</td>
<td>uint</td>
<td></td>
</tr>
<tr>
<td></td>
<td>long_name</td>
<td></td>
<td>string</td>
<td>Number of masked pixels in chunk&quot;&quot;</td>
</tr>
<tr>
<td></td>
<td>units</td>
<td></td>
<td>string</td>
<td>&quot;pixel&quot;</td>
</tr>
<tr>
<td></td>
<td>_FillValue</td>
<td></td>
<td>ushore</td>
<td>NC_FILL_UINT</td>
</tr>
<tr>
<td>number_of_missing_warning_pixels</td>
<td></td>
<td>Number of Earth pixels with missing_warning flag set</td>
<td>uint</td>
<td></td>
</tr>
<tr>
<td></td>
<td>long_name</td>
<td></td>
<td>string</td>
<td>&quot;Number of pixels with missing_warning flag set&quot;</td>
</tr>
<tr>
<td></td>
<td>units</td>
<td></td>
<td>string</td>
<td>&quot;pixel&quot;</td>
</tr>
<tr>
<td><em>FillValue</em></td>
<td>Number of Earth pixels with radiometric_warning_flag set</td>
<td><em>ushort</em></td>
<td>NC_FILL_UINT</td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------------------------------------</td>
<td>---------</td>
<td>--------------</td>
<td></td>
</tr>
<tr>
<td>number_of_radiometric_warning_pixels</td>
<td>Number of Earth pixels with radiometric_warning flag set</td>
<td><em>ushort</em></td>
<td>NC_FILL_UINT</td>
<td></td>
</tr>
<tr>
<td>long_name</td>
<td>string &quot;Number of pixels with radiometric_warning flag set&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>units</td>
<td>string &quot;pixel&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><em>FillValue</em></th>
<th>Number of Earth pixels with noise_warning_flag set</th>
<th><em>ushort</em></th>
<th>NC_FILL_UINT</th>
</tr>
</thead>
<tbody>
<tr>
<td>number_of_noise_warning_pixels</td>
<td>Number of Earth pixels with noise_warning flag set</td>
<td><em>ushort</em></td>
<td>NC_FILL_UINT</td>
</tr>
<tr>
<td>long_name</td>
<td>string &quot;Number of pixels with noise_warning flag set&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>units</td>
<td>string &quot;pixel&quot;</td>
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<table>
<thead>
<tr>
<th><em>FillValue</em></th>
<th>Number of Earth pixels with geolocation_warning_flag set</th>
<th><em>ushort</em></th>
<th>NC_FILL_UINT</th>
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</thead>
<tbody>
<tr>
<td>number_of_geolocation_warning_pixels</td>
<td>Number of Earth pixels with geolocation_warning_flag set</td>
<td><em>ushort</em></td>
<td>NC_FILL_UINT</td>
</tr>
<tr>
<td>long_name</td>
<td>string &quot;Number of pixels with geolocation_warning_flag set&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>units</td>
<td>string &quot;pixel&quot;</td>
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<table>
<thead>
<tr>
<th><em>FillValue</em></th>
<th>Number of Earth pixels with saturation_warning_flag set</th>
<th><em>ushort</em></th>
<th>NC_FILL_UINT</th>
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<td>number_of_saturation_warning_pixels</td>
<td>Number of Earth pixels with saturation_warning_flag set</td>
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<td>NC_FILL_UINT</td>
</tr>
<tr>
<td>long_name</td>
<td>string &quot;Number of pixels with saturation_warning_flag set&quot;</td>
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<tr>
<td>units</td>
<td>strin</td>
<td>&quot;pixel&quot;</td>
<td></td>
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<td>-------</td>
<td>-------</td>
<td>---------</td>
<td></td>
</tr>
<tr>
<td>_FillValue</td>
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<td>number_of_straylight_correction_warning_pixels</td>
<td>Number of Earth pixels with straylight_correction_warning flag set</td>
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</tr>
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<td>strin</td>
<td>&quot;Number of pixels with straylight_correction_warning flag set&quot;</td>
<td></td>
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<tr>
<td>units</td>
<td>strin</td>
<td>&quot;pixel&quot;</td>
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<td>number_of_extended_dynamic_range_warning_pixels</td>
<td>Number of Earth pixels with extended_dynamic_range_warning flag set</td>
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</tr>
<tr>
<td>long_name</td>
<td>strin</td>
<td>&quot;Number of pixels with extended_dynamic_range_warning flag set&quot;</td>
<td></td>
</tr>
<tr>
<td>units</td>
<td>strin</td>
<td>&quot;pixel&quot;</td>
<td></td>
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<tr>
<td>_FillValue</td>
<td>usho</td>
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<td>number_of_encoding_saturation_warning_pixels</td>
<td>Number of Earth pixels with encoding_saturation_warning flag set</td>
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A.2.7 Group:/state

Dimensions

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User Types

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Group Attributes

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Variables

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### A.2.8 Group:/state/platform

#### Dimensions

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#### User Types

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<th>Values</th>
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<tr>
<td>manoeuvre_type</td>
<td>See Enums worksheet</td>
<td>enum ubyte</td>
<td>See Enums table</td>
<td></td>
</tr>
<tr>
<td>reference_frame_type</td>
<td>See Enums worksheet</td>
<td>enum ubyte</td>
<td>See Enums table</td>
<td></td>
</tr>
<tr>
<td>yaw_flip_type</td>
<td>yaw_flip summer = 1, winter = 0</td>
<td>enum ubyte</td>
<td>See Enums table</td>
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</tbody>
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#### Group Attributes

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#### Variables

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<tr>
<td>yaw_flip</td>
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<td>Yaw flip configuration</td>
<td>yaw_flip_type</td>
<td>See Enums table</td>
<td></td>
</tr>
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### A.2.9 Group:/state/instrument

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<td>fci_mode_type</td>
<td>fci_mode_type</td>
<td></td>
</tr>
<tr>
<td>long_name</td>
<td></td>
<td>&quot;Mode of FCI instrument&quot;</td>
<td>string</td>
<td>&quot;Mode of FCI instrument&quot;</td>
<td></td>
</tr>
<tr>
<td><strong>level0_channels</strong></td>
<td>Array of strings indicating the FCI data channels delivered in the level 0 data (&quot;FDVIS0.4&quot;, &quot;FDVIS0.5&quot;, &quot;HRVIS0.6&quot;, &quot;FDVIS0.8&quot;, &quot;FDVIS0.9&quot;, &quot;FDNIR1.3&quot;, &quot;FDNIR1.6&quot;, &quot;HRNIR2.2&quot;, &quot;HRIR3.8&quot;, &quot;FAIR3.8&quot;, &quot;FDIR6.3&quot;, &quot;FDIR7.3&quot;, &quot;FDIR8.7&quot;, &quot;FDIR9.7&quot;, &quot;HRIR10.5&quot;, &quot;FDIR12.3&quot;, &quot;FDIR13.3&quot;)</td>
<td>string</td>
<td>number_of_l0_channels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>--------</td>
<td>-----------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>long_name</strong></td>
<td>&quot;FCI level 0 data channels&quot;</td>
<td>string</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>repeat_cycle_start_time</strong></td>
<td>Conversion of the &quot;repeat_cycle_start_time&quot; from the level 0 data ICU-I auxiliary data into UTC</td>
<td>double</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>long_name</strong></td>
<td>&quot;UTC start time of repeat cycle&quot;</td>
<td>string</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>standard_name</strong></td>
<td>&quot;time&quot;</td>
<td>string</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>units</strong></td>
<td>&quot;seconds since 2000-01-01 00:00:00.0&quot;</td>
<td>string</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>precision</strong></td>
<td>&quot;1 ms&quot;</td>
<td>string</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>_FillValue</strong></td>
<td>NC_FILL_DOUBLE</td>
<td>double</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>repeat_sequence_counter</strong></td>
<td>Copy of the &quot;repeat sequence counter&quot; from the level 0 data ICU-I auxiliary data</td>
<td>ushort</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Type</td>
<td>Value</td>
<td>Description</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>-----------</td>
<td>-------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>long_time</code></td>
<td>string</td>
<td>&quot;Repeat sequence counter&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>_FillValue</td>
<td>double</td>
<td>NC_FILL_USHORT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>repeat_cycle_counter</td>
<td>ushort</td>
<td></td>
<td>Copy of the “repeat cycle counter since the last transition to operational mode” from the level 0 ICU-I auxiliary data</td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>long_time</code></td>
<td>string</td>
<td>&quot;Repeat cycle counter since the last transition to operational mode&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>_FillValue</td>
<td>double</td>
<td>NC_FILL_USHORT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>repeat_sequence_id</td>
<td>ushort</td>
<td></td>
<td>Copy of the “repeat sequence identifier” from the level 0 data ICU-I auxiliary data</td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>long_time</code></td>
<td>string</td>
<td>&quot;Repeat sequence identifier&quot;</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>_FillValue</td>
<td>double</td>
<td>NC_FILL_USHORT</td>
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</tr>
<tr>
<td>repeat_cycle_counter_in_repeat_sequence</td>
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<td></td>
<td>Copy of the “repeat cycle counter in repeat sequence” from the level 0 data ICU-I auxiliary data</td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>long_time</code></td>
<td>string</td>
<td>&quot;Repeat cycle counter in the sequence&quot;</td>
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</tr>
<tr>
<td>Field</td>
<td>Type</td>
<td>Description</td>
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<td></td>
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<tr>
<td>---------------------</td>
<td>----------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>repeat_cycle_id</td>
<td>ushort</td>
<td>An identifier for the repeat cycle derived from the &quot;Repeat sequence identifier&quot;, &quot;Repeat cycle counter in current repeat sequence&quot; and the &quot;Scan Law&quot; from the level 0 data ICU-I auxiliary data. The repeat_cycle_id is a unique reference to the scan angles commanded to the FCI during a given repeat cycle.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>scan_law_id</td>
<td>ushort</td>
<td>Copy of the &quot;Scan law id&quot; from the level 0 ICU-I auxiliary data</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>channel_on</td>
<td>boolean</td>
<td>TRUE if the spectral channel is switched on and active</td>
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</table>

**_FillValue**

- double "NC_FILL_USH ORT"
- string "Repeat cycle identifier"
- string "Scan law identifier"
- string "Channel active flag"
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<tr>
<th>last_decontamination_start_time</th>
<th>Start time in UTC of most recent decontamination</th>
<th>double</th>
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</thead>
<tbody>
<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;UTC start time of most recent decontamination &quot;</td>
</tr>
<tr>
<td>standard_name</td>
<td>string</td>
<td>&quot;time&quot;</td>
</tr>
<tr>
<td>units</td>
<td>string</td>
<td>&quot;seconds since 2000-01-01 00:00:00.0&quot;;</td>
</tr>
<tr>
<td>precision</td>
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<td>&quot;1 ms&quot;</td>
</tr>
<tr>
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<td>NC_FILL_DOUBLE</td>
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</tbody>
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<table>
<thead>
<tr>
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<th>End time in UTC of most recent decontamination</th>
<th>double</th>
</tr>
</thead>
<tbody>
<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;UTC end time of most recent decontamination &quot;</td>
</tr>
<tr>
<td>standard_name</td>
<td>string</td>
<td>&quot;time&quot;</td>
</tr>
<tr>
<td>units</td>
<td>string</td>
<td>&quot;seconds since 2000-01-01 00:00:00.0&quot;;</td>
</tr>
<tr>
<td>_FillValue</td>
<td>double</td>
<td>NC_FILL_DOUBLE</td>
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<table>
<thead>
<tr>
<th>last_detection_chain_parameter_change_time</th>
<th>Time in UTC of the last change in detection chain parameters, corresponding to the start of the repeat cycle</th>
<th>double</th>
<th>number_of_l0_channels</th>
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</thead>
<tbody>
<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;UTC end time of last change in the detection chain parameters&quot;</td>
<td></td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>standard_name</td>
<td>string</td>
<td>&quot;time&quot;</td>
<td></td>
</tr>
<tr>
<td>units</td>
<td>string</td>
<td>&quot;seconds since 2000-01-01 00:00:00.0&quot;;</td>
<td></td>
</tr>
<tr>
<td>precision</td>
<td>string</td>
<td>&quot;1 ms&quot;</td>
<td></td>
</tr>
<tr>
<td>_FillValue</td>
<td>double</td>
<td>NC_FILL_DOUBLE</td>
<td></td>
</tr>
<tr>
<td>last_heated_black_body_calibration_time</td>
<td>Time in UTC of the last heated black body calibration for the IR spectral channels, corresponding to the start of the calibration data acquisition</td>
<td>double</td>
<td></td>
</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;UTC end time of last heated black body calibration&quot;</td>
<td></td>
</tr>
<tr>
<td>standard_name</td>
<td>string</td>
<td>&quot;time&quot;</td>
<td></td>
</tr>
<tr>
<td>units</td>
<td>string</td>
<td>&quot;seconds since 2000-01-01 00:00:00.0&quot;;</td>
<td></td>
</tr>
<tr>
<td>precision</td>
<td>string</td>
<td>&quot;1 ms&quot;</td>
<td></td>
</tr>
<tr>
<td>_FillValue</td>
<td>double</td>
<td>NC_FILL_DOUBLE</td>
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</tbody>
</table>
### A.2.10 Group:/state/processor

#### Dimensions

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>last_mnd_calibration_time</td>
<td>Time in UTC of the last metallic neutral density calibration for the VNIR spectral channels, corresponding to the start of the calibration data acquisition</td>
<td>double</td>
<td></td>
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</tbody>
</table>

#### User Types

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>long_name</td>
<td>&quot;UTC end time of last metallic neutral density calibration&quot;</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>standard_name</td>
<td>&quot;time&quot;</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>units</td>
<td>&quot;seconds since 2000-01-01 00:00:00.0&quot;;</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>precision</td>
<td>&quot;1 ms&quot;</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>_FillValue</td>
<td>NC_FILL_DOUBLE</td>
<td>double</td>
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</tr>
</tbody>
</table>
### Group Attributes

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>resampling_method_type</td>
<td>Resampling method applied to the level 1b samples to create the level 1c dataset</td>
<td>ubyte enum</td>
<td>see Enums table</td>
<td></td>
</tr>
<tr>
<td>weighting_function_type</td>
<td>Weighting function used with the selected resampling method</td>
<td>ubyte enum</td>
<td>see Enums table</td>
<td></td>
</tr>
<tr>
<td>projection_type</td>
<td>Projection for the reference grid</td>
<td>ubyte enum</td>
<td>see Enums table</td>
<td></td>
</tr>
</tbody>
</table>

### Variables

<table>
<thead>
<tr>
<th>Name</th>
<th>Attribute</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>detector_equalization_enabled</td>
<td></td>
<td>TRUE if detector equalization has been applied to the dataset</td>
<td>boolean</td>
<td></td>
<td></td>
</tr>
<tr>
<td>long_name</td>
<td></td>
<td>&quot;Detector equalization enabled for the channel&quot;</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mtf_adaptation_enabled</td>
<td></td>
<td>TRUE if MTF adaptation has been applied</td>
<td>boolean</td>
<td></td>
<td>number_of_l0_channels</td>
</tr>
<tr>
<td><strong>long_name</strong></td>
<td><strong>string</strong></td>
<td><strong>&quot;MTF adaptation enabled for the channel&quot;</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------------</td>
<td>------------</td>
<td>---------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>earth_straylight_correction_enabled</td>
<td>boolean</td>
<td>TRUE if earth stray light correction has been applied to the dataset</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sun_straylight_correction_enabled</td>
<td>boolean</td>
<td>TRUE if sun stray light correction has been applied to the dataset</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>resampling_method</td>
<td>resampling_method_t</td>
<td>Resampling method applied to the level 1b samples to</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>create the level 1c dataset</strong></td>
<td><strong>long_name</strong></td>
<td><strong>string</strong></td>
<td>&quot;Selected resampling method&quot;</td>
<td></td>
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</tr>
<tr>
<td>-------------------------------</td>
<td>-------------</td>
<td>-----------</td>
<td>----------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>weighting_function</strong></td>
<td>Weighting function used with the selected resampling method.</td>
<td>weighting_function_type</td>
<td></td>
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</tr>
<tr>
<td><strong>long_name</strong></td>
<td>string</td>
<td>&quot;Weighting method used with the selected resampling method&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>radiometric_warning</strong></td>
<td>Radiometric calibration in the previous repeat cycles has led to a potential problem in the calibration of the channel data for the</td>
<td>boolean</td>
<td>number_of_l0_channels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>complete repeat cycle, e.g. a missing black body calibration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------------------------</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>long_name</td>
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</tr>
<tr>
<td>string</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Radiometric calibration warning per channel for the repeat cycle&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>comment</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>string</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Radiometric calibration in the previous repeat cycles has led to a potential problem in the calibration of the channel data for the complete repeat cycle&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>geometric_warning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The geometric processing in the previous repeat cycles has not allowed the update of the INR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>boolean</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>number_of_l1c_channels</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
state vector the required accuracy to allow current repeat cycle measurements to be guaranteed.

<table>
<thead>
<tr>
<th>long_name</th>
<th>string</th>
<th>&quot;Geometric calibration warning per channel for the repeat cycle&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>comment</td>
<td>string</td>
<td>&quot;Geometric processing in the previous repeat cycles has not allowed the update of the INR state vector to the required accuracy to allow current repeat cycle measurements to be guaranteed.&quot;</td>
</tr>
<tr>
<td>reference_grid</td>
<td>Identifies to which of the three SSD-based grids the ssd_type</td>
<td>number_of_reference_grids</td>
</tr>
<tr>
<td>ssd_type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>number_of_reference_grids</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>long_name</strong></td>
<td><strong>string</strong></td>
<td>&quot;Reference grid for the channel&quot;</td>
</tr>
<tr>
<td><strong>comment</strong></td>
<td><strong>string</strong></td>
<td>&quot;Reference grid is based on channel SSD&quot;</td>
</tr>
</tbody>
</table>

### reference_grid_identifier

- **long_name**: File name for the reference grid definition file, accessible to the user via the archive.
- **comment**: "File name for the reference grid definition file"

### reference_grid_version

- **long_name**: Version number of the set of reference grid parameters. A change in version number between datasets
- **comment**: "File name for the reference grid definition file"
implies the grid must be recalculated.

<table>
<thead>
<tr>
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<th>&quot;Version of reference grid parameters&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>_FillValue</td>
<td>ushort</td>
<td>NC_FILL_USHORT</td>
</tr>
<tr>
<td>reference_grid_earth_model</td>
<td>string</td>
<td>Earth model used for reference grid</td>
</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;Earth model used for reference grid&quot;</td>
</tr>
<tr>
<td>reference_grid_projection</td>
<td>projection_type</td>
<td>Projection used for reference grid</td>
</tr>
<tr>
<td>projection_origin_longitude</td>
<td>double</td>
<td>Longitude of projection origin</td>
</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;Longitude of projection origin&quot;</td>
</tr>
<tr>
<td>standard_name</td>
<td>string</td>
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<tr>
<td>units</td>
<td>string</td>
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<tr>
<td>Variable</td>
<td>Type</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>projection_origin_latitude</td>
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<td>Latitude of projection origin</td>
</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;Latitude of projection origin&quot;</td>
</tr>
<tr>
<td>standard_name</td>
<td>string</td>
<td>&quot;latitude&quot;</td>
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<td>units</td>
<td>string</td>
<td>&quot;degrees North&quot;</td>
</tr>
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<td>reference_altitude</td>
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<tr>
<td>reference_grid_spatial_sampling_angle_ns</td>
<td>float</td>
<td>Spatial sampling angle for each reference grid in North-South direction</td>
</tr>
<tr>
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<td>string</td>
<td>&quot;Spatial sampling angle for each reference grid in North-South direction&quot;</td>
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<tr>
<td>Variable Name</td>
<td>Type</td>
<td>Description</td>
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<td>number_of_reference_grids</td>
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<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;Spatial sampling angle for each reference grid in East-West direction&quot;</td>
</tr>
<tr>
<td>units</td>
<td>string</td>
<td>&quot;radian&quot;</td>
</tr>
<tr>
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<tr>
<td>earth_polar_radius</td>
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</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;Earth polar radius&quot;</td>
</tr>
<tr>
<td>units</td>
<td>string</td>
<td>&quot;m&quot;</td>
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<tr>
<td>_FillValue</td>
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<td>NC_FILL_DOUBLE</td>
</tr>
<tr>
<td>earth_equatorial_radius</td>
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<td></td>
</tr>
<tr>
<td>long_name</td>
<td>units</td>
<td>_FillValue</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------</td>
<td>-------------------</td>
</tr>
<tr>
<td>&quot;Earth equatorial</td>
<td>&quot;m&quot;</td>
<td>&quot;NC_FILL_DOU</td>
</tr>
<tr>
<td>radius&quot;</td>
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<td>BLE&quot;</td>
</tr>
<tr>
<td>reference_grid_number_of_columns</td>
<td>uint</td>
<td>number_of_reference_grids</td>
</tr>
<tr>
<td>number_of_reference_grids</td>
<td>long_name</td>
<td>&quot;Number of columns in reference grid&quot;</td>
</tr>
<tr>
<td></td>
<td>_FillValue</td>
<td>ushort &quot;NC_FILL_UINT&quot;</td>
</tr>
<tr>
<td>reference_grid_number_of_rows</td>
<td>uint</td>
<td>number_of_reference_grids</td>
</tr>
<tr>
<td>number_of_reference_grids</td>
<td>long_name</td>
<td>&quot;Number of rows in reference grid&quot;</td>
</tr>
<tr>
<td></td>
<td>_FillValue</td>
<td>ushort &quot;NC_FILL_UINT&quot;</td>
</tr>
<tr>
<td>azimuth_angle_at_reference_grid_origin</td>
<td>double</td>
<td>number_of_reference_grids</td>
</tr>
<tr>
<td>azimuth_angle from the GEOS projection origin to the centre of the first reference grid column</td>
<td>long_name</td>
<td>&quot;Azimuth angle from the GEOS</td>
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### A.2.11 Group:/state/celestial

#### Dimensions

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<th>Name</th>
<th>Description</th>
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<th>Values</th>
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<tr>
<td>elevation_angle_at_reference_grid_origin</td>
<td>Elevation angle from the GEOS projection origin to the centre of the first reference grid row</td>
<td>double</td>
<td>number_of_reference_grids</td>
<td></td>
</tr>
<tr>
<td>long_name</td>
<td>&quot;Elevation angle from the GEOS projection origin to the centre of the first reference grid row&quot;</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>units</td>
<td>&quot;radian&quot;</td>
<td>string</td>
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### User Types

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### Group Attributes

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### Variables

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<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>moon_shadow_presence</td>
<td>long_name</td>
<td>TRUE if the moon shadow on the Earth occurs in this chunk</td>
<td>boolean</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sunglint_presence</td>
<td>long_name</td>
<td>TRUE if sunglint is possible within the chunk</td>
<td>boolean</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sunglint_extent_latitude_min</td>
<td></td>
<td>Minimum latitude boundary of the</td>
<td>double</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field</td>
<td>Type</td>
<td>Description</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>---------</td>
<td>-----------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sunglint_extent_latitude_max</td>
<td>double</td>
<td>Maximum latitude boundary of the rectangular extent of the sunglint within the chunk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;Minimum latitude of sunglint within chunk&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>standard_name</td>
<td>string</td>
<td>&quot;latitude&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>units</td>
<td>string</td>
<td>&quot;degrees North&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>_FillValue</td>
<td>double</td>
<td>NC_FILL_DOUBLE</td>
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<table>
<thead>
<tr>
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<th>Description</th>
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</thead>
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<tr>
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<td>Minimum longitude boundary of the rectangular extent of the sunglint within the chunk</td>
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<tr>
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<td>&quot;Minimum longitude of sunglint within chunk&quot;</td>
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<td>standard_name</td>
<td>string</td>
<td>&quot;longitude&quot;</td>
</tr>
<tr>
<td>units</td>
<td>string</td>
<td>&quot;degrees North&quot;</td>
</tr>
<tr>
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<td>NC_FILL_DOUBLE</td>
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<tr>
<td>variable</td>
<td>units</td>
<td>string</td>
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<tr>
<td>----------------------------------</td>
<td>-----------</td>
<td>----------------------</td>
</tr>
<tr>
<td>sunglint_extent_longitude_max</td>
<td>double</td>
<td>&quot;degrees East&quot;</td>
</tr>
<tr>
<td></td>
<td>long_name</td>
<td>&quot;Maximum longitude boundary of the rectangular extent of the sunglint within the chunk&quot;</td>
</tr>
<tr>
<td></td>
<td>standard_name</td>
<td>&quot;longitude&quot;</td>
</tr>
<tr>
<td></td>
<td>units</td>
<td>&quot;degrees East&quot;</td>
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<tr>
<td></td>
<td>_FillValue</td>
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<td>earth_sun_distance</td>
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<td>index</td>
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<tr>
<td></td>
<td>long_name</td>
<td>&quot;Distance between Earth and Sun&quot;</td>
</tr>
<tr>
<td></td>
<td>units</td>
<td>&quot;km&quot;</td>
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<tr>
<td></td>
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<tr>
<td>sun_satellite_distance</td>
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<td>index</td>
</tr>
<tr>
<td></td>
<td>long_name</td>
<td>&quot;Distance between satellite and Sun&quot;</td>
</tr>
<tr>
<td></td>
<td>units</td>
<td>&quot;km&quot;</td>
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<tr>
<td></td>
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<td>description</td>
<td>type</td>
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<tr>
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<td>------------------------------------------------------------------------------</td>
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<tr>
<td>sun_eclipse_by_earth</td>
<td>If TRUE indicates an eclipse of the sun by the earth, as viewed by the satellite</td>
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<td>long_name</td>
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<td>string</td>
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<tr>
<td>title</td>
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<td>string</td>
</tr>
<tr>
<td>sun_eclipse_by_moon</td>
<td>If TRUE indicates an eclipse of the sun by the moon, as viewed by the satellite</td>
<td>boolean</td>
</tr>
<tr>
<td>long_name</td>
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<td>string</td>
</tr>
<tr>
<td>title</td>
<td></td>
<td>string</td>
</tr>
<tr>
<td>solar_elevation</td>
<td>Solar angle in instrument frame at time(index)</td>
<td>float</td>
</tr>
<tr>
<td>standard_name</td>
<td></td>
<td>string</td>
</tr>
<tr>
<td>long_name</td>
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<tr>
<td>units</td>
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<tr>
<td>_FillValue</td>
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<tr>
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<td>Solar angle in instrument frame at time(index)</td>
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<tr>
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<td></td>
<td>units</td>
<td>string</td>
</tr>
<tr>
<td></td>
<td>_FillValue</td>
<td>string</td>
</tr>
<tr>
<td>subsolar_latitude</td>
<td>Latitude of the sub-solar point at time(index)</td>
<td>float</td>
</tr>
<tr>
<td></td>
<td>long_name</td>
<td>string</td>
</tr>
<tr>
<td></td>
<td>units</td>
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<td>_FillValue</td>
<td>string</td>
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<tr>
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<td>standard_name</td>
<td>string</td>
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<tr>
<td>subsolar_longitude</td>
<td>Longitude of the sub-solar point at time(index)</td>
<td>float</td>
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<td>long_name</td>
<td>string</td>
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<tr>
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<td>_FillValue</td>
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### A.3 FCI-1C-RRAD-TRAIL

#### A.3.1 Group:root (/)

**Global Attributes**

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<tr>
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<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
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<tr>
<td>Conventions</td>
<td>Conventions that the product conforms to. This could be a future version of the CF Conventions that is applicable to netCDF4.</td>
<td>string</td>
<td>e.g. &quot;CF-1.7&quot;</td>
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</tr>
<tr>
<td>title</td>
<td>Dataset/product name</td>
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<td></td>
</tr>
<tr>
<td>summary</td>
<td>As defined in the relevant dataset/product format specification.</td>
<td>string</td>
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<tr>
<td>keywords</td>
<td>As defined in the relevant dataset/product format specification.</td>
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<tr>
<td>keywords_vocabulary</td>
<td>As defined in the relevant dataset/product format specification.</td>
<td>string</td>
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<tr>
<td>history</td>
<td>As per [CF]</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>institution</td>
<td>This field may be extended with other values should datasets/products be generated in other locations.</td>
<td>string</td>
<td>“original generated file”</td>
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<td>As per the dataset name field “data_designator” in dataset name</td>
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<td></td>
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<td>data_source</td>
<td>As per the dataset name field “data_source” in dataset name</td>
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<td>Variable</td>
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<td>-------------------------------------------------------------------------------</td>
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<td>processing_level</td>
<td>As per the dataset name field “level” in dataset name</td>
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<td>coverage</td>
<td>As per the dataset name field “coverage” in dataset name</td>
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<td>As per the dataset name field “type” in dataset name</td>
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<td>As per the dataset name field “subtype” in dataset name</td>
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<td>As per the dataset name field “component1” in dataset name</td>
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<td>As per the dataset name field “component2” in dataset name</td>
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<td>As per the dataset name field “component3” in dataset name</td>
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<tr>
<td>product_id</td>
<td>The identifying product_id as used in the SIP</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>baseline_version</td>
<td>Baseline version. The baseline version will reference of all other version numbers. Assumes processor_version is not sufficient for this.</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>release_version</td>
<td>Release version. Used to tag datasets that can be considered to have a contiguous consistency sufficient for example, for consideration as a climate set.</td>
<td>string</td>
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<td></td>
</tr>
<tr>
<td>processor_version</td>
<td>Processor version. Currently assumes a single processor version number suffices for the relevant IDPF or L2PP. Currently undefined if processor version also includes configuration of static auxiliary data and processor switch configuration, etc.</td>
<td>string</td>
<td></td>
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</tr>
<tr>
<td>algorithm_version</td>
<td>Algorithm version. Currently unclear how this would be used and it may be redundant with processor_version.</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>format_version</td>
<td>Format version of the dataset/product.</td>
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<td>time_coverage_start</td>
<td>As per the dataset name field “start_time” in dataset name. Renamed in line with Attribute Convention for Dataset Discovery</td>
<td>string</td>
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<tr>
<td>time_coverage_end</td>
<td>As per the dataset name field “end_time” in dataset name. Renamed in line with Attribute Convention for Dataset Discovery</td>
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</tr>
<tr>
<td>processing_mode</td>
<td>As per the dataset name field “processing_mode” in dataset name</td>
<td>string</td>
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<tr>
<td>special_compression</td>
<td>As per the dataset name field “special_compression” in dataset name</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>subsetting</td>
<td>If this field is empty then no further strings follow. If this value is a single specified internal compression method as listed in the “special_compression” field in dataset name then it is followed by two strings: (1) human-readable parameters describing the exact internal compression performed (2) either a URL providing a description of the internal compression method or the words “NO URL”. If the value is “MULTI”, then this is followed by sets of triplets of strings (one per internal compression applied) A triplet consists of: (1) an internal compression code as listed in the “special_compression” field in dataset name; (2) human-readable parameters describing the exact internal compression performed; (3) either a URL providing a description of the internal compression method or the words “NO URL”.</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>disposition_mode</td>
<td>As per the dataset/product name field “disposition_mode” in dataset name</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>source</td>
<td>Characterisation of the type of data as per [CF].</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>runtime_data</td>
<td>Space-separated string array of the SIP names of all nonproduct input datasets used in the creation of the dataset (auxiliary data, configuration file, DPP files, etc.) (Was part of &lt;source&gt; field)</td>
<td>string</td>
<td>&lt;runtime_value&gt;</td>
<td></td>
</tr>
<tr>
<td>----------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------</td>
<td>-----------------</td>
<td></td>
</tr>
<tr>
<td>parent_data</td>
<td>Space-separated string array of the SIP names of all parent products/datasets used in the creation of the dataset (Was part of &lt;source&gt; field)</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>linked_data</td>
<td>Space-separated string array of the SIP names of all datasets to be linked with this dataset in the archive (e.g. for a Level 0 dataset this would be all additional datasets required to create the virtual L0+ dataset in the archive). (Was part of &lt;source&gt; field)</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>facility_or_tool</td>
<td>As per the dataset name field “facility_or_tool” in dataset name</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>environment</td>
<td>As per the dataset name field “environment” in dataset name</td>
<td>string</td>
<td></td>
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</tr>
<tr>
<td>references</td>
<td>“www.eumetsat.int”</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>comment</td>
<td>Unless otherwise specified in the relevant dataset/product format specification, “None.”</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>date_created</td>
<td>UTC time of processing formatted in Abbreviated Generalised Time format and defined as the time of the formatting of the dataset/product by the processor. Renamed in line with Attribute Convention for Dataset Discovery</td>
<td>string</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| group_tag            | String that represents a grouping of datasets that allows chunks and quick-looks to be linked together. The string has the format: \(<platform>_<datsource>_<processing_level>_<type>_<subtype>_<YYYY>_<DDD>_<NNNN>_<release_version>\) where:  
\(<\) indicates the same value as the named global metadata field in the brackets (as described in this table)  
YYYY = the year value of the “repeat_cycle_time_position” field  
DDD = day in year value derived from the “repeat_cycle_time_position” field, left padded with zeroes: 001 = Jan 1st, etc.  
NNNN = copy of the “repeat_cycle_in_day” field | string |                 |
<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>repeat_cycle_in_day</td>
<td>4-digit number (right-justified, zero-filled) indicating the expected current repeat cycle or group accumulation interval in the day for this particular dataset. For details on how to determine the expected repeat cycle see [EXPRC]. The counter starts at 0001 for the first repeat cycle at or after midnight (based on the time_position value) and resets for the next repeat cycle at or after the following midnight. Datasets/products that have no repeat cycle or group accumulation interval (e.g. certain DPP files) should use a fixed value of 0000 to indicate the field is not applicable.</td>
<td>string</td>
</tr>
<tr>
<td>processed_count_in_repeat_cycle</td>
<td>Cumulative count of the dataset chunk in the repeat cycle or group accumulation interval. Resets when the repeat_cycle_in_day value changes. The counter increments for each created chunk in a repeat cycle or accumulation interval. It does not increment when a chunk is not created due to missing parent data.</td>
<td>string</td>
</tr>
<tr>
<td>count_in_repeat_cycle</td>
<td>4-digit number (right-justified, zero-filled) indicating the expected count value of the dataset chunk in the repeat cycle or group accumulation interval based on the scan pattern or equivalent information. The counter will have discontinuities when chunks are not produced. The counter starts from 1 and resets when the repeat_cycle_in_day value changes. The counter increments for each chunk in a repeat cycle or accumulation interval (whether header, body or trailer). A value of 0 is used for datasets for which the counter is not applicable (e.g. datasets which are not chunk-able).</td>
<td>string</td>
</tr>
<tr>
<td>instrument_configuration_id</td>
<td>List of space-separated values of the “instrument configuration identifier” from the level 0 data ICU-I auxiliary data. Each unique ICID/ICID Version combination produces an entry in the list e.g. an ICID 100 that exists in the product with ICID Versions 1 and 2 will produce two “100” entries in the list.</td>
<td>string</td>
</tr>
<tr>
<td>instrument_configuration_id_version</td>
<td>List of space-separated values of the “instrument configuration identifier version” from the level 0 data ICU-I auxiliary data. Each ICID in the instrument_configuration_id field should have a matching ICID Version entry in</td>
<td>string</td>
</tr>
<tr>
<td>Field</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>----------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>subsettable_groups</td>
<td>Space separated list of paths to groups that have the subsettable=&quot;yes&quot; group attribute.</td>
<td></td>
</tr>
<tr>
<td>subsettable_groups_present</td>
<td>Space separated list of paths to groups that are present in the product. Will be the same as subsettable_groups for unsubsetted products.</td>
<td></td>
</tr>
<tr>
<td>mtg_name</td>
<td>String field containing the MTG WMO-convention name for the file.</td>
<td></td>
</tr>
<tr>
<td>alternative_name</td>
<td>String field containing a possible alternative name for the file (e.g. Sentinel-4 naming convention)</td>
<td></td>
</tr>
<tr>
<td>purpose</td>
<td>As per the dataset/product name field “purpose” in dataset name.</td>
<td></td>
</tr>
<tr>
<td>format</td>
<td>As per the dataset/product name field “format” in dataset name.</td>
<td></td>
</tr>
<tr>
<td>id</td>
<td>Can contain a DOI for reprocessed climate datasets (configuration file). Otherwise set to an empty string.</td>
<td></td>
</tr>
<tr>
<td>naming authority</td>
<td>Will contain the DOI issuing authority for reprocessed climate datasets (configuration file) if id attribute is used. Otherwise set to an empty string.</td>
<td></td>
</tr>
<tr>
<td>creator_type</td>
<td>Specifies type of creator with one of the following: 'person', 'group', 'institution', or 'position'.</td>
<td></td>
</tr>
<tr>
<td>creator_institution</td>
<td>The institution of the creator; should uniquely identify the creator's institution.</td>
<td></td>
</tr>
<tr>
<td>creator_name</td>
<td>The name of the person (or other creator type specified by the creator_type attribute) principally responsible for creating this data.</td>
<td></td>
</tr>
<tr>
<td>creator_email</td>
<td>The email address of the person (or other creator type specified by the creator_type attribute) principally responsible for creating this data.</td>
<td></td>
</tr>
<tr>
<td>creator_url</td>
<td>The URL of the person (or other creator type specified by the creator_type attribute) principally responsible for creating this data.</td>
<td></td>
</tr>
<tr>
<td>license</td>
<td>URL to a standard or specific license, enter &quot;Freely Distributed&quot; or &quot;None&quot;, or describe any restrictions to data access and distribution in free text.</td>
<td></td>
</tr>
<tr>
<td>standard_name_vocabulary</td>
<td>The name and version of the controlled vocabulary from which variable standard names are taken. (Values for any standard_name attribute must come from the CF Standard Names vocabulary for the data file or product to comply with CF.) Example: 'CF Standard Name Table v27'.</td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>project</td>
<td>The name of the project(s) principally responsible for originating this data. Multiple projects can be separated by commas.</td>
<td></td>
</tr>
<tr>
<td>time_coverage_duration</td>
<td>Describes the duration of the data set.</td>
<td></td>
</tr>
<tr>
<td>time_coverage_resolution</td>
<td>Describes the targeted time period between each value in the data set.</td>
<td></td>
</tr>
<tr>
<td>cdm_datatype</td>
<td>The data type, as derived from Unidata's Common Data Model Scientific Data types and understood by THREDDS [THREDDS]</td>
<td></td>
</tr>
<tr>
<td>comment</td>
<td>Miscellaneous information about the data, not captured elsewhere. (See [CF])</td>
<td></td>
</tr>
<tr>
<td>date_time_position</td>
<td>This is the start time of the repeat cycle (accumulation interval) shifted forwards or backwards to the nearest 30 seconds bin counting from 00:00:00. This removes minor variations and offsets in the actual observation start time of the repeat cycle. Repeat cycle Observations starting at 11:59:58, 12:00:00 and 12:00:05 would all have a date_time_position value with a time of 12:00:00. An observation starting at 23:59:45 would have value of 00:00:00 and be the first repeat cycle of the next day.</td>
<td></td>
</tr>
<tr>
<td>time_position</td>
<td>This is the time string taken from date/time string in date_time_position.</td>
<td></td>
</tr>
<tr>
<td>geospatial_lat_min</td>
<td>Geospatial_lat_min specifies the southernmost latitude covered by the dataset.</td>
<td></td>
</tr>
<tr>
<td>geospatial_lat_max</td>
<td>Geospatial_lat_max specifies the northernmost latitude covered by the dataset.</td>
<td></td>
</tr>
<tr>
<td>geospatial_lon_min</td>
<td>Geospatial_lon_min specifies the westernmost longitude covered by the dataset.</td>
<td></td>
</tr>
<tr>
<td>geospatial_lon_max</td>
<td>Geospatial_lon_max specifies the easternmost longitude covered by the dataset.</td>
<td></td>
</tr>
</tbody>
</table>
## User Types

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>boolean</td>
<td>See Enums spreadsheet. There is no boolean type in netCDF. This enumerated type at root level can be used by all datasets/products. This user type definition only needs to be present when it is used within the dataset.</td>
<td>enum byte</td>
<td>See Enums table</td>
<td></td>
</tr>
<tr>
<td>trilean</td>
<td>See Enums spreadsheet. For situations where an undefined state is also required. This user type definition only needs to be present when it is used within the dataset.</td>
<td>enum byte</td>
<td>See Enums table</td>
<td></td>
</tr>
<tr>
<td>ssd_type</td>
<td>Identifies the Spatial Sampling Distance (SSD) at nadir used to sample the data</td>
<td>ubyte enum</td>
<td>see Enums table</td>
<td></td>
</tr>
<tr>
<td>swath_direction_type</td>
<td>Identified the direction of swath acquisition from East to West or West to East.</td>
<td>ubyte enum</td>
<td>see Enums table</td>
<td></td>
</tr>
</tbody>
</table>

## Dimensions

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>body_chunk</strong></td>
<td>Number of body chunks that were produced for the current repeat cycle or equivalent time period.</td>
<td>&lt;runtime_value&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>----------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>number_of_l0_channels</strong></td>
<td>Number of data channels delivered by the FCI instrument used to create the level 1c data [17 if all channels are present, otherwise set at according to the channels available from the instrument]</td>
<td>configured_value (17)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>number_of_l1c_channels</strong></td>
<td>Number of spectral channels present in the originally generated dataset [16 if all FDHSI channels are present, 4 if all HRFI channels are present, otherwise set at according to the selected/available channels]</td>
<td>configured_value(16,4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>number_of_reference_grids</strong></td>
<td>Number of reference grid used by the channels [default 2], Note although 3</td>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Different grid exist for the FCI there are only 2 per mission (FDHSI/HRFI)

<table>
<thead>
<tr>
<th>Name</th>
<th>Attribute</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>available_body_chunks</td>
<td></td>
<td>Names of all the body chunk files that were produced for the current repeat cycle or equivalent time period.</td>
<td>String</td>
<td></td>
<td>body_chunk</td>
</tr>
<tr>
<td>long_name</td>
<td></td>
<td></td>
<td>String</td>
<td>&quot;Names of body chunk files produced for this product&quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Level 1c spectral channels present in dataset</td>
<td>string</td>
<td></td>
<td>number_of_1lc_channels</td>
</tr>
<tr>
<td>long_name</td>
<td></td>
<td></td>
<td>string</td>
<td>&quot;Level 1c spectral channels present in dataset&quot;</td>
<td></td>
</tr>
</tbody>
</table>
A.3.2 Group:/data

**Dimensions**

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**User Types**

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<th>Type</th>
<th>Values</th>
<th>Shape</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
<td>None defined</td>
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**Group Attributes**

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<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
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<tbody>
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<td>None defined</td>
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**Variables**

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<th>Attribute</th>
<th>Description</th>
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<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
<td>None defined</td>
</tr>
</tbody>
</table>

A.3.3 Group:/data/<channel_group>

**Dimensions**

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<td>None defined</td>
</tr>
</tbody>
</table>
## User Types

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>None defined</td>
<td></td>
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</table>

## Group Attributes

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>long_name</td>
<td>A string uniquely identifying the channel wavelength and resolution e.g. “FCI HRFI Visible 0.6 micron channel”</td>
<td>string</td>
<td>“FCI &lt;target&gt; channel”</td>
<td></td>
</tr>
<tr>
<td>subsettable</td>
<td>Group can be included or excluded from the dataset according to configured selection</td>
<td>string</td>
<td>&quot;yes&quot;</td>
<td></td>
</tr>
</tbody>
</table>

## Variables

<table>
<thead>
<tr>
<th>Name</th>
<th>Attribute</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>number_of_rows</td>
<td></td>
<td>The number of rows in the Level 1c Body data chunk which will depend on the coverage</td>
<td>ushort</td>
<td>configured_value</td>
<td></td>
</tr>
<tr>
<td>long_name</td>
<td></td>
<td></td>
<td>string</td>
<td>“Number of rows in the current repeat cycle”</td>
<td></td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th><strong>number_of_columns</strong></th>
<th>The number of columns in the Level 1c Body data chunk this will equal either 5568, 11136 or 22272 data points depending on the channel.</th>
<th><strong>ushort</strong></th>
<th><strong>configured_value</strong> (5568, 11136 or 22272)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>long_name</strong></td>
<td><strong>string</strong></td>
<td>“Number of columns in the current repeat cycle”</td>
<td></td>
</tr>
<tr>
<td><strong>start_row_number</strong></td>
<td>Start row number for the configured repeat cycle coverage. 0 for FD but varies for other coverage areas (Q2, Q3, T2, etc.)</td>
<td><strong>ushort</strong></td>
<td><strong>configured_value.</strong></td>
</tr>
<tr>
<td><strong>long_name</strong></td>
<td><strong>string</strong></td>
<td>“Start row number for the current repeat cycle”</td>
<td></td>
</tr>
<tr>
<td><strong>end_row_number</strong></td>
<td>Start row number for the configured repeat cycle coverage. Number_of_rows-1 for FD but varies for other coverage areas</td>
<td><strong>ushort</strong></td>
<td><strong>configured_value.</strong></td>
</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td>“End row number for the current repeat cycle”</td>
<td></td>
</tr>
<tr>
<td>-------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>-----------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>channel_srf_identifier</td>
<td>Identifier for the SRF for this channel.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>channel_mtf_identifier</td>
<td>Identifier for the MTF for this channel.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>channel_srf_version</td>
<td>Version number of the SRF for this channel.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>channel_mtf_version</td>
<td>Version number of the MTF for this channel.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>central_wavelength_specified</td>
<td>Specified central wavelength</td>
<td></td>
<td></td>
</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td>“Channel Spectral Response Function identifier”</td>
<td></td>
</tr>
<tr>
<td>string</td>
<td>“Channel Spectral Response Function identifier version”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>string</td>
<td>“Channel Modulation Transfer Function identifier”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>string</td>
<td>“Channel Modulation Transfer Function identifier version”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>long_name</td>
<td>units</td>
<td>_FillValue</td>
<td>&quot;Specified central wavelength of channel&quot;</td>
</tr>
<tr>
<td>---------------------------</td>
<td>------------------</td>
<td>--------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>spectral_width_specified</td>
<td>Specified spectral width</td>
<td>float</td>
<td>NC_FILL_FLOAT</td>
</tr>
<tr>
<td>long_name</td>
<td>units</td>
<td>_FillValue</td>
<td>&quot;Specified spectral width of channel&quot;</td>
</tr>
<tr>
<td>central_wavelength_actual</td>
<td>Actual (measured) wavelength</td>
<td>float</td>
<td>NC_FILL_FLOAT</td>
</tr>
<tr>
<td>long_name</td>
<td>units</td>
<td>_FillValue</td>
<td>&quot;Actual central wavelength of channel&quot;</td>
</tr>
<tr>
<td>spectral_width_actual</td>
<td>Actual (measured) spectral width</td>
<td>float</td>
<td>NC_FILL_FLOAT</td>
</tr>
<tr>
<td>ssd_index</td>
<td>SSD-based index for this channel</td>
<td>sss_type</td>
<td>NC_FILL_FLOAT</td>
</tr>
<tr>
<td>long_name</td>
<td>sss_type</td>
<td>_FillValue</td>
<td>&quot;Index selector for this channel based on SSD&quot;</td>
</tr>
<tr>
<td>ssd</td>
<td>float</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### A.3.4 Group:/data/<channel_group>/measured

#### Dimensions

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>number_of_radiometric_noise_lut_steps</td>
<td>Number of steps in the radiometric noise Look Up Table (LUT). Configured value. Default = 1024</td>
<td>configured_value (1024,1024)</td>
<td>configured_value (1024,1024)</td>
<td></td>
</tr>
</tbody>
</table>

#### User Types

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>None defined</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

#### Group Attributes

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>None defined</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

#### Variables

<table>
<thead>
<tr>
<th>Name</th>
<th>Attribute</th>
<th>Description</th>
<th>Type</th>
<th>Value</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>radiometric_noise_lut_noise</td>
<td></td>
<td>The radiometric noise Look Up Table (LUT) provides ushort number of radiometric_noise_lut_steps</td>
<td>ushort</td>
<td></td>
<td>number_of_radiometric_noise_lut_steps</td>
</tr>
<tr>
<td>Variable Name</td>
<td>Description</td>
<td>Type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>-------------</td>
<td>------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>radiometric_noise_lut_radiance</td>
<td>the output of a radiometric noise model for each of the effective radiance code words given in the radiometric_noise_lut_radiance variable.</td>
<td>float</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>number_of_radiometric_noise_lut_steps</td>
<td></td>
<td>float</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>radiance_unit_conversion_coefficient</td>
<td>Conversion coefficients to convert radiance units. Details of use to be given in User Guide.</td>
<td>float</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>radiance_to_bt_conversion_constant_c1</td>
<td>Conversion constant C1 (in mW/[m2.sr.(cm-1)4]) to convert radiance to brightness temperature to be used in the calculation of brightness temperature for IR spectral channels. Variable is set to _FillValue for VNIR spectral channels.</td>
<td>float</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>radiance_to_bt_conversion_constant_c2</td>
<td>Conversion constant C2 (in cm.K) to convert radiance to brightness temperature to be used in the calculation of brightness temperature for IR spectral channels. Variable is set to _FillValue for VNIR spectral channels.</td>
<td>float</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>variable_name</td>
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<td>---------------</td>
<td>-------------</td>
<td>------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>radiance_to_bt_conversion_coefficient_a</td>
<td>Conversion coefficient A (unitless) to convert radiance to brightness temperature to be used in the calculation of brightness temperature for IR spectral channels. Variable is set to _FillValue for VNIR spectral channels.</td>
<td>float</td>
<td></td>
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<tr>
<td>radiance_to_bt_conversion_coefficient_b</td>
<td>Conversion coefficient B (in K) to convert radiance to brightness temperature to be used in the calculation of brightness temperature for IR spectral channels. Variable is set to _FillValue for VNIR spectral channels.</td>
<td>float</td>
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<tr>
<td>radiance_to_bt_conversion_coefficient_wavenumber</td>
<td>Conversion coefficient NU (in cm⁻¹) to convert radiance to brightness temperature to be used in the calculation of brightness temperature for IR spectral channels. Variable is set to _FillValue for VNIR spectral channels.</td>
<td>float</td>
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<tr>
<td>channel_effective_solar_irradiance</td>
<td>Channel effective solar irradiance at 1 AU to be used in the derivation of the reflectance for VNIR spectral channels. Variable</td>
<td>float</td>
<td></td>
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</table>
is set to _FillValue for IR spectral channels.

### A.3.5 Group:/data/<channel_group>/swath

**Dimensions**

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<tr>
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<td>Number of swaths in the dataset</td>
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**Group Attributes**

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**Variables**

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</tr>
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<tr>
<td>number_of_earth_samples</td>
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<td>Number of Earth samples detected</td>
<td>uint</td>
<td></td>
<td>number_of_swaths</td>
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<tr>
<td>number_of_missing_samples</td>
<td></td>
<td>Number of samples</td>
<td>uint</td>
<td></td>
<td>number_of_swaths</td>
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<tr>
<td>Variable</td>
<td>Description</td>
<td>Type</td>
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<tr>
<td>number_of_oversaturated_samples</td>
<td>Number of samples flagged as over-saturated</td>
<td>uint</td>
<td>number_of_swaths</td>
<td></td>
<td></td>
</tr>
<tr>
<td>number_of_undersaturated_samples</td>
<td>Number of earth samples flagged as under-saturated</td>
<td>uint</td>
<td>number_of_swaths</td>
<td></td>
<td></td>
</tr>
<tr>
<td>number_of_extended_dynamic_range_samples</td>
<td>Number of earth samples for IR3.8 input level 0 datasets where fire radiometric range samples have replaced those from the normal radiometric range due to saturation of the normal radiometric range. Set to zero for all other spectral channels.</td>
<td>uint</td>
<td>number_of_swaths</td>
<td></td>
<td></td>
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<tr>
<td>swath_coverage_compliance</td>
<td>Compliance to swath coverage requirement [SRD] FCI-05330 for the swath between the current and last repeat cycles. TRUE indicates compliance.</td>
<td>trilean</td>
<td>number_of_swaths</td>
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<tr>
<td>--------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------</td>
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<tr>
<td>swath_overlap_compliance</td>
<td>Compliance to swath overlap requirement [SRD] FCI-05300 for current swath to next swath in the northerly direction. TRUE indicates compliance.</td>
<td>trilean</td>
<td>number_of_swath_boundaries</td>
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</tr>
<tr>
<td>interswath_navigation_error</td>
<td>Calculated interswath navigation error evaluated at 95.45% confidence level</td>
<td>double</td>
<td>number_of_swaths</td>
<td></td>
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</tr>
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</table>
interswath_navigation_compliance | Compliance to interswath navigation error requirement [SRD] FCI-06470 for current swath to next swath in the northerly direction. TRUE indicates compliance. | trilean | number_of_swaths

A.3.6 **Group:/data/<channel_group>/quality_channel**

**Dimensions**

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<th>Values</th>
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<tr>
<td>channel_status_type</td>
<td>Status of the channel.</td>
<td>enum ubyte</td>
<td>see Enums table</td>
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**Group Attributes**

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<tr>
<td>channel_status</td>
<td></td>
<td>Status of the channel. Selected from [NOMINAL, NON-NOMINAL]. Defined by the compliance status of the channels to its overall requirements.</td>
<td>channel_status_type</td>
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<td>number_of_expected_earth_pixels</td>
<td></td>
<td>Number of earth pixels that are expected be in the nominal dataset</td>
<td>uint</td>
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</tr>
<tr>
<td>number_of_masked_pixels</td>
<td></td>
<td>Number of space pixels that have been masked.</td>
<td>uint</td>
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<tr>
<td>number_of_missing_warning_pixels</td>
<td></td>
<td>Number of Earth pixels with missing_warning flag set</td>
<td>uint</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Attribute</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
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<tr>
<td>_FillValue</td>
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<th>Type</th>
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<tr>
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<td>NC_FILL_UINT</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>flag set in repeat cycle&quot;</td>
<td></td>
</tr>
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<tr>
<td>units</td>
<td>string</td>
<td>&quot;pixel&quot;</td>
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<td>_FillValue</td>
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<td>NC_FILL_UINT</td>
<td></td>
<td></td>
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<tr>
<td>number_of_radiometric_warning_pixels</td>
<td>Number of Earth pixels with radiometric_warning flag set</td>
<td>uint</td>
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<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;Number of pixels with radiometric_warning flag set in repeat cycle&quot;</td>
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<td></td>
</tr>
<tr>
<td>units</td>
<td>string</td>
<td>&quot;pixel&quot;</td>
<td></td>
<td></td>
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<tr>
<td>_FillValue</td>
<td>ushort</td>
<td>NC_FILL_UINT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>number_of_noise_warning_pixels</td>
<td>Number of Earth pixels with noise_warning flag set</td>
<td>uint</td>
<td></td>
<td></td>
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<td>long_name</td>
<td>string</td>
<td>&quot;Number of pixels with noise_warning flag set in repeat cycle&quot;</td>
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<tr>
<td>units</td>
<td>string</td>
<td>&quot;pixel&quot;</td>
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<tr>
<td>_FillValue</td>
<td>ushort</td>
<td>NC_FILL_UINT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>number_of_geolocation_warning_pixels</td>
<td>Number of Earth pixels with geolocation_warning flag set</td>
<td>uint</td>
<td></td>
<td></td>
</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;Number of pixels with geolocation_warning flag set in repeat cycle&quot;</td>
<td></td>
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</table>
| units | string | "pixel"
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<thead>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>number_of_saturation_warning_pixels</td>
<td>Number of Earth pixels with saturation_warning flag set</td>
<td>uint</td>
</tr>
<tr>
<td>number_of_straylight_correction_warning_pixels</td>
<td>Number of Earth pixels with straylight_correction_warning flag set</td>
<td>uint</td>
</tr>
<tr>
<td>number_of_extended_dynamic_range_warning_pixels</td>
<td>Number of Earth pixels with extended_dynamic_range_warning flag set</td>
<td>uint</td>
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<tr>
<td>_FillValue</td>
<td>Description</td>
<td>Data Type</td>
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<tr>
<td>------------</td>
<td>-------------</td>
<td>-----------</td>
</tr>
<tr>
<td>number_of_encoding_saturation_warning_pixels</td>
<td>Number of Earth pixels with encoding_saturation_warning flag set</td>
<td>uint</td>
</tr>
<tr>
<td>percentage_expected_pixels_achieved</td>
<td>Percentage of pixels that were expected to be generated that were achieved. As defined by (number_of_expected_earth_pixels - number_of_missing_warning_pixels)/number_of_expected_earth_pixels</td>
<td>float</td>
</tr>
<tr>
<td>completeness_compliance</td>
<td>Flag to indicate if image has passed the completeness requirement ([SRD] FCI-05360). TRUE indicates compliance.</td>
<td>trilean</td>
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</tbody>
</table>

- _FillValue: _FillV value
- Description: Description of the parameter
- Data Type: Data type of the parameter
- Notes: Notes or explanation of the parameter
<table>
<thead>
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<th>Variable</th>
<th>Description</th>
<th>Type</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>accuracy_compliance</td>
<td>Flag to indicate if image has passed the accuracy requirement ([SRD] FCI-05390). TRUE indicates compliance.</td>
<td>trilean</td>
<td>&quot;Set True when compliant with accuracy requirement&quot;</td>
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<tr>
<td>coverage_compliance</td>
<td>Status of compliance to the coverage requirement ([SRD] FCI-05270). TRUE indicates compliance.</td>
<td>trilean</td>
<td>&quot;Set True when compliant with coverage requirement&quot;</td>
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<tr>
<td>radiometric_restricted_zone_applied</td>
<td>If TRUE indicates that some of the pixels created during the repeat cycle lie within the radiometric restricted zone around the sun ([SRD] FCI-06650), implying a relaxation in the radiometric requirements for those pixels.</td>
<td>trilean</td>
<td>&quot;Radiometric restricted zone requirement relaxations applied&quot;</td>
</tr>
<tr>
<td>absolute_pixel_position_knowledge_error</td>
<td>Estimate of the absolute pixel position knowledge error for the whole image</td>
<td>float</td>
<td>&quot;Estimate of the absolute pixel position knowledge error&quot;</td>
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<td>string &quot;m&quot;</td>
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<td>ushort NC_FILL_FLOAT</td>
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<td>description</td>
<td>type</td>
<td>notes</td>
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<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>absolute_pixel_position_knowledge_error_compliance</td>
<td>Status of compliance to the absolute pixel position knowledge error requirement for the whole image ([SRD] FCI-06380). TRUE indicates compliance.</td>
<td>trilean</td>
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<tr>
<td>absolute_pixel_position_knowledge_error_500</td>
<td>Estimate of the absolute pixel position knowledge error within 500 by 500 pixel imagette</td>
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<td>&quot;Set True when compliant with absolute pixel position knowledge error requirement &quot;</td>
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<td>units</td>
<td></td>
<td>string</td>
<td>&quot;m&quot;</td>
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<tr>
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<td>ushort</td>
<td>NC_FILL_FLOAT</td>
</tr>
<tr>
<td>absolute_pixel_position_knowledge_error_500_compliance</td>
<td>Status of compliance to the absolute pixel position knowledge error requirement within 500 by 500 pixel imagettes ([SRD] FCI-06410). TRUE indicates compliance.</td>
<td>trilean</td>
<td></td>
</tr>
<tr>
<td>long_name</td>
<td></td>
<td>string</td>
<td>&quot;Set True when compliant with absolute pixel position knowledge error in 500 x 500 pixel vignette requirement &quot;</td>
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<td>Parameter</td>
<td>Description</td>
<td>Type</td>
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</tr>
<tr>
<td>relative_pixel_position_knowledge_error</td>
<td>Estimate of the relative pixel position knowledge error relative to last repeat cycle</td>
<td>float</td>
<td></td>
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<tr>
<td>_long_name</td>
<td></td>
<td>string</td>
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<tr>
<td>units</td>
<td></td>
<td>string</td>
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<td>ushort</td>
<td>NC_FILL_FLOAT</td>
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<td>relative_pixel_position_knowledge_error_compliance</td>
<td>Status of compliance to the relative pixel position knowledge error requirement relative to last repeat cycle requirement ([SRD] FCI-06500). TRUE indicates compliance.</td>
<td>trilean</td>
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<td>string</td>
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</tr>
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<td>radiometric_noise_compliance</td>
<td>Status of compliance to the radiometric noise requirement ([SRD] FCI-05690). TRUE indicates compliance.</td>
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<td></td>
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<td>string</td>
<td>&quot;Set True when compliant with radiometric noise requirement &quot;</td>
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<tr>
<td>noise_power_spectral_density_compliance</td>
<td>Status of compliance to the noise power spectral density requirement ([SRD] FCI-05720). TRUE indicates compliance.</td>
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### A.3.7 Group:/data/quality

#### Dimensions

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<tr>
<td>number_of_rppke_channel_pairs</td>
<td>Number of channel pairs evaluated for the Relative Pixel Position Error (RPPKE) between channels (RPPKE) [FDHSI default = 64, HRFI default = 4]</td>
<td></td>
<td>configured_value(64,4)</td>
<td></td>
</tr>
<tr>
<td>number_of_icra_channel_pairs</td>
<td>Number of channel pairs evaluated for the HRFI Inter-channel coregistration accuracy(ICRA) [FDHSI default = 56, HRFI default = 2]</td>
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#### User Types

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<th>Description</th>
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<th>Values</th>
<th>Shape</th>
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#### Group Attributes

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<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
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<tbody>
<tr>
<td>geometric_restricted_zone_earth_applicable</td>
<td></td>
<td>TRUE indicates that the sun is in the geometric restricted zone associated to the time around the eclipse of the sun by the Earth when viewed from the satellite, during a portion of the repeat cycle and geometric requirements relaxation applies ([SRD] FCI-06620)</td>
<td>boolean</td>
<td></td>
<td></td>
</tr>
<tr>
<td>long_name</td>
<td></td>
<td>&quot;Geometric restricted operations due to a Sun eclipse by Earth from satellite during the repeat cycle&quot;</td>
<td>string</td>
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<td></td>
</tr>
<tr>
<td>geometric_restricted_zone_moon_applicable</td>
<td></td>
<td>TRUE indicates that the sun is in the geometric restricted zone associated to the time around the eclipse of the sun by the moon when viewed from</td>
<td>boolean</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
the satellite, during a portion of the repeat cycle and geometric requirements relaxation applies ([SRD] FCI-06620)

<table>
<thead>
<tr>
<th><strong>long_name</strong></th>
<th><strong>string</strong></th>
<th>“Geometric restricted operations due to a Sun eclipse by the Moon from satellite during the repeat cycle”</th>
</tr>
</thead>
</table>

**rppke_channel_pairs_id**

Identification of channel pairs evaluated for relative pixel position knowledge error (RPPKE). The first dimension corresponds to the same dimension as the dimension for the variable `rppke_between_channels`, the second dimension identifies a channel pair corresponding to an index selection from the variable `l1c_channels_present`.

<table>
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<tr>
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<th><strong>ubyte</strong></th>
<th>“IR channel pairs evaluated for”</th>
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<td>FillValue</td>
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<tr>
<td>rppke_between_channels</td>
<td>float</td>
<td>NC_FILL_FLOAT</td>
</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;Relative pixel position knowledge error between channels&quot;</td>
</tr>
<tr>
<td>units</td>
<td>string</td>
<td>&quot;m&quot;</td>
</tr>
<tr>
<td>_FillValue</td>
<td>trilean</td>
<td></td>
</tr>
<tr>
<td>Overall status of compliance to the relative pixel position knowledge error between channels. TRUE indicates compliance. ([SRD] FCI-06560)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;Set True when compliant with relative pixel position knowledge error between channels requirement&quot;</td>
</tr>
<tr>
<td>Field</td>
<td>Description</td>
<td>Type</td>
</tr>
<tr>
<td>-----------------------</td>
<td>---------------------------------------------------------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>icra_channel_pairs_id</td>
<td>Identification of channel pairs evaluated for the interchannel coregistration accuracy (ICRA). The first dimension corresponds to the same dimension as the dimension for the variable hrfi_icra, the second dimension identifies a channel pair corresponding to an index selection from the variable l1c_channels_present</td>
<td>ubyte</td>
</tr>
<tr>
<td>long_name</td>
<td></td>
<td>string</td>
</tr>
<tr>
<td>icra</td>
<td>Values of interchannel coregistration accuracy between channels of the same sampling distance. NC_FILL_FLOAT indicates an unavailable comparison</td>
<td>float</td>
</tr>
<tr>
<td>long_name</td>
<td></td>
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</tr>
<tr>
<td>units</td>
<td>string</td>
<td>&quot;m&quot;</td>
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<td>------------</td>
<td>--------</td>
<td>--------------</td>
</tr>
<tr>
<td>icra_compliance</td>
<td>string</td>
<td>Overall status of interchannel corregistration accuracy between channels. TRUE indicates compliance. ([SRD] FCI-06530)</td>
</tr>
<tr>
<td>repeat_cycle_start_compliance</td>
<td>string</td>
<td>The repeat cycle has started within the allowed margins of the required time. TRUE indicates compliance. ([SRD] FCI-05420)</td>
</tr>
<tr>
<td>comment</td>
<td>string</td>
<td>&quot;Repeat cycle has started within the allowed margins of the required time&quot;</td>
</tr>
<tr>
<td>repeat_cycle_duration_compliance</td>
<td>The repeat cycle has the correct duration within the allowed limits. TRUE indicates compliance.</td>
<td>trilean</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;Set True when compliant with repeat cycle duration requirement&quot;</td>
</tr>
<tr>
<td>comment</td>
<td>string</td>
<td>&quot;Repeat cycle has a duration within the allowed limits&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>repeat_cycle_timing_compliance</th>
<th>The repeat cycle has the correct timing within the allowed limits. TRUE indicates compliance. ([SRD] FCI-05450)</th>
<th>trilean</th>
<th></th>
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<td>&quot;Set True when compliant with repeat cycle timing requirement&quot;</td>
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<td>comment</td>
<td>string</td>
<td>&quot;Repeat cycle has timing within the allowed limits&quot;</td>
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A.3.8  Group:/state

Dimensions

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User Types

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Group Attributes

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Variables

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A.3.9  Group:/state/platform

Dimensions

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<td>Minimum value from the subsatellite_latitude vector</td>
<td>float</td>
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<tr>
<td></td>
<td>units</td>
<td></td>
<td>string</td>
<td>&quot;degrees_north&quot;</td>
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<tr>
<td></td>
<td>_FillValue</td>
<td></td>
<td>float</td>
<td>NC_FILL_FLOAT</td>
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<tr>
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<td>standard_name</td>
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<td>string</td>
<td>&quot;latitude&quot;</td>
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<tr>
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<td>long_name</td>
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<td></td>
<td></td>
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<td></td>
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<td>string</td>
<td>&quot;degrees_east&quot;</td>
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<td>_FillValue</td>
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<td>float</td>
<td>NC_FILL_FLOAT</td>
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<tr>
<td></td>
<td>standard_name</td>
<td></td>
<td>string</td>
<td>&quot;longitude&quot;</td>
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<tr>
<td>subsatellite_maximum_latitude</td>
<td>Maximum value from the subsatellite_latitude vector</td>
<td>float</td>
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<tr>
<td>-------------------------------</td>
<td>---------------------------------------------------</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>long_name</strong></td>
<td>string</td>
<td>&quot;Maximum sub-satellite latitude&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>units</strong></td>
<td>string</td>
<td>&quot;degrees_north&quot;</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>_FillValue</strong></td>
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<td>NC_FILL_FLOAT</td>
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<td></td>
</tr>
<tr>
<td><strong>standard_name</strong></td>
<td>string</td>
<td>&quot;latitude&quot;</td>
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<table>
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<th>Maximum value from the subsatellite_longitude vector</th>
<th>float</th>
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<tr>
<td><strong>long_name</strong></td>
<td>string</td>
<td>&quot;Maximum sub-satellite longitude&quot;</td>
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<tr>
<td><strong>units</strong></td>
<td>string</td>
<td>&quot;degrees_east&quot;</td>
</tr>
<tr>
<td><strong>_FillValue</strong></td>
<td>float</td>
<td>NC_FILL_FLOAT</td>
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<tr>
<td><strong>standard_name</strong></td>
<td>string</td>
<td>&quot;longitude&quot;</td>
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### A.3.10 Group:/state/instrument

**Dimensions**

<table>
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**User Types**

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<th>Shape</th>
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</thead>
<tbody>
<tr>
<td>fci_mode_type</td>
<td></td>
<td>ubyte enum</td>
<td>see Enums table</td>
<td></td>
</tr>
</tbody>
</table>
### Group Attributes

<table>
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### Variables

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<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>fci_mode</td>
<td></td>
<td>FCI Mode. Note that in decontamination mode only the Visible channels are generated. For refocusing mode the level 1c product is generated only if Earth targets are used and the data is not disseminated. VNIR calibration does not generate earth view data during the ‘blind’ LAC the other 4 LACs in the 10 minute cycle are disseminated, but are not expected to meet geometric performance.</td>
<td>fci_mode_type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>level0_channels</td>
<td></td>
<td>Array of strings indicating the FCI data channels delivered in the level 0 data (“FDVIS0.4”, “FDVIS0.5”, “HRVIS0.6”, “FDVIS0.8”, “FDVIS0.9”, “FDNIR1.3”, “FDNIR1.6”, “HRNIR2.2”,</td>
<td>string</td>
<td></td>
<td>number_of_l0_channels</td>
</tr>
<tr>
<td></td>
<td></td>
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</tr>
</tbody>
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### Table: Metadata Attributes

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<th>Description</th>
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</thead>
<tbody>
<tr>
<td>long_name</td>
<td>string</td>
</tr>
<tr>
<td>repeat_cycle_start_time</td>
<td>Conversion of the “repeat_cycle_start_time” from the level 0 data ICU-I auxiliary data into UTC</td>
</tr>
<tr>
<td>standard_name</td>
<td>string</td>
</tr>
<tr>
<td>units</td>
<td>string</td>
</tr>
<tr>
<td>precision</td>
<td>string</td>
</tr>
<tr>
<td>_FillValue</td>
<td>double</td>
</tr>
<tr>
<td>repeat_sequence_counter</td>
<td>Copy of the “repeat sequence counter” from the level 0 data ICU-I auxiliary data</td>
</tr>
<tr>
<td>long_time</td>
<td>string</td>
</tr>
<tr>
<td>_FillValue</td>
<td>double</td>
</tr>
<tr>
<td>repeat_cycle_counter</td>
<td>Copy of the “repeat cycle counter since the last”</td>
</tr>
<tr>
<td>Field Name</td>
<td>Data Type</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>transition to operational mode</td>
<td>string</td>
</tr>
<tr>
<td>repeat_sequence_id</td>
<td>ushort</td>
</tr>
<tr>
<td>repeat_cycle_counter_in_repeat_sequence</td>
<td>ushort</td>
</tr>
<tr>
<td>repeat_cycle_id</td>
<td>ushort</td>
</tr>
</tbody>
</table>
The current repeat cycle type is an identifier for the repeat cycle derived from the “Repeat sequence identifier”, “Repeat cycle counter in current repeat sequence” and the "Scan Law" from the level 0 data ICU-I auxiliary data. The repeat_cycle_id is a unique reference to the scan angles commanded to the FCI during a given repeat cycle.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>long_time</td>
<td>string</td>
<td>&quot;Repeat cycle identifier&quot;</td>
</tr>
<tr>
<td>_FillValue</td>
<td>double</td>
<td>NC_FILL_USHORT ORT</td>
</tr>
<tr>
<td>scan_law_id</td>
<td>ushort</td>
<td>Copy of the &quot;Scan law id&quot; from the level 0 ICU-I auxiliary data</td>
</tr>
<tr>
<td>long_time</td>
<td>string</td>
<td>&quot;Scan law identifier&quot;</td>
</tr>
<tr>
<td>_FillValue</td>
<td>double</td>
<td>NC_FILL_USHORT ORT</td>
</tr>
<tr>
<td>channel_on</td>
<td>boolean</td>
<td>TRUE if the spectral channel is switched on and active</td>
</tr>
<tr>
<td>long_time</td>
<td>string</td>
<td>&quot;Channel active flag&quot;</td>
</tr>
<tr>
<td>last_decontamination_start_time</td>
<td>double</td>
<td>Start time in UTC of most recent decontamination</td>
</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;UTC start time of most recent decontamination&quot;</td>
</tr>
<tr>
<td>Field</td>
<td>Data Type</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>-----------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>standard_name</td>
<td>string</td>
<td>&quot;time&quot;</td>
</tr>
<tr>
<td>units</td>
<td>string</td>
<td>&quot;seconds since 2000-01-01 00:00:00.0&quot;;</td>
</tr>
<tr>
<td>precision</td>
<td>string</td>
<td>&quot;1 ms&quot;</td>
</tr>
<tr>
<td>_FillValue</td>
<td>double</td>
<td>NC_FILL_DOUBLE</td>
</tr>
<tr>
<td>last_decontamination_end_time</td>
<td>double</td>
<td>End time in UTC of most recent decontamination</td>
</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;UTC end time of most recent decontamination &quot;</td>
</tr>
<tr>
<td>standard_name</td>
<td>string</td>
<td>&quot;time&quot;</td>
</tr>
<tr>
<td>units</td>
<td>string</td>
<td>&quot;seconds since 2000-01-01 00:00:00.0&quot;;</td>
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<tr>
<td>precision</td>
<td>string</td>
<td>&quot;1 ms&quot;</td>
</tr>
<tr>
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<td>NC_FILL_DOUBLE</td>
</tr>
<tr>
<td>last_detection_chain_parameter_change_time</td>
<td>double</td>
<td>Time in UTC of the last change in detection chain parameters, corresponding to the start of the repeat cycle when the parameters were activated</td>
</tr>
<tr>
<td></td>
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<tr>
<td>&quot;UTC end time of last change in the detection chain parameters&quot;</td>
<td>&quot;time&quot;</td>
<td>&quot;seconds since 2000-01-01 00:00:00.0&quot;;</td>
</tr>
<tr>
<td>&quot;UTC end time of last heated black body calibration&quot;</td>
<td>&quot;time&quot;</td>
<td>&quot;seconds since 2000-01-01 00:00:00.0&quot;;</td>
</tr>
<tr>
<td>Time in UTC of the last heated black body calibration for the IR spectral channels, corresponding to the start of the calibration data acquisition</td>
<td>Time in UTC of the last metallic neutral density calibration</td>
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calibration for the VNIR spectral channels, corresponding to the start of the calibration data acquisition

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<td>string</td>
<td>&quot;UTC end time of last metallic neutral density calibration&quot;</td>
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<td>standard_name</td>
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<td>string</td>
<td>&quot;time&quot;</td>
<td></td>
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<td>string</td>
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<td>precision</td>
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<td>string</td>
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A.3.11 Group:/state/processor

Dimensions

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User Types

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<th>Type</th>
<th>Values</th>
<th>Shape</th>
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<tr>
<td>resampling_method_type</td>
<td>Resampling method applied to the level 1b</td>
<td>ubyte enum</td>
<td>TruncatedShannon8=0, TruncatedShannon16=1, BiCubicSpline=2,</td>
<td></td>
</tr>
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</table>
samples to create the level 1c dataset, NUFTTIteration=3, NearestNeighbour =4

<table>
<thead>
<tr>
<th>weighting_function_type</th>
<th>Weighting function used with the selected resampling method.</th>
<th>ubyte enum</th>
<th>None = 0, Kaiser=1, Hamming = 2</th>
</tr>
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<tbody>
<tr>
<td>projection_type</td>
<td>Projection for the reference grid</td>
<td>ubyte enum</td>
<td>Geostationary = 0</td>
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**Group Attributes**

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<td>TRUE if detector equalization has been applied to the dataset</td>
<td>boolean</td>
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<td>number_of_l0_channels</td>
</tr>
<tr>
<td>long_name</td>
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<td>&quot;Detector equalization enabled for the channel&quot;</td>
<td>string</td>
<td></td>
<td></td>
</tr>
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<td>mtf_adaptation_enabled</td>
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<td>TRUE if MTF adaption has been applied</td>
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<td>number_of_l0_channels</td>
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<tr>
<td>long_name</td>
<td>type</td>
<td>description</td>
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<td>-----------------------------------------------------------------------------</td>
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<td></td>
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</tr>
<tr>
<td>earth_straylight_correction_enabled</td>
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<td>TRUE if earth straylight correction has been applied to the dataset</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sun_straylight_correction_enabled</td>
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<td>TRUE if sun straylight correction has been applied to the dataset</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>resampling_method</td>
<td>resampling_method_type</td>
<td>Resampling method applied to the level 1b samples to</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Field</td>
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<td>Description</td>
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<td>--------------------------</td>
<td>---------</td>
<td>-----------------------------------------------------------------------------</td>
<td></td>
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<tr>
<td><code>create the level 1c dataset</code></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>long_name</code></td>
<td><code>string</code></td>
<td>&quot;Selected resampling method&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>weighting_function</code></td>
<td></td>
<td>Weighting function used with the selected resampling method&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>weighting_function_t</code></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>long_name</code></td>
<td><code>string</code></td>
<td>&quot;Weighting method used with the selected resampling method&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>radiometric_warning</code></td>
<td><code>boolean</code></td>
<td>Radiometric calibration in the previous repeat cycles has led to a potential problem in the calibration of the channel data for the channel.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>number_of_l0_channels</code></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>complete repeat cycle, e.g. a missing black body calibration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------------------------</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>long_name</th>
<th>string</th>
<th>&quot;Radiometric calibration warning per channel for the repeat cycle&quot;</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>comment</th>
<th>string</th>
<th>&quot;Radiometric calibration in the previous repeat cycles has led to a potential problem in the calibration of the channel data for the complete repeat cycle&quot;</th>
</tr>
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</table>

<table>
<thead>
<tr>
<th>geometric_warning</th>
<th>boolean</th>
<th>The geometric processing in the previous repeat cycles has not allowed the update of the INR</th>
</tr>
</thead>
</table>

<p>| number_of_l1c_channels | boolean | |
|------------------------|---------|</p>
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<thead>
<tr>
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<th>string</th>
<th>&quot;Geometric calibration warning per channel for the repeat cycle&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>comment</td>
<td>string</td>
<td>&quot;Geometric processing in the previous repeat cycles has not allowed the update of the INR state vector to the required accuracy to allow current repeat cycle measurements to be guaranteed.&quot;</td>
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<tr>
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<td>Identifies which of the three SSD-based grids the</td>
<td>ssd_type</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>long_name</td>
<td>comment</td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>---------</td>
<td></td>
</tr>
<tr>
<td>string</td>
<td>&quot;Reference grid for the channel&quot;</td>
<td></td>
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<tr>
<td>reference_grid_identifier</td>
<td>Filename from which reference grid parameters have been read</td>
<td></td>
</tr>
<tr>
<td>string</td>
<td>&quot;Reference grid is based on channel SSD&quot;</td>
<td></td>
</tr>
<tr>
<td>reference_grid_version</td>
<td>Version number of the set of reference grid parameters. A change in version number between datasets implies the</td>
<td></td>
</tr>
<tr>
<td>string</td>
<td>&quot;File name for the reference grid definition file&quot;</td>
<td></td>
</tr>
<tr>
<td>long_name</td>
<td>data_type</td>
<td>description</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>-------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>grid must be recalculated.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;Version of reference grid parameters&quot;</td>
</tr>
<tr>
<td>_FillValue</td>
<td>ushort</td>
<td>NC_FILL_USHORT</td>
</tr>
<tr>
<td>reference_grid_earth_model</td>
<td>ushort</td>
<td>number_of_reference_grids</td>
</tr>
<tr>
<td>Earth model used for reference</td>
<td></td>
<td></td>
</tr>
<tr>
<td>grid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>reference_grid_projection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projection used for reference</td>
<td></td>
<td></td>
</tr>
<tr>
<td>grid Earth model used for</td>
<td></td>
<td></td>
</tr>
<tr>
<td>reference grid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>projection_type</td>
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<td></td>
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<tr>
<td>projection_origin_longitude</td>
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<td></td>
</tr>
<tr>
<td>Longitude of projection origin</td>
<td>double</td>
<td></td>
</tr>
<tr>
<td>projection_origin_longitude</td>
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<td></td>
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<tr>
<td>standard_name</td>
<td>string</td>
<td>&quot;longitude&quot;</td>
</tr>
<tr>
<td>units</td>
<td>string</td>
<td>&quot;degrees East&quot;</td>
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<td>Type</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------------------------------------</td>
<td>---------------</td>
<td>-----------------------------------------------------------------------------</td>
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<tr>
<td>projection_origin_latitude</td>
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<td>Latitude of projection origin</td>
</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;Latitude of projection origin&quot;</td>
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<td>standard_name</td>
<td>string</td>
<td>&quot;latitude&quot;</td>
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<tr>
<td>units</td>
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<td>&quot;degrees North&quot;</td>
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</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;Satellite reference altitude&quot;</td>
</tr>
<tr>
<td>units</td>
<td>string</td>
<td>&quot;m&quot;</td>
</tr>
<tr>
<td>number_of_reference_grids</td>
<td></td>
<td></td>
</tr>
<tr>
<td>reference_grid_spatial_sampling_angle_ns</td>
<td>float</td>
<td>Spatial sampling angle for each reference grid in North-South direction</td>
</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;Spatial sampling angle for each reference grid in&quot;</td>
</tr>
<tr>
<td>Variable</td>
<td>Type</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>-------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>units</td>
<td>string</td>
<td>&quot;radian&quot;</td>
</tr>
<tr>
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<td>double</td>
<td>NC_FILL_DOUBLE</td>
</tr>
<tr>
<td>reference_grid_spatial_sampling_angle_ew</td>
<td>float</td>
<td>Spatial sampling angle for each reference grid in East-West direction</td>
</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;Spatial sampling angle for each reference grid in East-West direction&quot;</td>
</tr>
<tr>
<td>units</td>
<td>string</td>
<td>&quot;radian&quot;</td>
</tr>
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<td>Earth polar radius</td>
</tr>
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<td>long_name</td>
<td>string</td>
<td>&quot;Earth polar radius&quot;</td>
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<tr>
<td>units</td>
<td>string</td>
<td>&quot;m&quot;</td>
</tr>
<tr>
<td>_FillValue</td>
<td>double</td>
<td>NC_FILL_DOUBLE</td>
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<tr>
<td>earth_equatorial_radius</td>
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<td>long_name</td>
<td>units</td>
<td>_FillValue</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>---------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>&quot;Earth equatorial radius&quot;</td>
<td>&quot;m&quot;</td>
<td>NC_FILL_DOUBLE</td>
</tr>
<tr>
<td>reference_grid_number_of_columns</td>
<td>Number of columns in reference grid</td>
<td>number_of_reference_grids</td>
</tr>
<tr>
<td>long_name</td>
<td>_FillValue</td>
<td>reference_grid_number_of_rows</td>
</tr>
<tr>
<td>&quot;Number of columns in reference grid&quot;</td>
<td>ushort</td>
<td>NC_FILL_UINT</td>
</tr>
<tr>
<td>reference_grid_number_of_rows</td>
<td>Number of rows in reference grid</td>
<td>number_of_reference_grids</td>
</tr>
<tr>
<td>long_name</td>
<td>_FillValue</td>
<td>azimuth_angle_at_reference_grid_origin</td>
</tr>
<tr>
<td>&quot;Number of rows in reference grid&quot;</td>
<td>ushort</td>
<td>NC_FILL_UINT</td>
</tr>
<tr>
<td>azimuth_angle_at_reference_grid_origin</td>
<td>Azimuth angle from the GEOS projection origin to the centre of the first reference grid column</td>
<td>number_of_reference_grids</td>
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</table>

<table>
<thead>
<tr>
<th>long_name</th>
<th>units</th>
<th>_FillValue</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Azimuth angle from the GEOS projection origin to the centre of the first reference grid column&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>Description</td>
<td>Type</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>units</td>
<td>projection origin to the centre of the first reference grid column&quot;</td>
<td>string</td>
</tr>
<tr>
<td>_FillValue</td>
<td></td>
<td>ushort</td>
</tr>
<tr>
<td>elevation_angle_at_reference_grid_origin</td>
<td>Elevation angle from the GEOS projection origin to the centre of the first reference grid row</td>
<td>double</td>
</tr>
<tr>
<td>long_name</td>
<td>&quot;Elevation angle from the GEOS projection origin to the centre of the first reference grid row&quot;</td>
<td>string</td>
</tr>
<tr>
<td>units</td>
<td></td>
<td>string</td>
</tr>
<tr>
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<td></td>
<td>ushort</td>
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</tbody>
</table>

A.3.12 Group:/state/celestial

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Description</td>
<td>Type</td>
<td>Values</td>
<td>Shape</td>
</tr>
<tr>
<td>Name</td>
<td>Description</td>
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<td>Values</td>
<td>Shape</td>
</tr>
<tr>
<td>Name</td>
<td>Description</td>
<td>Type</td>
<td>Values</td>
<td>Shape</td>
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### User Types

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<th>Shape</th>
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<tbody>
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### Group Attributes

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<th>Shape</th>
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<tbody>
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<td></td>
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### Variables

<table>
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<th>Attribute</th>
<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>moon_shadow_presence</td>
<td></td>
<td>TRUE if the moon shadow on the Earth occurs in this dataset within the FCI field of regard during the repeat cycle</td>
<td>boolean</td>
<td></td>
<td></td>
</tr>
<tr>
<td>long_name</td>
<td></td>
<td>&quot;Moon shadow on the Earth occurs in this dataset&quot;</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sunglint_presence</td>
<td></td>
<td>TRUE if sunglint is possible within the FCI field of regard during the repeat cycle</td>
<td>boolean</td>
<td></td>
<td></td>
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</table>
### A.3.13 Group:/data/<channel_group>/external_calibration_coefficients

#### Dimensions

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<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>number_of_external_calibration_coefficients</td>
<td>Number of polynomial correction coefficients</td>
<td>configured_value</td>
<td></td>
<td></td>
</tr>
<tr>
<td>min_max</td>
<td>Dimensions for defining minimum and maximum of a range</td>
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<td></td>
<td></td>
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</tbody>
</table>

#### User Types

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<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
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#### Group Attributes

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<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
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#### Variables

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<th>Description</th>
<th>Type</th>
<th>Values</th>
<th>Shape</th>
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<td>File name of the file</td>
<td>string</td>
<td></td>
<td></td>
</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;Name of file from which the External Calibration Coefficients were read.&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>--------</td>
<td>------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>external_calibration_coefficients_update_time</td>
<td>Time in UTC of the last update of External Calibration Coefficients parameters</td>
<td>double</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;UTC time for the last update of the External...&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Calibration Coefficients&quot;</td>
<td>standard_name</td>
<td>string</td>
<td>&quot;time&quot;</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>--------------------------</td>
<td>---------------</td>
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<td>-------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>units</td>
<td>string</td>
<td>&quot;seconds since 2000-01-01 00:00:00.0&quot;;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>_FillValue</td>
<td>doubl e</td>
<td>NC_FILL_DOUBLE</td>
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<td></td>
</tr>
<tr>
<td>validity_period</td>
<td>Minimu m and maximum times in UTC over which the External Calibration Coefficients are valid</td>
<td>doubl e</td>
<td>min_max</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>long_name</td>
<td>string</td>
<td>&quot;UTC start and end times between which the External Calibration Coefficients are valid&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>standard_name</td>
<td>string</td>
<td>&quot;time&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>units</td>
<td>string</td>
<td>&quot;seconds since 2000-01-01 00:00:00.0&quot;;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------</td>
<td>--------------------------------------------------</td>
<td>--------------------------------------</td>
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<td></td>
</tr>
<tr>
<td>_FillValue</td>
<td>double</td>
<td>NC_FILL_DOUBLE</td>
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<td></td>
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</tr>
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<td>external_calibration_coefficients_valid</td>
<td>External calibration coefficients valid for the current repeat cycle</td>
<td>boolean</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>long_name</td>
<td>string</td>
<td>&quot;External Calibration Coefficients are valid for this repeat cycle&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>external_calibration_coefficients_correction_coefficients</td>
<td>Coefficients for External Calibration Coefficients polynomial correction with first</td>
<td>double</td>
<td>number_of_external_calibration_coefficients</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field Name</td>
<td>Description</td>
<td>Type</td>
<td>Constraints</td>
<td></td>
<td></td>
</tr>
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<td>----------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td></td>
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</tr>
<tr>
<td>external_calibration_coefficients_correction_covariance_matrix</td>
<td>Covariance matrix for the External Calibration Coefficients polynomial correction coefficients</td>
<td>double</td>
<td>number_of_external_calibration_coefficients, number_of_external_calibration_coefficients</td>
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<td></td>
</tr>
<tr>
<td>radiance_validity_range</td>
<td>Minimum and maximum radiance for which the External Calibration Coefficients</td>
<td>double</td>
<td>min_max, number_of_external_calibration_coefficients</td>
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</tr>
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<td>Calibrations</td>
<td>Correction coefficients are valid</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------</td>
<td>----------------------------------</td>
<td>---</td>
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</tbody>
</table>
APPENDIX B  NETCDF AND APPLICABLE STANDARDS AND CONVENTIONS

B.1  netCDF

The FCI L1c datasets are netCDF-4 files and use the enhanced data model. In addition, they utilise the Hierarchical Data Format version 5 (HDF5) as the storage layer and so can also be read as HDF-5 files.

Use of the enhanced netCDF-4 data model allows groups to be created to aid with the natural collection of various data and the subsetting of channels. In addition, enumerated variable types allow flags to be defined once and used throughout the dataset.

Also, the use of the HDF-5 data layer allows the use of the additional compression functionality as described in Section 7.9.

B.2  CF Conventions

The current Climate and Forecast Conventions (CF 1.7) are applicable to version 3 of the netCDF data model. As such, the FCI L1c datasets cannot conform terms of the conventions although they do try to follow the spirit of the conventions as far as possible. However, there are plans to create a CF-2 document to cover the enhanced netCDF-4 model.

B.3  NetCDF Attribute Convention for Dataset Discovery

The table below shows the conformance of the MTG products to the NetCDF Attribute Convention for Dataset Discovery [NACDD]. The datasets are conformant with all the Highly Recommended attributes and the majority of the recommended attributes that are applicable to the datasets.

<table>
<thead>
<tr>
<th>ACDD Attribute</th>
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APPENDIX C  NETCDF TOOLS

C.1  Overview

The MTG netCDF datasets make use of a number of features of the enhanced netCDF-4 data model, including groups, unsigned integer data types and enumerated data types. FCI products always use the enhanced netCDF-4 format, and therefore their data layer is always HDF-5. Not all netCDF tools are capable of utilizing enhanced netCDF-4 datasets. However, the netCDF-4 files also use HDF-5 as the data layer, and so the datasets may also be examined with HDF-5 tools.

This Appendix lists freely available tools that are known to be compatible with the MTG netCDF-4 datasets.

This is not an exhaustive list as other tools and libraries may also be compatible with the enhanced netCDF-4 model, or may be updated to be so in future.

C.2  netCDF Libraries and Tools

NetCDF libraries are being developed by Unidata, a member of the UCAR Community Programs. Libraries can be downloaded from their webpage:

   http://www.unidata.ucar.edu

The netCDF distribution provides a number of command line tools for looking at the structure and contents of netCDF datasets.

HDF-5 and gzip need to be installed before netCDF.

C.2.1  gzip

Gzip is used as the internal compression tool for the MTG netCDF-4 datasets. The gzip libraries need to be installed before installing HDF-5. Currently FCI products do not need gzip compression, and therefore the gzip library is not required.

C.2.2  HDF-5

HDF-5 (Hierarchical Data Format, version 5) is used as the storage layer for the MTG netCDF-4 datasets. The HDF-5 libraries need to be compiled before installing netCDF-4.

HDF 5 is being developed by The HDF Group. The latest libraries can be downloaded from their webpage:

   https://www.hdfgroup.org
C.2.3 FCI Decompressor

NetCDF-4 could implement compression using the filter capabilities of the HDF5 library. These filters are provided by third-party entities, and their code is available in HDF5. The FCIDECOMP filter (“FCI DECOMPressor”, ID=32018) is the filter procured by EUMETSAT to decompress FCI level 1c data [FCIDECOMP]. The HDF-5 filter is well integrated into the netCDF-C library. However, other libraries (for example: netCDF-Java) could not use these filtering capabilities. In this case, a possible workaround is to remove the compression using the netCDF “nccopy” command line.

  nccopy -F none compressed.nc uncompressed.nc

C.3 Panoply

Panoply is a freely available, cross-platform java application that provides as GUI for browsing and plotting geo-gridded and other arrays from netCDF datasets. It can also handle other formats such as GRIB, HDF, etc. It is supported by NASA and is available from:

  http://www.giss.nasa.gov/tools/panoply/

As it is implemented in Java, it provides the same GUI in different operating systems and does not require administrative or root privileges to install.

It can display the CDL description as well as images, and makes use of many of the CF conventions. For instance, it converts integer counts from the `effective_radiance` variable to float numbers in the images using the `scale_factor` and `add_offset` variable attributes. Please note that the compressed data needs to be decompressed as described in Section 7.9 or Appendix C.2.3 before it is displayed in Panoply.

C.4 HDFView

HDFView is a freely available, cross-platform java application with a GUI for browsing and editing HDF4 and HDF5 files.

It is available from:

  http://www.hdfgroup.org/products/java/hdfview/

C.5 Pytroll

[Information to be added in a later issue]