

EPS-SG MWI-ICI L1 and L2 products, product formats, test data, data dissemination

12th of October, MWI-ICI user webinar



Outline

- **Introduction to MWI and ICI L1B and L2 Products**
- **Format description**
- **Test datasets**
- **Data dissemination baseline**

MWI and ICI Missions Products

Level-1B

Filename	W_XX-EUMETSAT-Darmstadt,SAT,SGB[1-3]-[MWI or ICI]-1B-RAD _C_EUMT_YYYYMMDDhhmmss____YYYYMMDDhhmmss_YYYYMMDDhhmmss_O_N____.nc
Product ID	MWI-1B-RAD, ICI-1B-RAD
Product Description	<u>Top of Atmosphere Spectral Radiance observed by MWI or ICI (geolocated, calibrated and quality-controlled).</u>
Format	netCDF-4 (following the Climate and Forecast (CF) metadata conventions)
Size (MBytes/orbit)	MWI: 1101.0, ICI: 430.0

Level-2

Filename	W_XX-EUMETSAT-Darmstadt,SAT,SGB[1-3]-MSP-02- LIW_C_EUMT_YYYYMMDDhhmmss____YYYYMMDDhhmmss_YYYYMMDDhhmmss_O_N____.nc
Product ID	MSP-02-LIW
Product Description	Cloud and atmospheric properties derived from MWI and ICI measurements: <u>MWI: Cloud liquid water path (LWP)</u> <u>ICI: Cloud ice water path (IWP), mean ice particle size by mass and mean mass height</u>
Format	netCDF-4 (following the CF conventions)
Size (MBytes/orbit)	85.0

In addition to the centrally generated products at EUMETSAT Headquarters, several L2 and L3 products are developed by the EUMETSAT Satellite Application Facilities (SAFs): Hydrology SAF, Nowcasting SAF, Climate Monitoring SAF, Ocean and Sea Ice SAF

Global, regional and local missions

- The EPS-SG System (including MWI and ICI) supports three types of missions:

- **Global Mission:**

For product generation and distribution of the information acquired by the on-board instruments over the full globe;

- **Regional Mission:**

For product generation and distribution of the information acquired by the on-board instruments with improved timeliness over the regional region of interest (Europe and the North Atlantic)

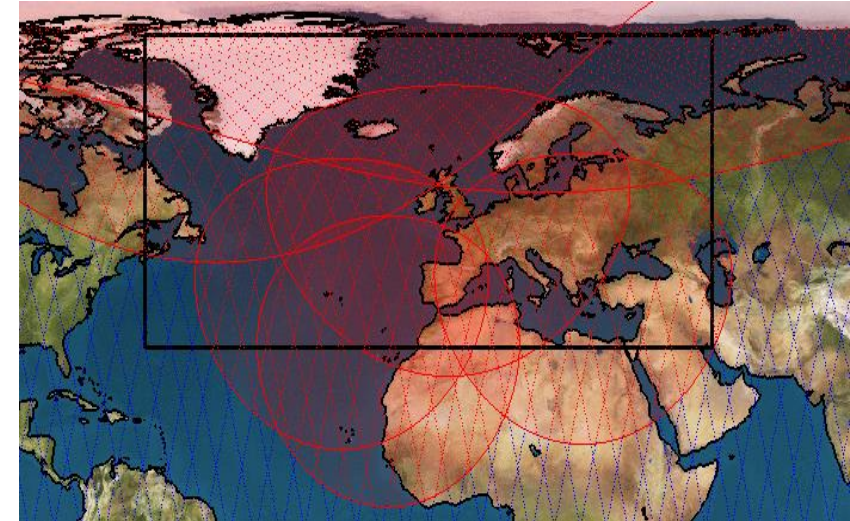
- **Local Mission:**

For distribution of instrument data to user stations via Direct-Broadcast at any location with visibility of the satellites.

Expected timeliness:

70 min. for global L1, 80 min. for global L2 EPS-SG

30 min. for regional L1, 40 min. for regional L2 EPS-SG



L1b Product Format

- Full format is described in the Product Format Specification (PFS, instrument-specific):

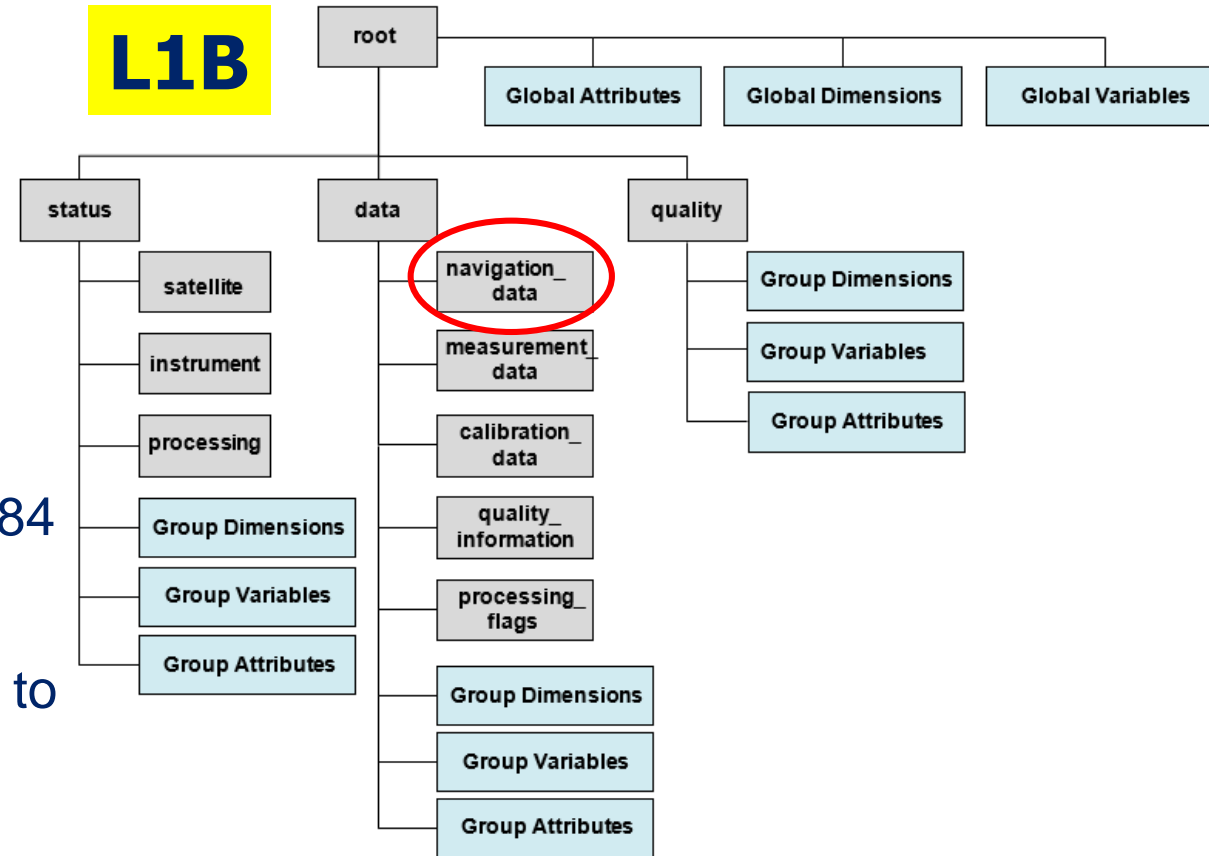
MWI L1B: <https://www.eumetsat.int/media/47583>

ICI L1B: <https://www.eumetsat.int/media/47582>

- The structure of the netCDF is common to all the EPS-SG missions and is described in the EPS-SG General Product Format Specification (GPFS):

<https://www.eumetsat.int/media/46295>

- navigation_data** group consists of:
 - UTC start time of the Earth view for each scan;
 - Geolocation data in TIE POINT resolution on WGS84 ellipsoid for each horn (ICI)/data group (MWI): lat, lon, OZA, AZI, solar zenith and azimuth angle.
 - Orthorectified lat/lon in FULL resolution but relative to WGS84 lat/lon to reconstruct geolocation over DEM.
 - Terrain elevation and land fraction;
 - Sun glint angle, moon angle, RFI flag (only MWI-1).
 - Additional information per scan, e.g. sub-satellite position, spacecraft altitude.



Remarks on navigation_data

- The data groups for MWI and the horns for ICI are reported in the tables.
- The following procedures are described in details in the PFS:
 - Reconstruction of geolocation data from tie points to full resolution (linear Interpolation in time performed in ECEF coordinates).
 - Reconstruction of time for each Earth sample (only the start time of each scan is provided in output):

$$time_sample(i,j,k) = time_start_scan_utc(i) + t_{offset}(j) + T_{int} \cdot (k - 1) - t_{offset}(1)$$


where t_{offset} is provided for each channel in PFS

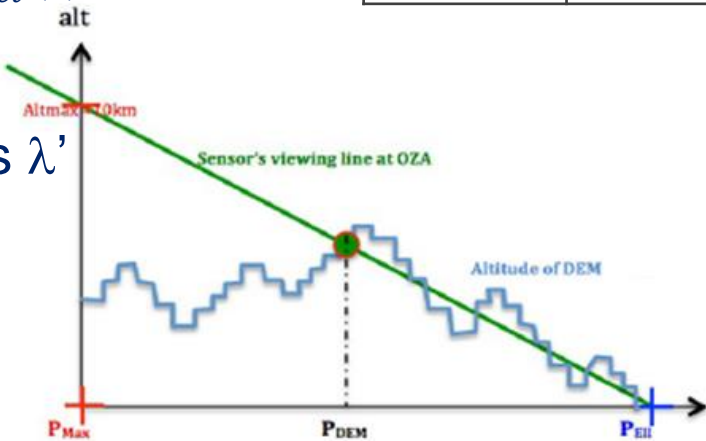
- Reconstruction of orthorectified latitudes φ' and longitudes λ' over the DEM (delta_lat/delta_lon in meters are provided):

$$\varphi' = \varphi + \frac{delta_lat}{R_{AV}}$$

$$\lambda' = \lambda + \frac{delta_lon}{R_{AV} \cdot \cos(\varphi)}$$

where R_{AV} is the average Earth radius (6371 km), kept fixed for simplicity.

ICI Horn Number	Channel	MWI Data group	Channel	
1	ICI-1 V	1	MWI-1 V	
	ICI-2 V		MWI-1 H	
	ICI-3 V	2	MWI-2 V	
2	ICI-4 V		MWI-2 H	
3	ICI-4 H	3	MWI-3 V	
4	ICI-5 V		MWI-3 H	
	ICI-6 V	4	MWI-4 V	
	ICI-7 V		MWI-4 H	
5	ICI-8 V		MWI-5 V	
	ICI-9 V		MWI-5 H	
	ICI-10 V		MWI-6 V	
6	ICI-11 V		MWI-6 H	
7	ICI-11 H		MWI-7 V	
			MWI-7 H	
		5	MWI-8 V	
			MWI-8 H	
		6	MWI-9 V	
			MWI-10 V	
			MWI-11 V	
			MWI-12 V	
		7	MWI-13 V	
		8	MWI-14 V	
			MWI-15 V	
			MWI-16 V	
			MWI-17 V	
			MWI-18 V	



L1b Product Format

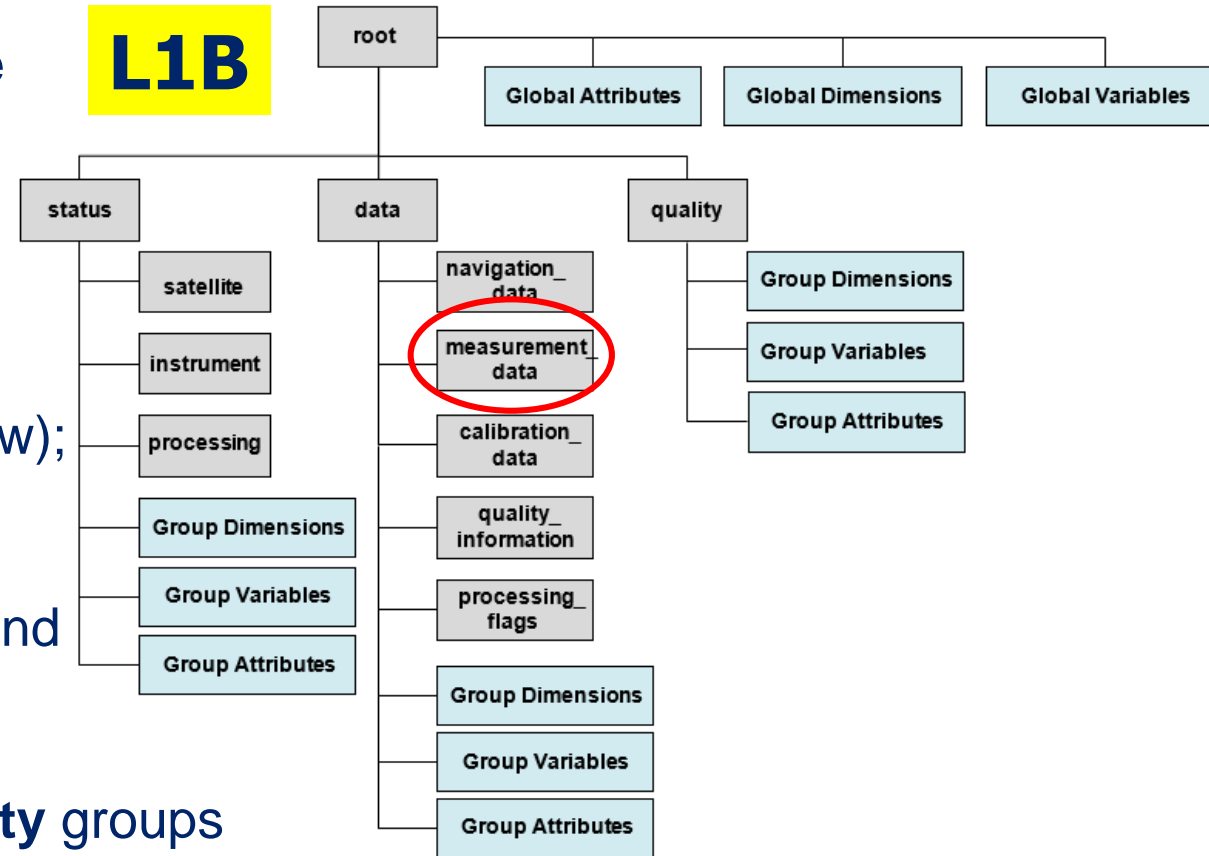
- **measurement_data** group consists of:
 - Calibrated radiances in $\text{mW}/(\text{m}^2 \cdot \text{sr} \cdot (\text{cm}^{-1}))$ per channel in FULL resolution.

Data is stored as integers and can be unpacked to the floating point value using the scale factor and offset:

$\text{Unpacked_data} = \text{packed_data} \cdot \text{scale_factor} + \text{add_offset}$

- **calibration_data** group consists of:
 - Sidelobe correction contribution;
 - Values of the calibration counts (warm and cold view);
 - Calibration coefficients (gain, offset etc.)
 - Noise diode status flag (only for MWI-1 to MWI-3)
 - Values of the temperature reading from the PRTs and thermistors mounted on the main components.

- **quality_information**, **processing_flags** and **quality** groups provide useful overall indicators on the quality of the Products and of the processing:
Calibration and navigation flags, processing flags, gaps information, duration of data missing/degraded



L1b Product Format

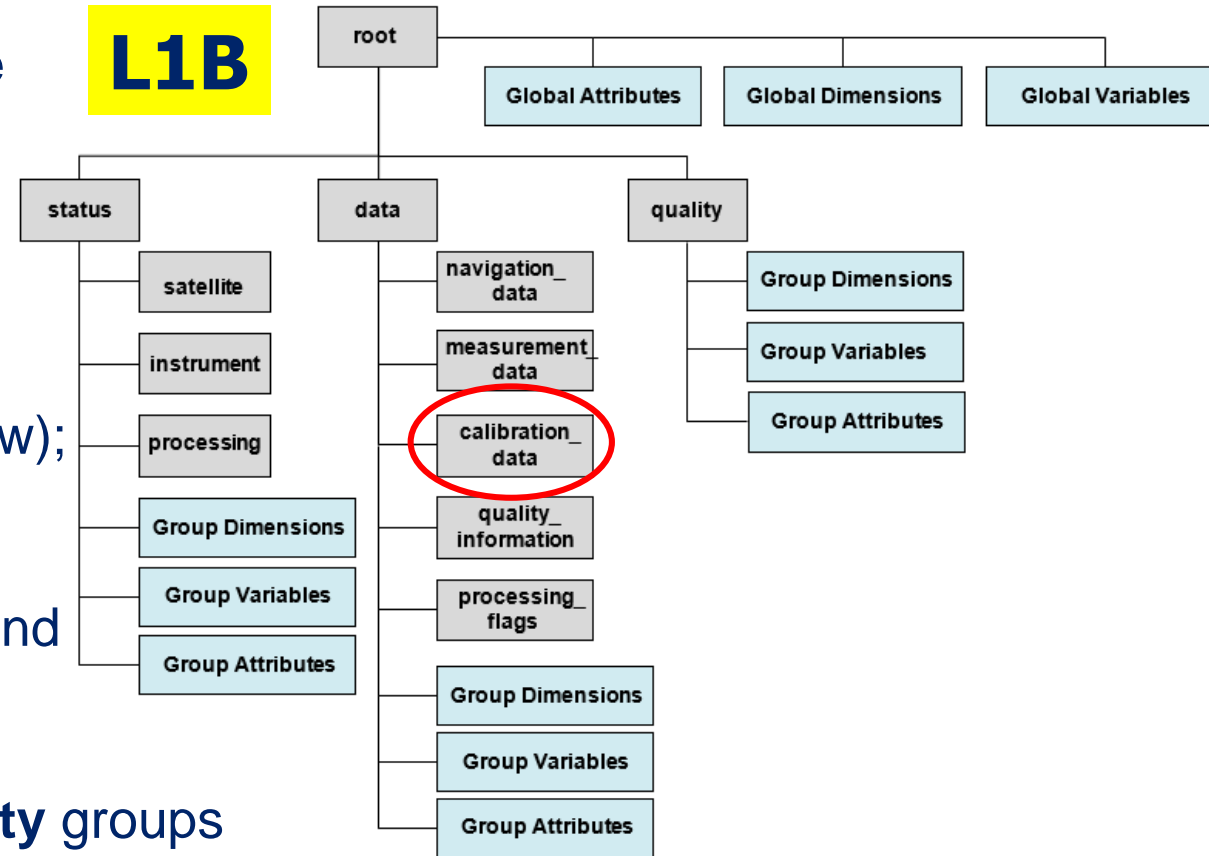
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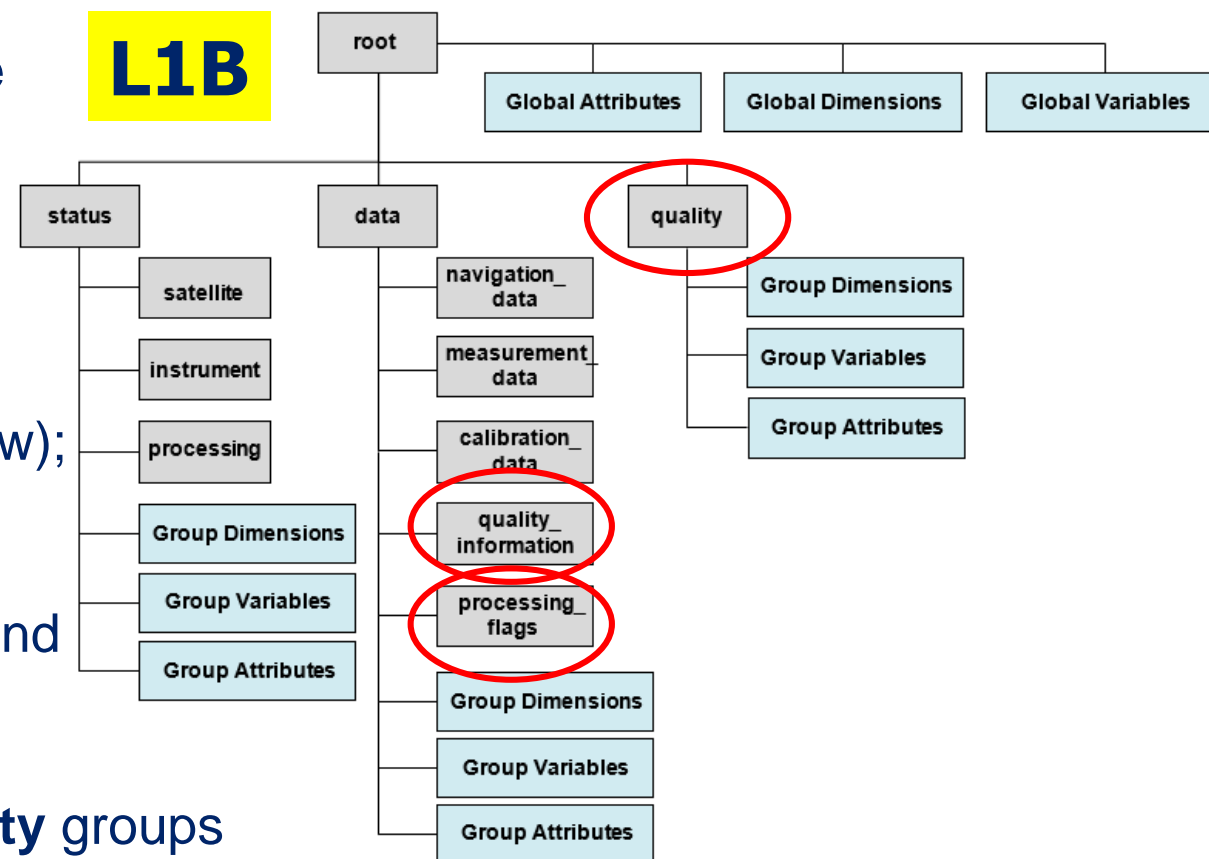
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- **quality_information**, **processing_flags** and **quality** groups provide useful overall indicators on the quality of the Products and of the processing:
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L2 Product Format

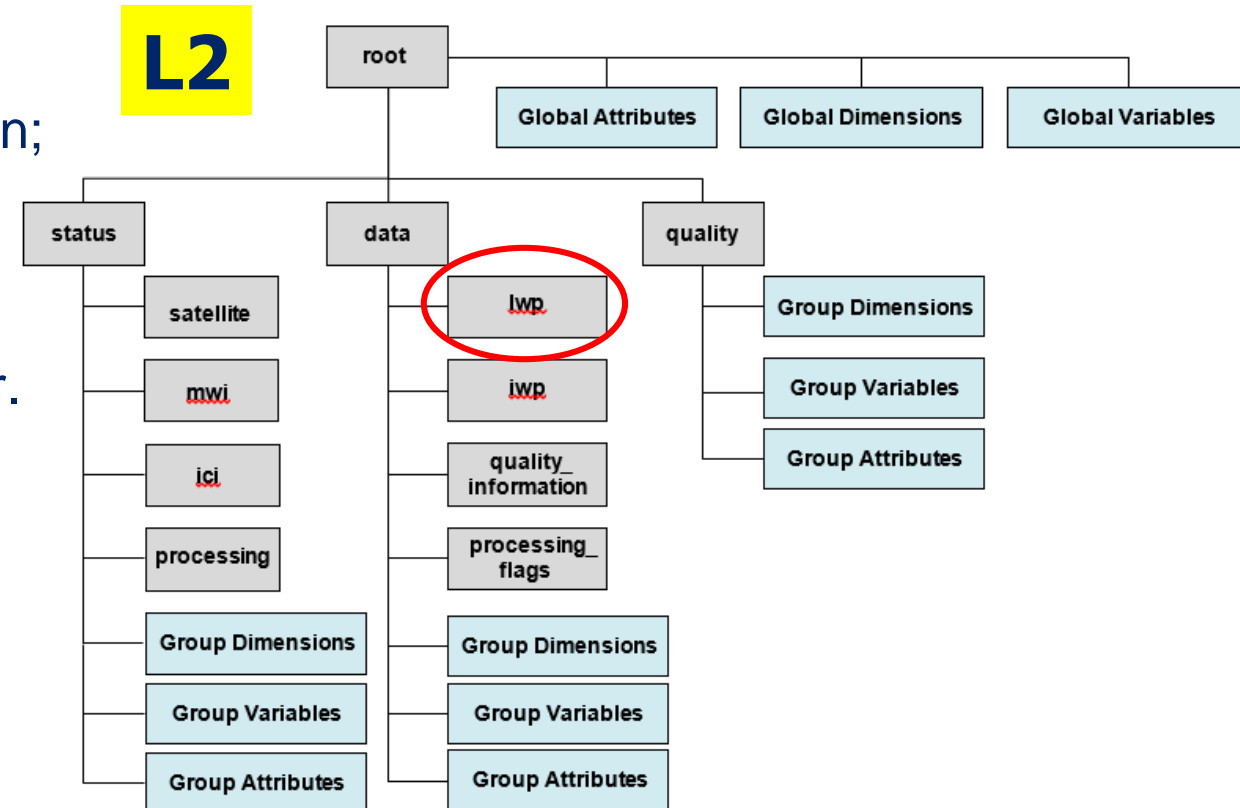
- Full format specification is available at the following link:
MWI-ICI L2: <https://www.eumetsat.int/media/47681>

- lwp data consists of:**

- UTC start time of the Earth view for each MWI scan;
- Lat/lon of each MWI L2 pixel;
- Surface type;
- LWP (kg/m²) and retrieval error;
- Diagnostic TCWV (kg/m²) and corresponding error.

- iwp data consists of:**

- UTC start time of the Earth view for each ICI scan;
- Lat/lon of each ICI L2 pixel;
- Surface type;
- Lat/lon of the mean ice mass height;
- IWP (kg/m²) and corresponding error;
- Mean particle diameter (m) and corresponding error;
- Mean ice mass height (m) and corresponding error.



L2 Product Format

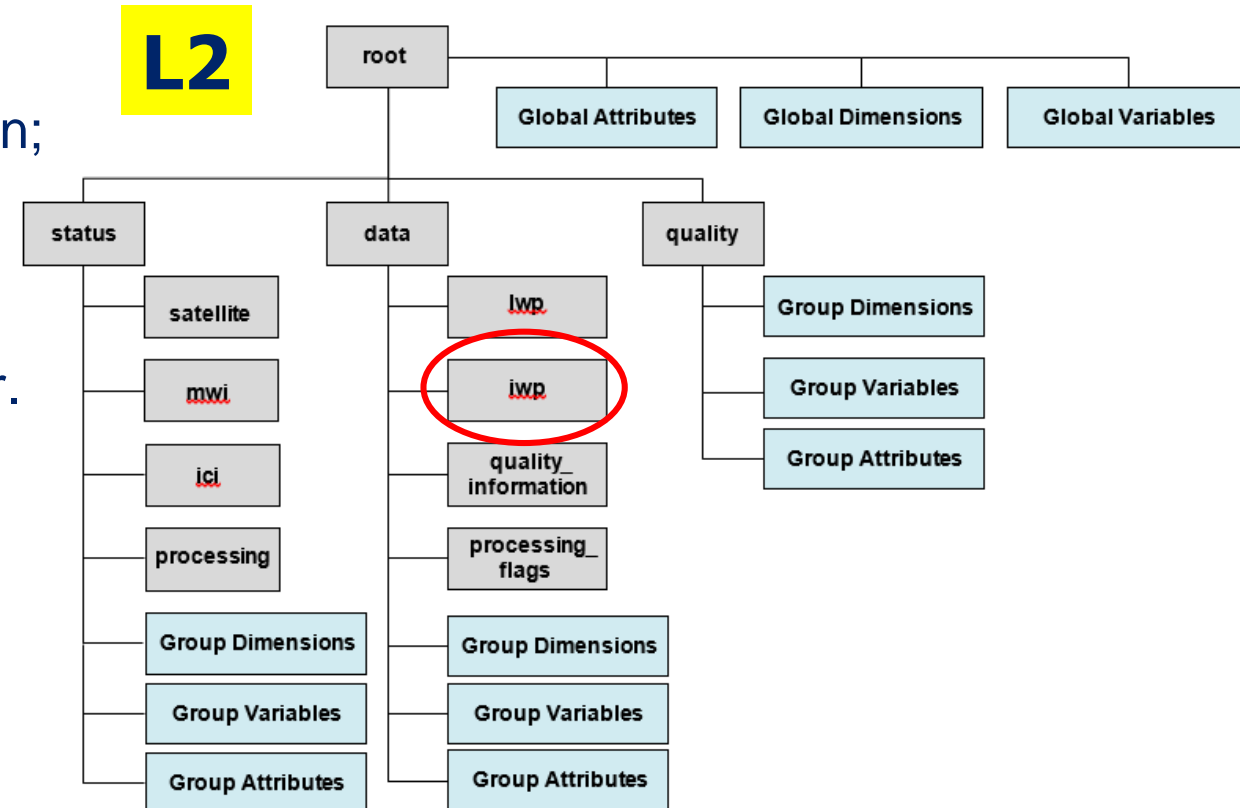
- Full format specification is available at the following link:
MWI-ICI L2: <https://www.eumetsat.int/media/47681>

- lwp data consists of:**

- UTC start time of the Earth view for each MWI scan;
- Lat/lon of each MWI L2 pixel;
- Surface type;
- LWP (kg/m²) and retrieval error;
- Diagnostic TCWV (kg/m²) and corresponding error.

- iwp data consists of:**

- UTC start time of the Earth view for each ICI scan;
- Lat/lon of each ICI L2 pixel;
- Surface type;
- Lat/lon of the mean ice mass height;
- IWP (kg/m²) and corresponding error;
- Mean particle diameter (m) and corresponding error;
- Mean ice mass height (m) and corresponding error.



Test Data Package v1



EUMETSAT Polar System-Second Generation (EPS-SG) simulated MWI and ICI Level 1B and Level 2 test data are now available for user familiarisation (28 January 2021).

Published on
28 January 2021

The EPS-SG MWI is a conically scanning radiometer, capable of measuring thermal radiance emitted by the Earth, in the microwave region of the electromagnetic spectrum, providing cloud and precipitation products and all weather surface imagery.

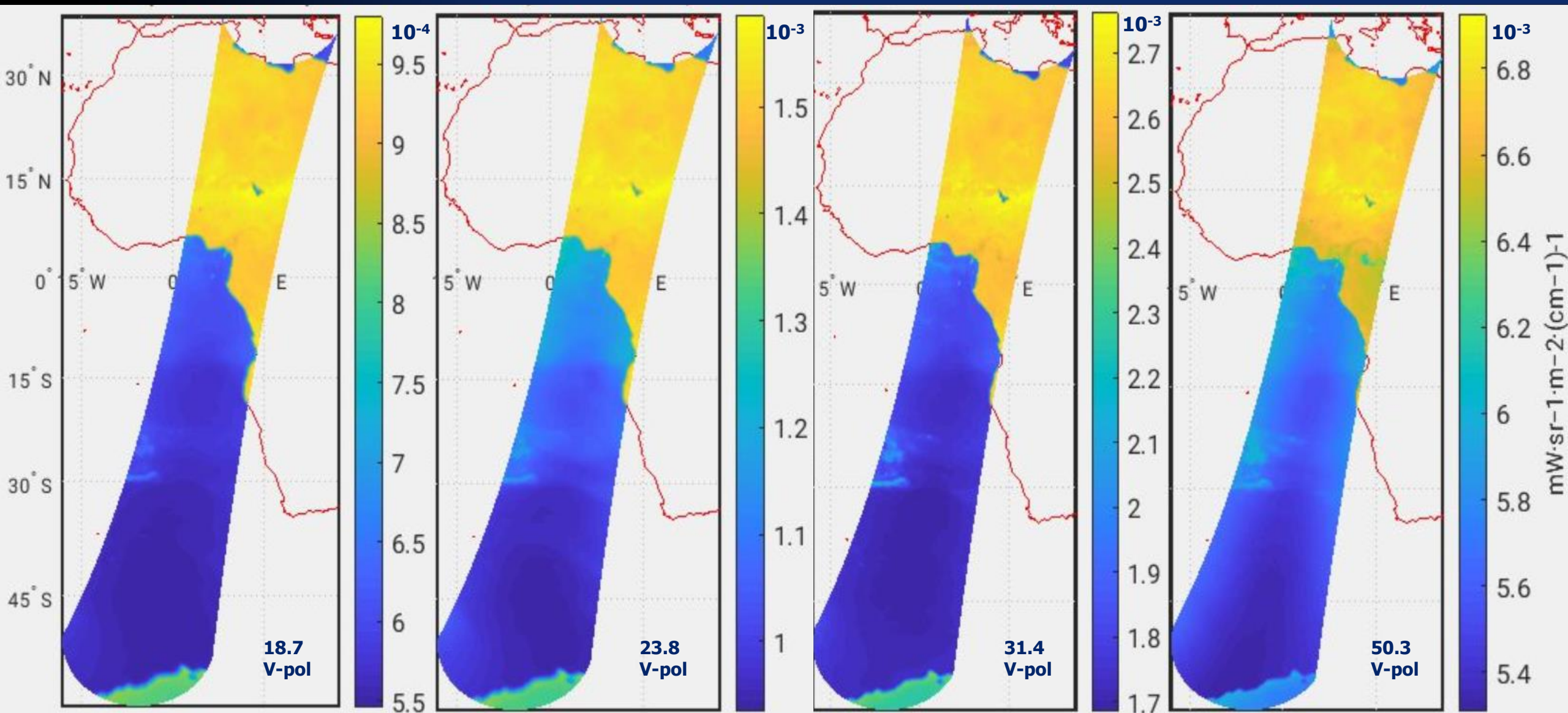


The EPS-SG ICI is a conically scanning millimetre/sub-millimetre wave radiometer providing information on ice clouds.

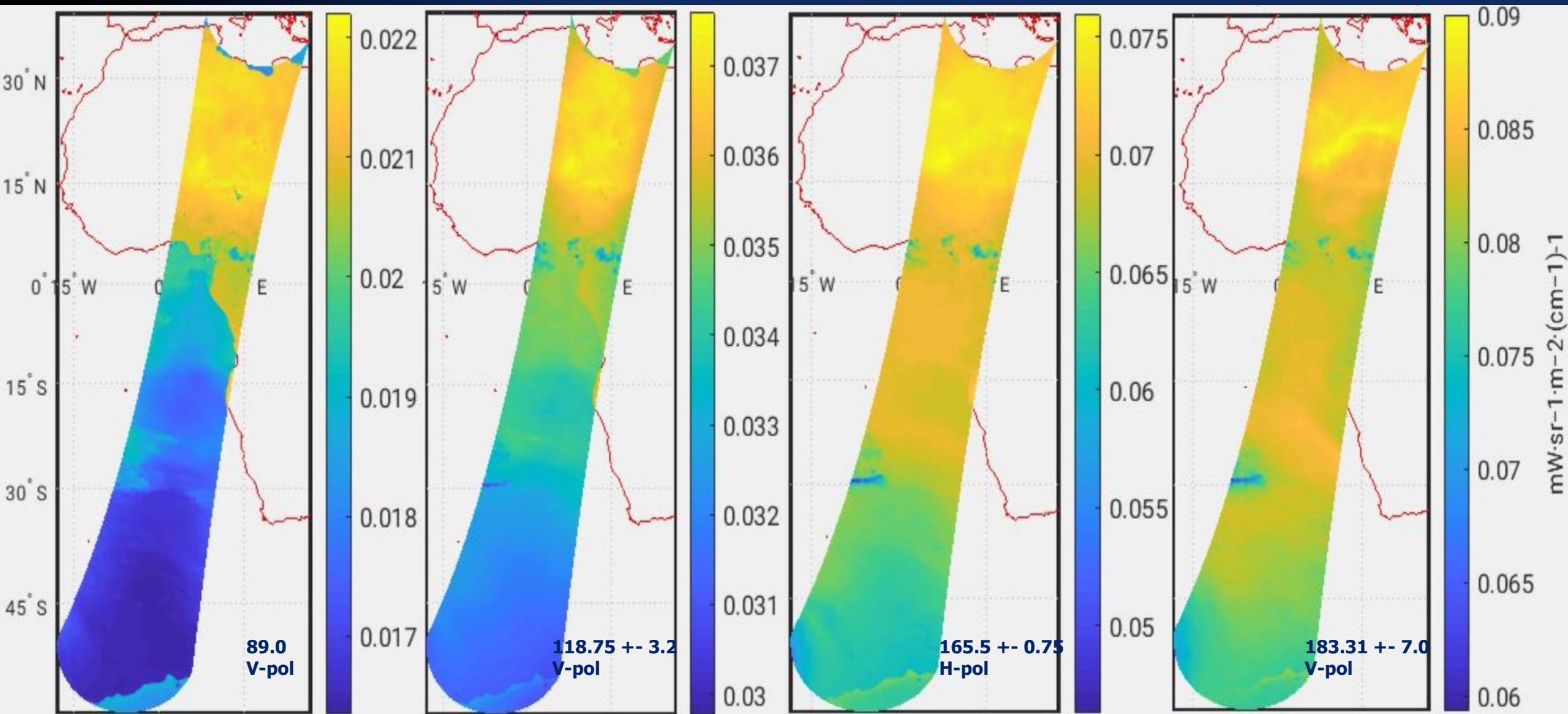
Test Data Package (TDP) v1

- The TDP V1 has been published for user familiarization with Product formats.
- The TDP V1 is based on a quarter of orbit (over Africa, Atlantic Ocean and North Antarctica, see next slides), 1140 scans in a single granule (not in line with the operational baseline which uses the 3 minutes processing windows, i.e. 135-scans granules).
- The TDP V1 envisages only the nominal scenario (degraded conditions are not considered, e.g. data gaps, counts or temperature outside the limits, satellite manoeuvres etc.).
- The L1b sidelobe correction and moon correction algorithms have not been implemented in TDP v1, as well as the RFI processing of MWI-1.
- For L2 TDP V1 the following functionalities have not been implemented:
 - For ICI: computation of the latitude and longitude of the mean ice mass height;
 - For MWI: computation of the TCWV retrieval errors.

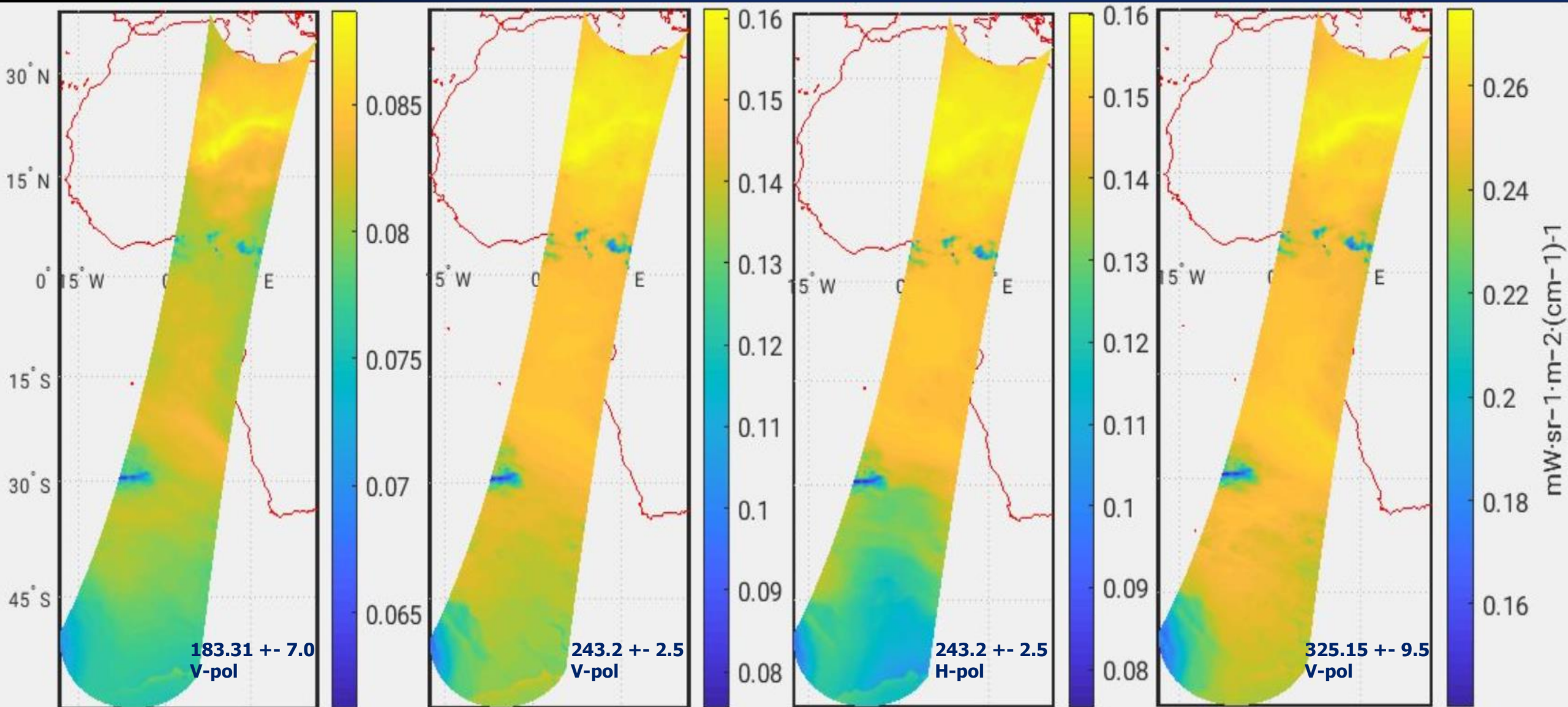
L1B Test Data Package V1: MWI Radiances



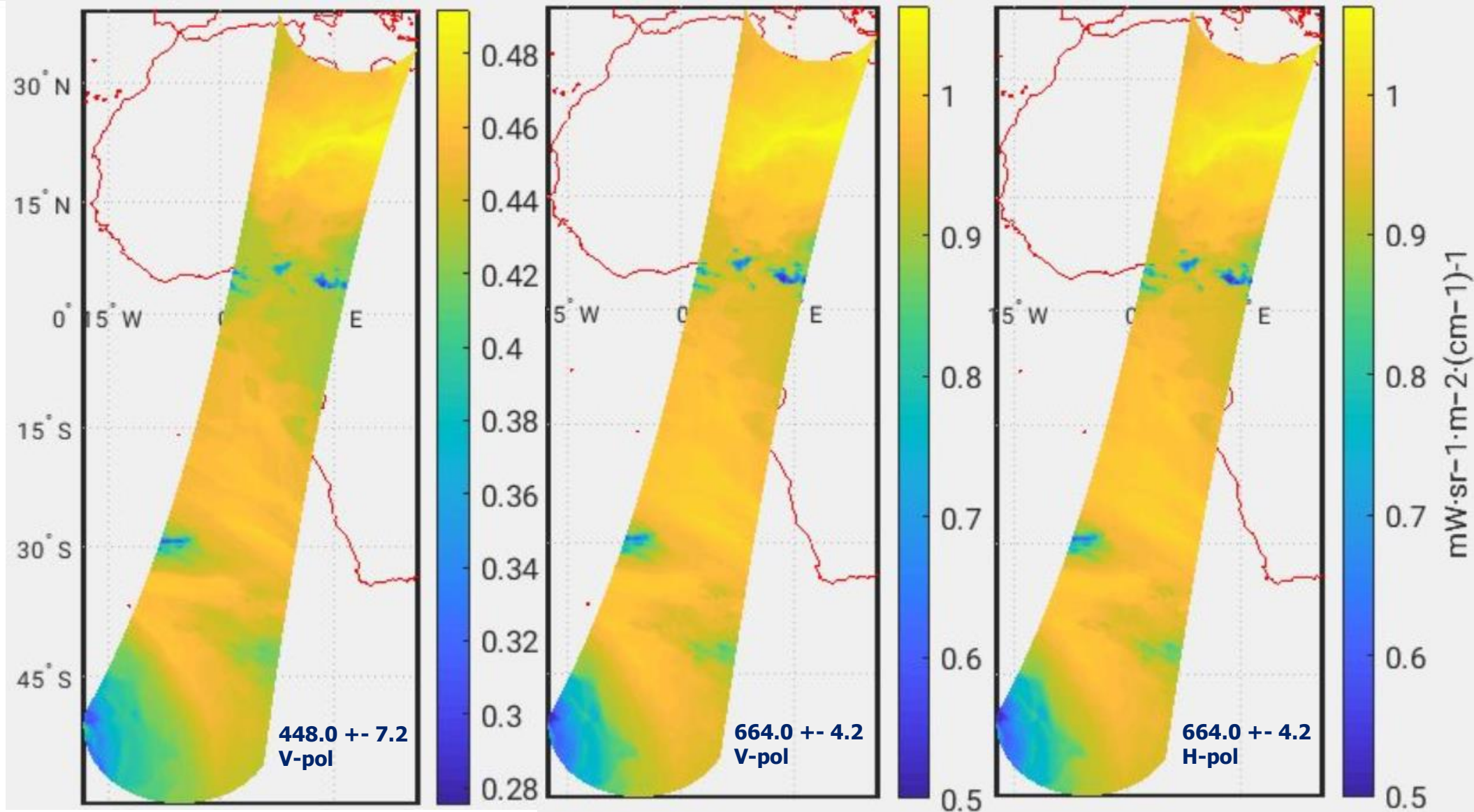
L1B Test Data Package V1: MWI Radiances



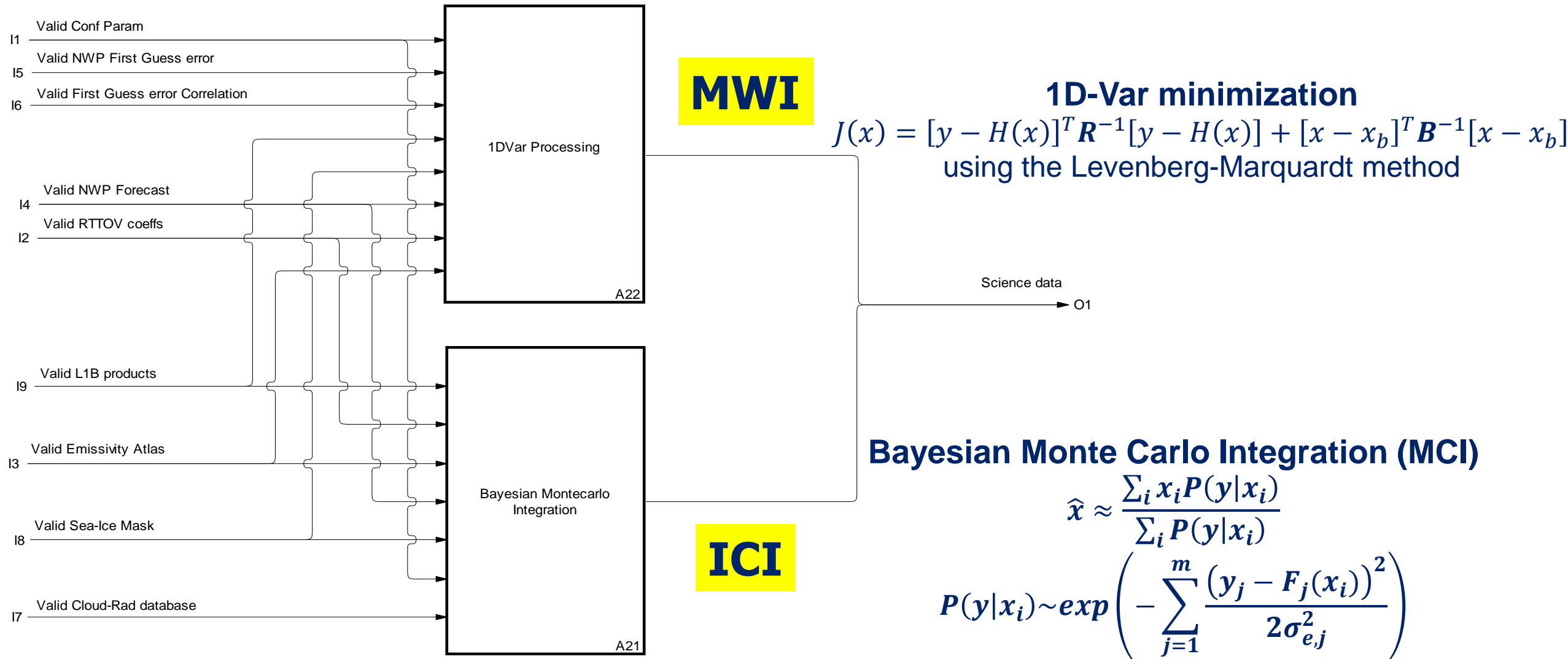
L1B Test Data Package V1: ICI Radiances



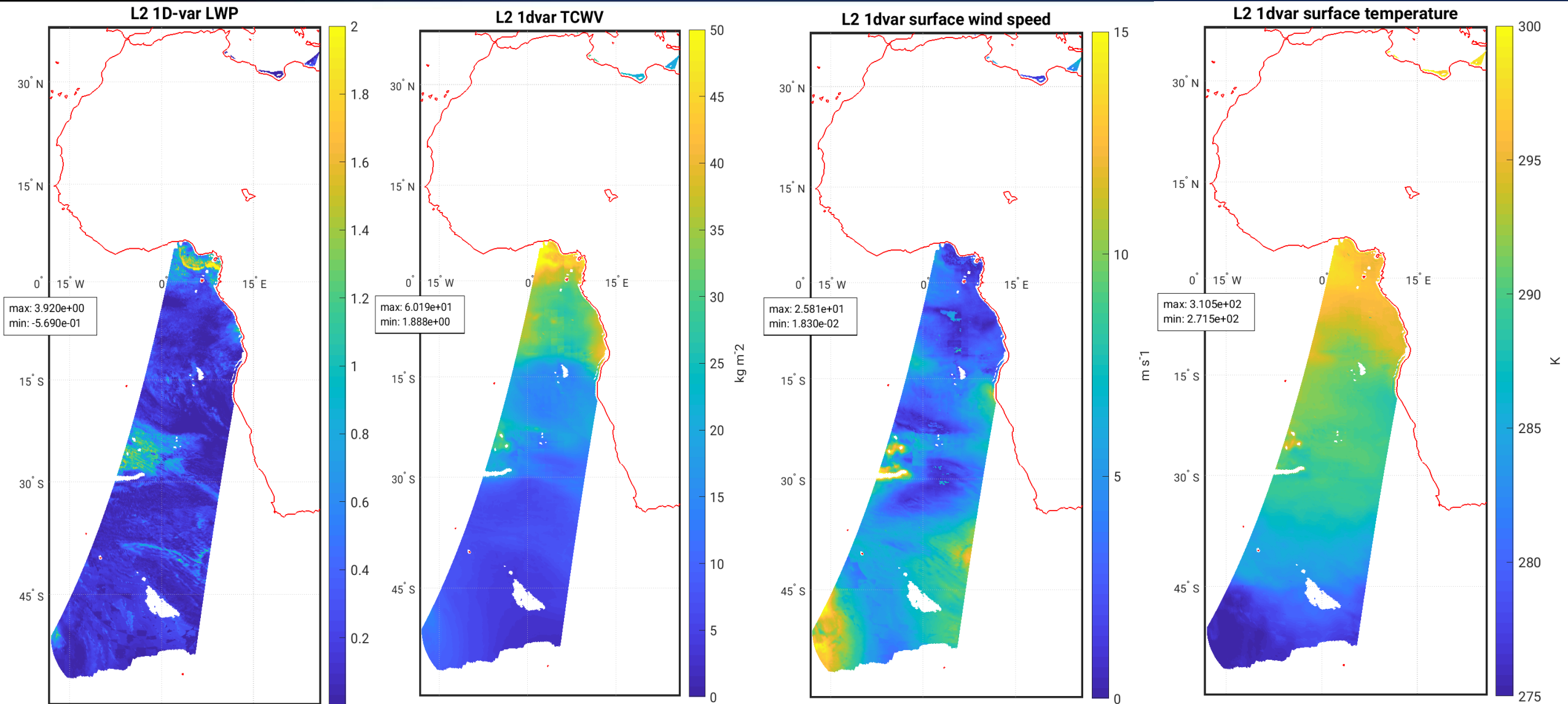
L1B Test Data Package V1: ICI Radiances



Functional decomposition of the MWI-ICI L2 processor

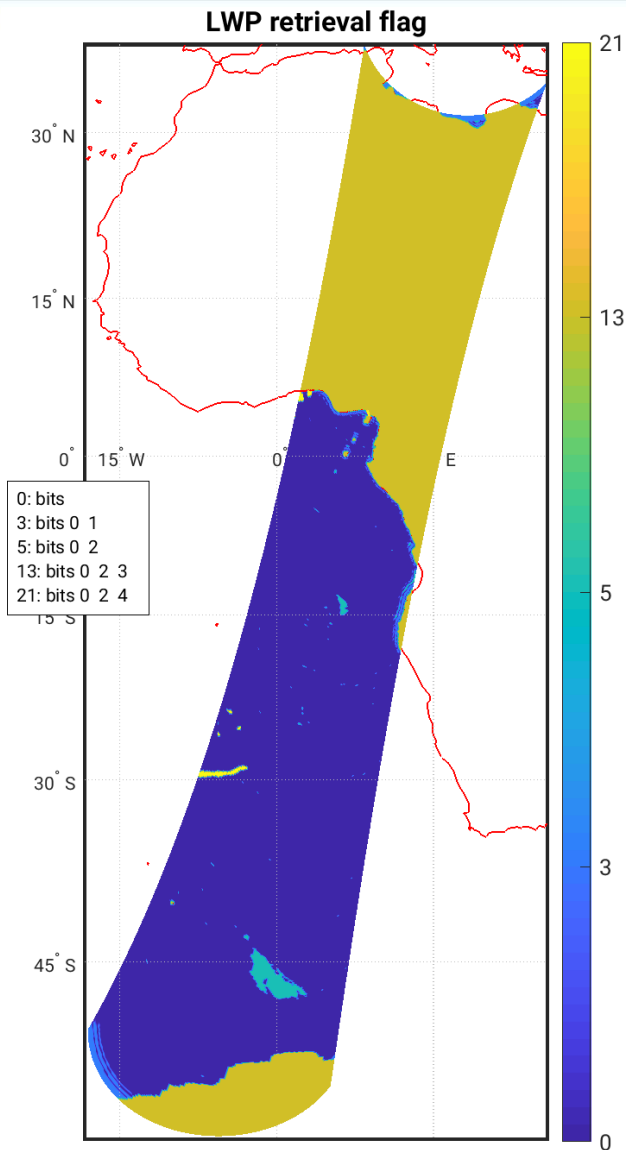


L2 Test Data v1: 1D-Var outputs

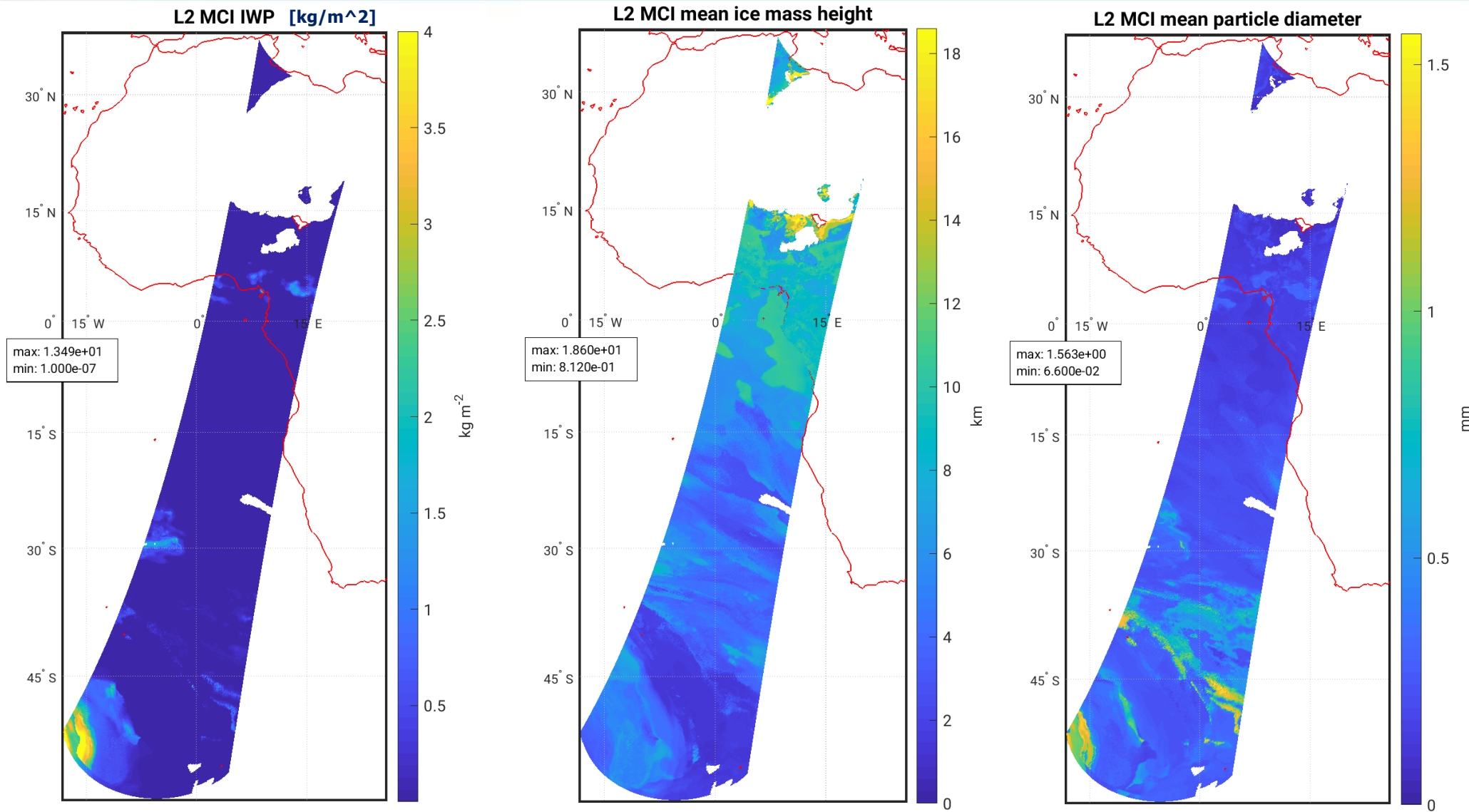


L2 Test Data : 1D-Var flags for MWI LWP retrieval

lwp_retrieval_flag	
Bit	Meaning
0	LWP retrieval is missing, degraded or not performed for the footprint
1	LWP retrieval is degraded for the footprint
2	LWP retrieval is missing for the footprint because 1D-Var does not converge
3	LWP retrieval is not performed because the footprint is not on open water
4	LWP retrieval is not performed because of precipitation screening
5-7	To be set

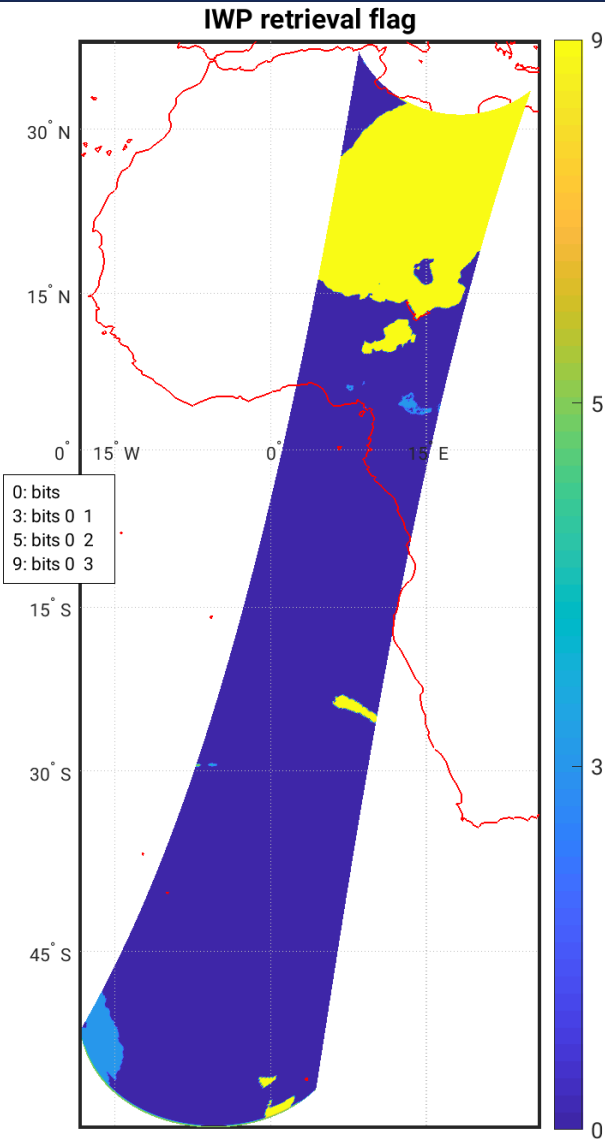


L2 Test Data Package v1: Monte Carlo Integration (MCI) retrieved Ice Water Path (IWP)



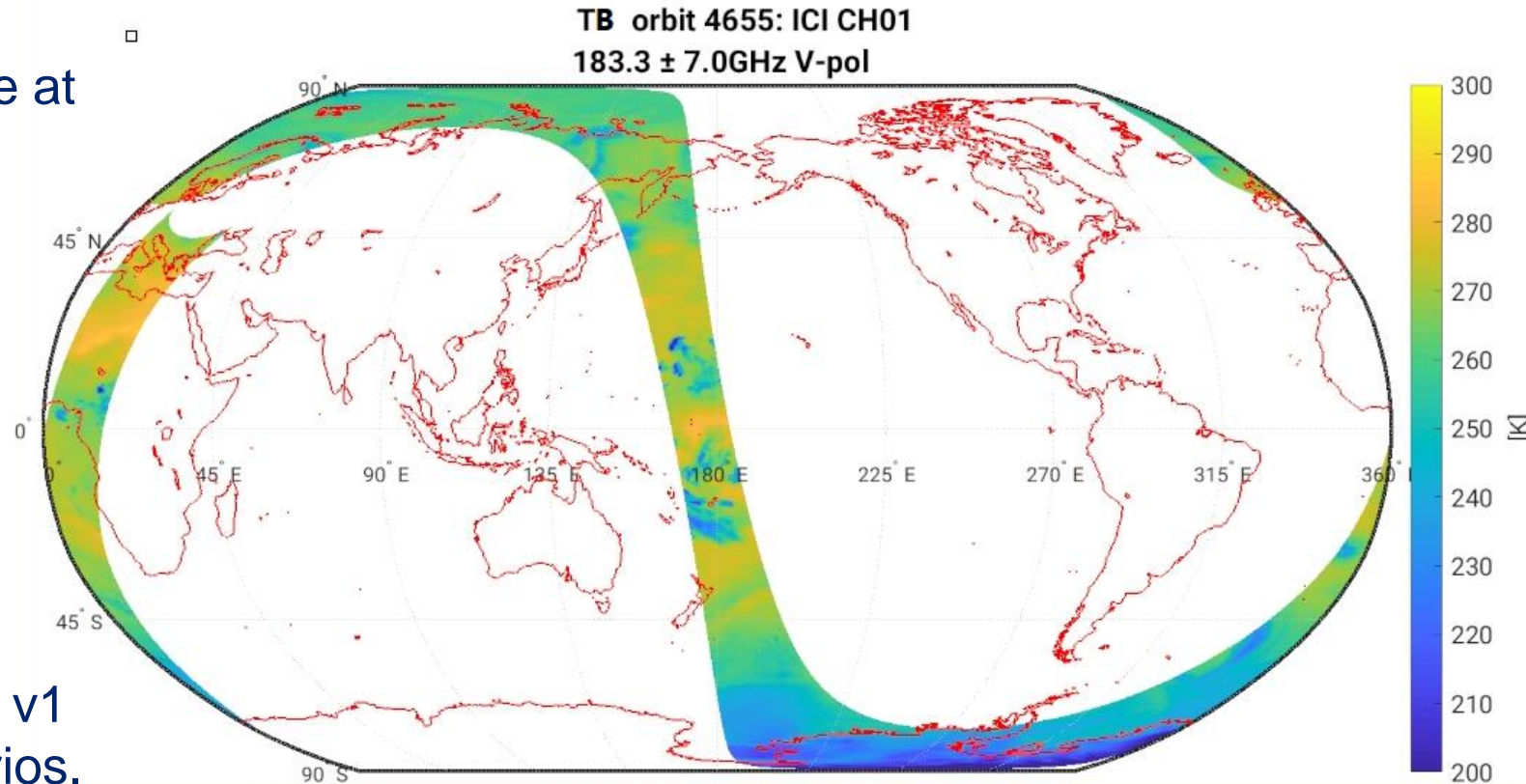
L2 Test Data v1: MCI flags for ICI retrievals

iwp_retrieval_flag	
Bit	Meaning
0	Retrieval of good quality for the footprint if bit is 0. Set to 1 if the IWP retrieval is degraded, missing or not performed because of clear sky conditions
1	IWP retrieval is of degraded quality for the footprint
2	IWP retrieval is missing for the footprint
3	IWP retrieval is not performed because of clear sky conditions
4-7	To be set



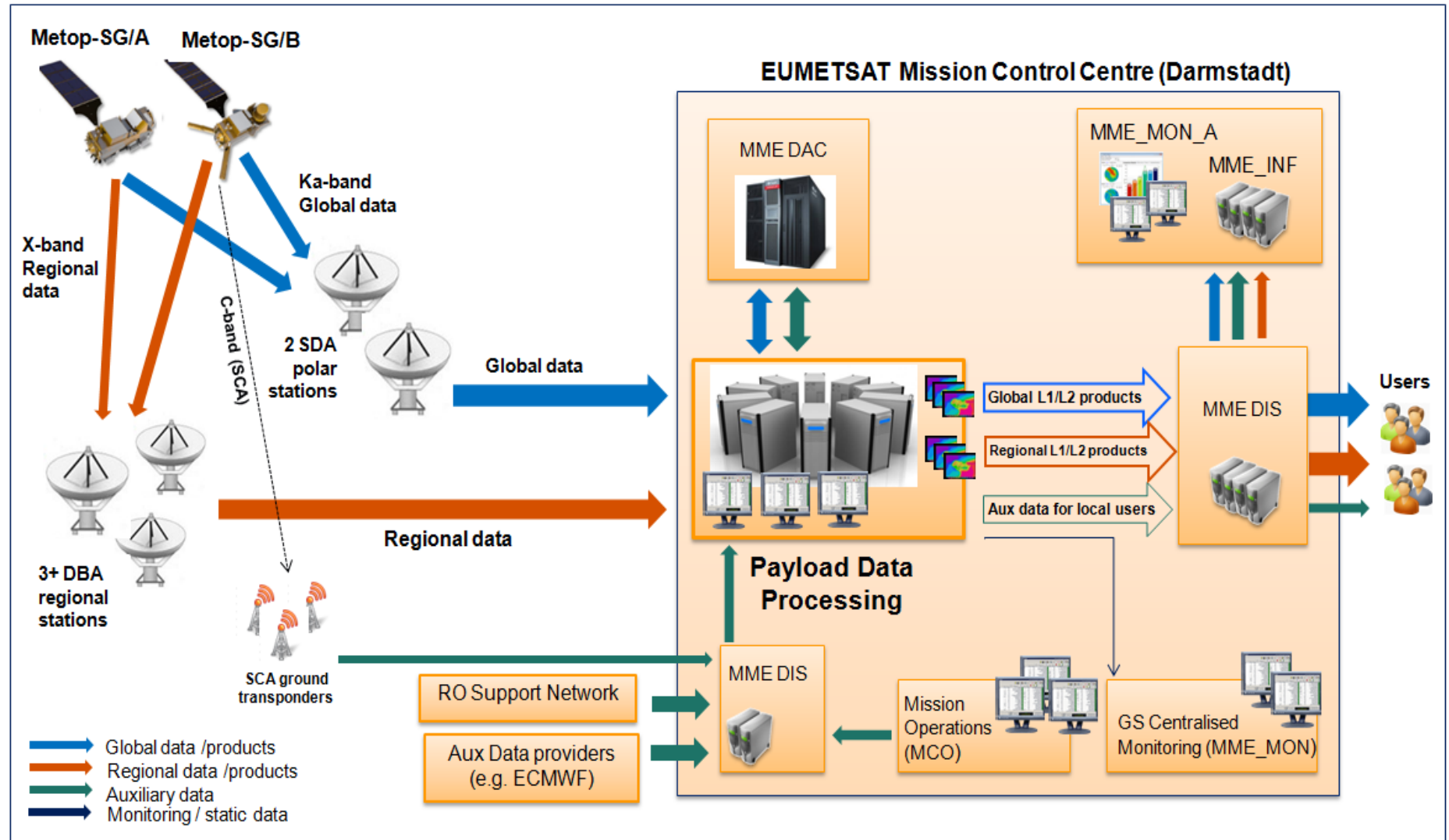
Test Data Package v2

- The Test Data Package v2 will be published on the EUMETSAT web site at beginning of 2023.
- It will be based on 3 orbits (2 of them consecutive) and it will contain more realistic radiances.
- TDP v2 will implement all the functionalities not considered for TDP v1 and will also include degraded scenarios.



EPS-SG Data and Products Generation, Archiving and Dissemination Baseline at EUMETSAT HQ

Context of NRT Global and Regional Processing



Data dissemination: Format of the Product files

Product ID	Global / Regional	EUMETCAST	GTS	Archive
MWI-1B-RAD	G	netCDF-4 BUFR	BUFR	netCDF-4 BUFR
ICI-1B-RAD	G	netCDF-4 BUFR	BUFR	netCDF-4 BUFR
MWI-1B-RAD	R	netCDF-4 BUFR	BUFR	netCDF-4 BUFR
ICI-1B-RAD	R	netCDF-4 BUFR	BUFR	netCDF-4 BUFR
MSP-02-LIW	G	netCDF-4	N/A	netCDF-4
MSP-02-LIW	R	netCDF-4	N/A	netCDF-4

Please consider that the BUFR file disseminated via EUMETCAST will be different from that distributed via GTS, because GTS has specific requirements in terms of file size (≤ 50 Mb).

EUMETSAT Data dissemination services

PUSH SERVICES



Near-real time data delivery via satellite or terrestrial networks.

EUMETCast
Satellite/Terrestrial
<https://www.eumetsat.int/eumetcast>

PULL SERVICES



Viewing and exploring your data...

EUMETView
<https://view.eumetsat.int/>



Centralized data storing & downloading...

EUMETSAT
Data store
<https://data.eumetsat.int/>



Customizing your data...

Data Tailor

ADDITIONAL SERVICES



EO Portal
eoportal.eumetsat.int
Create/manage user account, subscribe to EUMETSAT services



Direct dissemination
via local missions



Data Centre
archive.eumetsat.int
Data Preservation & offline media requests



Product Navigator
navigator.eumetsat.int
Explore service catalogue, supporting documentation



Global Telecommunication Service
in BUFR format

Summary

- MWI/ICI L1B and L2 products have been defined and the implementation of their operational processors is progressing;
- Product formats have been defined, using NetCDF-4 as native format, as described in the Product Format Specifications (PFS);
- Global and regional products follow the same processing and their formats are identical;
- The first version of Test data is publically available. New version of the test data (on 3 orbits) will be released at beginning 2023 for both L1B and L2 Products.
- EUMETSAT provides to users several services for data reception, downloading, customization and visualization/exploration.