

The Biomass Processing Suite (BPS): an Overview of Biomass Operational Processor and Products



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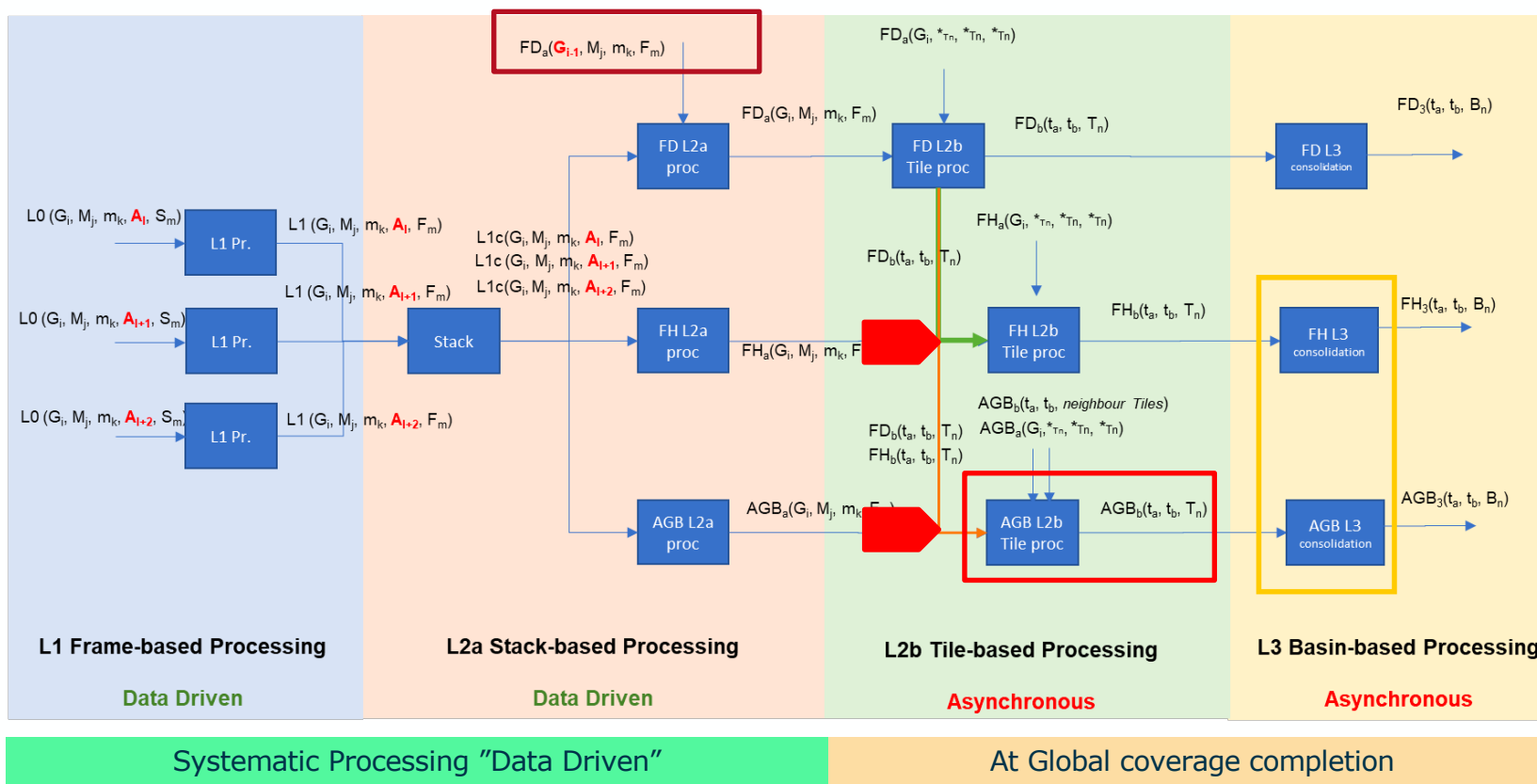




Biomass Production Model



- The production model addresses the organisation of a complex processing flow into a set of logical inter-related tasks
- Has been devised from a thorough review of the Algorithm Description



Production highlights:

FD L2A requires previous GC(i-1) information

FH and AGB L2B requires a Forest-Non-Forest from FD (creates dependency on the processing) **or external** (either from BIOMASS data or not)

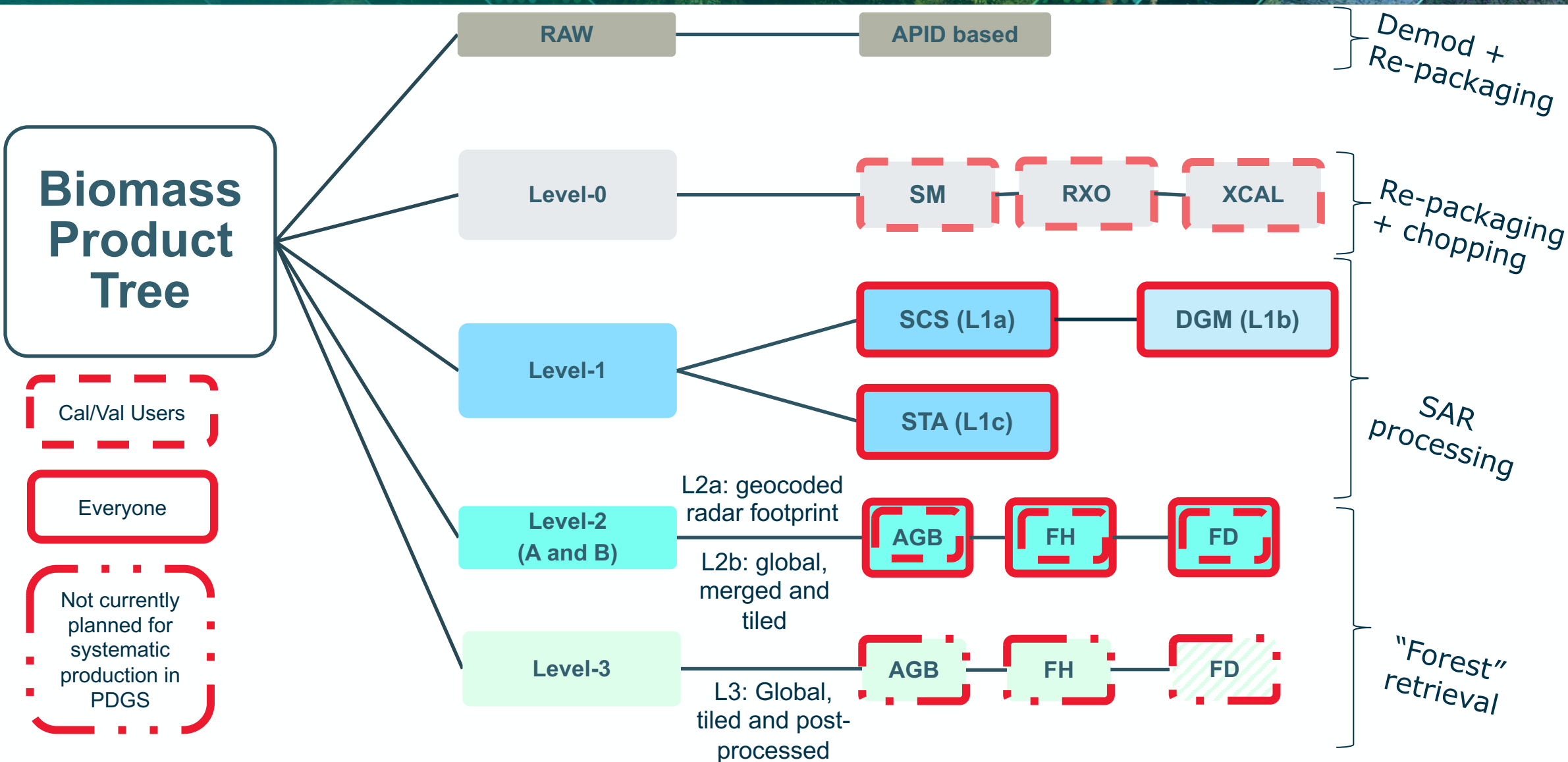
Initial AGB L2B requires external reference AGB data and a few iterations to cope with the limited distribution of the reference

Stay tuned! The global AGB Estimation Algorithm for ESA's BIOMASS Mission 11:50





Biomass Product Overview





Level-1 product family



L1 A

Single-look Complex Slant (SCS) data

- SAR focused complex data lying in the Zero-Doppler azimuth plane and in slant-range geometric projection.
- Includes antenna pattern, RFI and ionosphere corrections.
- Four polarimetric channels are provided.
 - Correspond to 21 s acquisition time

L1 B

Detected Ground Multi-look (DGM) data

- SAR focused detected data lying in the Zero-Doppler azimuth plane and in ground range geometric projection
 - Multilooked
- (optionally) de-noised. Default is to provide de-noising information but not to apply it.

L1 C

Stack interferometric product (STA)

- Co-registered and calibrated SCS products from the same swath and major cycle acquisitions.
- Default of 3 images for INT and 7 for TOM phases.
- Includes azimuth spectral filtering, baseline calibration, residual ionosphere correction and SKP residual phase screen estimation.
- Three polarimetric channels are provided



Level-1 product family



L1 A

Single-look Complex Slant (SCS) data

Resolution (rg x az [m]):

22,8 x 7,6 to 23,5 x 7,9

Pixel spacing (rg x az [m]):

19,8 x 6,7

Number of looks (rg x az):

1x1

L1 B

Detected Ground Multi-look (DGM) data

Resolution (rg x az [m]):

54,3 x 50,5 to 55,3 x 50,5

Pixel spacing (rg x az [m]):

25 x 25

Number of looks (rg x az):

1x6

L1 C

Stack interferometric product (STA)

Resolution (rg x az [m]):

22,8 x 7,6 to 23,5 x 7,9

Pixel spacing (rg x az [m]):

19,8 x 6,7

Number of looks (rg x az):

1x1





Level-2 product family



L2 A FH

Forest Height

- Obtained by processing an entire L1C stack (TOM or INT).
- Same L1 SCS coverage geocoded onto a Discrete Global Grid for forest products.
 - Not tiled.
- Represents top canopy height.

L2 A FD

Forest Disturbance

- Obtained by processing an entire L1C stack (INT).
- Same L1 SCS coverage geocoded onto a Discrete Global Grid for forest products.
 - Not tiled.
- Indicates forest change between two global cycles, including classification of pixels into forest/non-forest.

L2 A GN

Ground Notched

- Obtained by processing an entire L1C stack (TOM or INT)
 - Same L1 SCS coverage geocoded onto a Discrete Global Grid for forest products
 - Not tiled
- Corresponds to ground cancelled data, enhancing volume contribution



Level-2 product family



L2 A FH

Forest Height

Resolution [m]:

200

Pixel spacing (lat x lon):

3" x 3" to 3" x 6"

Number of looks (rg x az):

4 x 25

L2 A FD

Forest Disturbance

Resolution [m]:

50

Pixel spacing (lat x lon):

1.5" x 1.5" to 1.5" x 3"

Number of looks (rg x az):

1 x 6

L2 A GN

Ground Notched

Resolution [m]:

100

Pixel spacing (lat x lon):

1.5" x 1.5" to 1.5" x 3"

Number of looks (rg x az):

2 x 12

Dissemination of L2A to the general community currently under evaluation





Level-2 product family



L2 B FH

Forest Height

- Obtained by processing all L2a products relative to a specific geographic DGG tile in the Global cycle.
 - Tiled.
- Layers: Forest height (float), quality (float), heat map, input FNF mask

L2 B FD

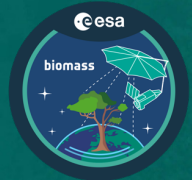
Forest Disturbance

- Obtained by processing all L2a products relative to a specific geographic DGG tile in the Global cycle.
 - Tiled.
- Layers: Forest disturbance (int), computed forest mask (int), probability of change (float), heat map

L2 B AGB

Above Ground Biomass

- Obtained by processing all L2a products relative to multiple geographic DGG tiles in the Global cycle.
 - Tiled
- Estimation window larger than measurement window, promoting consistence across tiles
- Layers: AGB (float), quality (float, currently being defined), heat map



Level-2 product family



L2 B FH

Forest Height

Resolution [m]:

200

Coverage on map:

1° x 1°

Pixel spacing:

50° S - 50° N: - 3" x 3"

50° S/N - 60° S/N: - 3" x 4.5"

60° S/N - 70° S/N: - 3" x 3"

L2 B FD

Forest Disturbance

Resolution [m]:

50

Coverage on map:

1° x 1°

Pixel spacing:

50° S - 50° N: - 1.5" x 1.5"

50° S/N - 60° S/N: - 1.5" x

2.25"

60° S/N - 70° S/N: - 1.5" x 3"

L2 B AGB

Above Ground Biomass

Resolution [m]:

200

Coverage on map:

1° x 1°

Pixel spacing:

50° S - 50° N: - 3" x 3"

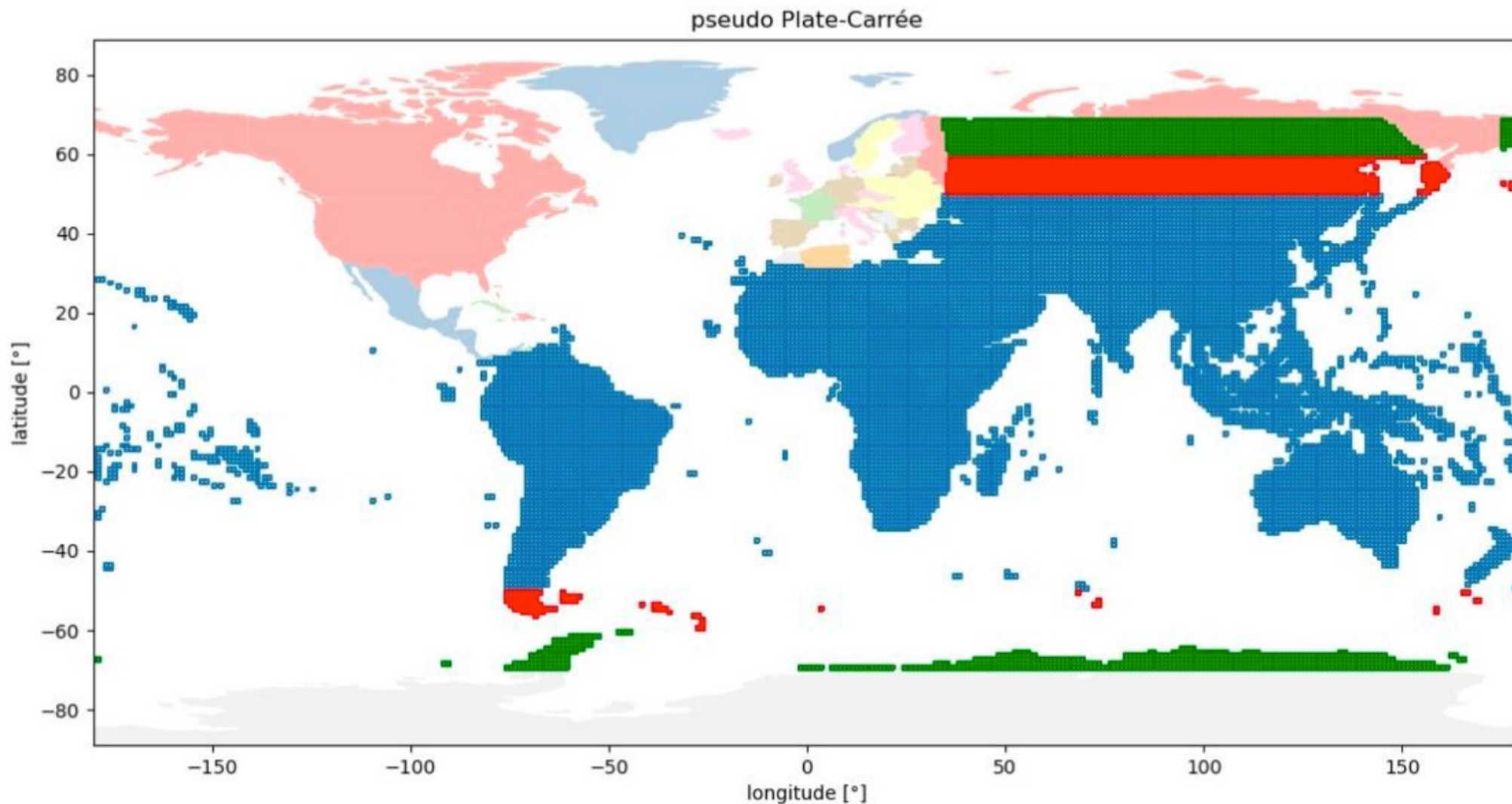
50° S/N - 60° S/N: - 3" x 4.5"

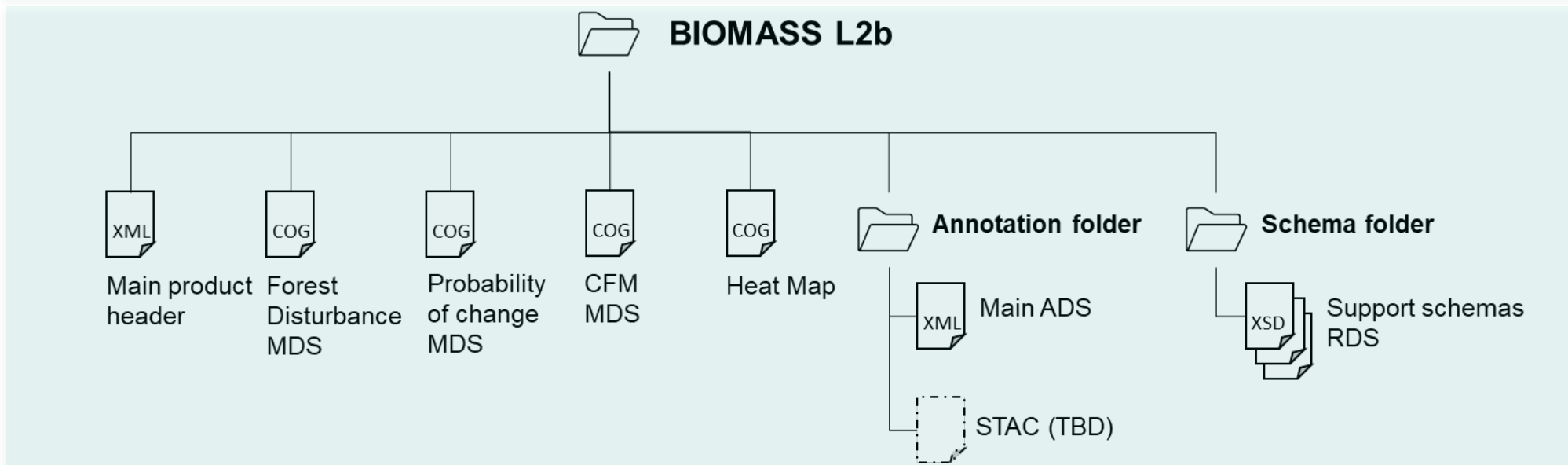
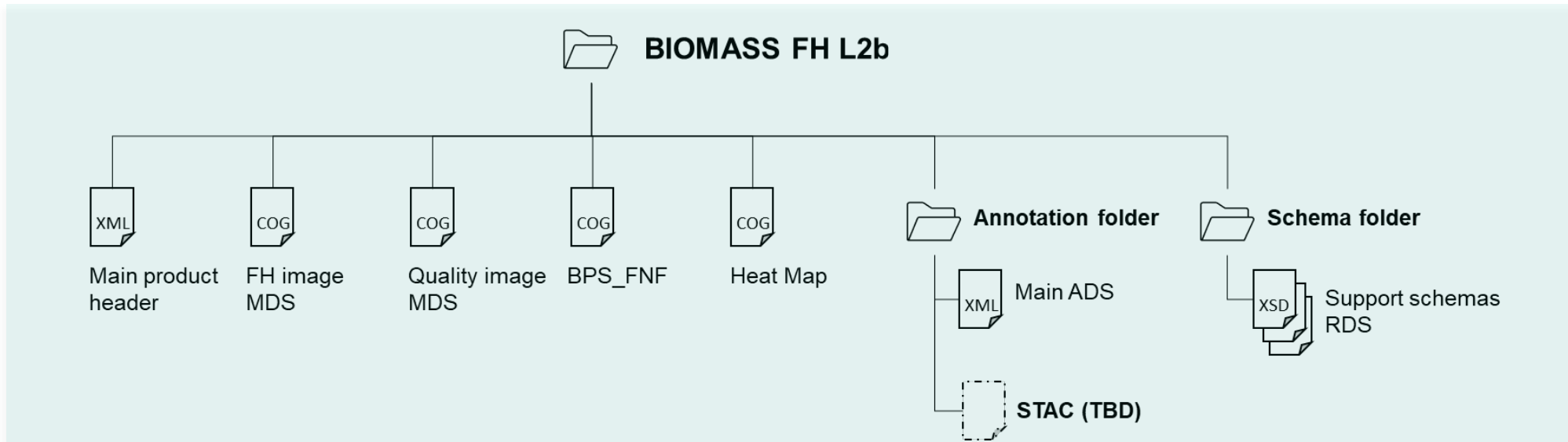
60° S/N - 70° S/N: - 3" x 3"





Discrete Global Grid (DGG) / the "tile" concept







Product Naming Convention for L2B products



<MMM>_<TTTTTTTTTT>_<P>_G<CC>_T<TTTTTTT>_B<BBB>_<BB>_<DDDDDD>

where:

<MMM>: Satellite ID;

<TTTTTTTTTT>: Product Type/File Type, i.e.:

FP_FD__L2B: Forest Disturbance L2b product;

FP_FH__L2B: Forest Height L2b product;

<P>: Mission phase identifier;

<CC>: Global Coverage identifier;

<TTTTTTTT>: Tile number of the product, the seven digits are [N|S]aa[E|W]bbb, where:

N|S: stands for North or South;

aa: latitude in two digits padded with zeros (at 0° N or S are both valid);

E|W: stands for East or West;

bbb: longitude over 3 digits padded with zeros (at 0° E or W are both valid);

<BBB>: Basin literal identifier of the product (string);

<BB>: Baseline Identifier;

<DDDDDD>: Compact creation date.





Product Naming Convention for L2B products



<MMM>_<TTTTTTTTTT>_<P>_G<CC>_T<TTTTTTT>_B<BBB>_<BB>_<DDDDDD>

BIO_FP_FD__L2B_I_G01_TS01E013_B001_02_C89EK9

- ├─ annotation
 - | ├─ bio_fp_fd__l2b_i_g01_ts01e013_b001_annot.xml
 - | └─ bio_fp_fd__l2b_i_g01_ts01e013_b001.json
- ├─ bio_fp_fd__l2b_i_g01_ts01e013_b001_02_c89ek9.xml
- ├─ bio_fp_fd__l2b_i_g01_ts01e013_b001_i_acquisition_id_image.tiff
- ├─ bio_fp_fd__l2b_i_g01_ts01e013_b001_i_cfm.tiff
- ├─ bio_fp_fd__l2b_i_g01_ts01e013_b001_i_fd.tiff
- ├─ bio_fp_fd__l2b_i_g01_ts01e013_b001_i_heatmap.tiff
- ├─ bio_fp_fd__l2b_i_g01_ts01e013_b001_i_probability.tiff
- └─ schema
 - ├─ bio-common-types.xsd
 - ├─ bio-l2b-fd-main-annotation.xsd
 - ├─ bio-l2l3-common-annotations.xsd
 - └─ bio-l2l3-fd-proc-annotations.xsd





The PDGS – Authentication & Information



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The PDGS – Dissemination



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ESA SMOS Online Dissemination

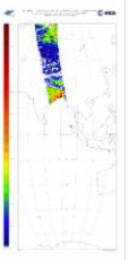
SMOS L1 and L2 Science data [Info](#)

Collection: SMOS L1 and L2 Science data
Level: L2SM
Type: MIR_SMUDP2_nc
Year: 2022
Month: 09
Day: 23

Available products (29)

SM_OPER_MIR_SMUDP2_20220923T232229_20220924T001649_700_001_1.nc

[Download Product](#) | [Product Info](#) | [Browse](#)



beginAcquisition:	2022-09-23T23:22:28.620Z
endAcquisition:	2022-09-24T00:15:49.063Z
orbitDirection:	ASCENDING
productQualityStatus:	NOMINAL
productQualityDegradationTag:	
fileClass:	OPER

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42°12'43" -38°58'22"

ALOS PALSAR products
 1 to 50 of 50586

	Product Type	Start	Stop	Mission	Instrument	Instrument Mode	Swath	Polarisation	Orbit	Track
↓	FBD_RAW_0P	2009-10-06T21:29:23.602Z	2009-10-06T21:29:40.002Z	ALOS	PALSAR	FBD	S34.3	HH, HV	019719	638
↓	FBD_RAW_0P	2009-10-06T21:30:21.104Z	2009-10-06T21:30:37.505Z	ALOS	PALSAR	FBD	S34.3	HH, HV	019719	638
↓	FBD_RAW_0P	2009-10-06T21:31:35.030Z	2009-10-06T21:31:51.431Z	ALOS	PALSAR	FBD	S34.3	HH, HV	019719	638
↓	FBD_RAW_0P	2009-10-06T21:30:45.749Z	2009-10-06T21:31:02.148Z	ALOS	PALSAR	FBD	S34.3	HH, HV	019719	638
↓	FBD_RAW_0P	2009-10-06T21:32:07.884Z	2009-10-06T21:32:24.283Z	ALOS	PALSAR	FBD	S34.3	HH, HV	019719	638
↓	FBD_RAW_0P	2009-10-06T21:32:16.097Z	2009-10-06T21:32:32.496Z	ALOS	PALSAR	FBD	S34.3	HH, HV	019719	638
↓	FBD_RAW_0P	2009-10-06T21:31:43.244Z	2009-10-06T21:31:59.644Z	ALOS	PALSAR	FBD	S34.3	HH, HV	019719	638
↓	FBD_RAW_0P	2009-10-06T21:33:21.798Z	2009-10-06T21:33:38.197Z	ALOS	PALSAR	FBD	S34.3	HH, HV	019719	638
↓	FBD_RAW_0P	2009-10-06T21:33:38.221Z	2009-10-06T21:33:54.621Z	ALOS	PALSAR	FBD	S34.3	HH, HV	019719	638
↓	FBD_RAW_0P	2009-10-06T21:34:52.127Z	2009-10-06T21:35:08.527Z	ALOS	PALSAR	FBD	S34.3	HH, HV	019719	638





Timeliness of data availability



L1AB

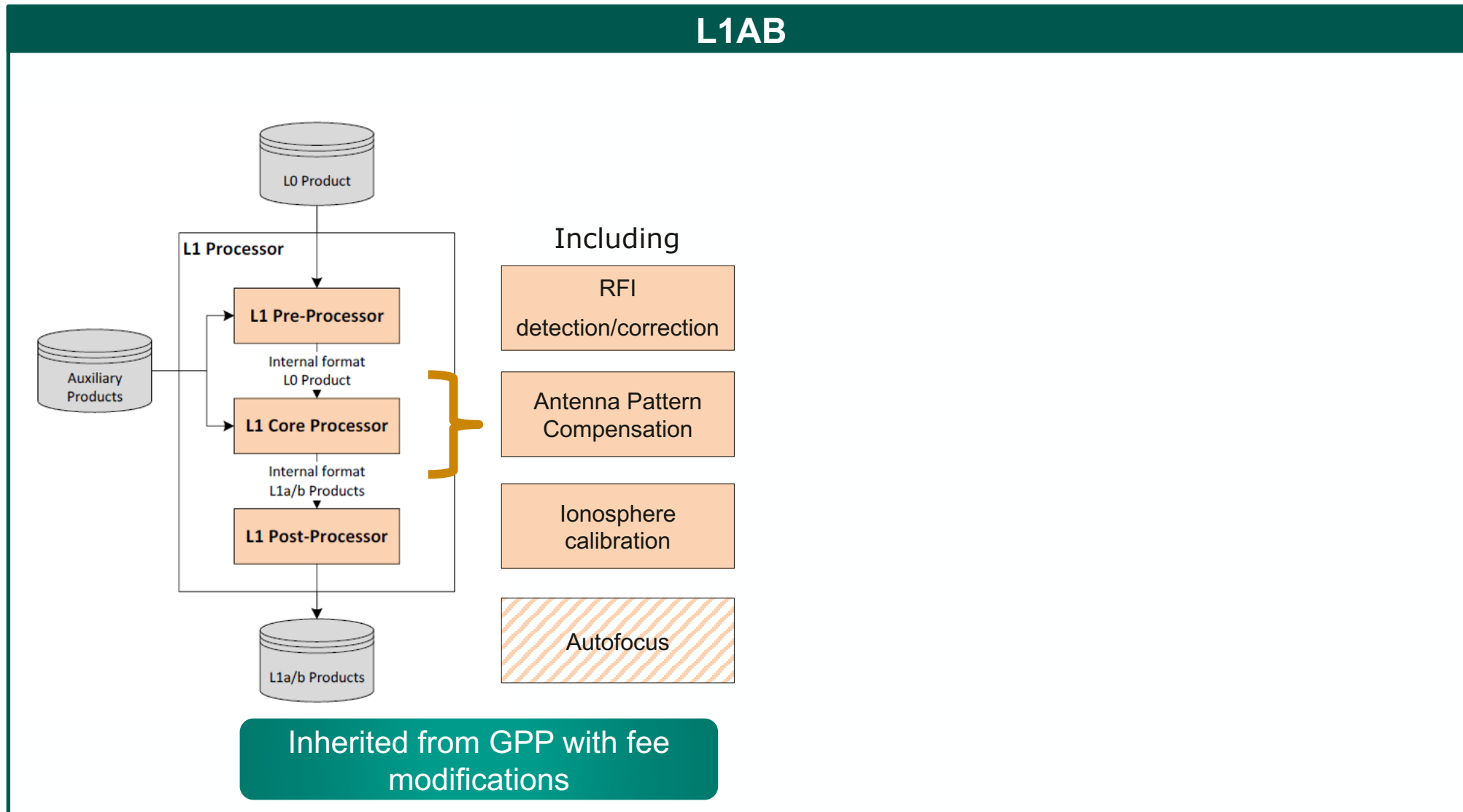
- Products are disseminated after each data-take is completely transferred to the ground segment and processed
- Timeliness of around **6 h from sensing**

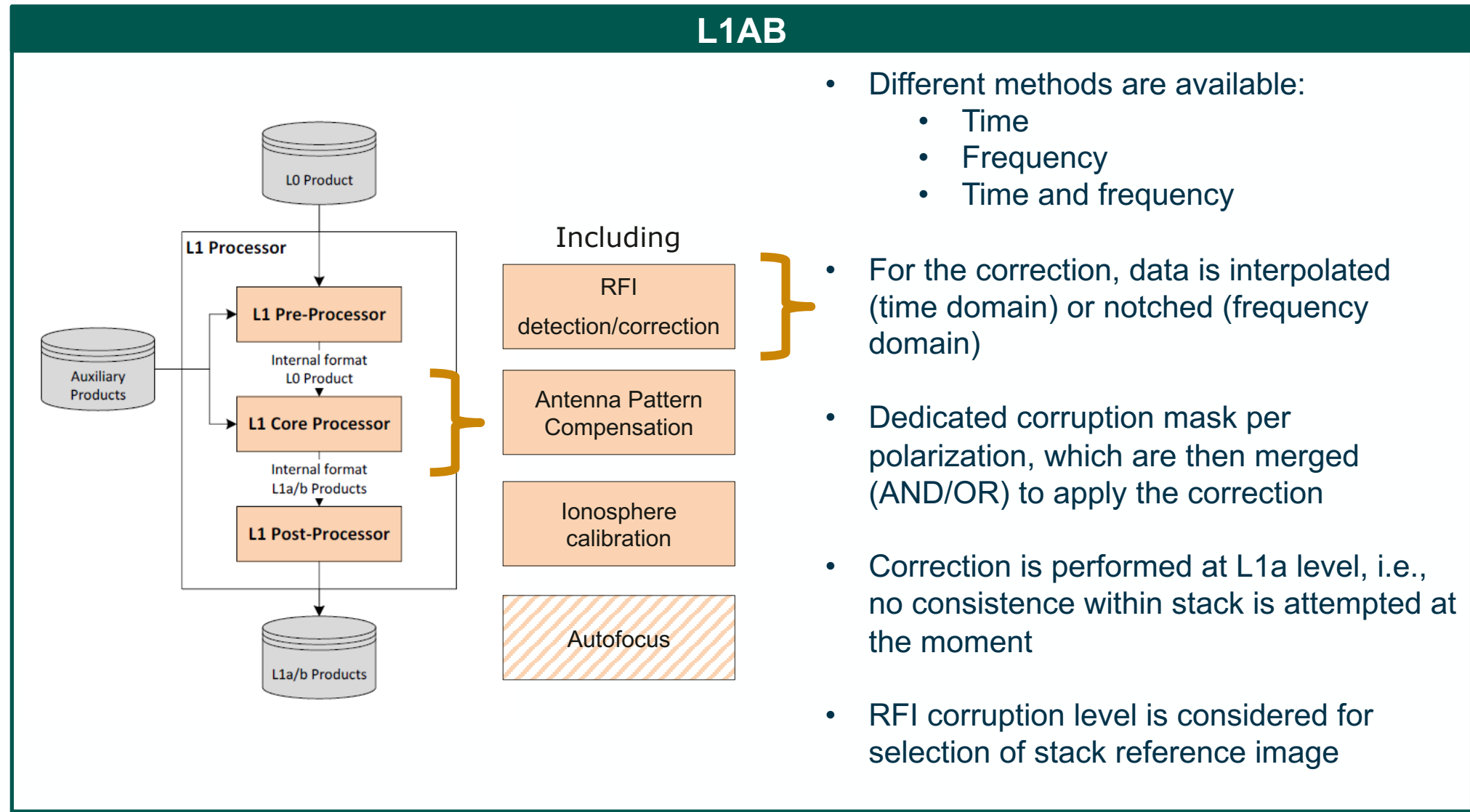
L1C and L2A

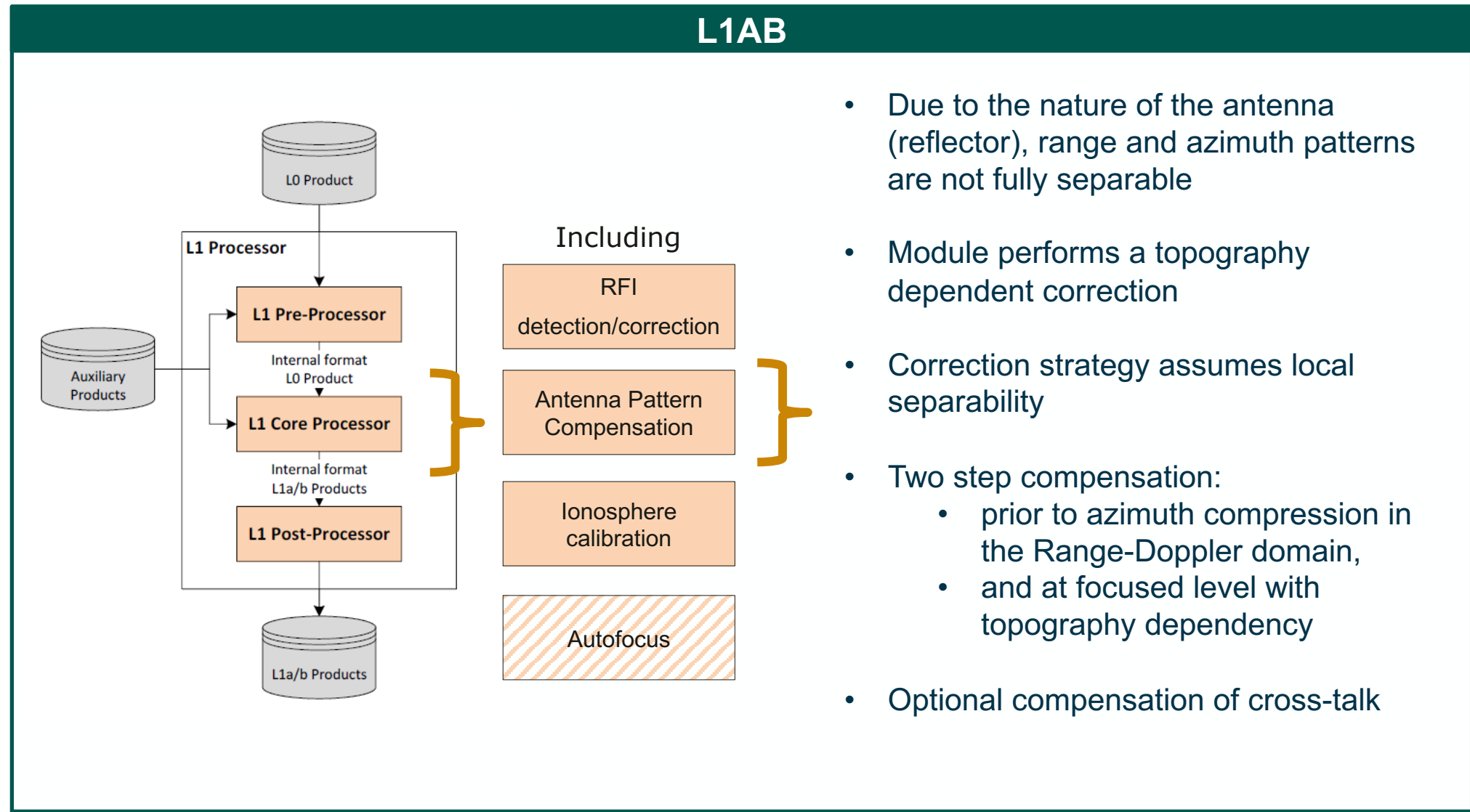
- Products currently expected to be available 2 days after the completion of each cycle
- Timeliness of around **11 days (INT)** and **23 days (TOM)**
- L2A dissemination currently under evaluation

L2 B

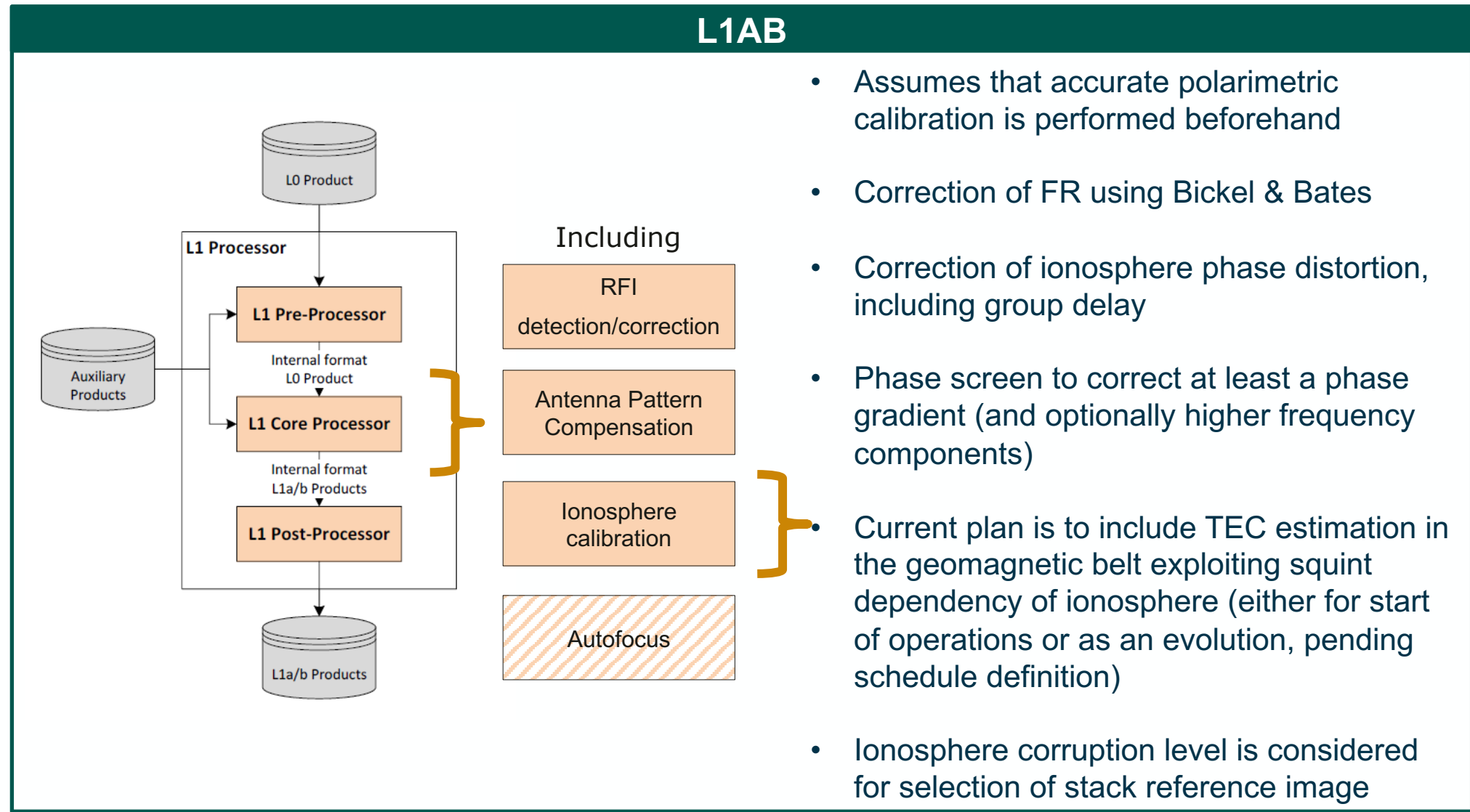
- Products will be available after the completion of each Global Coverage
- Dissemination will occur after expert qualification by the DISC
- Timeliness currently assumed to be around **1 month after the completion of each Global coverage**

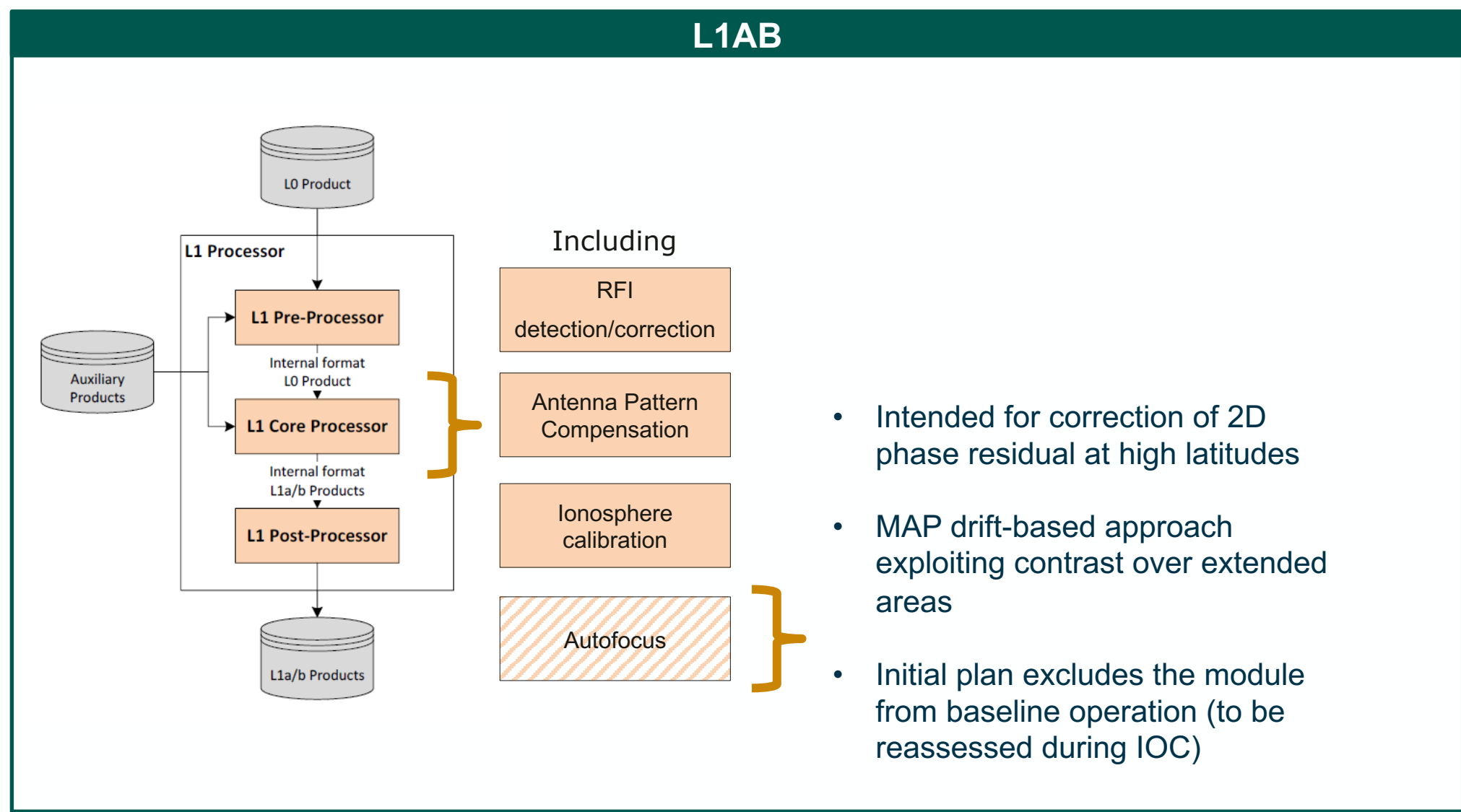






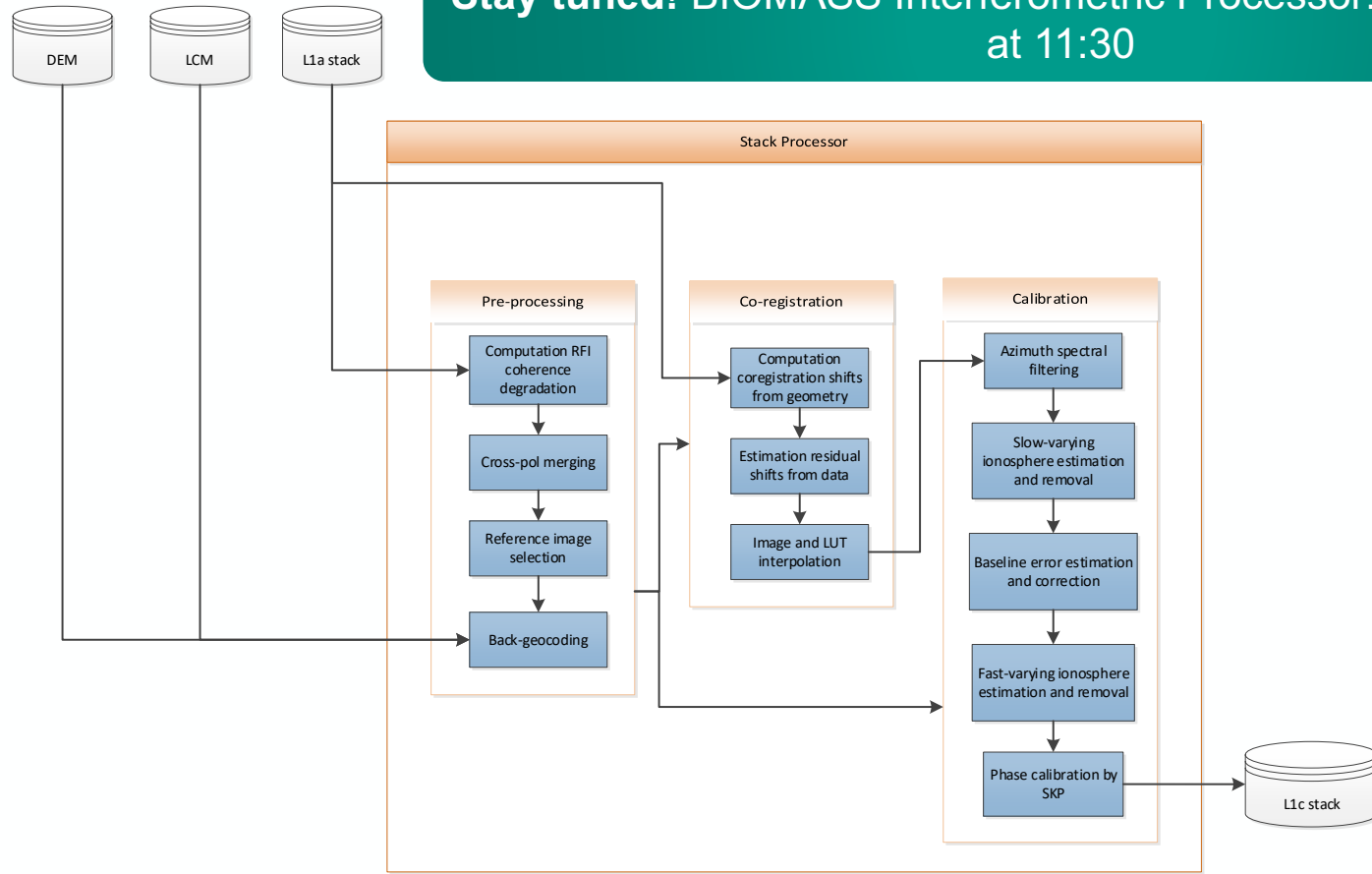
- Due to the nature of the antenna (reflector), range and azimuth patterns are not fully separable
- Module performs a topography dependent correction
- Correction strategy assumes local separability
- Two step compensation:
 - prior to azimuth compression in the Range-Doppler domain,
 - and at focused level with topography dependency
- Optional compensation of cross-talk



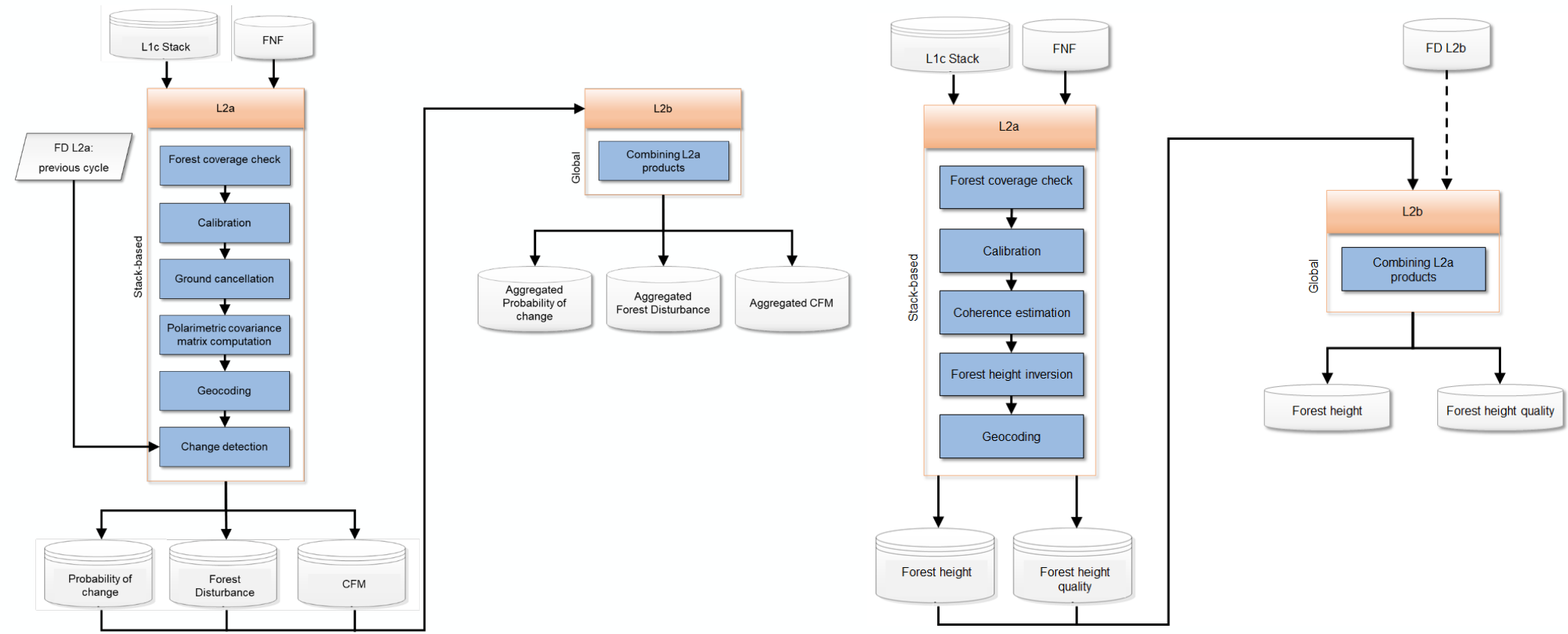


L1C

Stay tuned! BIOMASS Interferometric Processor: Current Status, at 11:30



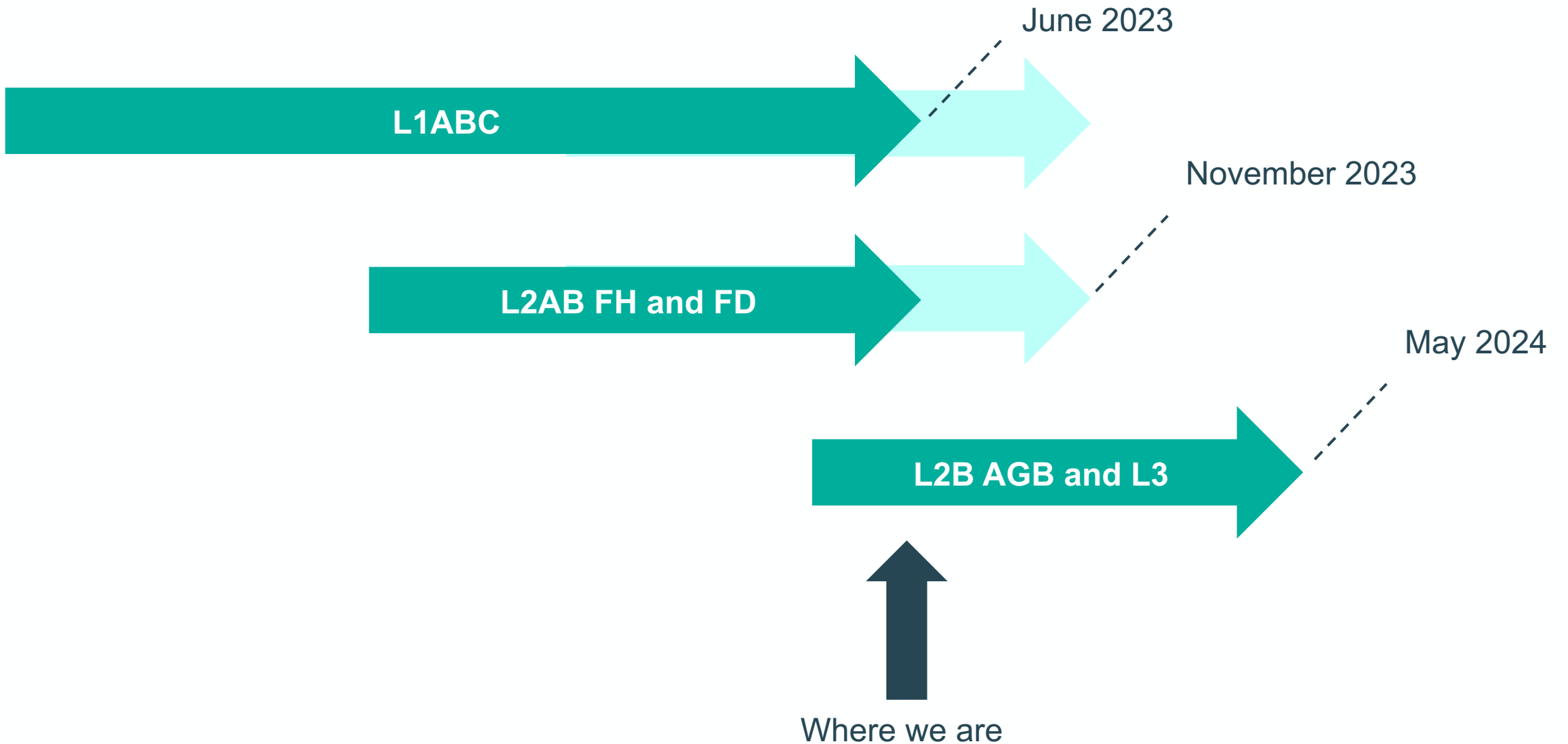
L2AB FD FH



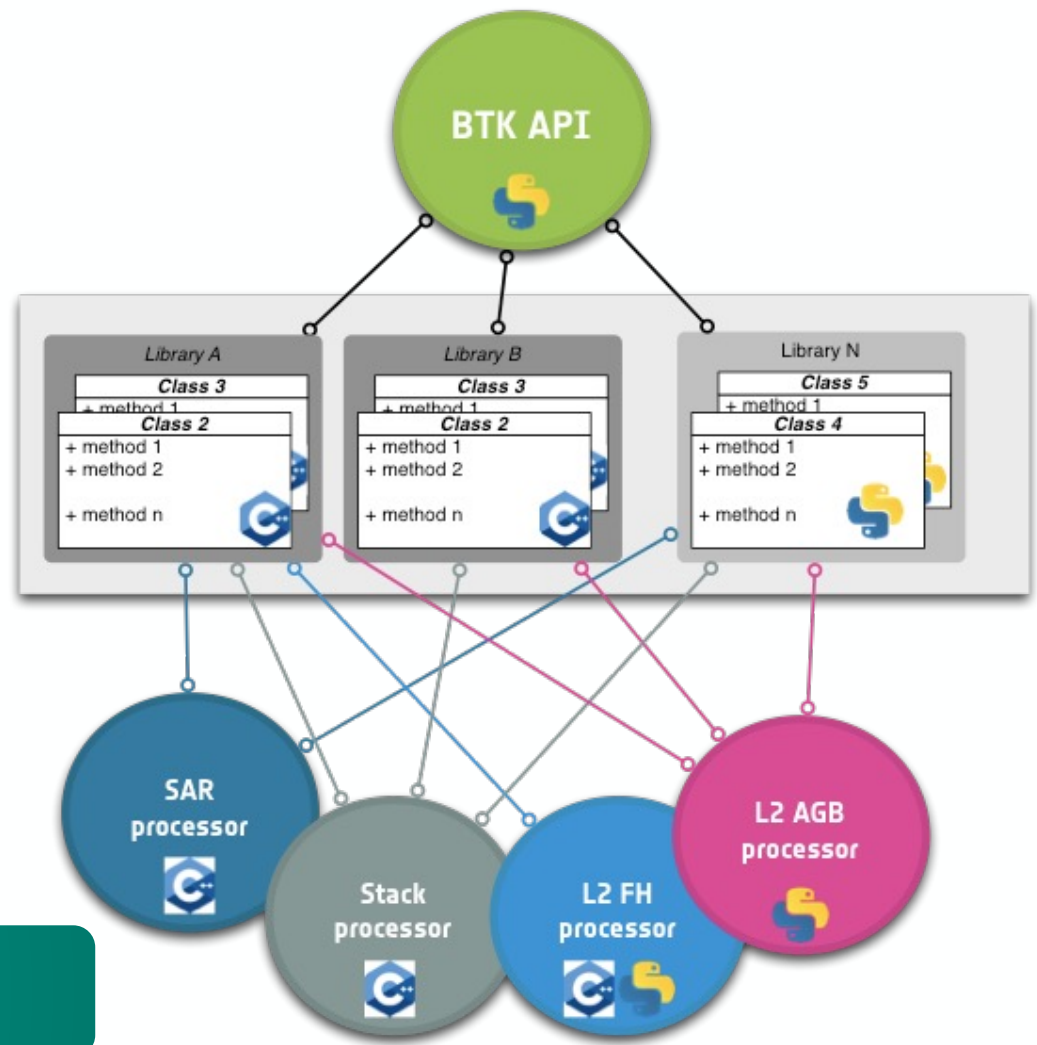
Stay tuned! BIOMASS Level-2 Algorithms: Current Status, at 12:10



BPS: Development status overview



- Expose BPS functionalities and allows the use of the BPS software in a customized way.
- Include quality tools to analyse BPS products.
- Aims at stimulating scientific contributions which could eventually help to evolve the BPS processor itself
- Ease the product exploitation for the BIOMASS primary and secondary objectives or for educational purposes.
- Planned to be deployed in the MAAP and should be a component of the BioPAL



Stay tuned! BIOMASS MAAP and BioPAL, at 12:30



Conclusions



- L1ABC, L2AB FH, L2AB FD formats and algorithms are mostly consolidated. Further developments/improvements are expected during the mission's life time.
- Functional development of L1ABC, L2AB FH, L2AB FD processors is nearly completed. Scientific validation advanced but still on-going.
- First strategy for operational L2B AGB retrieval has been defined. Product and algorithms are being now consolidated and implementation is starting.
- L3 approach currently being developed. *Current assumption* is that L3 processor will be available at the MAAP, and products wont be initially systematic produced at the PDGS.
- BPS development is planned to finished by Q2 2024, well in advance of BIOMASS launch.