Sentinel-2 Mission Status

Bianca Hoersch, Sentinel-2 Mission Manager

"Preparations for the Sentinel-2 in Europe"

Oslo, 11-12 October 2016

Copernicus Space Component: the dedicated Sentinels …

S1A/B: Radar Mission — 3 Apr 2014/25 Apr 2016

S2A/B: High Resolution Optical Mission — 23 June 2015/2017

S3A/B: Medium Resolution Imaging and Altimetry Mission — 16 Feb 2016/2017

S4A/B: Geostationary Atmospheric Chemistry Mission — 2021/2027

S5P: Low Earth Orbit Atmospheric Chemistry Mission — Mar 2017

S5A/B/C: Low Earth Orbit Atmospheric Chemistry Mission — 2021/2027

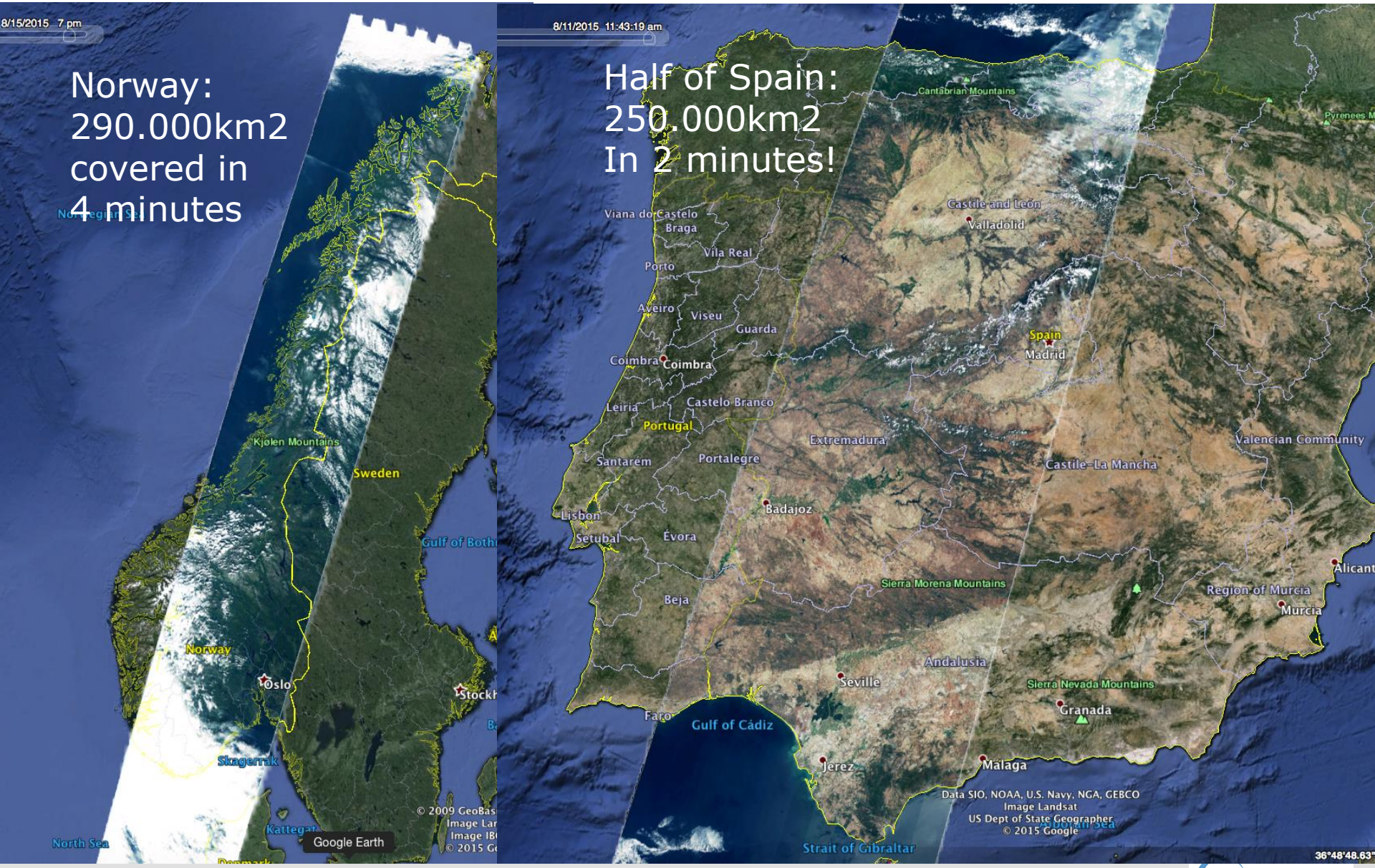
S6A/B: Altimetry Mission — 2020/2025

Sentinel-2
Superspectral imaging mission

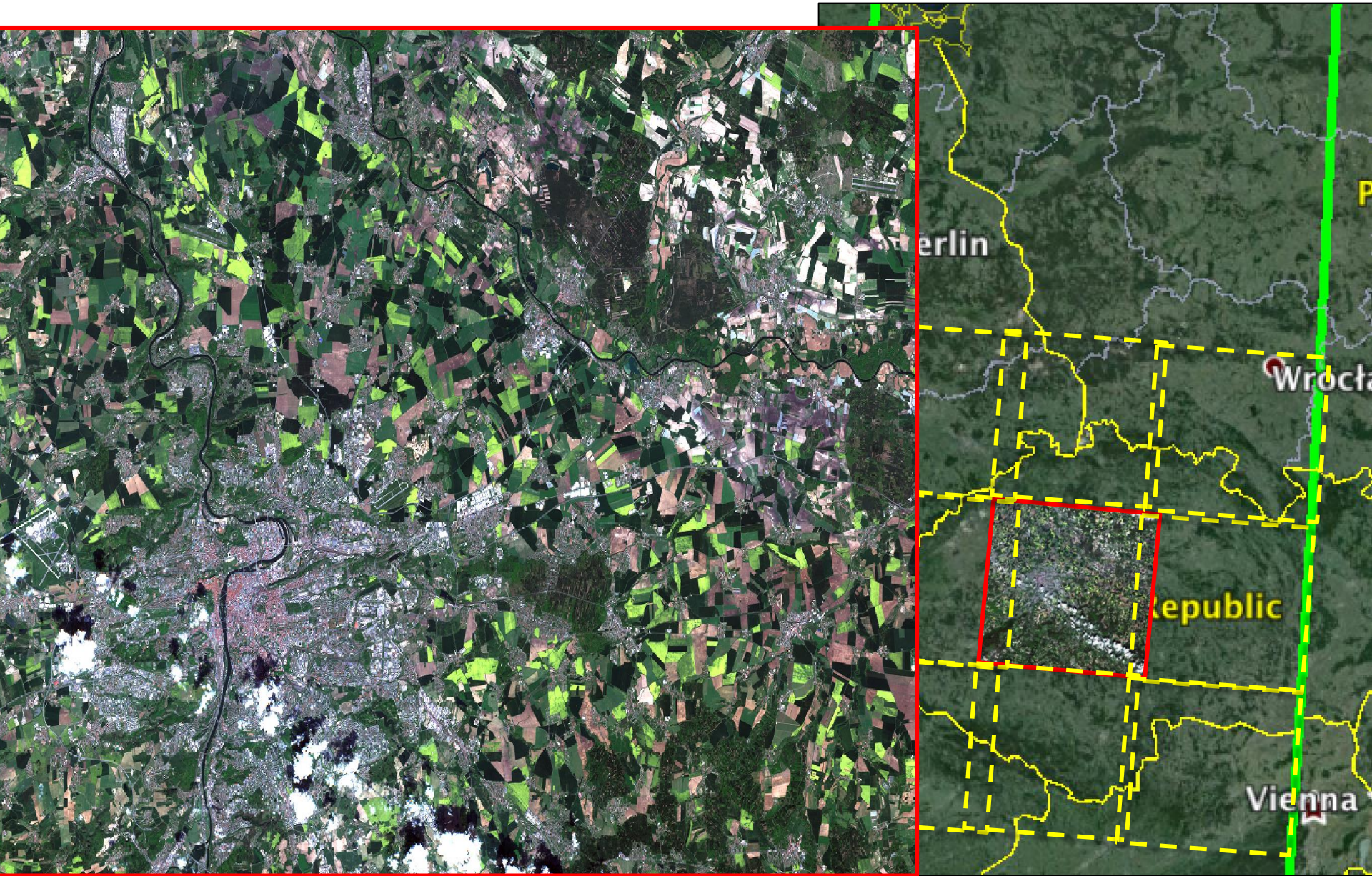
Mission profile

- **Two** Spacecraft operating in twin configuration
- Sun-synchronous orbit **786 km**, **LTDN** 10:30 AM
- Multispectral instrument with **13** spectral bands (**VIS, NIR & SWIR**), at **10**, **20** and **60 m** spatial resolution
- **290 km** swath width
- **5 days** revisit at Equator with 2 satellites
- **7 years** design life time, consumables for 12 years

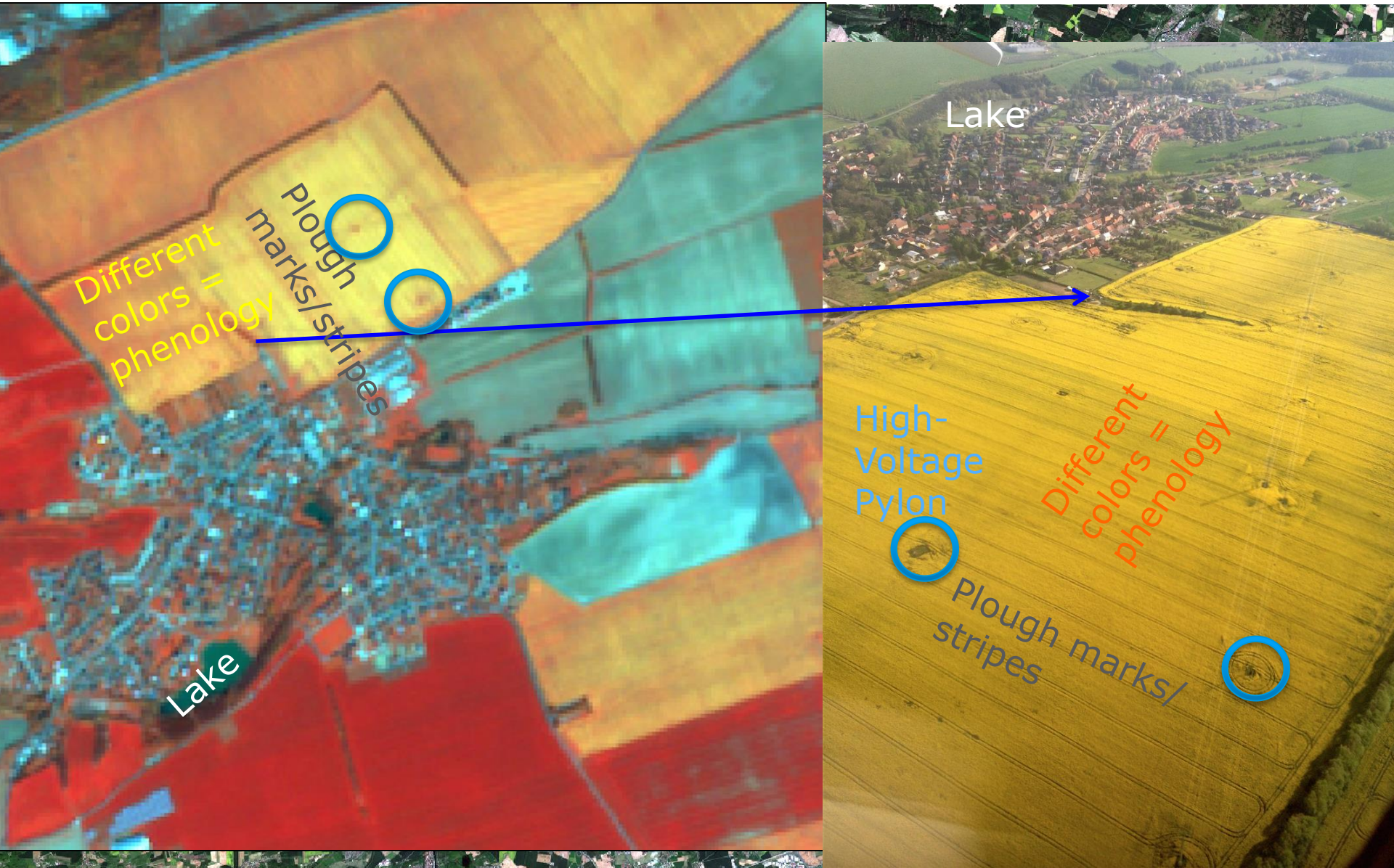
Capacity is key! Europe in few minutes



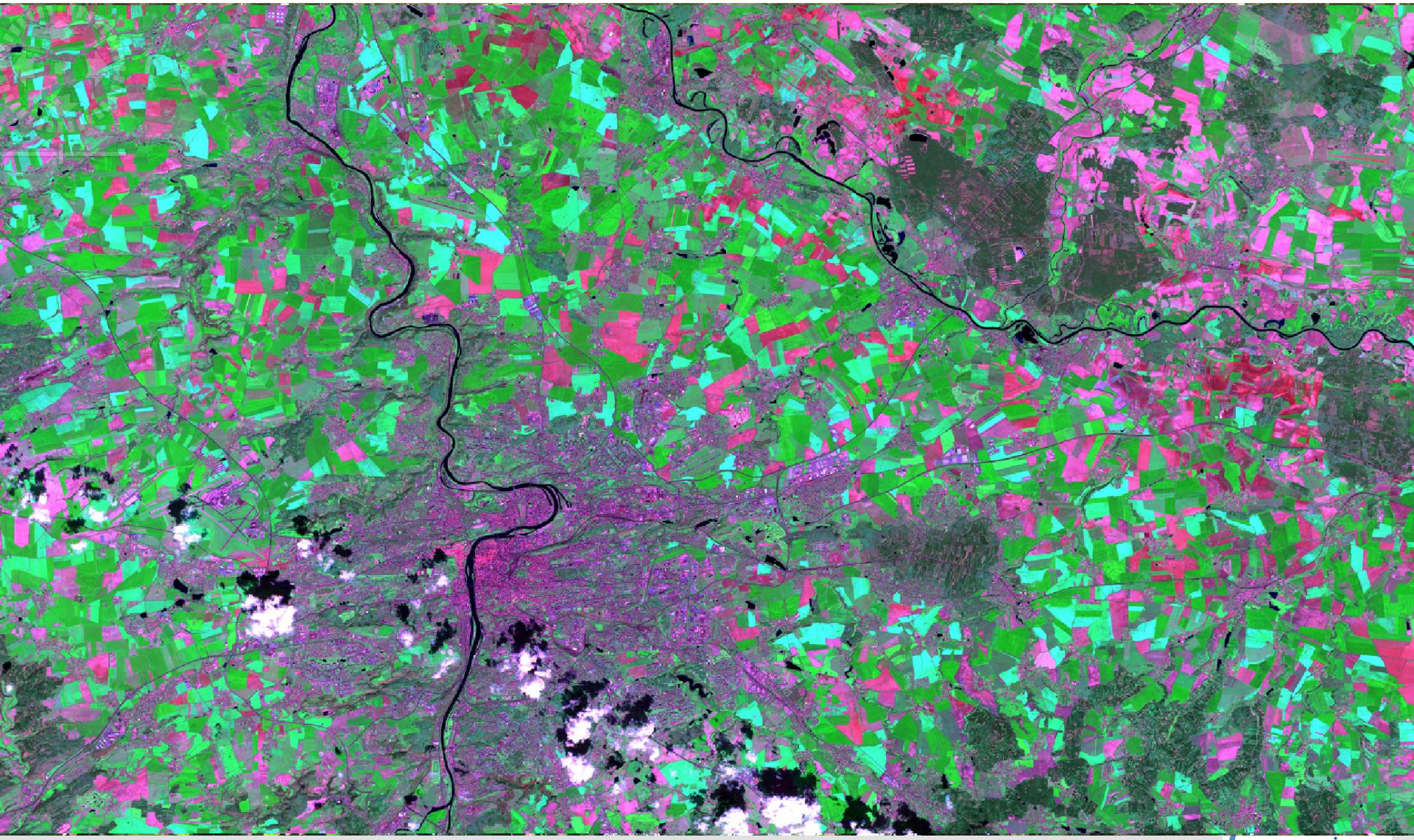
Prague, 6 May seen by Sentinel-2 Large Swath!

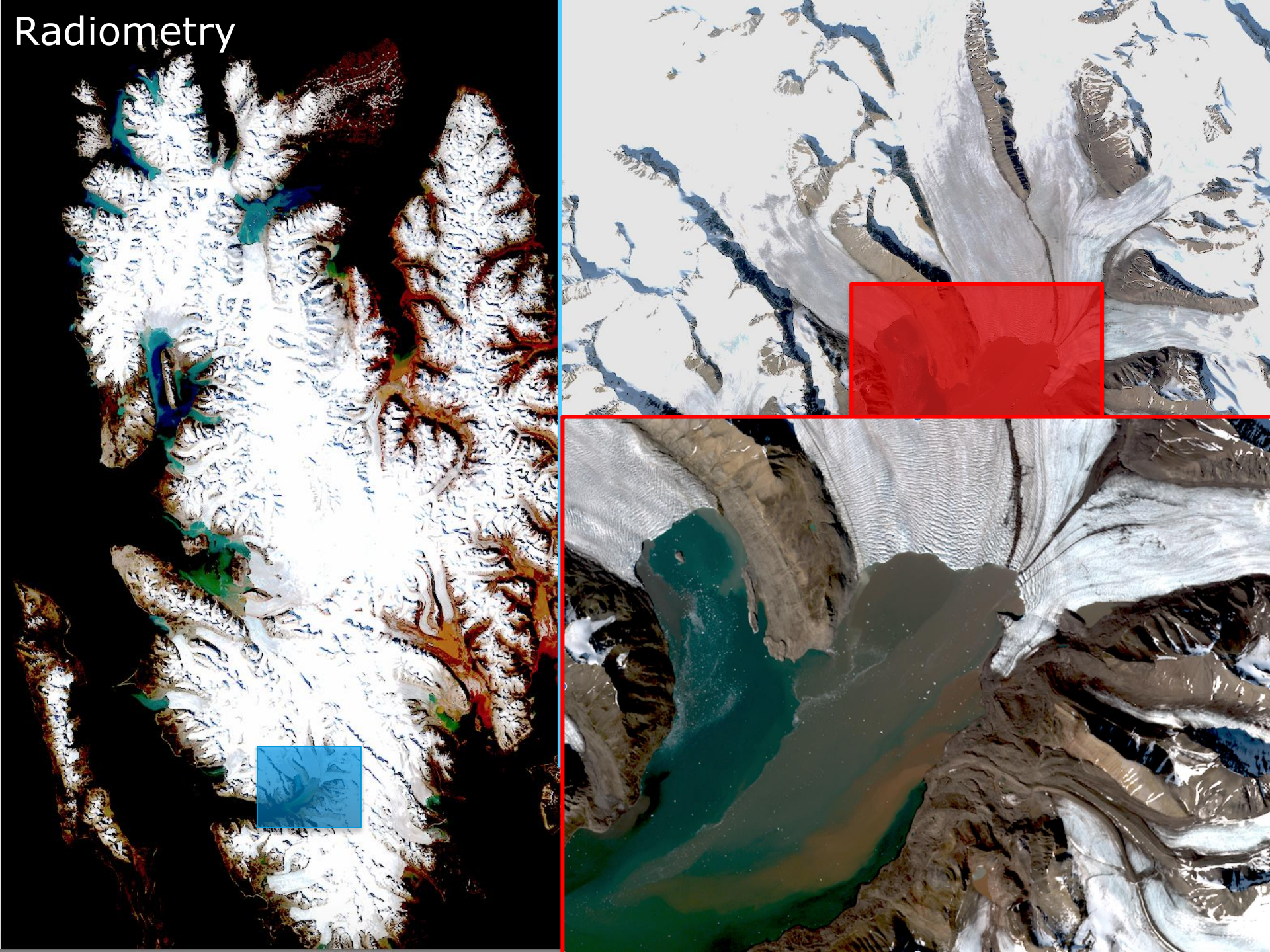


Agricultural fields Prague, 6 May by Sentinel-2: Sharp details on sub-field level!

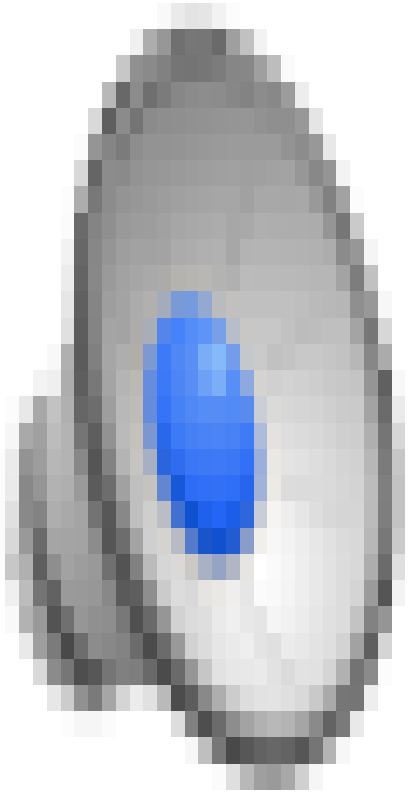


Prague, 6 May seen by Sentinel-2 MULTISPECTRAL

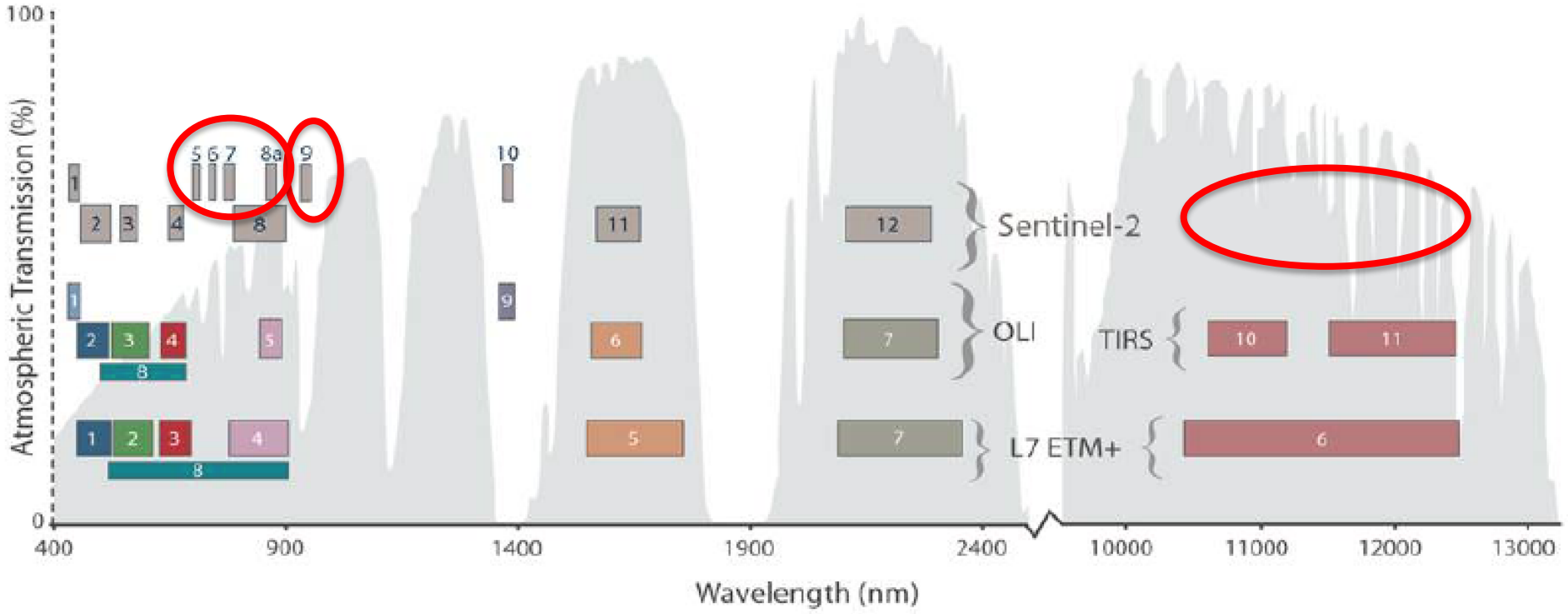



Radiometry

(here @North Cape)



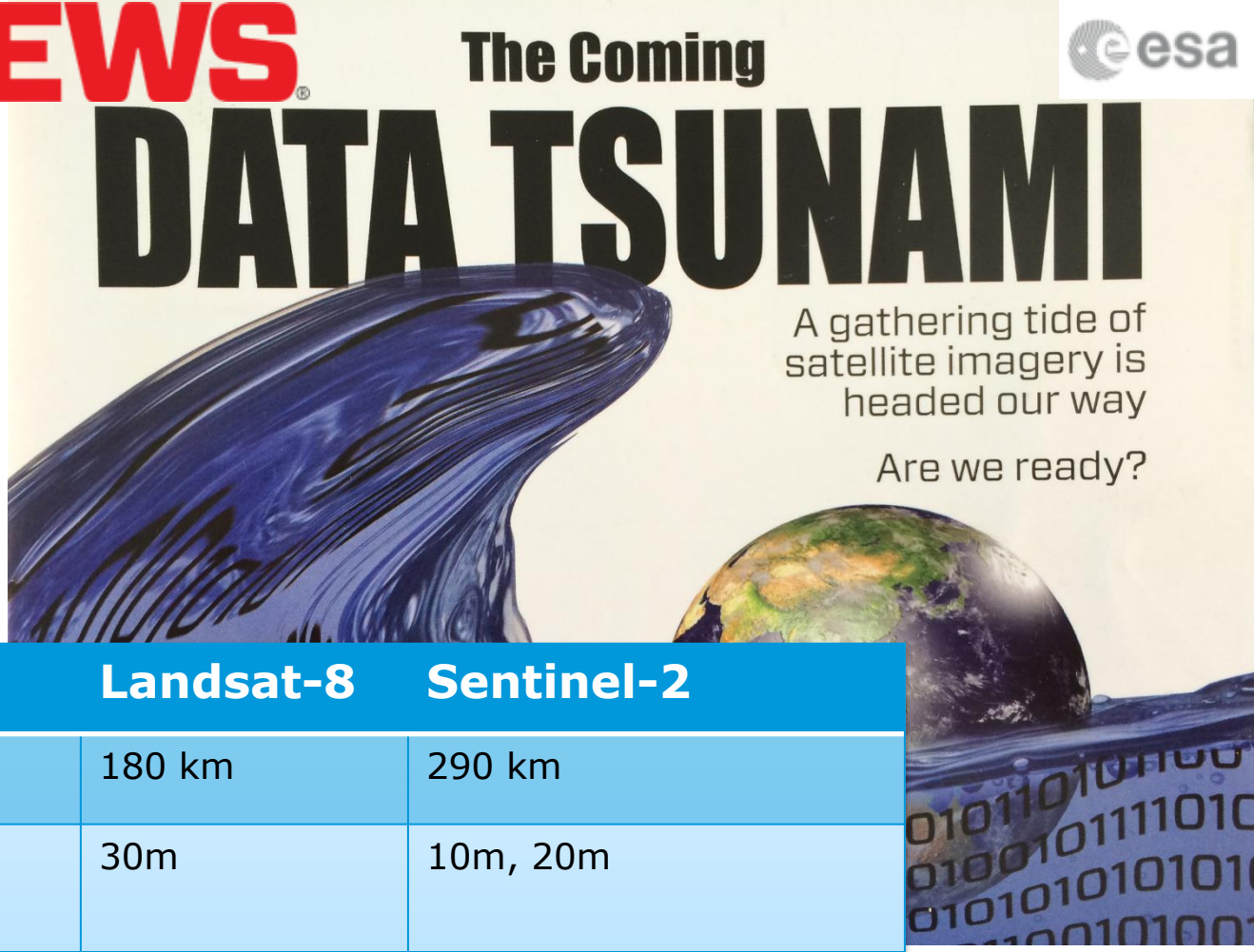
Complementary Sentinel-2/Landsat-8 spectral bands



Source: http://landsat.usgs.gov/L8_band_combos.php

SPACENEWS

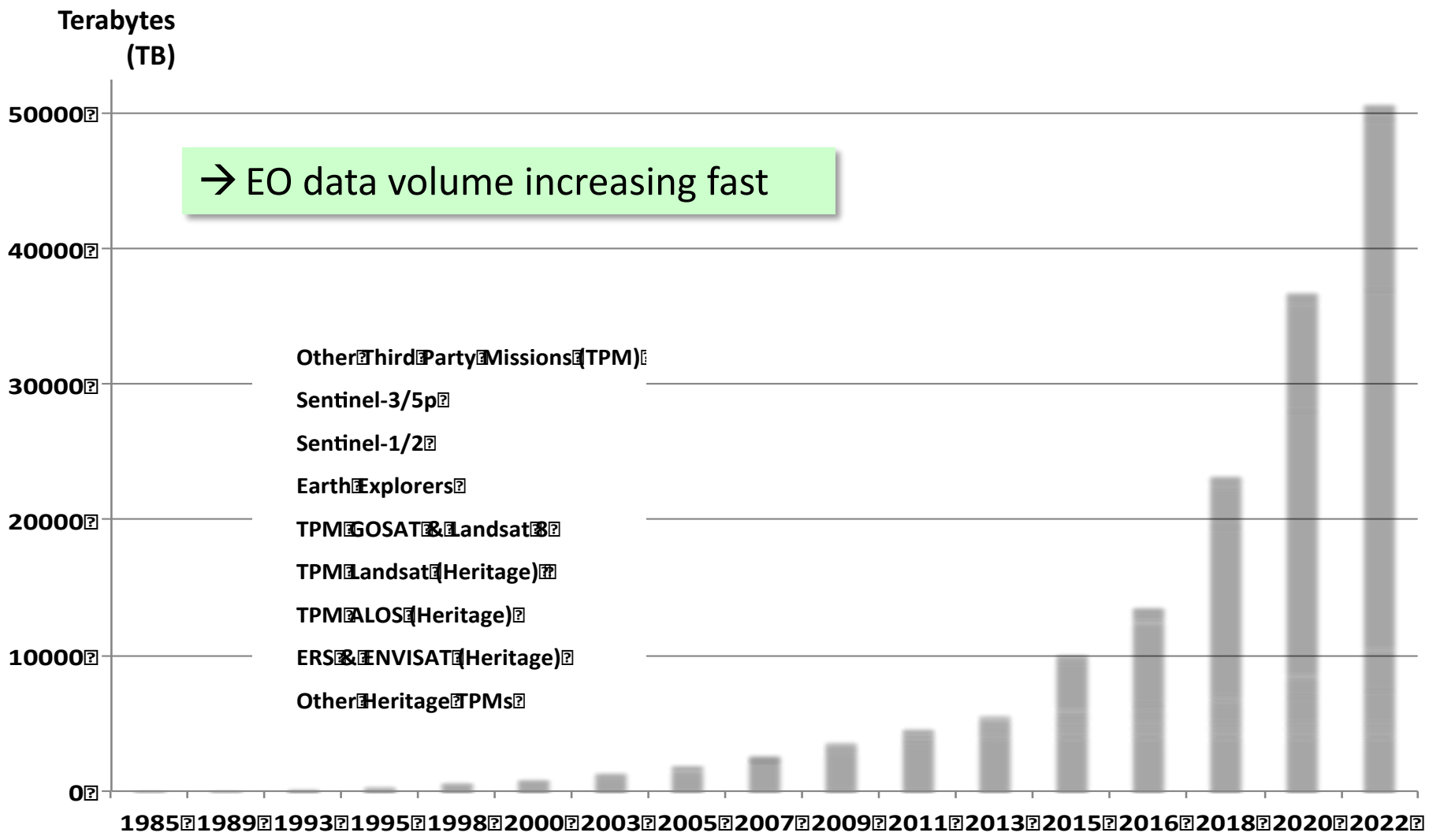
esa



	Spot-5	Landsat-8	Sentinel-2
Swath	60 km	180 km	290 km
Resolution multi-spectral	5m, 10m	30m	10m, 20m
Spectral bands	4 (+1)	9 (+2 TIR)	13
Typical Product size	190 MB (10m) 760 MB (5m)	1GB (2GB)	500MB (tile)/10GB (full swath)
Yearly volume	~800 TB (total Spot sats L1)	250 TB (L1T)	1.4 PB (2 sats, L1C) **3 PB (2 sats L1C+L2A)**

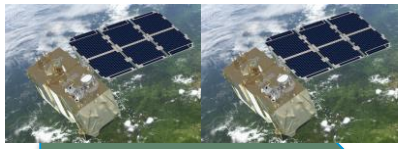
Copernicus
Europe's eyes on Earth

Increasing volume of EO data @ESA



Operational Qualification phase leading to the Routine Operations

Sentinel-2 full mission exploitation capacity based on the routine operations of the 2-satellite constellation
➔ gradually achieved



S2 Full Operational Capacity

S2B Operational qualification

S2A Routine Operations

S2A Operational qualification

S2A Space Segment Commissioning

S2B Space Segment Commissioning

S2A-Launch
23 June 2015

S2A IOCR
15 Oct 2015

1st S2A ROR
5 July 2016

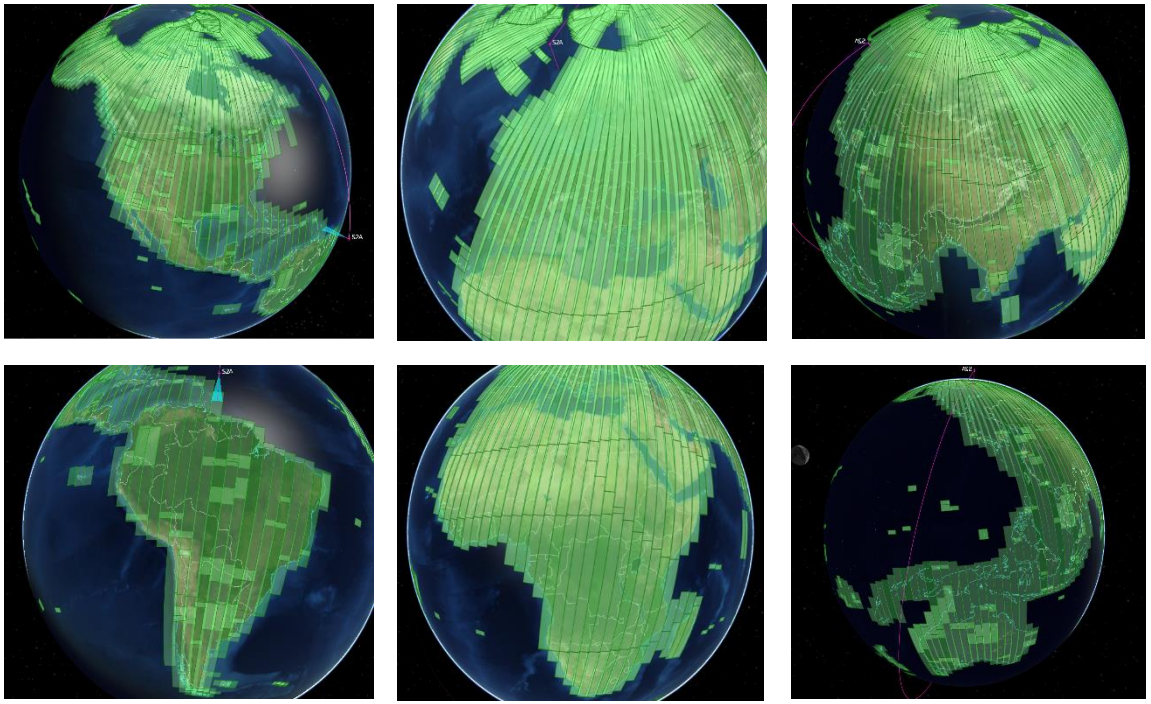
S2B Launch
28 Feb – 8 Mar 2017

S2 Mission ROR
~ autumn 2017

Sentinel-2 Observation Scenario - Overview

The Sentinel-2 **baseline observation scenario in routine phase systematically covers 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 coast**line
- The **whole Mediterranean Sea** as well as all inland water bodies and closed seas

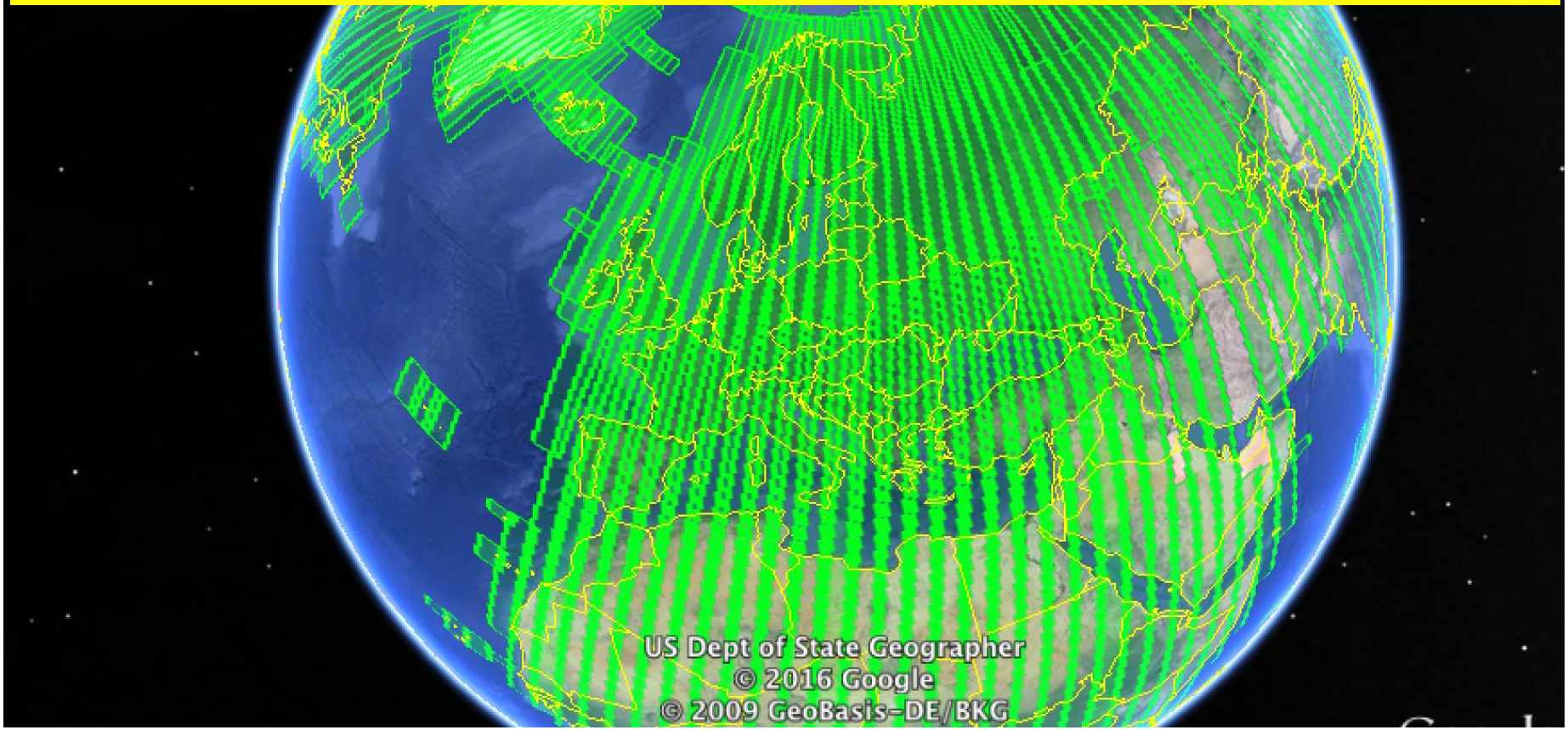


Sentinel-2 acquisition plan

Currently 10 days revisit in Europe, Africa and Greenland

Rest of the World in 20 days (=14.2min/orbit)

→ Continue to increase data acquisition: 10 days revisit of all land masses to be reached Q1/2017, using EDRS service / 4th X-band station



Sentinel-2 acquisition plan published online ahead of every repeat cycle at
https://sentinels.copernicus.eu/web/sentinel/missions/sentinel-2/acquisition-plans

Sentinel-2 Products

Name	High-level Description	Production	Preservation Strategy	Volume
Level-1B	Top-of-atmosphere radiances in sensor geometry	Systematic	Long-term	~27 MB (each 25x23km^2)
Level-1C	Top-of-atmosphere reflectances in cartographic geometry	Systematic	Long-term	~500 MB (each 100x100km^2)
Level-2A	Bottom-of-atmosphere reflectances in cartographic geometry	On user side* (using Sen2Cor on SNAP Toolbox**)	N/A	~600 MB (each 100x100km^2)

Excellent geometric and radiometric quality

In preparation

*: Systematic global production of L2A is currently being prepared.

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

Call for S2 Validation Team

esa

esa 1st sentinel-2 validation team meeting

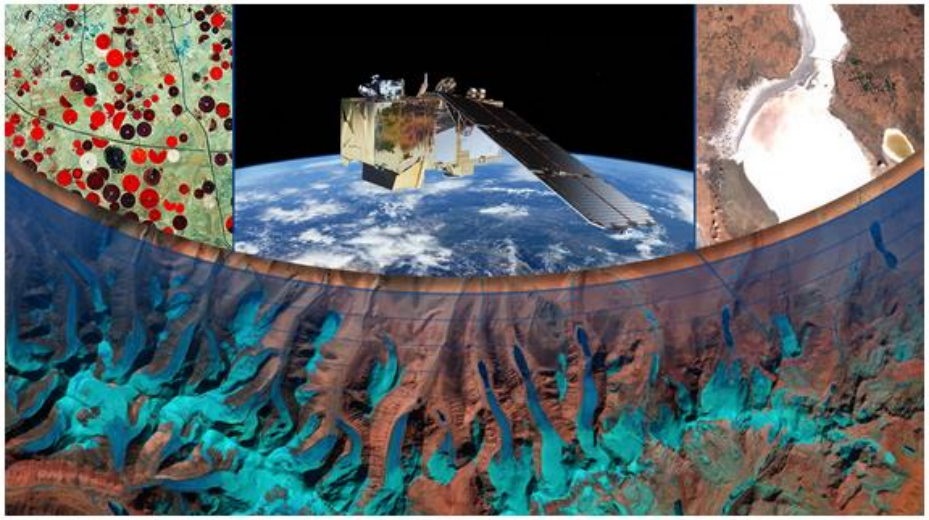
European Space Agency

List of events

- Home
- Objectives
- Deadlines
- Registration
- Abstract Submission
- Venue
- Contact
- Organizing Committee
- Hotel

1st Sentinel-2 Validation Team Meeting

28-29 November 2016
ESRIN, Frascati, Rome (Italy)



The Copernicus Sentinel-2A satellite was launched in June 2015. A second satellite, Sentinel-2B, will be launched early 2017 completing the deployment of the Sentinel-2 constellation. Calibration and validation activities are carried out operationally by ESA's Mission Performance Centre (MPC).

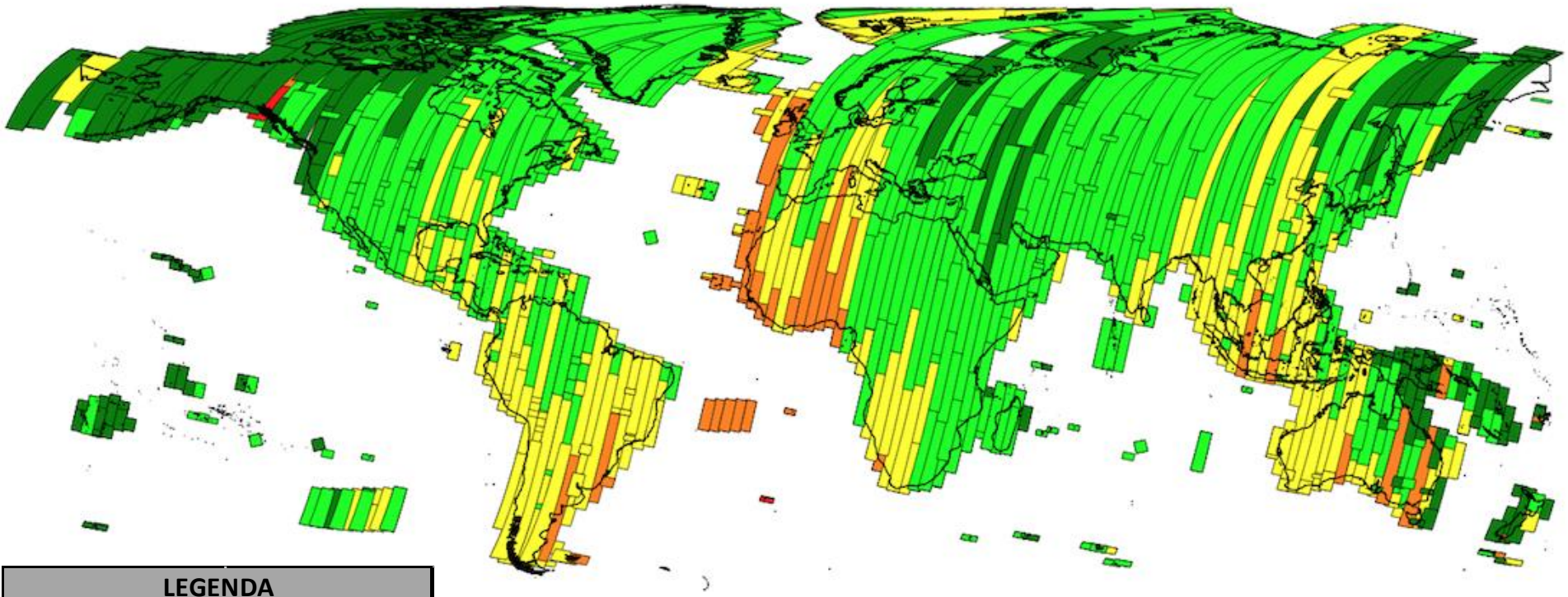
These activities can be complemented with the expertise from independent teams such as the experts involved in relevant Cal/Val international groups, or by individual principal investigators, users, laboratories, and institutions.

These experts are invited to be part of the so-called Sentinel-2 Validation Team (S2VT). The work performed by the S2VT will complement on a best-effort and with no supply of funds basis, the baseline validation activities.

Registration and abstract submission opening	22 September 2016
Registration and abstract submission closing	06 November 2016
Notification of acceptance and preliminary programme	18 November 2016
Release of the final programme at the meeting	

Copernicus Europe's eyes on Earth

Sentinel-2A Data age (after downlink)

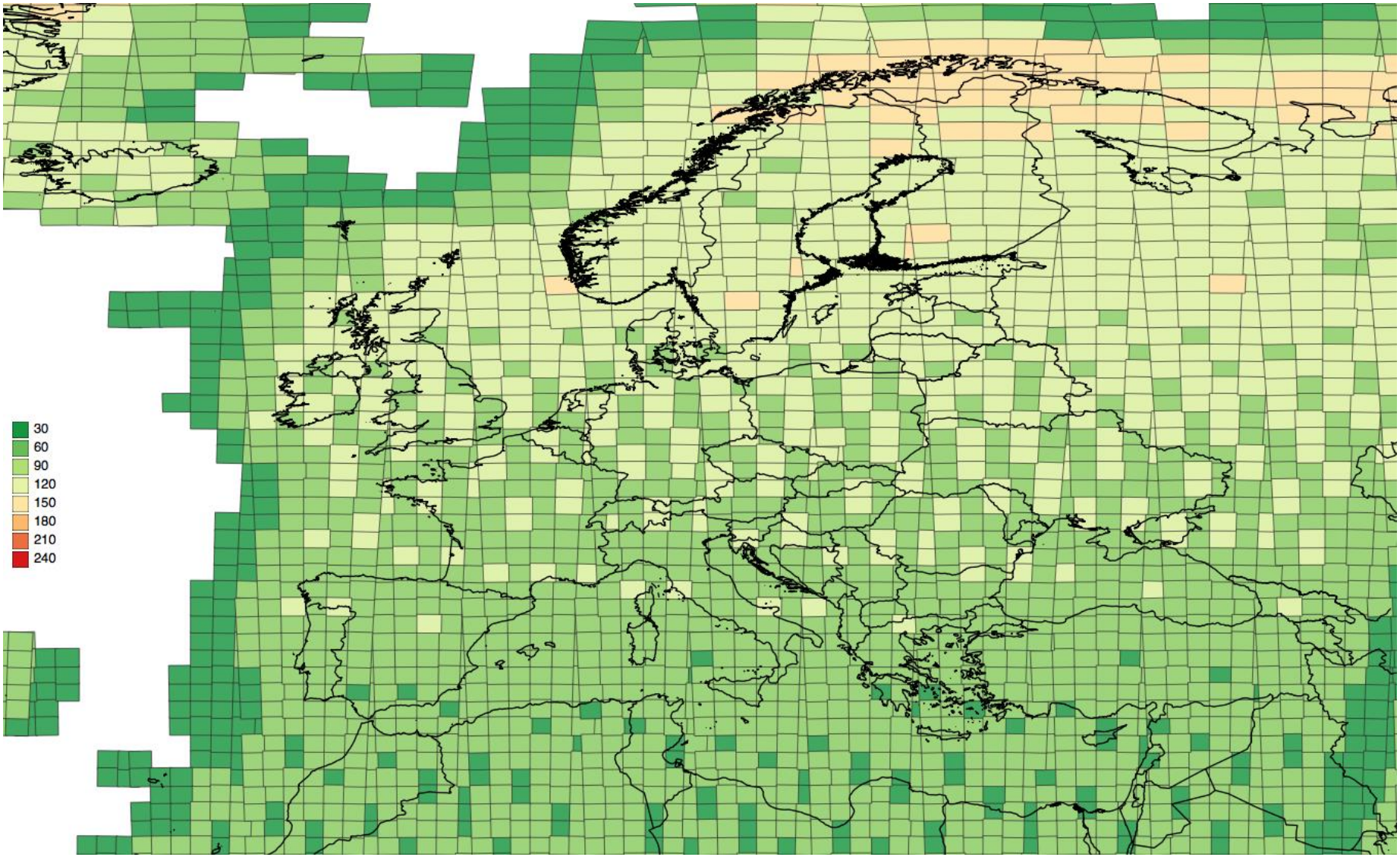


LEGENDA	
LATENCY	COLOUR
0-100 mins.	DARK GREEN
100-200 mins.	GREEN
200-300 mins.	YELLOW
300-400 mins	ORANGE
400-500 mins.	RED

100min to be added for on-ground processing

- On average data are ready in PDGS ±4-5 hours after sensing, for transfer to Hub
- Once EDRS and/or 4th X-band station are available, the map will be green everywhere
- Some delays during Aug/Sep

120-150 acquisitions over Norway since June 2015



Sentinel Data Access: Current Configuration

Online access at **sentinels.copernicus.eu**

Scientific Data Hub

Self Registration

> 44,709 Users

No Rolling Policy Applied

Sentinel-1A NTC
Sentinel-2A L1C
03-Oct-2014

16-Nov-2015

Max 2 Concurrent Downloads

Collaborative Data Hub

11 Collaborative Users
4 Data Hub Relay Users

Node 1: 30 days
Node 2: 9 days

Sentinel-1A NRT & NTC
Sentinel-2A L1C

Node 1: Max 10 downloads

Node 2: No specific threshold

International Access Hub

4 Users

30 Days

Sentinel-1A NTC
Sentinel-2A L1C

No specific threshold

Copernicus Services Data Hub

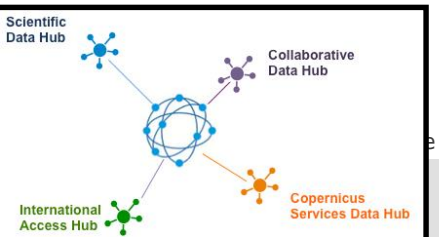
copernicus space component data access

108 Users

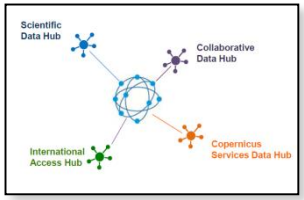
No Rolling Policy Applied

Sentinel-1A NRT & NTC
Sentinel-2A L1C
01-Dec-2015

Max 10 concurrent downloads



Statistics: 1 September 2016



Open Access Data Hub

(also called Scientific Data Hub)

✓ ***All data generated since October 2014 are currently available online***

- ✓ Simple self registration
- ✓ Users can set own scripts to automatically search filter and download products (APIs provided for automatic downloads via scripts)
- ✓ Quota restriction of 2 concurrent downloads to ensure bandwidth availability for all users
- ✓ Single user can engage up to 500 Mbps output network bandwidth

✓ **Open source** Web interface → *DataHubSystem*

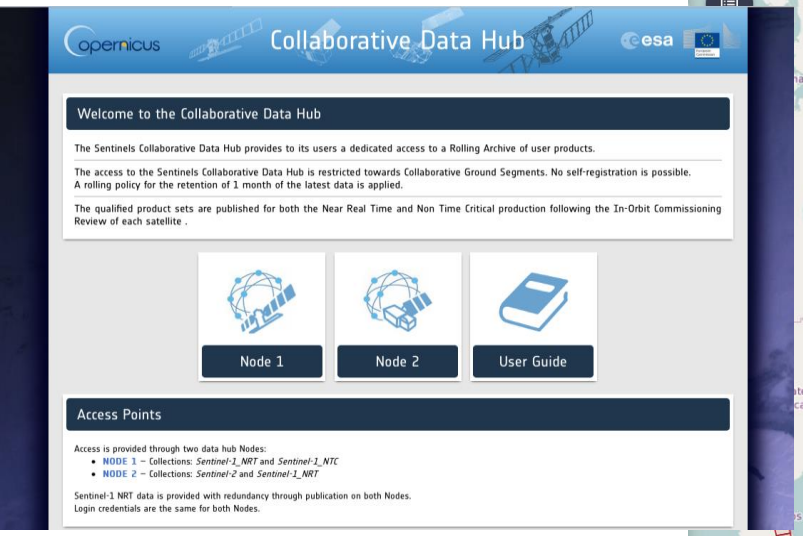
Open source Data Hub Server software available at:
https://github.com/SentinelDataHub/DataHubSystem

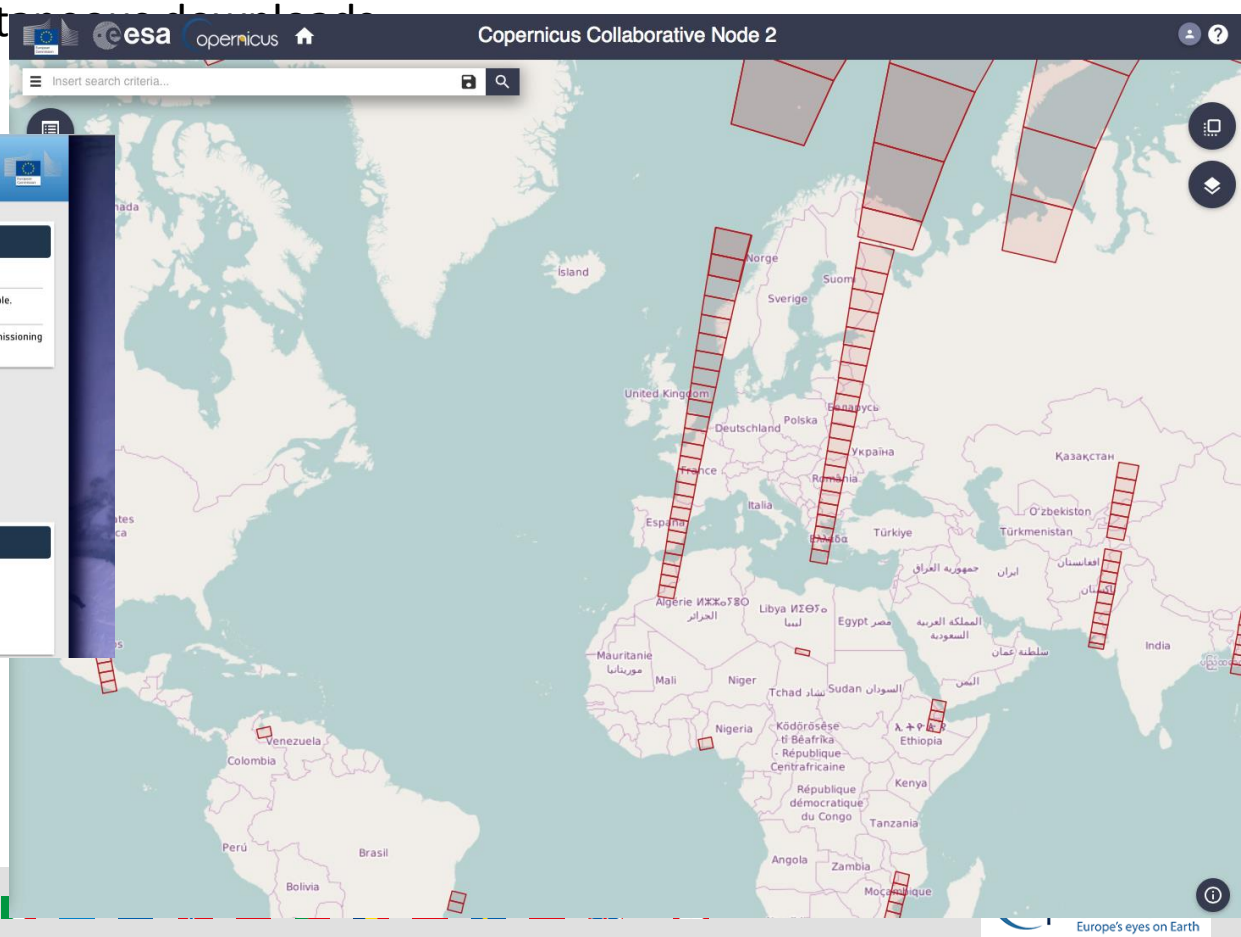
Open source **Sentinel Toolbox** available at:
https://github.com/senbox-org

Collaborative Ground Segment Data Hub

- Data Centre infrastructure is in operations since January 2015
  - Twelve accounts enabled, one per Participating States with CollGS agreements formalised
  - Two core data access nodes available
  - No restrictions in simult[illegible] downloads

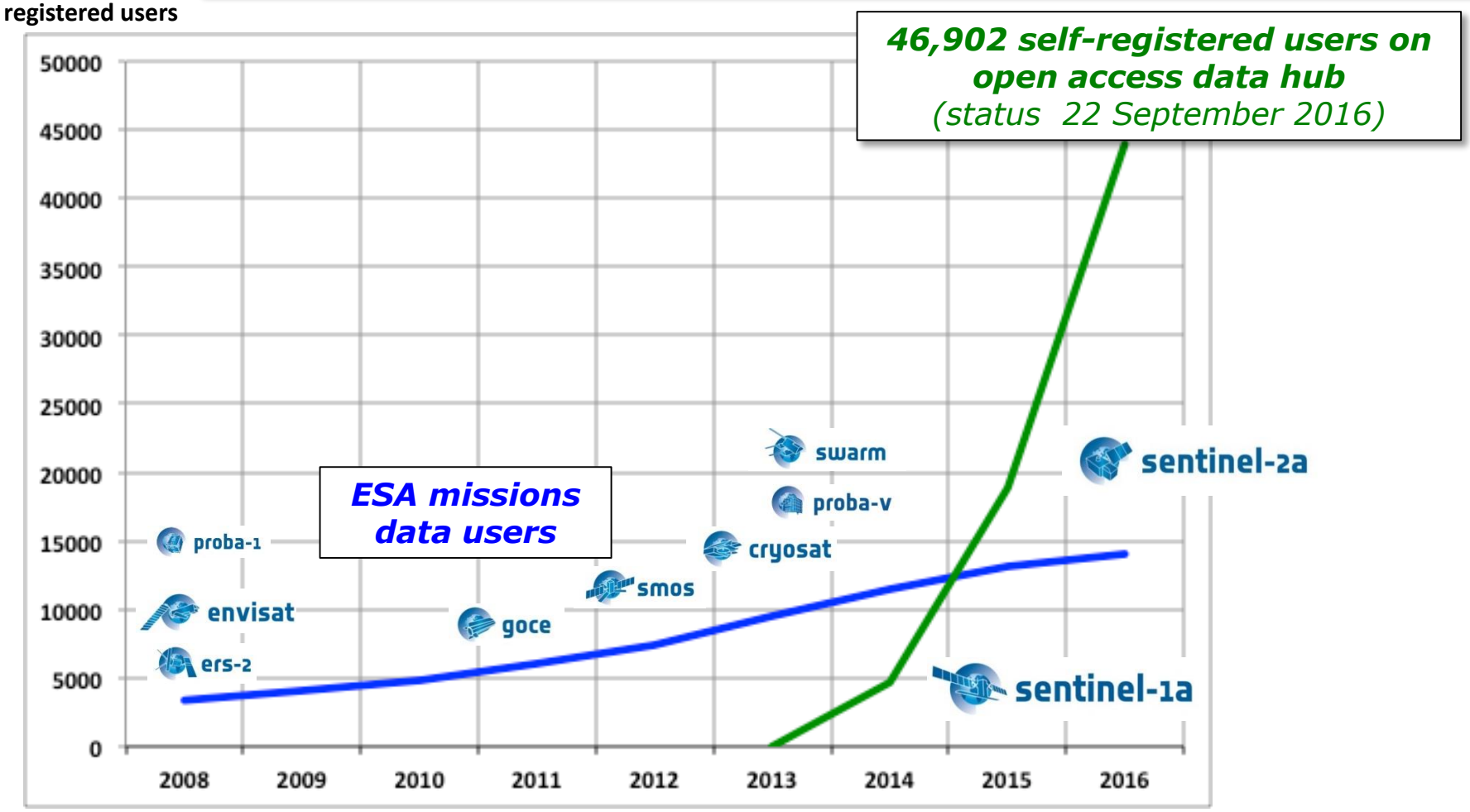
colhub.copernicus.eu



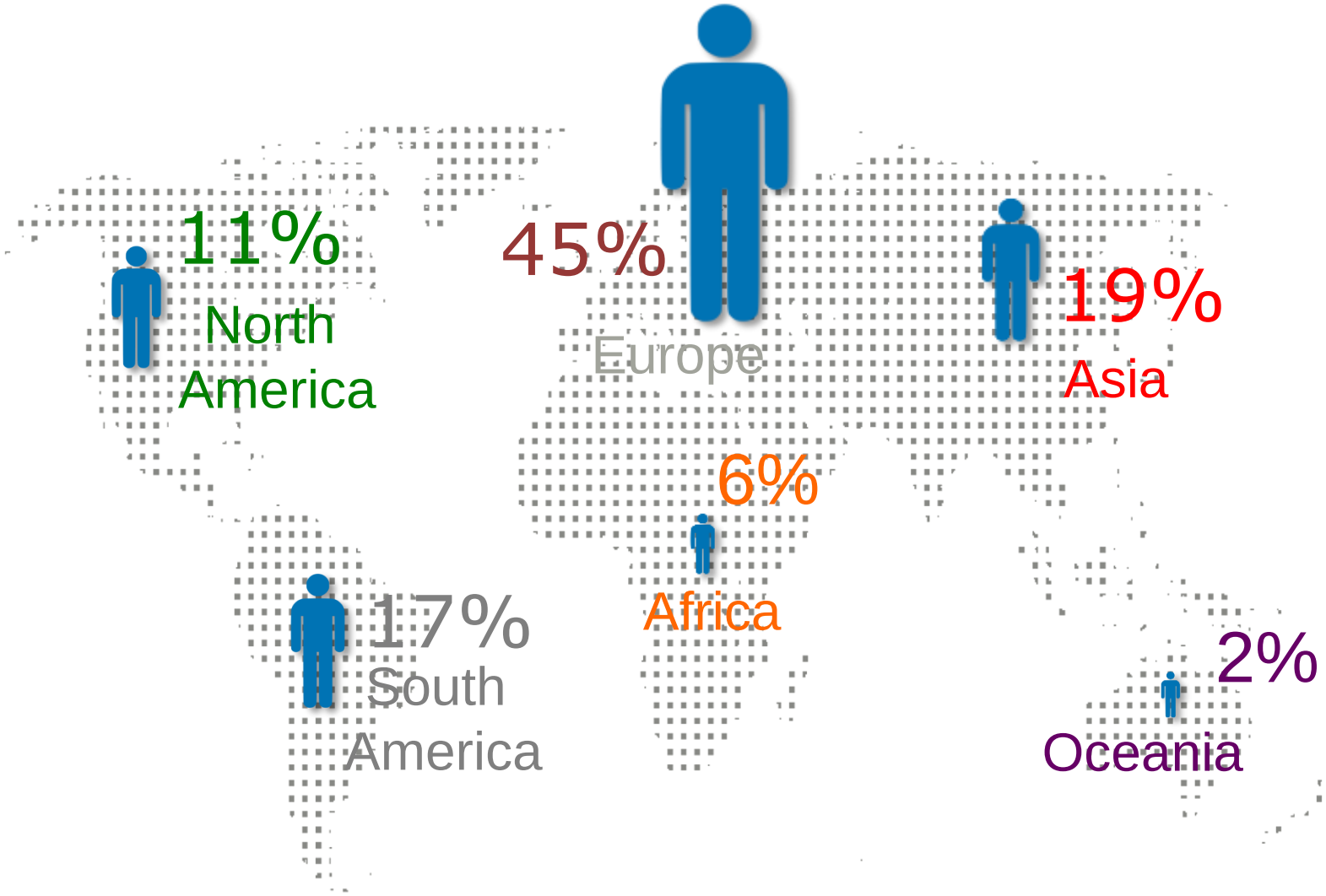


Sentinel data - Users Registration

A steady sharp increase of users
as a consequence of Data Policy and Mission Operations Concept:
systematic observation, acquisition, processing and dissemination



Sentinels Data Access Statistics – Global View

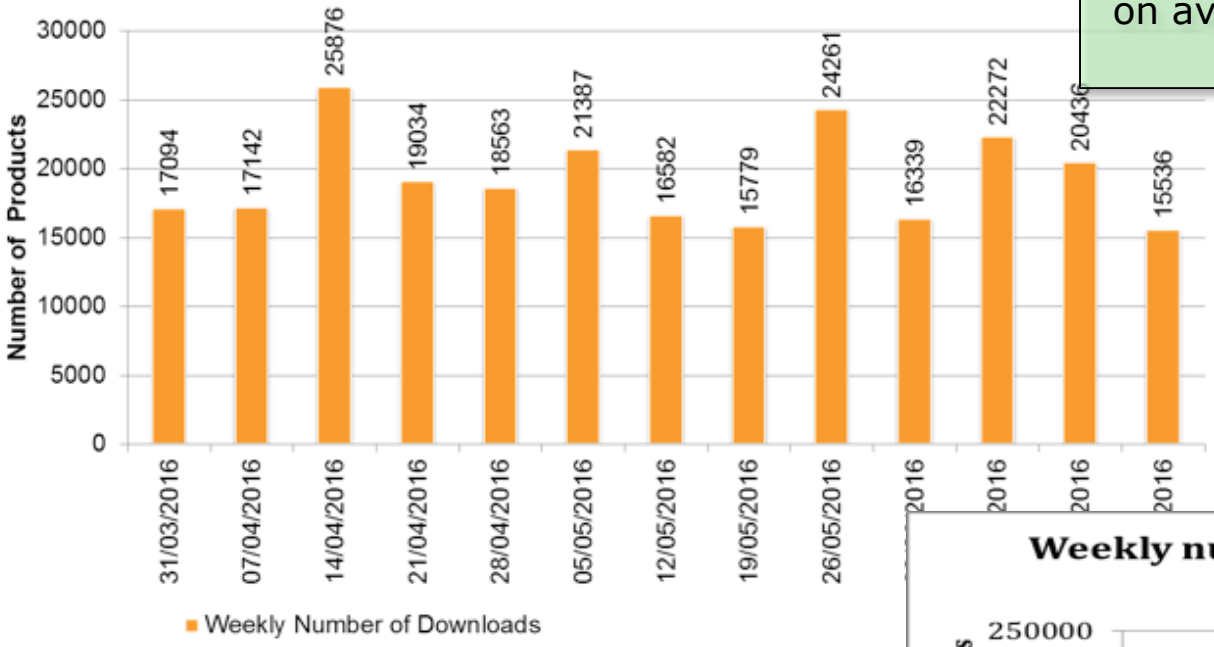


Statistics: Q2-2016 (30 June 2016)

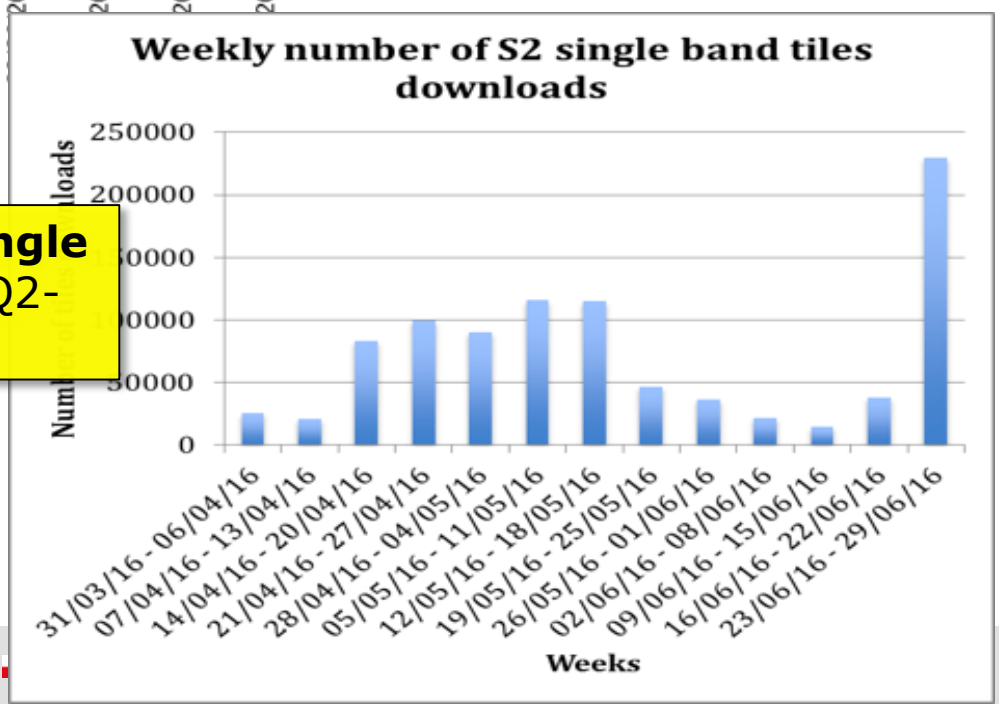
Sentinel-2: products distribution statistics

Approx. 250,000 products were downloaded during Q2-2016

Exploitation ratio - 1:9
on average each product published has been downloaded times

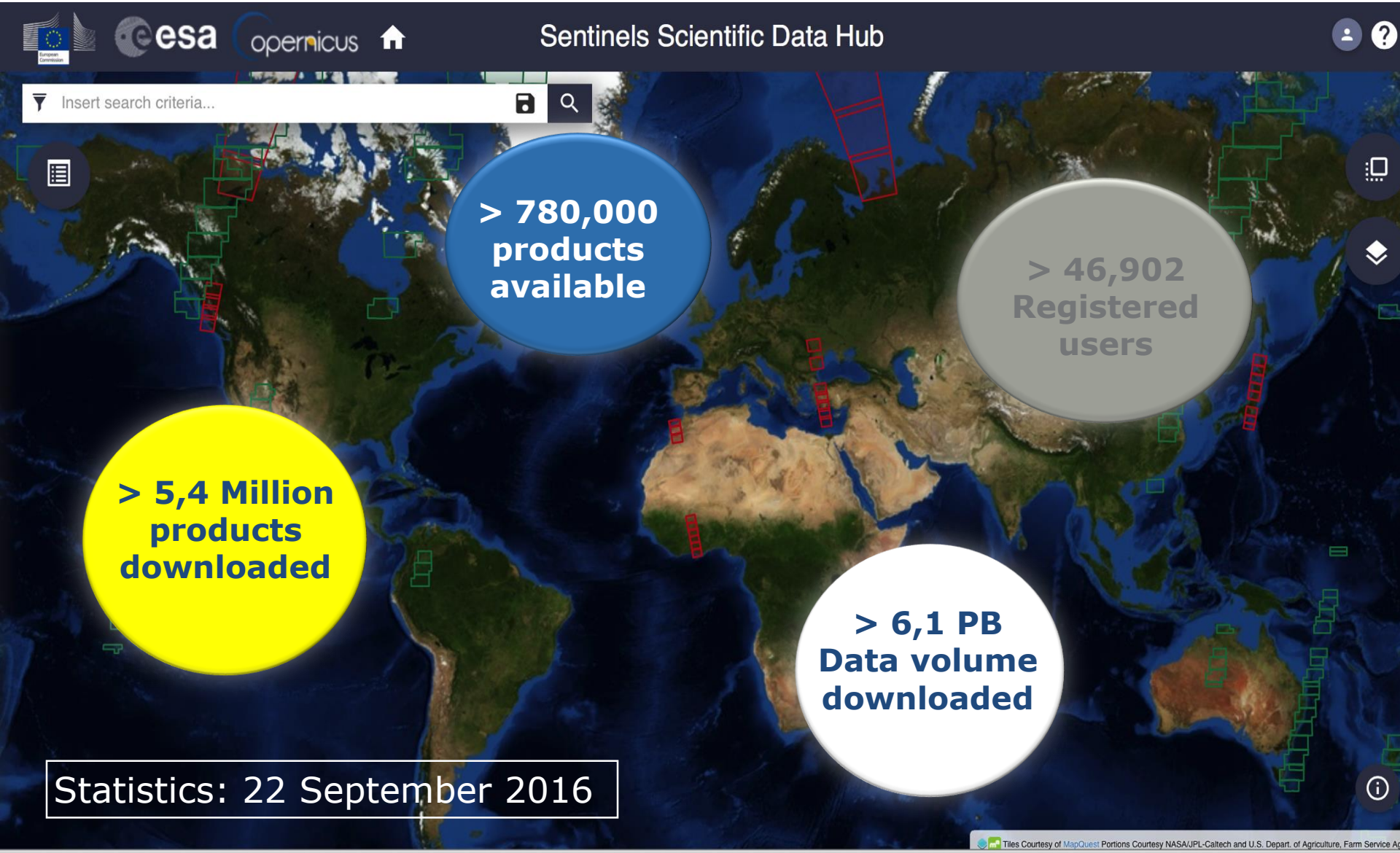


In addition, **an estimated 1 million single band tiles** were disseminated during Q2-2016



Note: currently S2 products comprise several Tiles and all Bands. Users can however download single bands and single tiles via the API libraries provided by ESA.

Sentinels Data Access Statistics - Open Access Data Hub



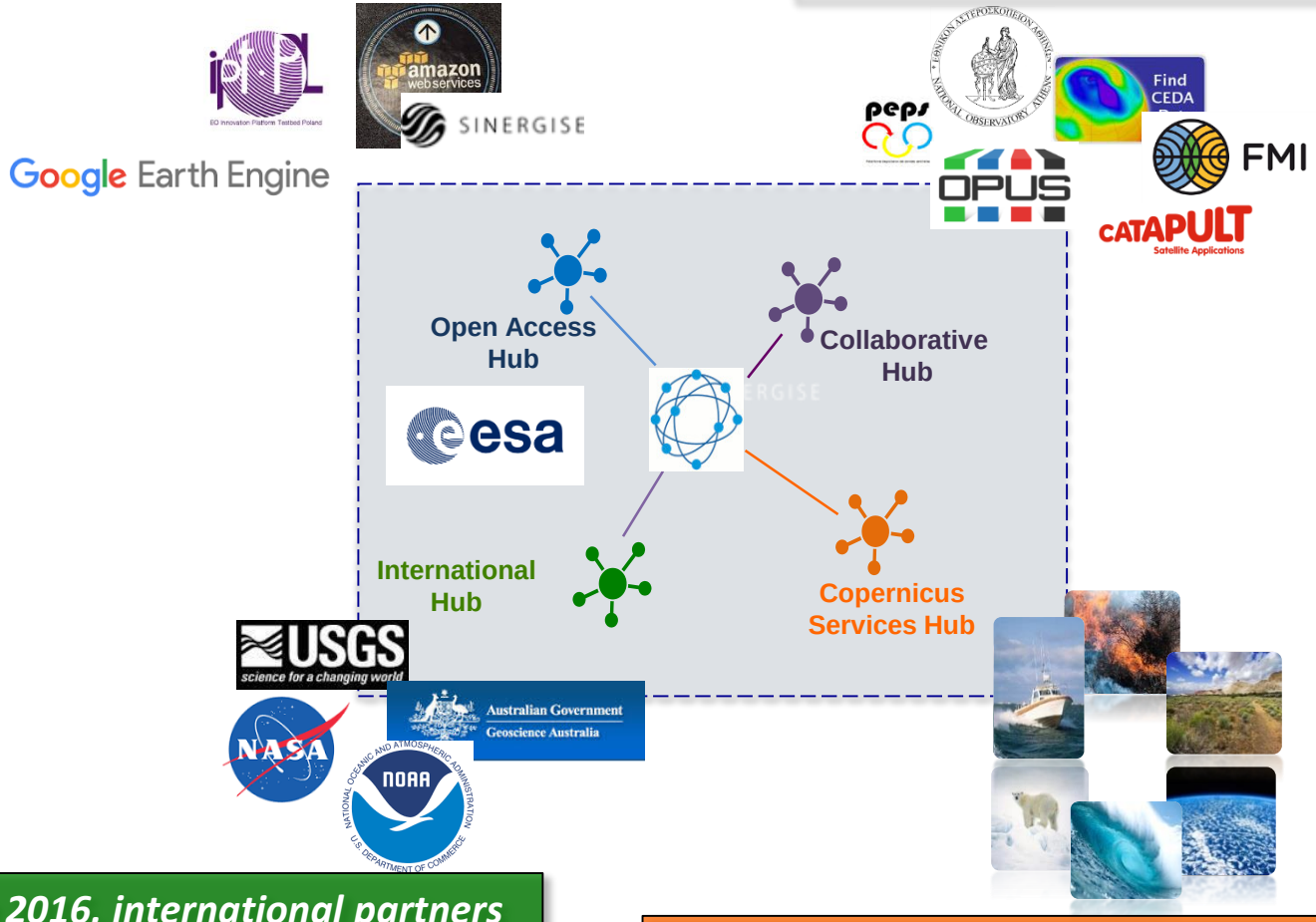
https://scihub.copernicus.eu

Copernicus Europe's eyes on Earth

Sentinels Products - Redistribution

Large and small private companies are re-distributing Sentinel products via free and pay-per-use schemes

Collaborative mirror sites directly serve more than 600 users (status end 2015)



As of spring 2016, international partners mirror sites have started disseminating towards own national communities

Copernicus Services are providing their higher level products to approx 10,000 users (status Q1-2016)

S2 user categories: an ever increasing number and range of applications

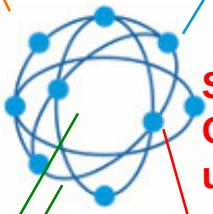
Copernicus Services

Collaborative Member States

Greece, Italy, Germany, UK, Portugal, Austria.

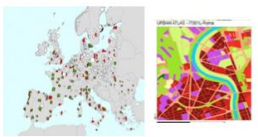
Norway, Finland, France, Canada, Sweden

Scientific/ Other use



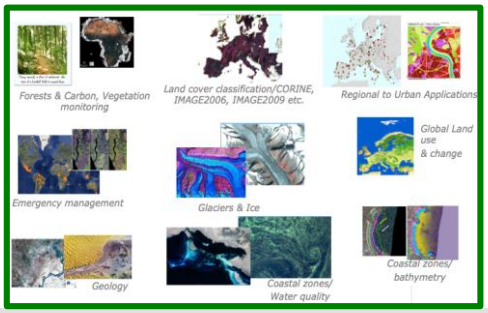
Forests & Carbon, Vegetation monitoring

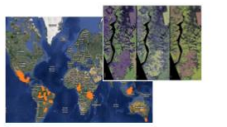
Land cover classification/CORINE, IMAGE2006, IMAGE2009 etc.



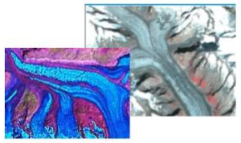
Regional to Urban Applications

International Collaborative





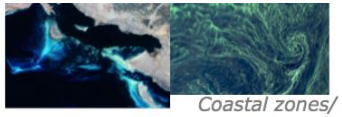
Emergency management



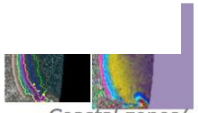
Glaciers & Ice

Global Land use & change

Geology



Coastal zones/ Water quality



Coastal zones/ bathymetry

Next steps

Reprocessing archive to single tiles & new format

New Format (TCI, filenames)

Single tiles

Atmospheric correction 'Pilot Europe'

EDRS/ 4th X-band: global 10-day revisit

S2A Rou

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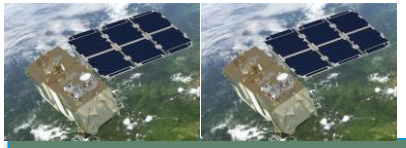
n

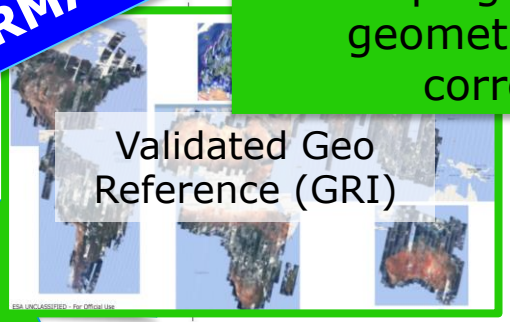
S2 Full Op acity



INCREASE OF CAPACITY, PERFORMANCE and HOMOGENEITY

Large reprocessing campaign with new geometry & atm. correction

-5 PB



Validated Geo Reference (GRI)

Atmospheric correction operational

S2B Space Segment Commissioning

S2B Launch
28 Feb – 8 Mar 2017

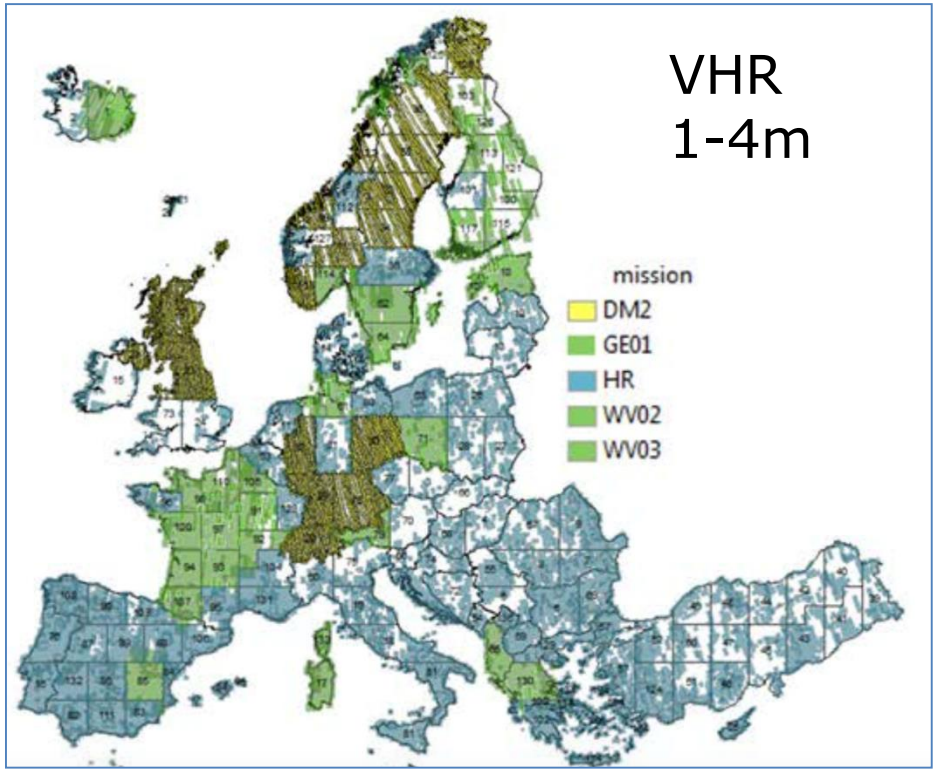
S2 Mission ROR
~ autumn 2017

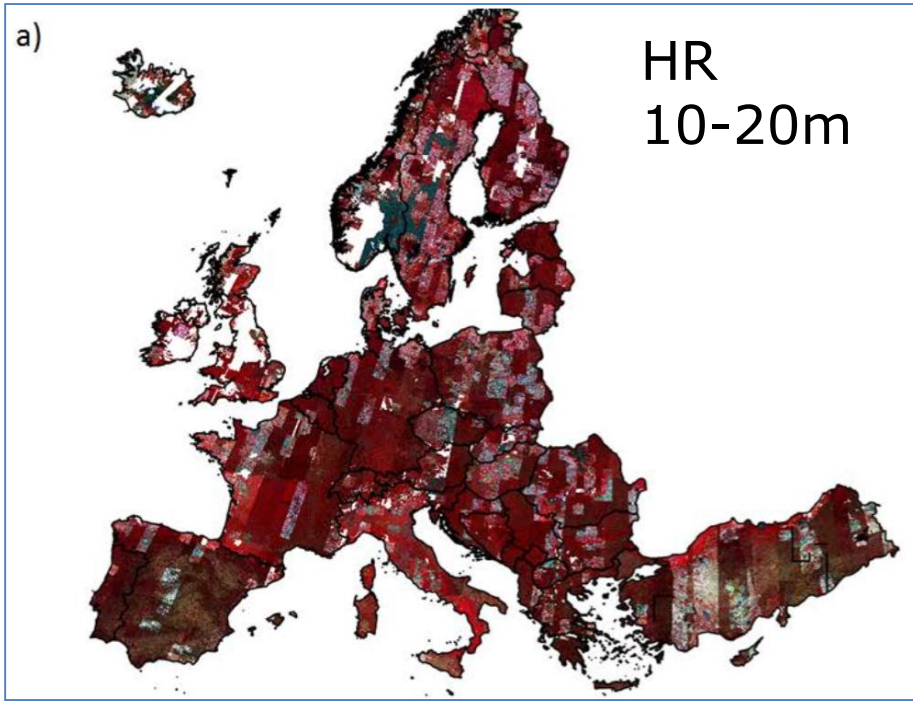
S2 geometric Baseline
2018

Copernicus Contributing Mission: Data Access

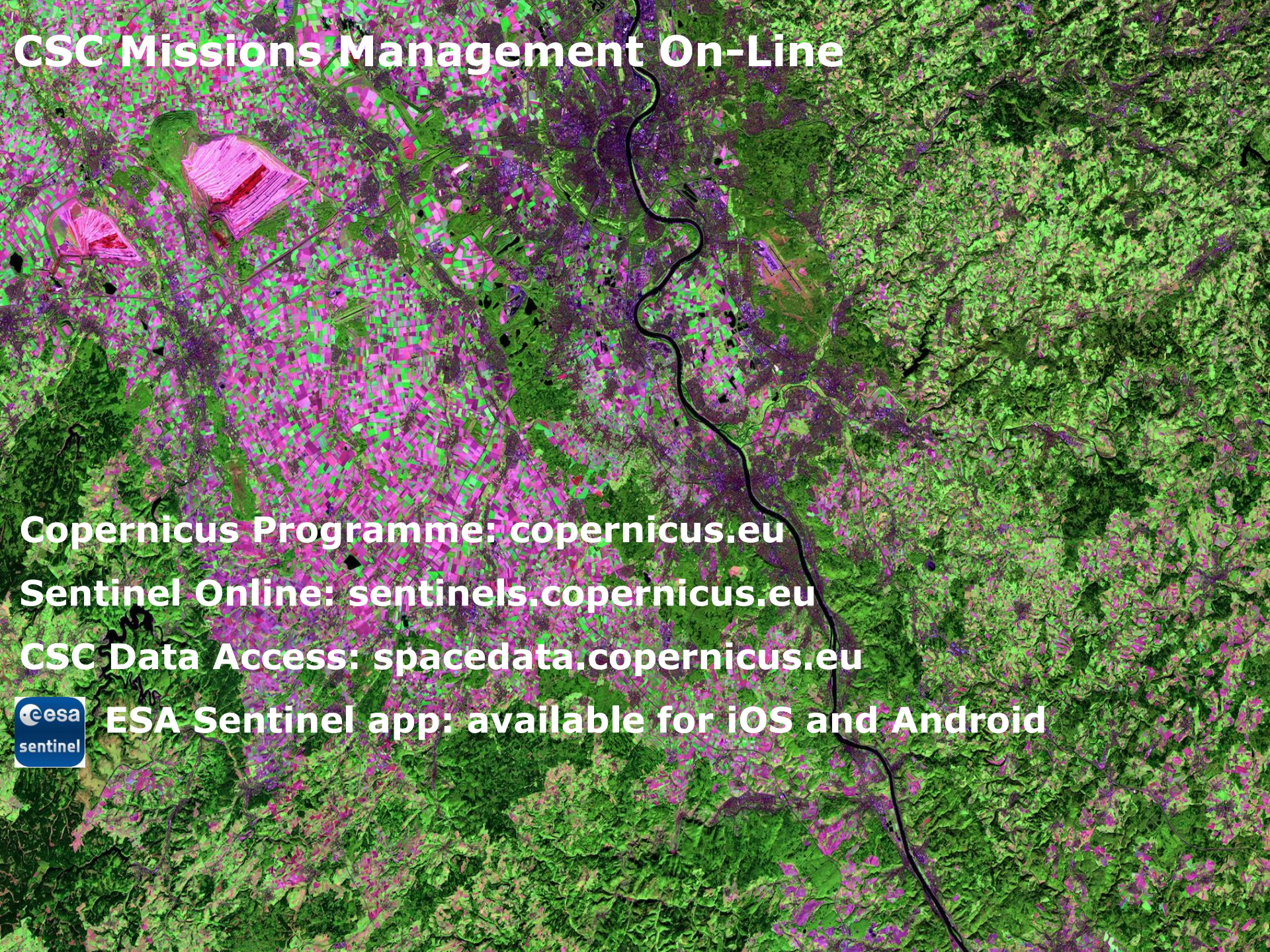
- Data from Missions other than Sentinels
- Can be accessed free of charge by National Public authorities
- For use within European Public tasks

spacedata.copernicus.eu





CSC Missions Management On-Line



Copernicus Programme: copernicus.eu

Sentinel Online: sentinels.copernicus.eu

CSC Data Access: spacedata.copernicus.eu

ESA Sentinel app: available for iOS and Android