

The Copernicus Sentinel-3 Mission: Getting Ready for Operations and Data Access

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Sentinel-3A Status



S3A Satellite on stand within the Acoustic Chamber at Thales Alenia Space in Cannes (Courtesy TAS-F)



S3B (left) and S3A (right) satellites close to each other within the clean room at Thales Alenia Space in Cannes in April 2015

Past months fundamental in defining the management and implementation of Copernicus Space Component and the Sentinels operations

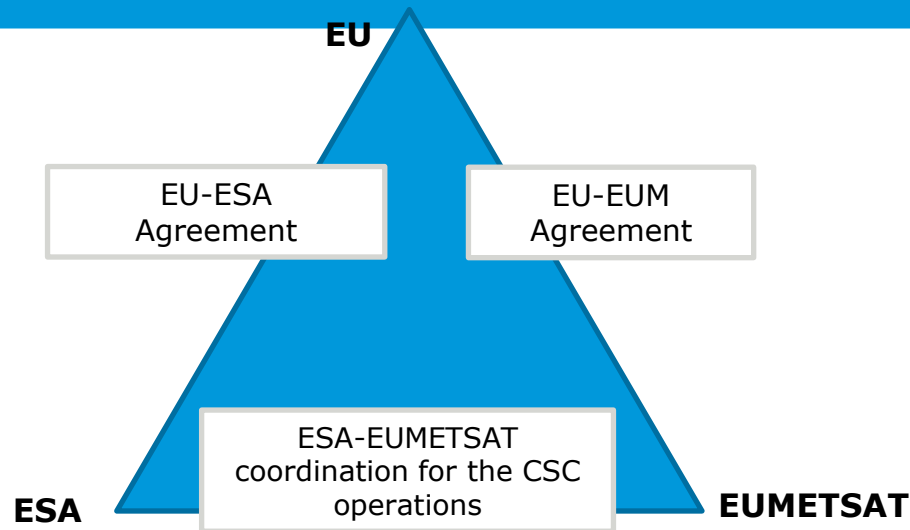
1. Providing the overall context: EU Copernicus Regulation approved (applicable from 25 April 2014)

- Establishes principle of a full, open and free data policy
- Defines responsibilities for ESA and EUMETSAT
- Defines the financial envelope for entire Copernicus context, i.e. services, in-situ and space components

2. Assigning roles to ESA and EUMETSAT:

- EU-ESA agreement on implementation of Copernicus programme including transfer of ownership of the Sentinels (applicable from 1 Nov 2014)
- EU-EUMETSAT agreement on the implementation of the Copernicus Programme including the transfer of ownership of certain assets (applicable from 7 Nov 2014)

NB: ESA and EUMETSAT share Sentinel-3 operations.



Operations, maintenance and evolution of

- ❑ the Flight Operations Segment for LEOP and Commissioning phases
- ❑ CSC shared multi-mission services (e.g. X-Band acquisition, POD)
- ❑ the **Sentinel-3 Land Payload Data Ground Segment**.

and Post-Launch space segment support activities

Operations, maintenance and evolution of

- ❑ the Flight Operations Segment for routine phase, including mission planning, and
- ❑ the **Sentinel-3 Marine Payload Data Ground Segment** including the EUMETSAT multi-mission facilities

Sentinel-3 ground segment: Status



ALL FACILITIES SUPPORTING S-3 GROUND SEGMENT ACTIVITIES ARE ESTABLISHED

Stations: Data Acquisition and Near Real Time Product Generation: Data downlink, data processing (NRT and offline)

For Sentinel-3: Svalbard

Processing and Archiving Centres (PAC): perform the Sentinels' systematic non-time-critical data processing, the on-the-fly data processing for specific cases and the reprocessing in case of processing algorithms or calibration parameters upgrades.

For Sentinel-3: Archiving and offline processing centres

- DLR for OLCI processing and archiving
- CLS for SRAL processing and archiving
- ACRI for SLSTR and S-3 synergy products processing and archiving

EUMETSAT's marine centre acts as PAC for marine products.

Missions Performance Centre (MPC): Operational Quality Control, Expert Support Laboratories (ESL), Calibration and Validation

For Sentinel-3: consortium led by ACRI



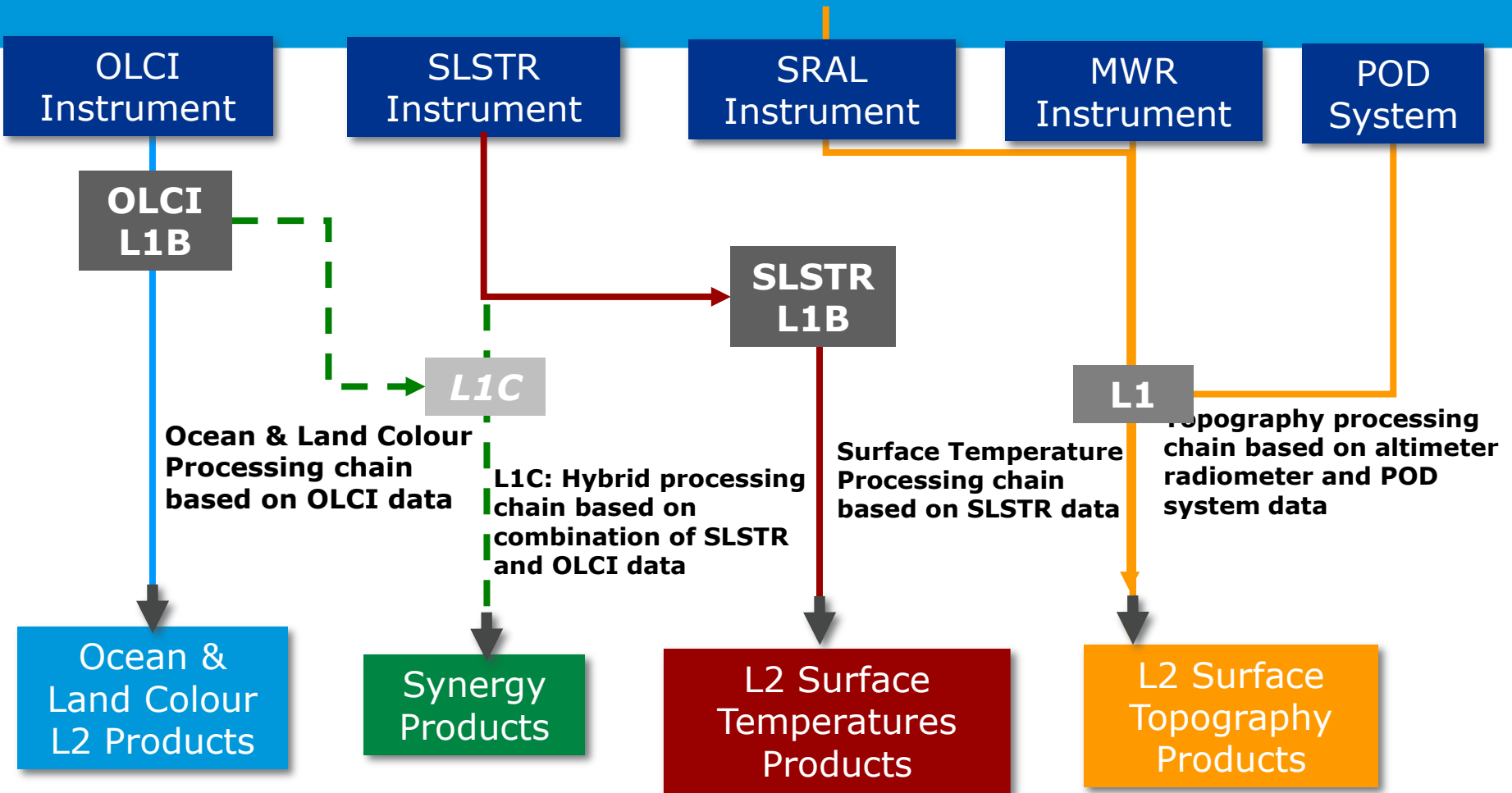
Archive and Offline Processing Centre



Mission Performance Centre (MPC)



Sentinel-3: processing chains



Product delivery timeliness:

- Near-Real Time (< 3 hr) availability of L2 products (and L1b)
- STC/NTC delivery of higher quality topography products

EC change requests: 100% SAR (Status: Approved)



S-3 will be the first mission to provide 100% SAR altimetry coverage!

- ❑ EC requested to operate SRAL in 100% SAR mode over land and ocean likewise (original baseline split LRM/SAR mode over land and ocean)
- ❑ ESA's and EUMETSAT's updated technical and financial assessment has been approved by the Commission in February 2015
- ❑ Expenditure for implementation comes from new EU/ESA and EU/EUMETSAT agreements, which introduced delay in implementation
- ❑ **The schedule for the implementation of the change request foresees the completion of the activities during the Sentinel-3A ramp-up, with the objective is to be ready to support the Sentinel-3A routine operations phase.**
- ❑ **Implementation foresees release of additional L1 data products (see table)**

Product Level	Product Description	Relevance for
L1A	Unpacked L0 data processed to engineering parameters with geo-location information	SAR processing specialists allowing fundamental studies on SAR processing such as Doppler beam formation and calibration studies using ground-based Transponders
L1B-SC	Geo-located, Calibrated gathered azimuth formed complex (I and Q) power echoes after slant/Doppler range correction	geophysical retrieval algorithm developers (over ocean, land and ice surfaces), surface characterisations studies (e.g. impact of sea state bias, wave directional effects etc) and QC systems
L1B	Geo-located, Calibrated Multi-looked power waveforms	geophysical retrieval algorithm developers and QC systems

EC change requests: AOD and FRP (Status: implementation under discussion)



Request from EC for two “new” operational products

Fire Radiative Power

- ❑ Spatial resolution: 1 km (pixel level) with a threshold at 10km
- ❑ Temporal resolution: 1 hour, with a threshold at 3 days
- ❑ Accuracy: goal 10%, threshold 30%
- ❑ Detection threshold: goal 5MW, threshold 50 MW
- ❑ Latency: Near-real time (< 3 h)
- ❑ Availability of products: goal 99%, with a threshold of 80%

Aerosol (Global)

- ❑ Spatial resolution: at pixel level (for regional applications), with a threshold at 100km
- ❑ Temporal resolution: defined by SLSTR design
- ❑ Accuracy: goal over land AOD 0.1, over ocean AOD 0.05
- ❑ Latency: Near-real time (< 3 h)
- ❑ Availability of products: goal 99%, with a threshold of 80%
- ❑ Format: goal BUFR, with threshold for netcdf or other format with decoding software
- ❑ Include uncertainties at pixel level (goal)
- ❑ AOD 550 nm over ocean and land (goal)

STATUS

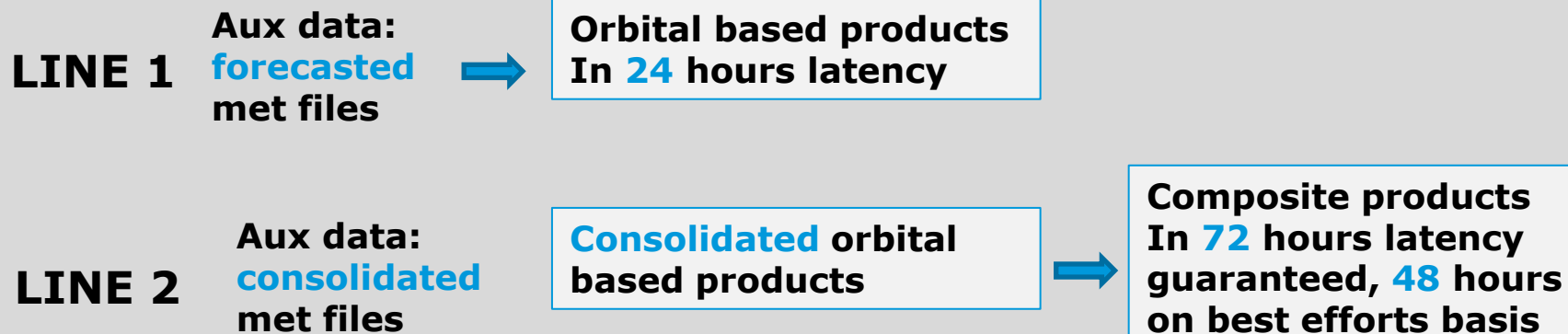
- ❑ First assessment sent to Commission with preliminary cost estimate in July 2013
- ❑ MAG meeting October 2013: solution for algorithm development presented for discussion and advice
- ❑ ESA and EUMETSAT working on updated technical implementation at present.
- ❑ Expenditure for implementation comes from new EU/ESA and EU/EUMETSAT agreements as part of CSC evolution.
- ❑ **Implementation will start in the 3rd quarter of 2015, to be completed during the Sentinel-3A ramp-up phase.**

EC change requests: SYN (Status: Approved)

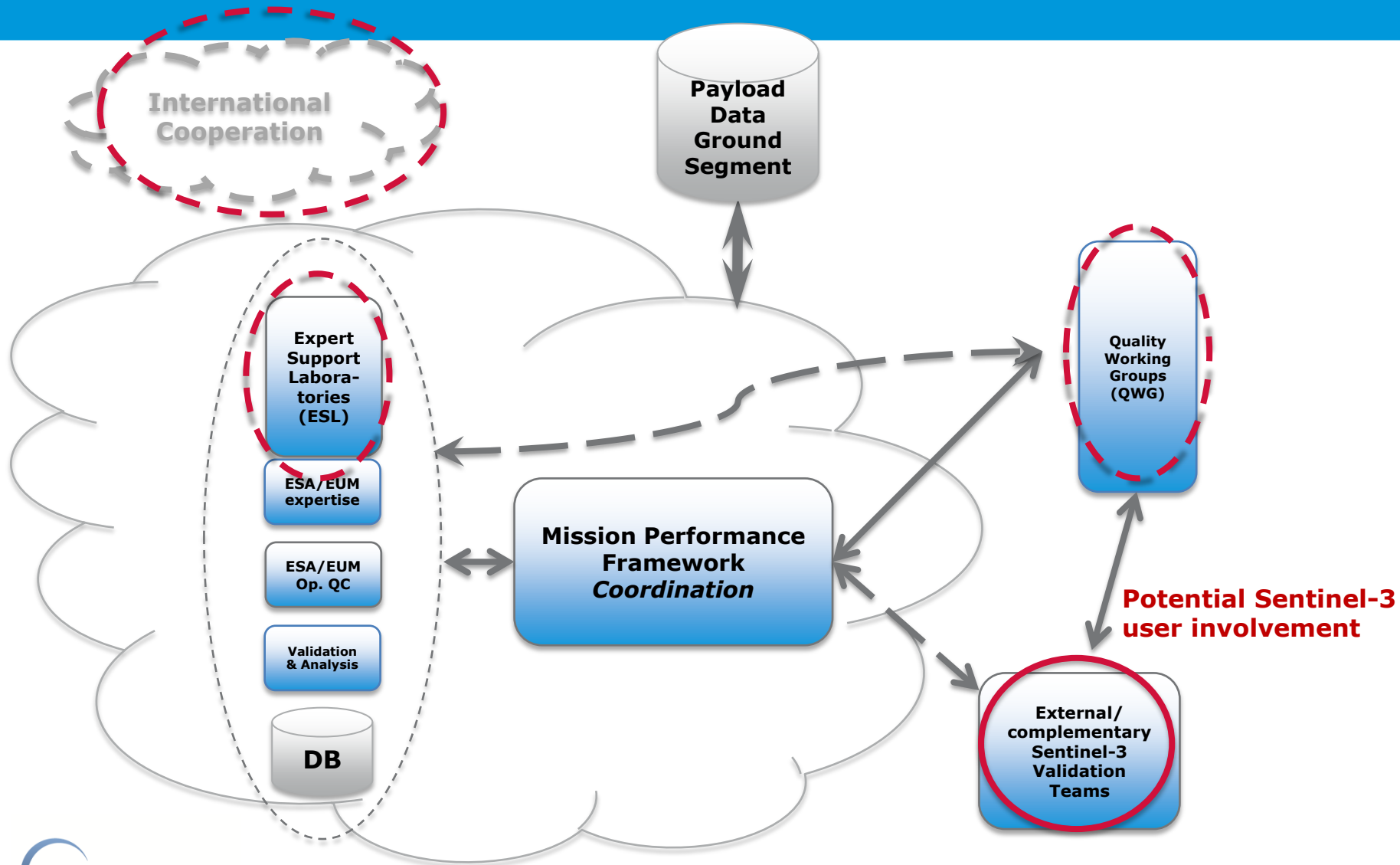


- ❑ EC requested to improve “the timeframe for delivery of Sentinel-3 Synergy products (both full resolution products (SY_2_SYN) and reduced resolution (SY_2_VGP, SY_2_VG1, SY_2_V10) with a commitment of availability within 24 hours.”
- ❑ Final detailed technical and financial assessment provided in April 2015, approved by EC in May 2015
- ❑ Implementation of the change proposal for the activities under ESA’s responsibility will start in the 2nd quarter of 2015, with the objective to be ready to support the Sentinel-3A ramp-up and routine operations phase.

Two distinct processing chains for orbital and composite products using different aux files



Interaction with users: Data quality



- ❑ The Copernicus Space Component Ground Segment data access is ensuring that **all Sentinels core products** are accessible **to all users online**
 - ❑ List of Sentinel baseline core products published in Sentinel Online portal
- ❑ Access to Sentinel **products** is made available via dedicated data hubs
 - ❑ User can self-register to the data hubs
 - ❑ All core products of the **last 12 months** of data is accessible via “rolling archives”
 - ❑ Data download via terrestrial network (output rates **up to 10 Gbps**)
- ❑ In addition, access to full **Sentinels long-term archive** will be made progressively available **to all users online** (when removing products from data hubs rolling archives)
 - ❑ no gap in online products availability

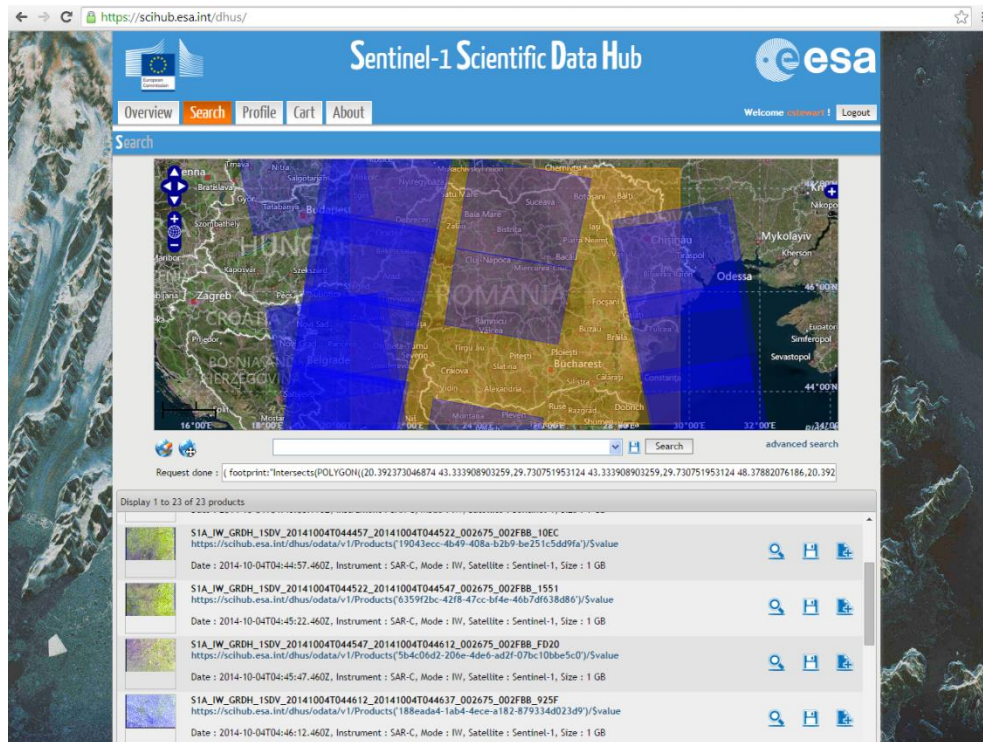


sentinel.esa.int:
contains information
about data and data
access point to
<https://scihub.esa.int/>

For ESA: open and free Sentinel-3 data access will follow same principle as for Sentinel-1, with different access routes depending on user typology

- Dedicated access for Copernicus Core services
- Sentinel Scientific Data Hub (rolling archive, self registration, limited quota)
- Collaborative Ground segment: national use
- International Agreements: bilateral data transfer as requested by EC

Open & Free 'Science and Other' Data Access – Initial Operations



- ❑ Open and Free access
- ❑ Terms and Conditions for Sentinel data use and distribution published
- ❑ Self Registration and Sample Products open since Sentinel-1A launch
- ❑ Routine Data flow opened on 3rd October
- ❑ Rolling Archive:
 - ❑ In routine phase, at least the last 2 months of all Sentinels core products will be always available
 - ❑ Today 7.5 months of data available, no data deleted
- ❑ Quota restriction of 2 concurrent downloads to ensure bandwidth availability for all users
- ❑ Automatic download through scripts

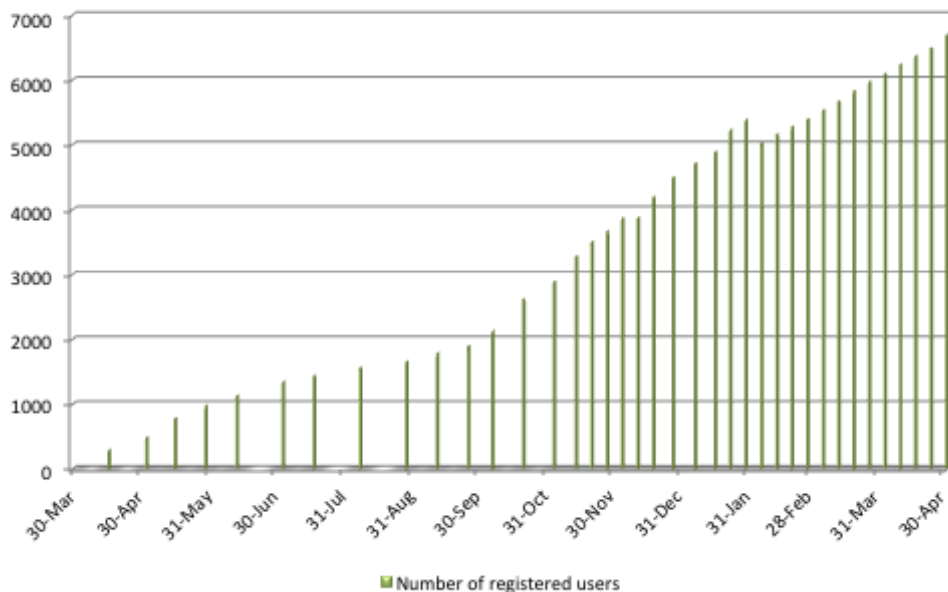
Sentinel-1 User and Data Statistics ("Scientific / Other Use" data hub)



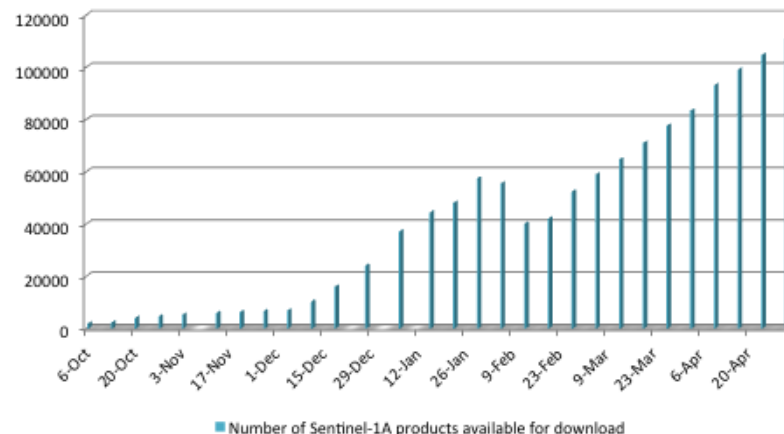
By 30 April 2015:

- ✓ **6700** registered users
- ✓ **110886** products available for download
- ✓ **805315** products downloaded by users, representing **993 TB** of data

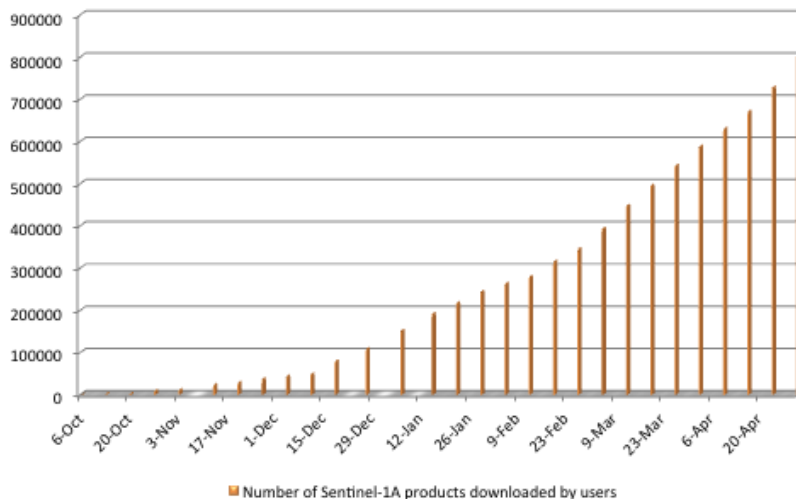
Number of registered users since registration opening on 30 March 2014



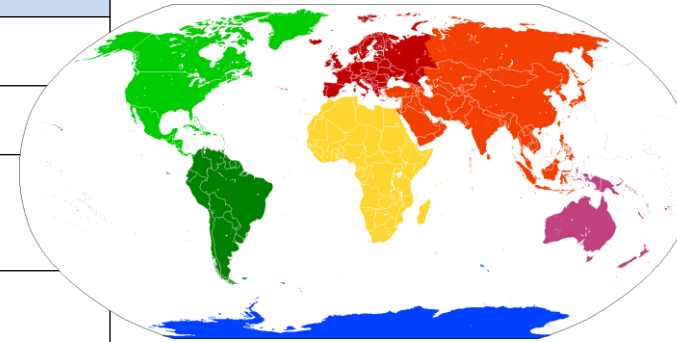
Number of Sentinel-1A products available for download



Number of Sentinel-1A products downloaded by users



Continent	Registrations	Number of Downloads: Reference period: First Quarter 2015
Africa	180	274
Asia	1255	29172
Europe	3568	207029
North America	737	193205
South America	187	12941
Australia	98	10898
Antarctica	3	40



- The total mission production has been downloaded **more than 6 times**
- Statistics are based **on users self registration** provided information
- Europe and North America are hosting the most active user communities

- ❑ Readiness of Sentinel-3A platform and instrument integration and testing on track for a launch around the end of Oct. 2015
- ❑ Sentinel-3B readiness advanced, on track for a launch approx. 18 months after the A model
- ❑ EU-ESA and EU-EUMETSAT agreements signed and in place now, providing full coverage for S-3 mission operational costs and programmatic frame for joint operations between ESA and EUMETSAT
- ❑ All ground segment facilities supporting the Sentinel-3 operations are in place
- ❑ EC issued some change requests to mission baseline (SRAL 100% SAR operations; additional products: AOD, FRP; SYN within 24 h), which are presently under investigation and implementation
- ❑ Data access will follow same route as for Sentinel-1 for ESA and through EUMETCast for EUMETSAT