

Copernicus Space Component & Sentinel-2 status



Bianca Hoersch
Sentinel-2 Mission Manager/ESA
on behalf of the Sentinel-2 team

...securing long term continuity of systematic observations from Space



2011

2015

2020

2030



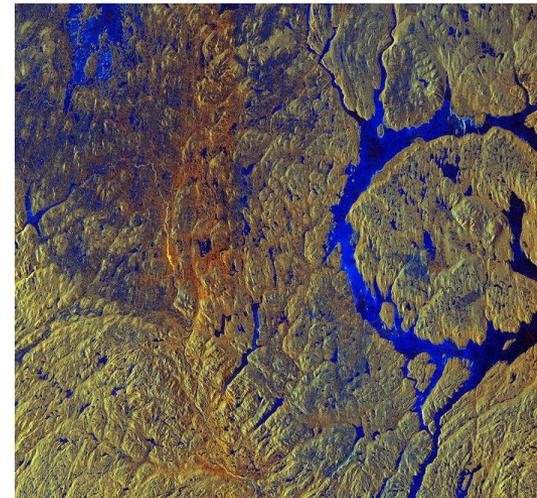
➤ Sentinel-1A **nominal routine operations continue**

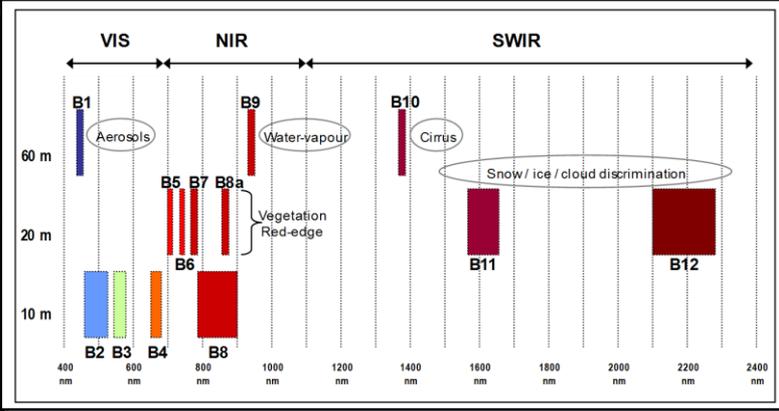
➤ **Latest Achievements** and *Issues*:

- 100% systematic processing of Single Look Complex L1 products over land (formal target was 25%)
- An average of **3 TB of products** is generated daily (formal target was 1.6 TB/day)
- Support provided to several emergency activations

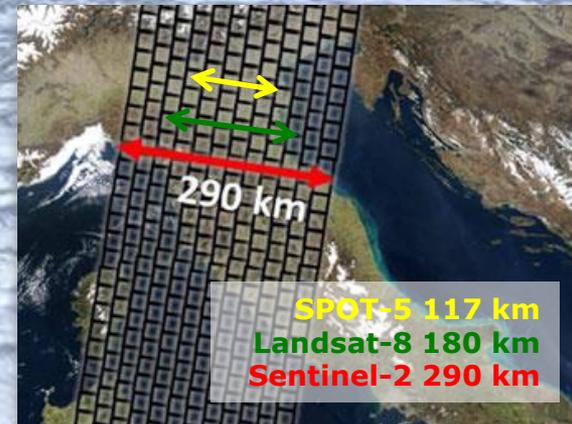
➤ **Upcoming Milestones**

- Continue increase in mission capacity
- Completion of GS upgrades for upcoming B-model launch
- Sentinel-1B launch: scheduled in April 2016





- 13 spectral bands in the Visible (VIS), Near Infrared (NIR), Short Wave Infrared (SWIR)
- Ground pixel resolution of 10m, 20m, 60m (for atmospheric correction) across a 290 km swath



1. Sentinel-2A launched 23 June 2015
2. Expert session 29-30 Sep 2015: **first data assessment by selected experts – thanks to NASA/USGS and related teams contributions!!**
3. 15 October 2015: In-orbit Commissioning Review: 2 issues to be corrected before opening data access
4. Opening of data access to all users (via SciHub) should have happened soon after, however delayed due to satellite recorder/MMFU anomaly investigation for 3 weeks: mission has been resumed 11 November, short outages on 18 Nov, 5 Dec and 10 Dec – quick restart procedure in place to minimise data loss
5. **Data access opening 3rd December (baseline 2.0)!** (baseline 2.01 since 10 December)
6. MMFU Software update uploaded on 15 December, since then ½ day outage on 19-20 Dec



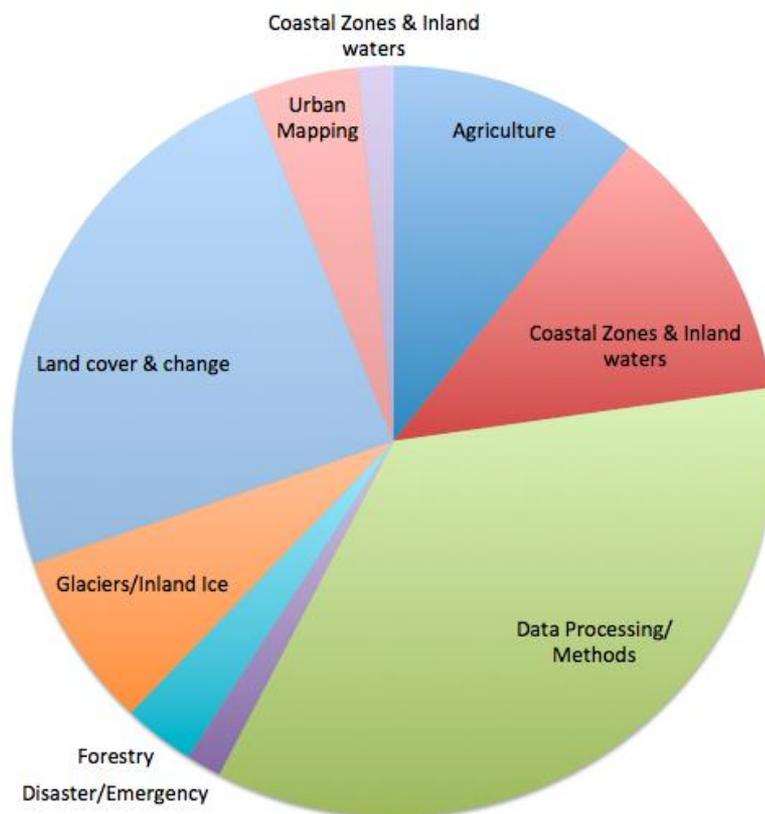
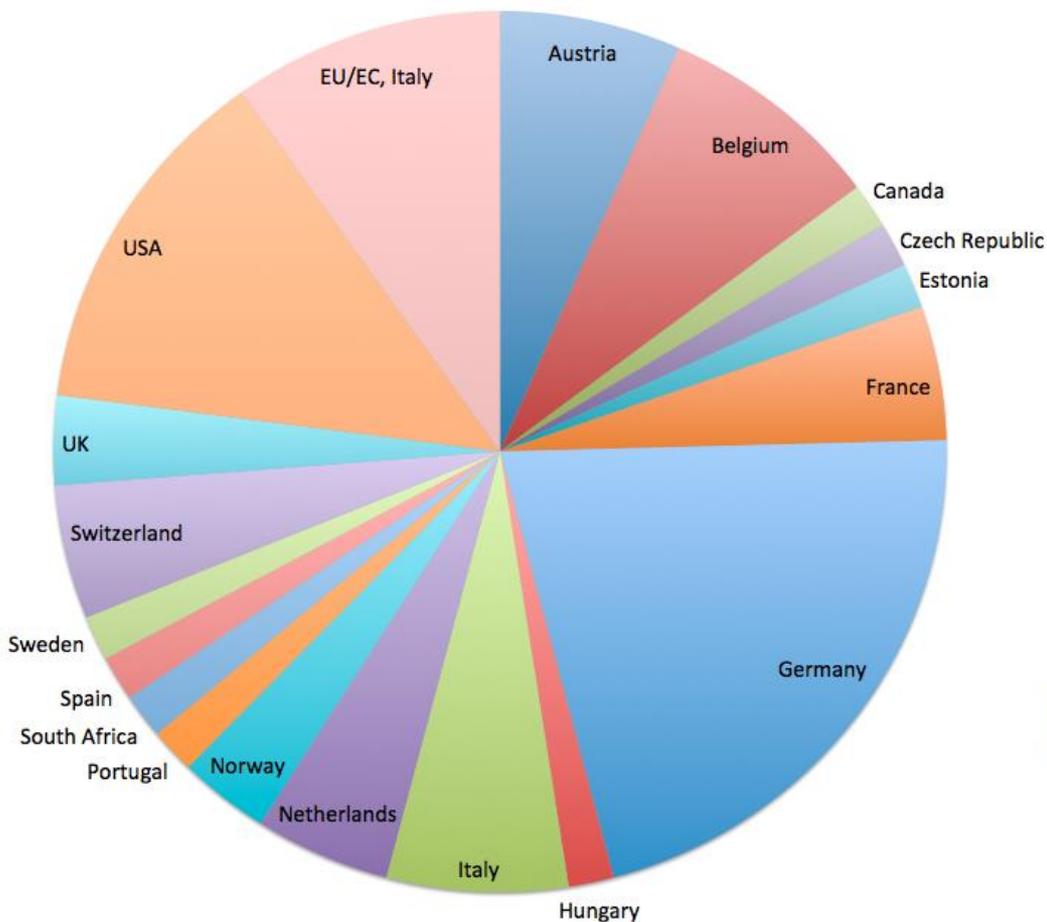
S2A Expert user feedback 29-30 Sep 2015

Meeting Objectives



1. Provide early access to S2A data for first assessment by Expert users
2. Receive feedback on pre-qualified products uptake in support to applications
3. Address in particular feedback on
 - a. Products
 - b. Formats
 - c. Data Quality (radiometric, geometric)
 - d. Compatibility with precursor/partner missions
 - e. Data access
 - f. Etc.
4. Provide independent product assessment as input to the Sentinel-2A In-Orbit Commission Review
5. Foster links with the S2 user communities, in preparation for Phase E2 exploitation

S2 Experts Meeting Participation



PROs

1. Overall an Excellent mission!

2. Data interface:

- Well structured user interface
- Users of S1 are already well aware, multi-Sentinel access great!
- Many data easily retrievable
- Fast search & high download speed

3. Quality: Very good radiometry!

- Spectral signatures matching those of Landsat well in shape, more signal than in Spot5
- Red-edge makes all the difference

4. Very good geometry, matching ground truth (apart steep terrain)...

5. Features of <10m size clearly distinguishable

6. S2 toolbox: good features in open-source

Room for improvement

1. Data Interface

- Filter by clouds, higher res. QLS
- **Product names/ length (windows!),** more info into XML files
- Subselection/subsetting (area, bands, individual tiles)

2. Data quality

- **Increase data quantization**: spread to 10.000 (1000 values today)
- **Crosstalk (to be applied to all SWIR bands), esp. for B10**
- **S2 tile grid minor corrections**
- **DEM harmonisation with Landsat?**
- Improve SNR for coastal?

3. More functionality and intuitiveness in S2toolbox

4. **Comparability with Landsat, mostly in geometry**

General recommendations on S2 A/B

- *Extend S2 observation baseline*
 - *seek to extend coastal regions, at least to cover as much as possible shallow waters & coral reefs*
 - *Seek night-time acquisitions on coastal regions*
 - *Antarctica is a MUST for climate change*
- **Align with Landsat-8 geometry! (make L8 convert...?)**
- *Compatibility with S3 for coastal required: cross validation & campaigns*
- **Think multi-mission: S2, S3, Landsat-8!**
- *Archive access beyond rolling Dhub (note: this is already envisaged)*
- **Access to DEM used in S2 PDGS under free and open basis required**
- **Global burnt area product required jointly with L8**
- *HOSTED PROCESSING! = e.g. L3 Mosaic should be offered on demand*
- *Coordinate with main GIS/software suppliers to enable S2 read-in*
- *Publish videos/tutorials e.g. scripts/APIs*
- **Importance to generate systematic L2A!**

S2B:

- Importance of the 2nd ...

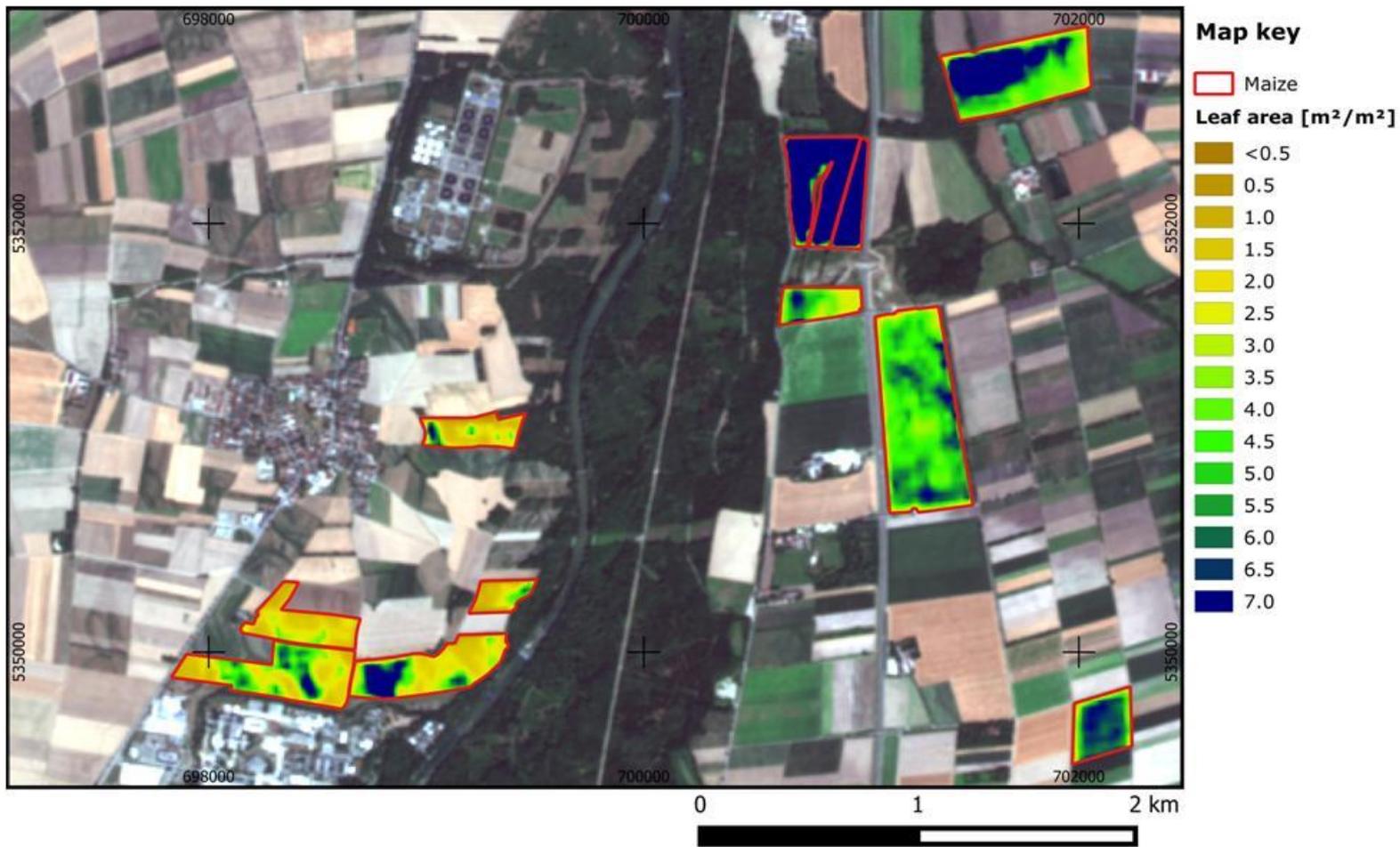
S2 next ...

- T...

1. All recommendations are analysed for implementation in the short-/medium- and long-term.
2. ESA will keep track of all recommendations and actions taken, in close coordination with the European Commission
3. Feedback to users to allow to report back on implemented enhancements

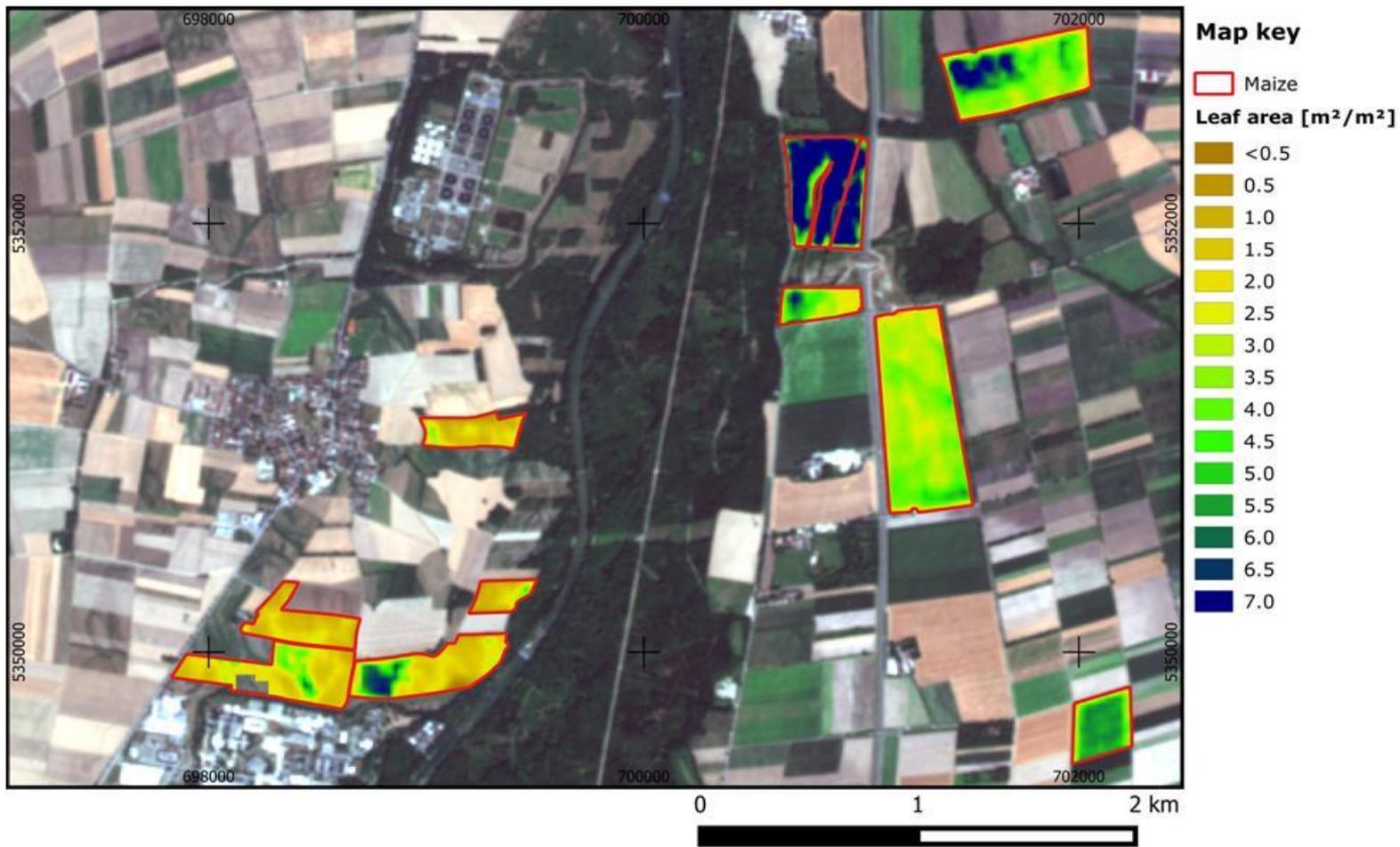
Crop Parameter Retrieval over time

Landsat 8
Jul 24, 2015
Leaf Area



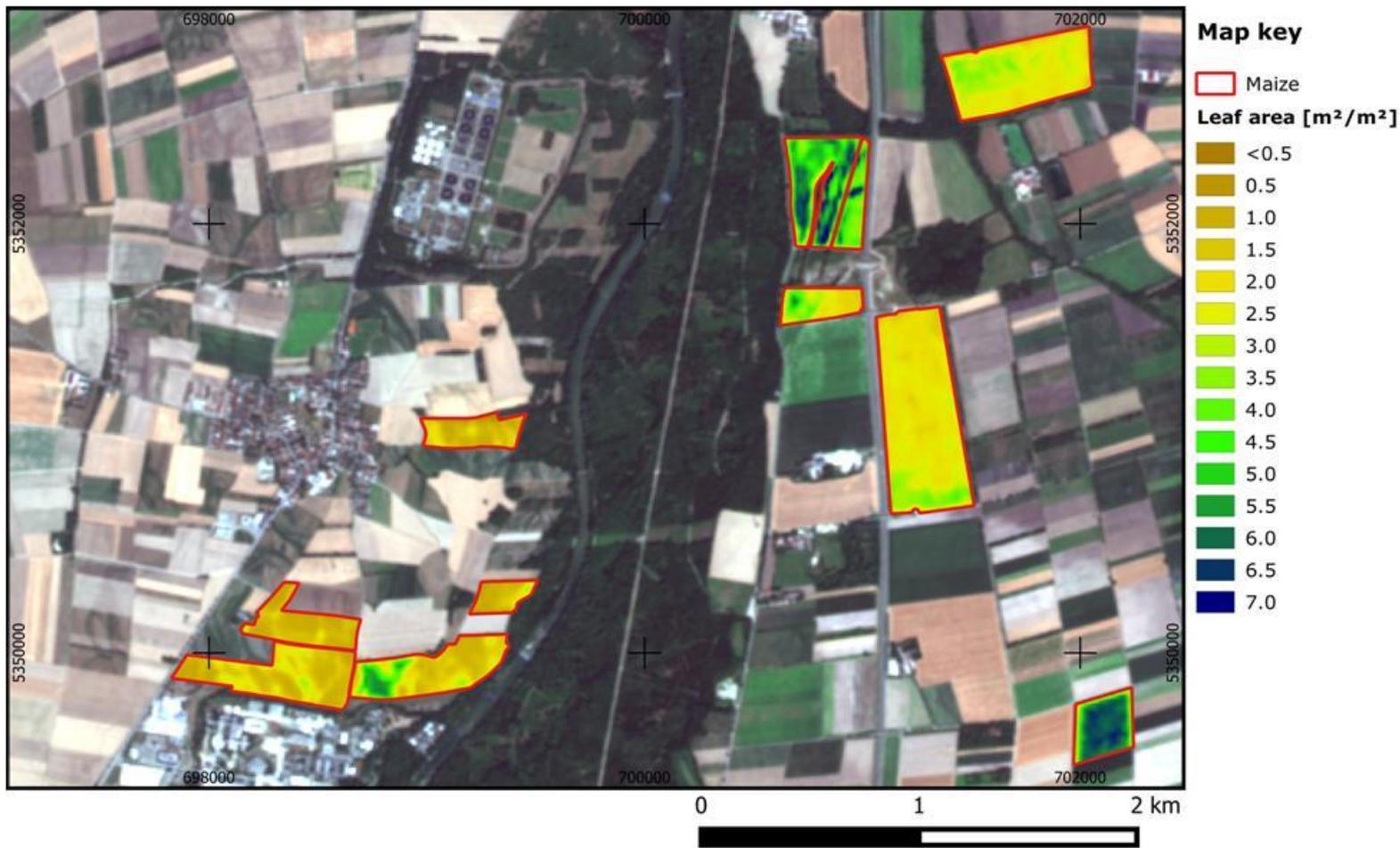
Crop Parameter Retrieval over time

Landsat 8
Jul 31, 2015
Leaf Area



Crop Parameter Retrieval over time

Sentinel-2A
Aug 06, 2015
Leaf Area



Crop Parameter Retrieval over time

Sentinel-2A
Aug 13, 2015
Leaf Area



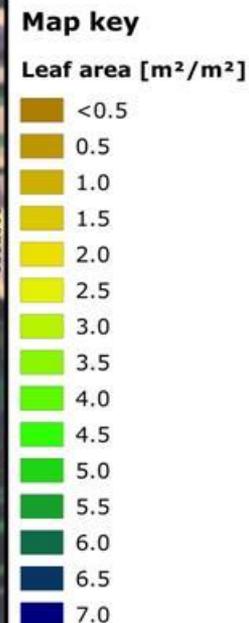
Crop Parameter Retrieval over time

Landsat 8
Sep 01, 2015
Leaf Area

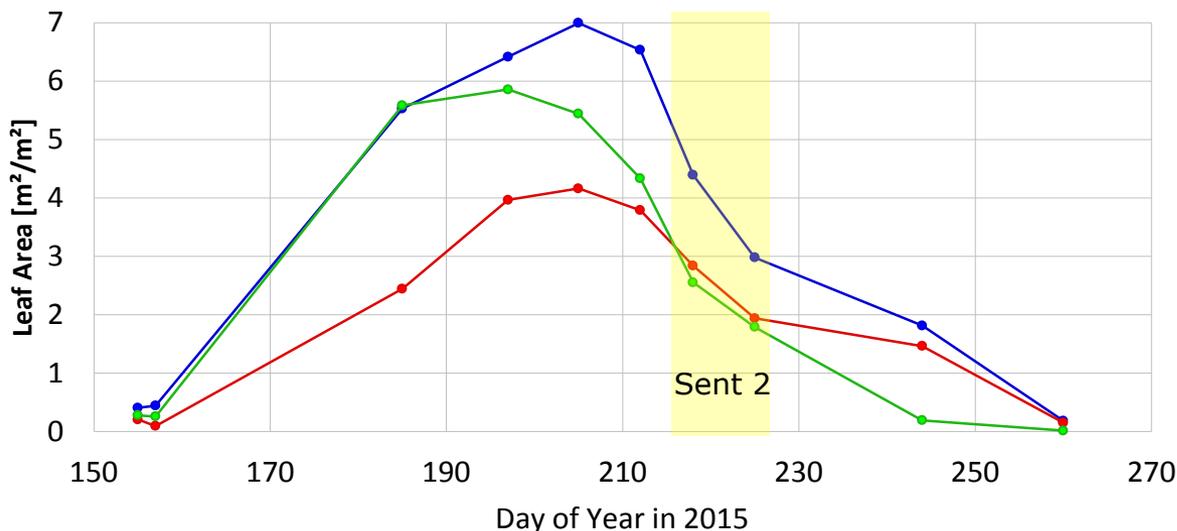


Crop Parameter Retrieval over time

Landsat 8
Sep 17, 2015
Leaf Area



Leaf Area development for selected maize fields



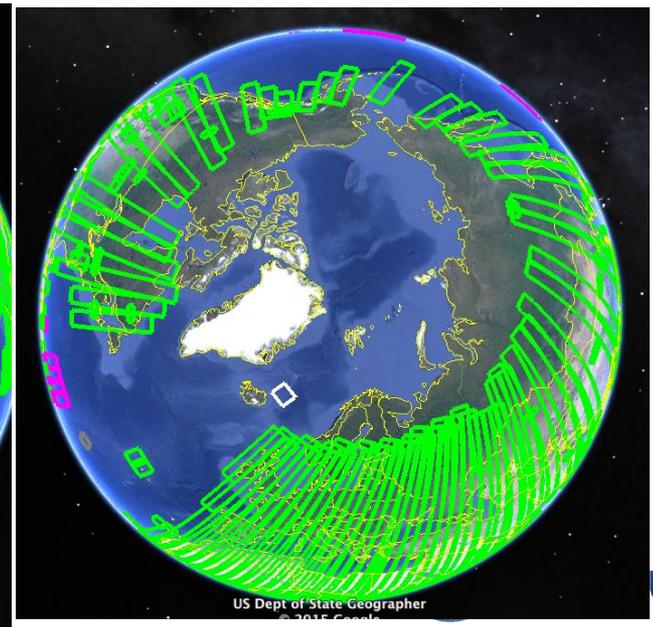
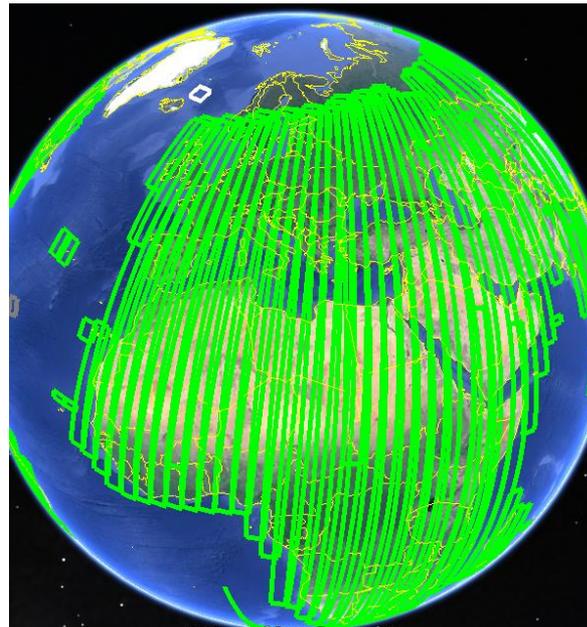
- The Sentinel-2 **baseline observation scenario in routine phase will systematically cover all land surfaces** between 56° South latitude (Cape Horn in South America) and 84° North latitude (north of Greenland), including also
 - **Major islands** (greater than 100 km² size), EU islands and all the other small islands located at less than **20 km from the coastline**
 - The **whole Mediterranean Sea** as well as all inland water bodies and closed seas



Observation scenario



1. Currently observation of average 10 min/orbit (i.e. >50% of average observation time in full operations)
 - Systematically Europe & Africa on every orbit
 - The rest of the world within a certain time interval: currently this is 30 days, and will be progressively reduced over the coming months to reach 10 days
2. observation plan is published ahead of every repeat cycle at <https://sentinels.copernicus.eu/web/sentinel/missions/sentinel-2/acquisition-plans>

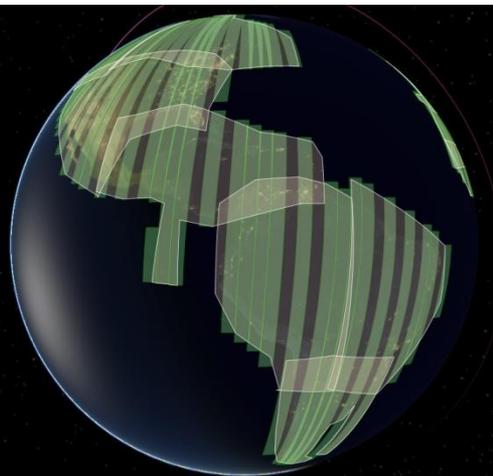


- Europe and Africa systematically covered every cycle (10 days/143 orbits)
- Iceland included
- Decreasing in overall minutes (Europe) coverage due to the (Sun Zenith Angle (SZA) constraint (82 deg.) during Northern winter
- North and South America acquisitions

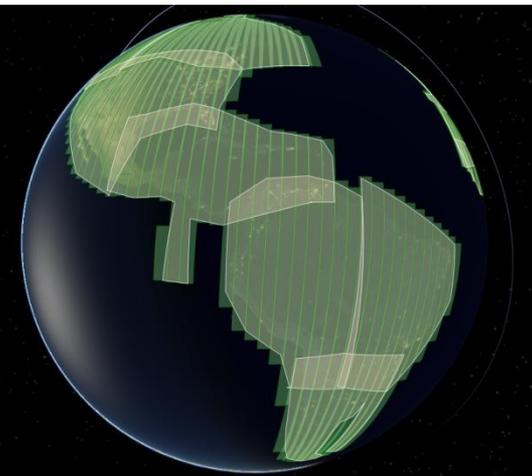
CYCLE 1



CYCLE 2

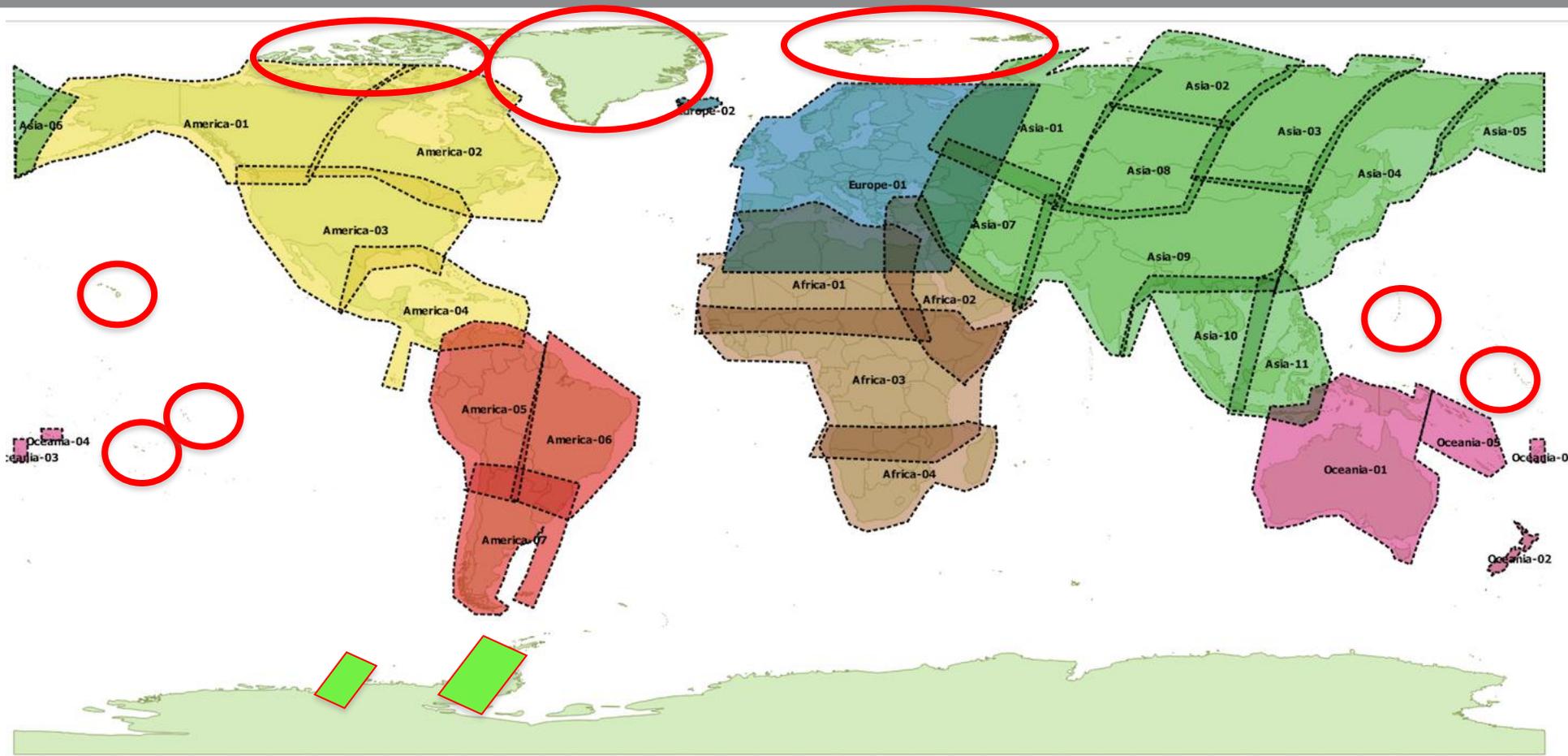


CYCLE 3

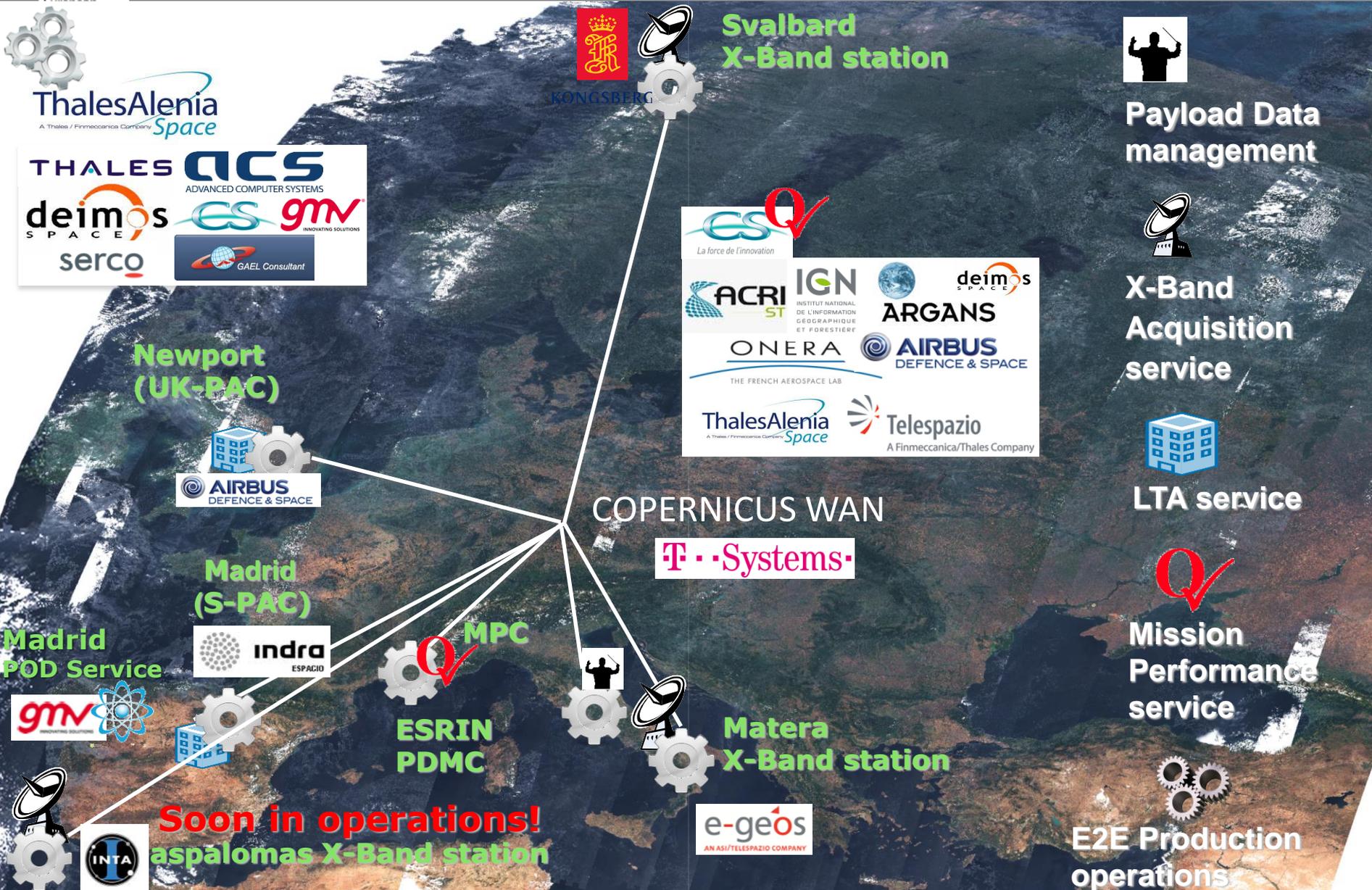


Sentinel-2 Global Reference image blocks

- ...**work in progress**



Payload Data GS organisation



Svalbard
X-Band station



Payload Data management



X-Band Acquisition service



LTA service



Mission Performance service



E2E Production operations



ES La force de l'innovation

ACRI ST IGN INSTITUT NATIONAL DE L'INFORMATION GÉOGRAPHIQUE ET FORESTIÈRE

ARGANS deimos SPACE

ONERA THE FRENCH AEROSPACE LAB AIRBUS DEFENCE & SPACE

ThalesAlenia Space Telespazio A Finmeccanica/Thales Company

Newport
(UK-PAC)

Madrid
(S-PAC)

MPC

ESRIN
PDMC

Matera
X-Band station

Madrid
POD Service



Soon in operations!
aspáomas X-Band station





Level 1C :
Top of Atmosphere
reflectances calibrated
& orthorectified



Level 2A :
Single date surface
reflectances after
cloud masking and
atmospheric
correction, produced
systematically



Level 3A :
*15 days time
composite of surface
reflectances, produced
every week*

- Level-1B available upon request for Expert users

Online data access at: sentinels.copernicus.eu

1. ESA Data Hub Software (DHuS) provides an **open source** Web Interface
2. Users can set scripts to **automatically download data**

Search

Italy

Request done: Italy

Display 1 to 100 of 208 products

Date	Instrument	Mode	IW	Satellite	Size
2014-10-06T17:11:35.337Z	SAR-C	Mode	IW	Satellite	1 GB
2014-10-06T17:12:00.337Z	SAR-C	Mode	IW	Satellite	1 GB
2014-10-06T17:12:25.337Z	SAR-C	Mode	IW	Satellite	1 GB
2014-10-06T17:13:15.338Z	SAR-C	Mode	IW	Satellite	1 GB
2014-10-06T17:12:50.337Z	SAR-C	Mode	IW	Satellite	1 GB
2014-10-06T17:13:40.336Z	SAR-C	Mode	IW	Satellite	1 GB
2014-10-06T17:14:05.337Z	SAR-C	Mode	IW	Satellite	1 GB

OPEN AND FREE

sentinel data hub

Scientific and Other Access

Access for Copernicus Services

COMING SOON

Access for International Agreements

COMING SOON

Access for Collaborative Ground Segment

click to access data

-  Scientific Hub
-  API Hub
-  **S-2 PreOpsHub**
-  User Guide
-  Roadmap

Access Points

Scientific Hub : access point for all sentinel mission with access to the interactive graphical user interface.

API Hub : access point for API users with no graphical interface. All API users regularly downloading the latest S-1 data are encouraged to use this access point for a better performance.

Sentinel-2 Pre-operational Hub : pre-operational access point for all users to Sentinel-2 data. **Login credentials are guest:guest** .

Due to the massive increase of requests on the Scientific Data Hub that have been creating performance issues in the recent days, a support site, named the API Hub, is now being operated in parallel to the Scientific Data Hub. This API Hub is dedicated to users of the scripting interface.

The API Hub Access is currently available only for users registered on SciHub before the 21st of December 16:46 UTC. The same user credentials are valid to access this site.

The API Hub may be accessed through the URL <https://scihub.copernicus.eu/apihub/>. This implies that the OpenSearch API is published at <https://scihub.copernicus.eu/apihub/search> and the OpenData API is published at <https://scihub.copernicus.eu/apihub/odata/v1>. The API Hub is managed with the same quota restrictions, ie. a limit of two parallel downloads per user. The site is publishing precisely the same data content as the Scientific Data Hub, with all new data as of the 16th November. A rolling policy for the Hub will be established following the first month of monitored operations.

Statistics

	2352 products published in the last 24h (SciHub + API Hub)		11549 products downloaded in the last 24h (SciHub + API Hub)		405499 queries responded in the last 24h (SciHub + API Hub)
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Data updated hourly

Latest News

[all the news](#)

Data Centre infrastructure is in operations since January 2015

- Nine accounts enabled, one per ESA Member States with CollGS agreements formalised
- No restrictions in simultaneous downloads

Sentinel-1 Collaborative Data Hub

Overview Search Profile Cart Management About

Welcome **esa_management** | Logout

Search

Request done : *

Display 1 to 25 of 9,196 products

<input type="checkbox"/>	Date : 2015-04-14T22:57:34.905Z, Instrument : SAR-C, Mode : IW, Satellite : Sentinel-1, Size : 814 MB				
<input type="checkbox"/>	S1A_IW_GRDH_1SDV_20150415T180951_20150415T181016_005498_007051_C0B4 https://colhub.esa.int/dhus/odata/v1/Products('1b568178-5394-4f4f-a051-dbeb522b311b')/\$value				
<input type="checkbox"/>	Date : 2015-04-15T18:09:51.119Z, Instrument : SAR-C, Mode : IW, Satellite : Sentinel-1, Size : 1 GB				
<input type="checkbox"/>	S1A_IW_RAW__05SV_20150415T014510_20150415T014543_005488_00701B_2D12 https://colhub.esa.int/dhus/odata/v1/Products('833bc743-ad5b-4194-94b3-d9583bc2bde')/\$value				
<input type="checkbox"/>	Date : 2015-04-15T01:45:10.642Z, Instrument : SAR-C, Mode : IW, Satellite : Sentinel-1, Size : 768 MB				

Welcome to the Sentinel-1 International Access Hub

The Sentinel-1 International Access Hub provides a dedicated access to a Rolling Archive of Sentinel-1 [Level-0](#) and [Level-1](#) user products for the international partners.

Products are available for the following Sentinel-1 acquisition modes:

- Strip Map (SM)
- Interferometric Wide Swath (IW)
- Extra Wide Swath (EW)

Level-0 products and Level-1 Ground Range Detected (GRD) products are available for all performed acquisitions. Level-1 Single Look Complex (SLC) products are available for acquisitions performed over specific regions of interest.

The access to the Sentinel-1 International Access Hub is restricted towards international partners.

No self-registration is possible.

The service is currently pointing towards the Scientific Data Hub to allow international partners to verify access characteristics.

The Sentinel-1 Level-1 products are preliminary qualified, in particular products are not radiometric calibrated. Operational product qualification, including absolute radiometric calibration, will continue during the next period.



Latest News

Sentinel-2 Pre-Operations Hub

Insert search criteria...

Display 1 to 25 of 745 products.

Request Done: (footprint:"Intersects(POLYGON((-129.818343625 15.1432568773876,-49.3105311250002 15.1432568773876,-49.3105311250002 59.638358113745255,-129.818343625 59.638358113745255,-129.818343625 15.1432568773876)))") AN

S2A_OPER_PRD_MSIL1C_PDMC_20160111T005457_R126_V20151218T165535_20151218T165535

[https://scihub.copernicus.eu/s2/odata/v1/Products\('44433011-2a10-4bc0-9594-cf217ac86c16'\)/\\$value](https://scihub.copernicus.eu/s2/odata/v1/Products('44433011-2a10-4bc0-9594-cf217ac86c16')/$value)

S2A S2A_OPER_PRD_MSIL1C_PDMC_20160111T005457_R126_V20151218T165535_20151218T165535

Download URL: [https://scihub.copernicus.eu/s2/odata/v1/Products\('44433011-2a10-4bc0-9594-cf217ac86c16'\)/\\$value](https://scihub.copernicus.eu/s2/odata/v1/Products('44433011-2a10-4bc0-9594-cf217ac86c16')/$value)
Mission: Sentinel-2; Instrument: MSI

S2A S2A_OPER_PRD_MSIL1C_PDMC_20160111T005457_R126_V20151218T165535_20151218T165535

Download URL: [https://scihub.copernicus.eu/s2/odata/v1/Products\('44433011-2a10-4bc0-9594-cf217ac86c16'\)/\\$value](https://scihub.copernicus.eu/s2/odata/v1/Products('44433011-2a10-4bc0-9594-cf217ac86c16')/$value)
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S2A S2A_OPER_PRD_MSIL1C_PDMC_20160111T005457_R126_V20151218T165535_20151218T165535

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Download URL: [https://scihub.copernicus.eu/s2/odata/v1/Products\('44433011-2a10-4bc0-9594-cf217ac86c16'\)/\\$value](https://scihub.copernicus.eu/s2/odata/v1/Products('44433011-2a10-4bc0-9594-cf217ac86c16')/$value)
Mission: Sentinel-2; Instrument: MSI

S2A S2A_OPER_PRD_MSIL1C_PDMC_20160111T005457_R126_V20151218T165535_20151218T165535

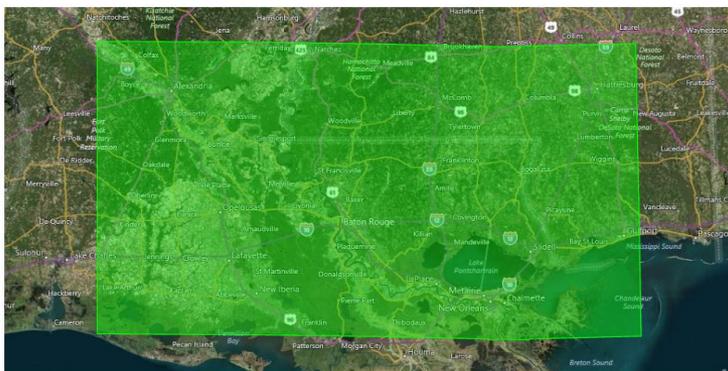
Download URL: [https://scihub.copernicus.eu/s2/odata/v1/Products\('44433011-2a10-4bc0-9594-cf217ac86c16'\)/\\$value](https://scihub.copernicus.eu/s2/odata/v1/Products('44433011-2a10-4bc0-9594-cf217ac86c16')/$value)
Mission: Sentinel-2; Instrument: MSI

S2A S2A_OPER_PRD_MSIL1C_PDMC_20160111T005457_R126_V20151218T165535_20151218T165535

Download URL: [https://scihub.copernicus.eu/s2/odata/v1/Products\('44433011-2a10-4bc0-9594-cf217ac86c16'\)/\\$value](https://scihub.copernicus.eu/s2/odata/v1/Products('44433011-2a10-4bc0-9594-cf217ac86c16')/$value)
Mission: Sentinel-2; Instrument: MSI

Products per page: 25 << >> page

Footprint



Attributes

Summary

Date: 2015-12-18T16:55:35.000Z
Instrument: MSI
Satellite: Sentinel-2
Size: 3.49 GB

Quicklook



Inspector

S2A_OPER_PRD_MSIL1C_PDMC_20160111T005457_R126_V20151218T165535.SAFE

- AUX_DATA
- DATASTRIP
- GRANULE

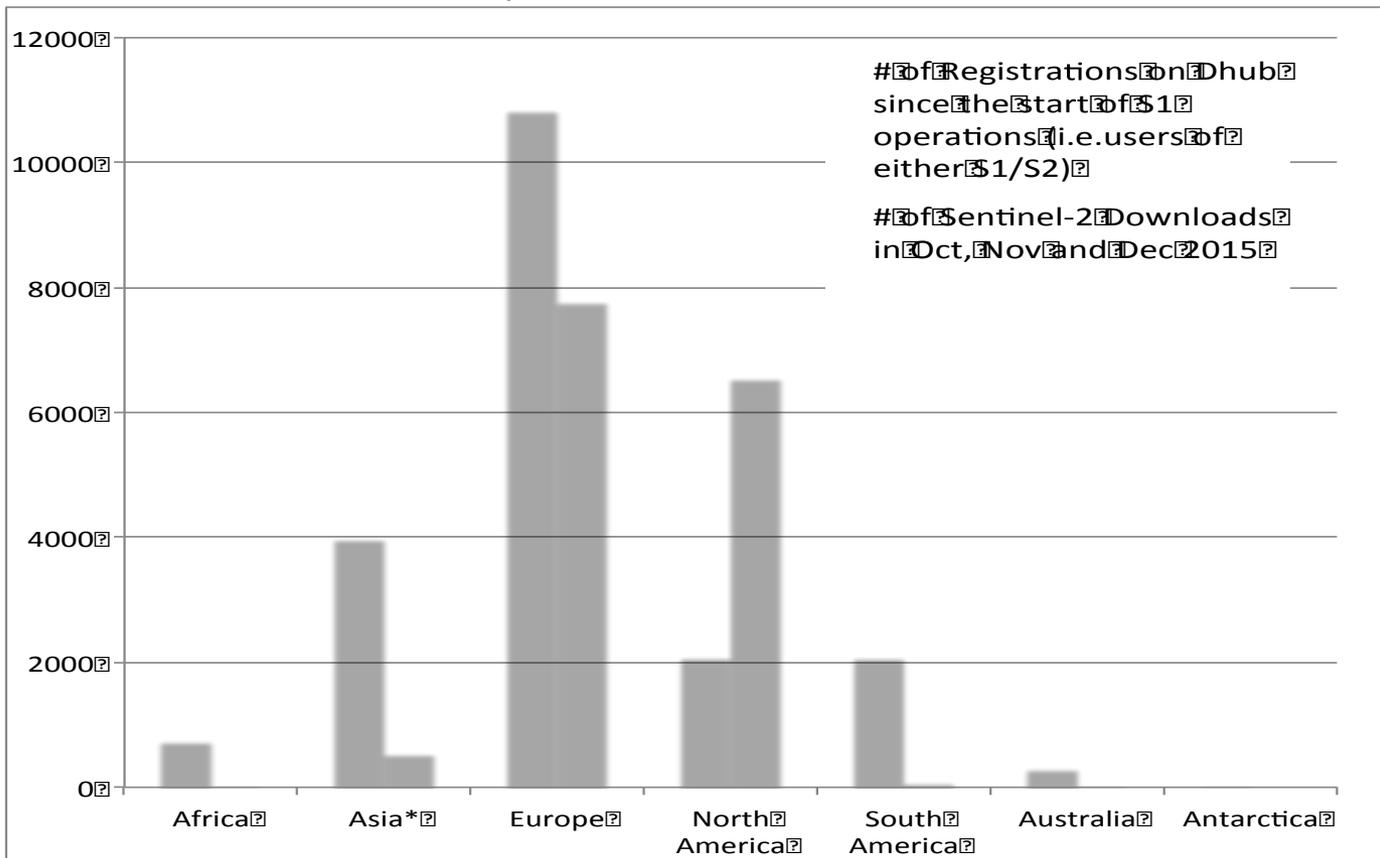




First data access statistics



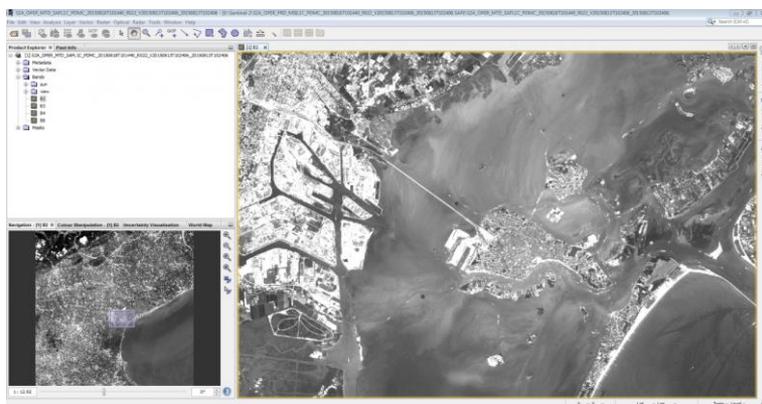
1. 34.5 Terrabytes downloaded in a week, nearly 5 Terrabytes per day !!!
2. 70 TB downloaded since opening, the equivalent of ~2 times the production available for download = 30 TB
3. Data availability in archive (with 2 stations): end-to-end an average of 5.5 hours from sensing, worst case ± 12 hours, best case ± 2 hours.



~3 % of Landsat download statistics

S1 downloads are about 50% of Landsat stats in Q4-2015

- ✓ The Sentinel-2 toolbox (SNAP) includes a rich set of visualisation, analysis and processing tools



- ✓ It also integrates the ESA Level-2A atmospheric processor Sen2Cor (TOA → BOA + classification options)



TOA Level-1C image data (left)
associated BOA image data (right)

<https://sentinels.copernicus.eu/web/sentinel/toolboxes/sentinel-2>

1. 3rd station Maspalomas entering in operations this week, gradual increase of data acquisition up to 15 min/orbit by end Feb
2. Continued ramp-up phase, with gradual increase of acquisition and processing capacity and further improvement of products quality, including start of S2 QWG and **S2VT meetings + harmonise L8-S2 (and heritage missions)**
3. Reprocessing campaign starting for all non-baseline 2.01 useful data since Jul/Aug 2015: readiness assumed in Q2/2016
3. Operational readiness of S2A is planned for IOCR+9 months, ~ Jul 2016
4. Start of **systematic surface reflectance (L2A) processing** for S2
5. Sentinel-2B expected for launch in Q4 2016
6. EDRS-A launch end Jan 2016: phase-in of an additional data downlink capacity!

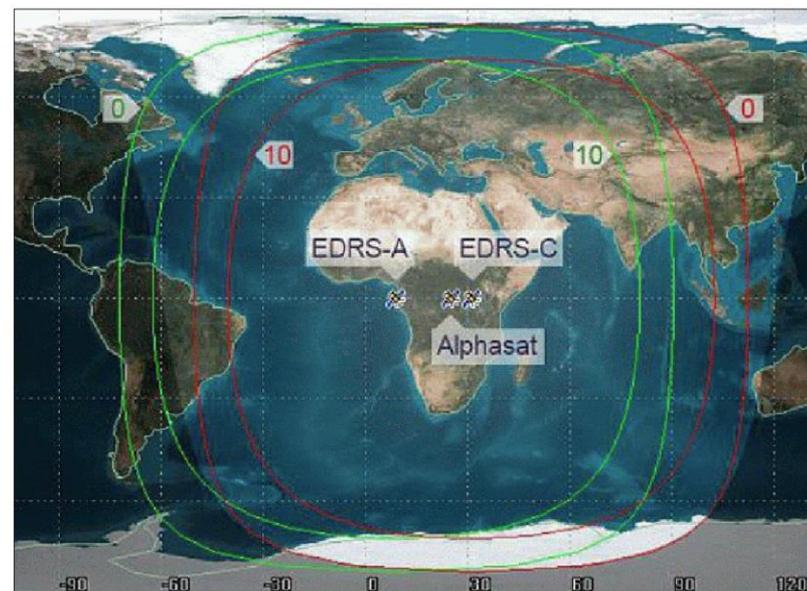
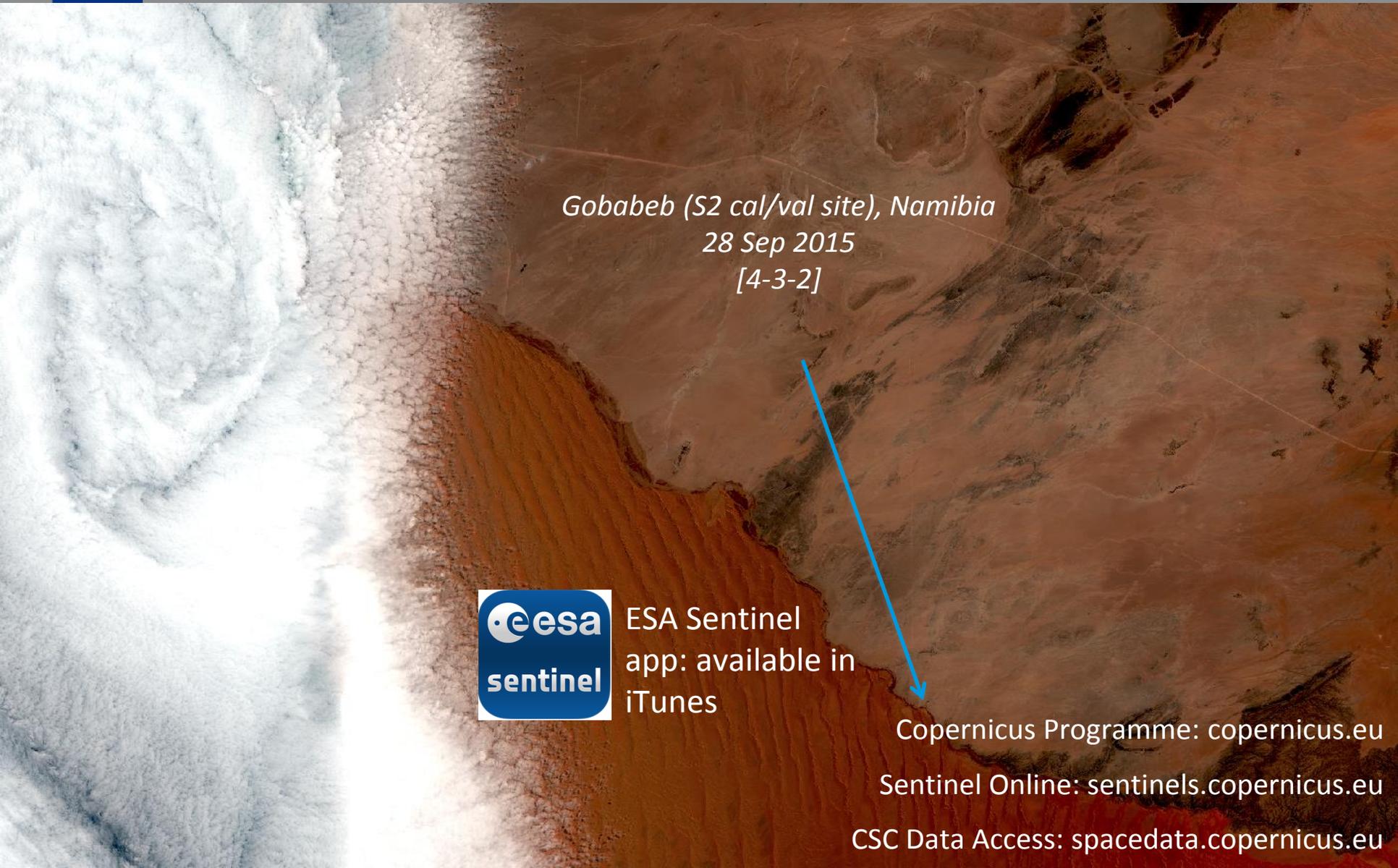


Figure 14: Orbital positions as well as visibility contours for 0° and 10° elevation of the EDRS spacecraft (green – EDRS-A, red – EDRS-C), image credit: EDRS consortium [23](#)



Gobabeb (S2 cal/val site), Namibia
28 Sep 2015
[4-3-2]



ESA Sentinel
app: available in
iTunes



Copernicus Programme: copernicus.eu

Sentinel Online: sentinels.copernicus.eu

CSC Data Access: spacedata.copernicus.eu