MTG LI Test Data

MTG LI Mission Advisory Group Meeting #11

09/02/2021

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Test Data Delivery to End Users - Overview

LI L2 test data was provided to End Users on 27 May 2020

- Delivery Note: MTGTD-57: LI Level 2 Format Familiarisation Products for Users
- Package Description: Providing information about the LI instrument and the processing steps from Level 0 to Level 2 as well as the FCI Level 1c 2km grid. Example script for reading and plotting the LFL product.
- Data:
  - 24 hours for 20/06/2013
  - based on GLD360 flash data (location and time) and LIS TRMM climatology (statistical flash and group properties) - not representative of the typical lightning energies that LI will be observing
  - Disseminated (LGR,LFL,AF,AFA,AFR) and archived (LGR,LFL,LEF,AF,AFA,AFR) Level 2 products
  - Following latest Format Specification and WMO file naming convention
  - Only BODY files, no Level 2 Trailer files were provided

Test Data Delivery to End Users – Files

- Disseminated:

Product	Total Number of Files	Files per Hour
LGR	8635	360 (Δt=10s)
LFL	8635	360 (Δt=10s)
AF	2879	120 (Δt=30s)
AFA	2879	120 (Δt=30s)
AFR	2879	120 (Δt=30s)

- Archived:

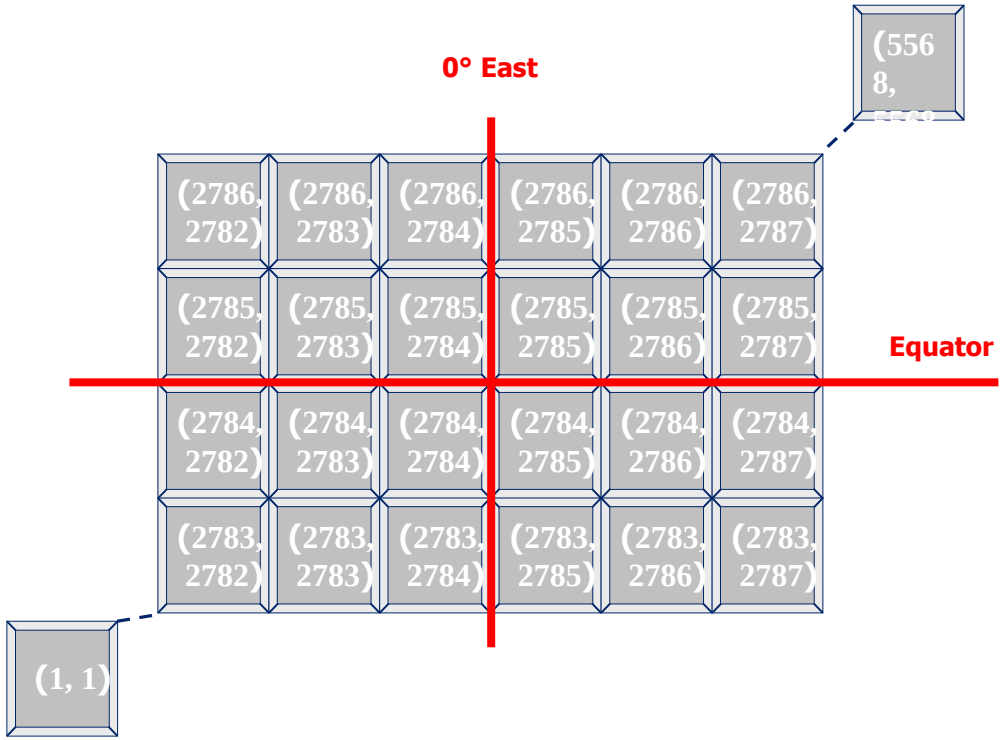
Product	Total Number of Files	Files per Hour
LGR	144	6 (Δt=10 min)
LFL	144	6 (Δt=10 min)
LEF	144	6 (Δt=10 min)
AF	144	6 (Δt=10 min)
AFA	144	6 (Δt=10 min)
AFR	144	6 (Δt=10 min)

FCI 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, λ_D (normally 0 deg). This point on the equator is the origin of the projection.
- 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).
- The normalized geostationary projection defines the line of sight of each pixel centre P as a vector representing the view from the virtual satellite.

Geolocation of LI L2 accumulated products

The LI Level 2 accumulated products are projected onto the same 2km reference grid used by the FCI 1C products.



Characteristics

- 5568 x 5568 pixels
- Grid spacing defined as spatial sampling of 2 km at subsatellite point
- Origin (1,1) in the South West (!)
- Rectification point on the corner between 4 pixels (same as 0.5 and 2km FCI grids)

Projection (WGS 84 ellipsoid)

- Equatorial radius of the Earth = 6378.137 km
- Earth flattening f=(r_eq-r_pol)/r_eq = 1/298.257223563
- Altitude of view point = 35786.400 km

Hence:

- Polar radius of the Earth = ca. 6356.752 km
- Earth-centre view-point distance = ca. 42164.537 km

Source: Poster by Mueller et al. at EUMETSAT Conference 2018, Proceedings available

Grid Information in the LI L2 Accumulated Products

- NetCDF Climate and Forecast (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 *mtg_geos_projection*).
- The pixel positions are provided as coordinate variables *x* (X coordinate in *mtg_geos_projection*) and *y* (Y coordinate in *mtg_geos_projection*).
- The packed x and y values correspond to the column and row numbers, respectively. The unpacked values provide the azimuth and elevation angles.
- More information including the formulas to calculate latitude and longitude are provided in the Test Data Description.

Example ncdump extract for LI-2-AF product

```
int mtg_geos_projection ;
        mtg_geos_projection:long_name = "MTG geostationary projection" ;
        mtg_geos_projection:grid_mapping_name = "geostationary" ;
        mtg_geos_projection:perspective_point_height = 35786400. ;
        mtg_geos_projection:semi_major_axis = 6378137. ;
        mtg_geos_projection:semi_minor_axis = 6356752.314 ;
        mtg_geos_projection:inverse_flattening = 298.2572236 ;
        mtg_geos_projection:latitude_of_projection_origin = 0LL ;
        mtg_geos_projection:longitude_of_projection_origin = 0LL ;
        mtg_geos_projection:sweep_angle_axis = "y" ;
short x(pixels) ;
        x:long_name = "azimuth scan angle encoded as column" ;
        x:standard_name = "projection x coordinate" ;
        x:unit = "radian" ;
        x:axis = "X" ;
        x:valid_range = "1, 5568" ;
        x:scale_factor = -5.58871526031607E-05 ;
        x:add_offset = 1.55617776423501E-01;
short y(pixels) ;
        y:long_name = "elevation scan angle encoded as row" ;
        y:standard_name = "projection y coordinate" ;
        y:unit = "radian" ;
        y:axis = "Y" ;
        y:valid_range = "1, 5568" ;
        y:scale_factor = 5.58871526031607E-05 ;
        y:add_offset = -1.55617776423501E-01;
```

The red colour indicates changes compared to the current test data set.

Grid Parameters for the FCI L1c reference grids

Parameter	Values
altitude	35786.400 km
semi_major_axis	6378.137 km
inverse_flattening	298.257223563
semi_minor_axis	calculated

Azimuth (X)

SSD (km)	λ_0		$\Delta\lambda$		X attributes	
	deg	rad	deg	rad	scale_factor [rad/count]	add_offset [rad]
0.5	8.91424050374461E+00	1.55582847104981E-01	8.00524494072526E-04	1.39717881644274E-05	-1.39717881644274E-05	1.55596818893146E-01
1	8.91384023975749E+00	1.55575861180529E-01	1.60104898783251E-03	2.79435763233999E-05	-2.79435763233999E-05	1.55603804756852E-01
2	8.91303970830389E+00	1.55561889270898E-01	3.20209797316468E-03	5.58871526031607E-05	-5.58871526031607E-05	1.55617776423501E-01

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Elevation (Y)

SSD (km)	ϕ_0		$\Delta\phi$		Y attributes	
	deg	rad	deg	rad	scale_factor [rad/count]	add_offset [rad]
0.5	-8.91424050374461E+00	-1.55582847104981E-01	8.00524494072526E-04	1.39717881644274E-05	1.39717881644274E-05	-1.55596818893146E-01
1	-8.91384023975749E+00	-1.55575861180529E-01	1.60104898783251E-03	2.79435763233999E-05	2.79435763233999E-05	-1.55603804756852E-01
2	-8.91303970830389E+00	-1.55561889270898E-01	3.20209797316468E-03	5.58871526031607E-05	5.58871526031607E-05	-1.55617776423501E-01

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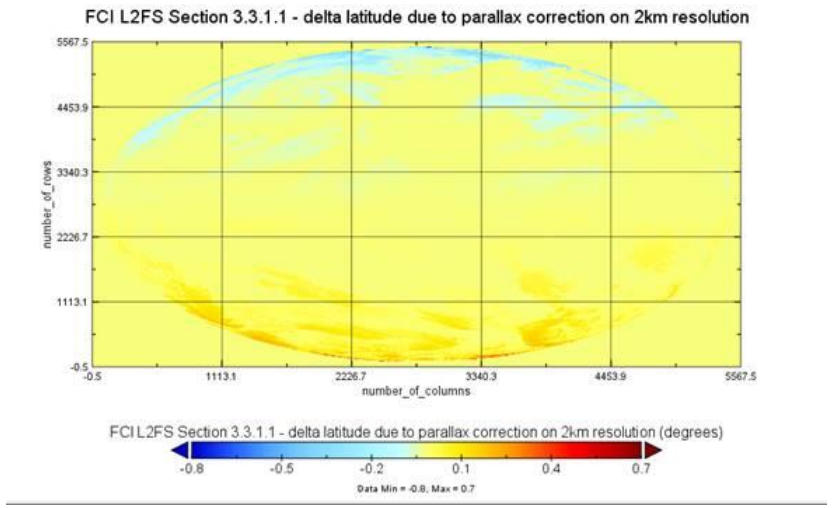
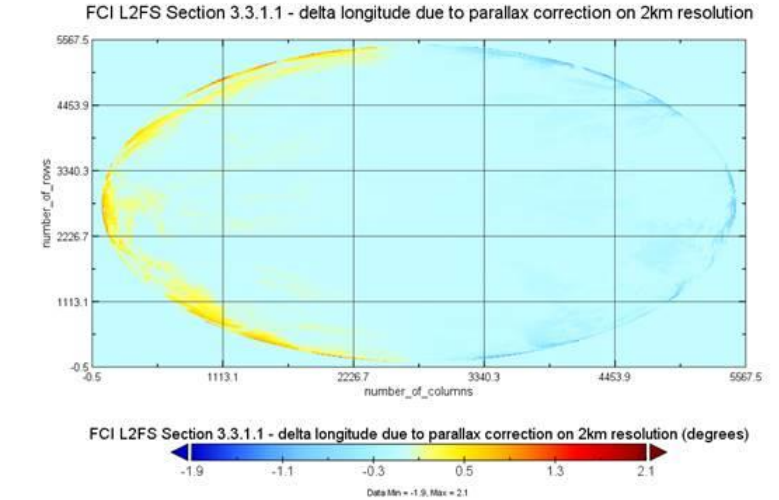
Test Data Delivery to End Users – Known Anomalies

- Questions from NWC SAF and E. Bruning
  - The constant offset lambda_0 and phi_0 that gives the angular position of the lower left corner pixel in the reconstructed image – update documentation (see Slide 6)
  - The angular spacing of the pixels and the total number of pixels. The smallest spacing in the file is 5.5879354e-05 radians (56 urad, or about 2 km, which is what I'd expect) and the valid range for the x and y variables is reported 5568 pixels. – update documentation (see Slide 7)
  - Documentation of the differences between the sample files in the ARC and DIS directories. – update documentation (see Slide 3)
  - The valid range attribute is reported as 1, 5568 for x and y, but the units attributes indicates radians, and the values appear to be in units of radians. – documentation update TBD (see Slide 7)
  - The pixels activated by a group do not appear to be continuous. Instead, some other pattern is present. This can be seen in the raw x,y locations as well as a the reconstructed grids, as shown in the two attached images. – TBD with E. Bruning and the LI MAG
- Correct values in mtg_geos_projection – data update (see Slide 7)
- Typo in file name of example script in Appendix A of the Test Data Description (correct 'MTGI1' to 'MTI1'). The filenames are correct. – documentation update

FCI L2 CTTH

- MTGTD-333: FCI L2 CTTH Example Content for LI MAG
- Example Cloud Top Temperature and Height (CTTH) data content
- FCI L1c 2 km grid
- The *delta_latitude* and *delta_longitude* variables contain the parallax corrections.
- Any feedback already, please?





LI Level 2 Product User Guide (LI L2 PUG)

- Content: “user friendly” combination of official format specification, processing specifications and ATBD with all the information needed by the user to understand and use the LI L2 data
- Timeline: Provide a first version to user with the next test data delivery (fixed anomalies, but no new content) probably in Autumn 2021
- Review by LI MAG members before the official release to the end users would be very helpful – if and who TBD during the meeting

Plans

- Presentation about format specification, data dissemination and test data during the User Preparation Webinar on the MTG Lightning Imager on 16-17 February 2021
- Re-Generation (format update only) of L2 test data (Autumn time frame) – to be announced at the meeting on 16-17 Feb
- Release of LI L2 PUG together with the test data update
- Any other suggestions ? Examples for using the FCI L2 CTTH from MAG members? Trailer file for LI-2-LFL-TRAIL?
- LI PUG: Include list of example netCDF tools to visualise netcdf; refer to satpy reader, if it exists