

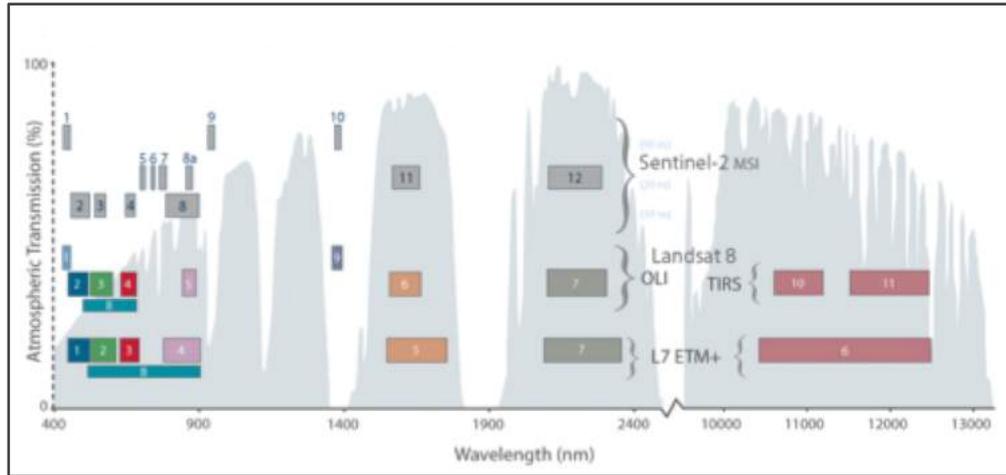
Sentinel-2 Mission Status

Ferran Gascon (Sentinel-2 Mission Manager)

16 October 2019, La Petite-Pierre

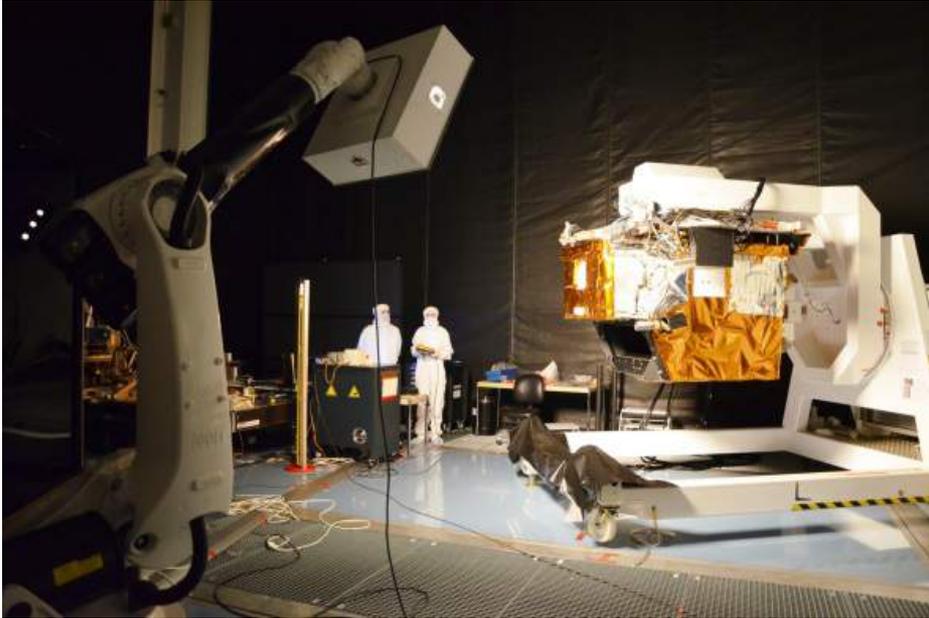
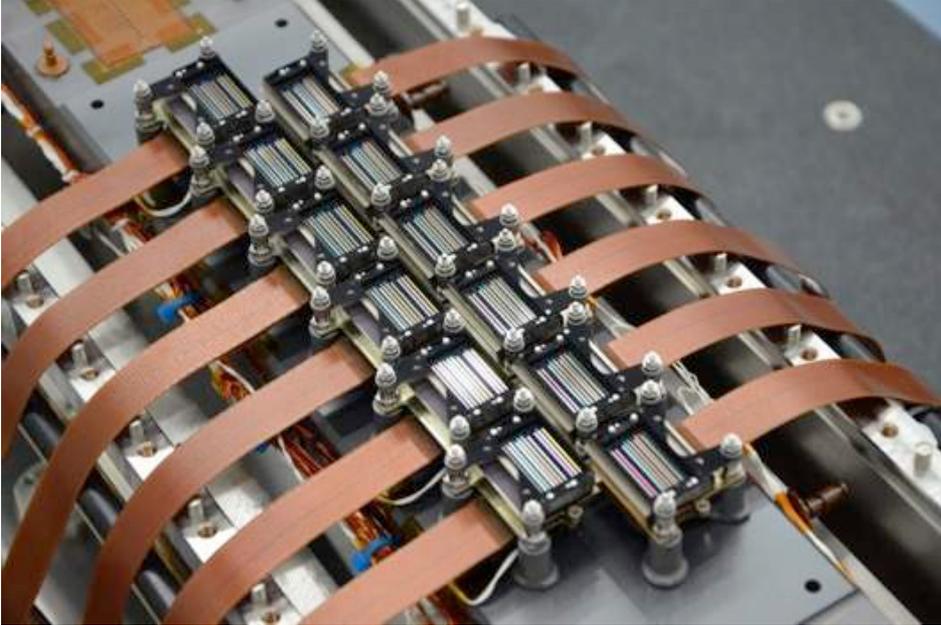
Sentinel-2 Mission

- ✓ Optical multi-spectral mission for the monitoring of land and coastal regions.
- ✓ Constellation of two satellites (Sentinel-2A and Sentinel-2B).
- ✓ Polar sun-synchronous orbit at an altitude of 786km, with LTDN 10h30.
- ✓ Swath of 294km.



- ✓ Free & open products for feeding a large range of applications.

Sentinel-2 Instrument



Going to Kourou



Last pictures before launch









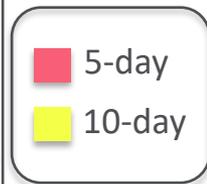
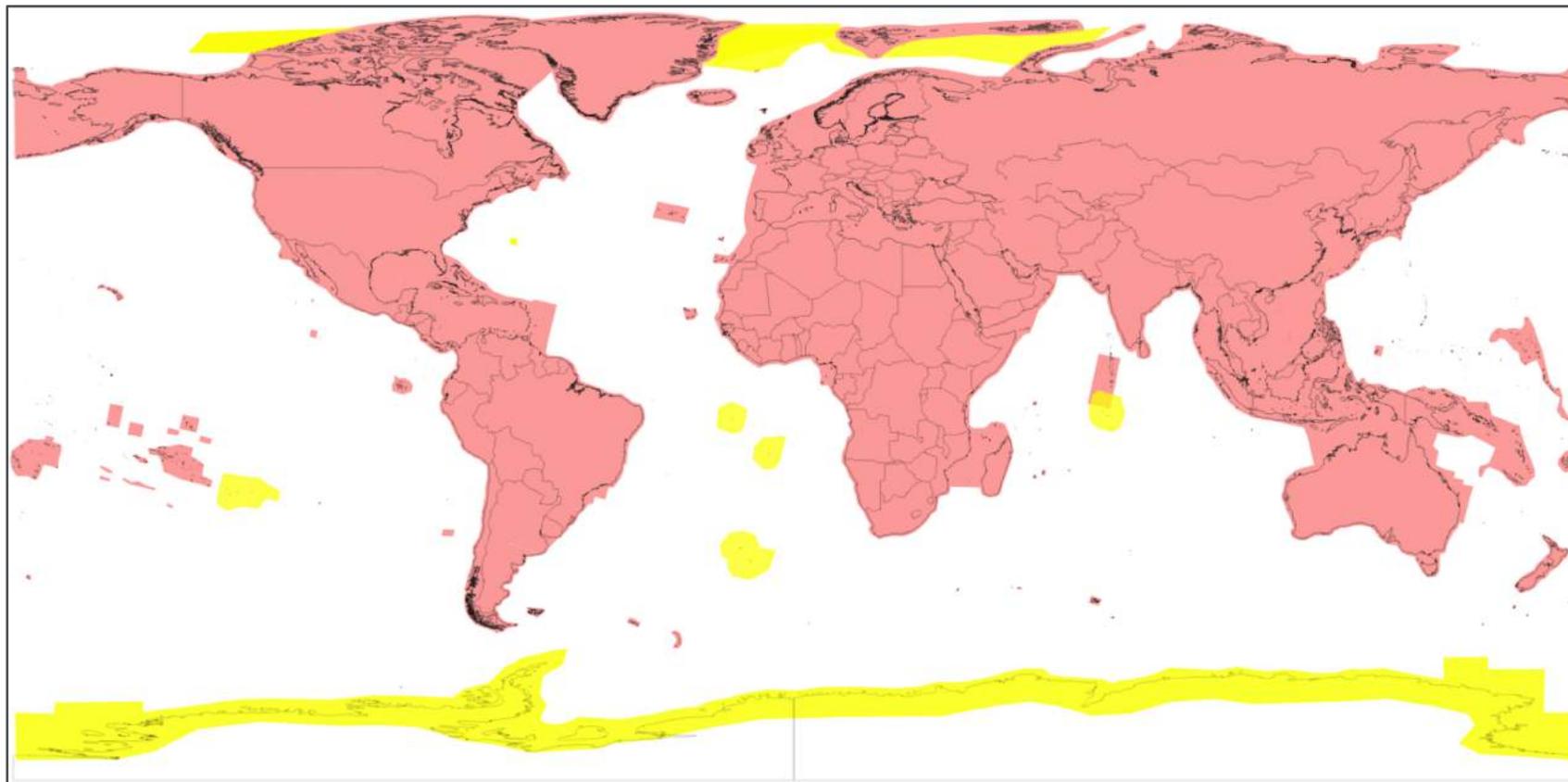
0 days 00 hours 00 minutes
Sentinel 2 constellation:
summer solstice

Mission Products Catalogue

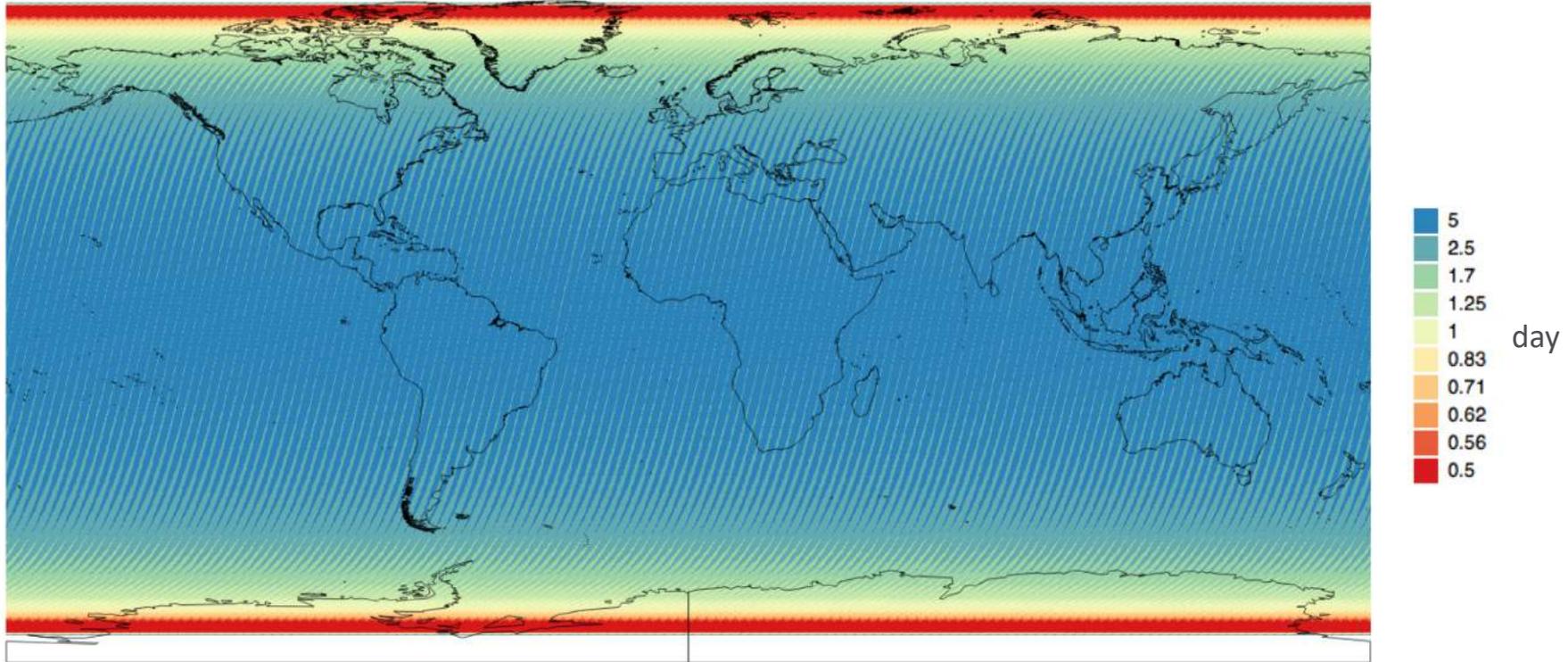
Product Name	Measurement Provided	Distribution
Level-1B	Top-of-atmosphere radiances in sensor geometry	Expert users
Level-1C	Top-of-atmosphere reflectances in cartographic geometry	All users
Level-2A	Surface reflectances and pixel classification in cartographic geometry	All users



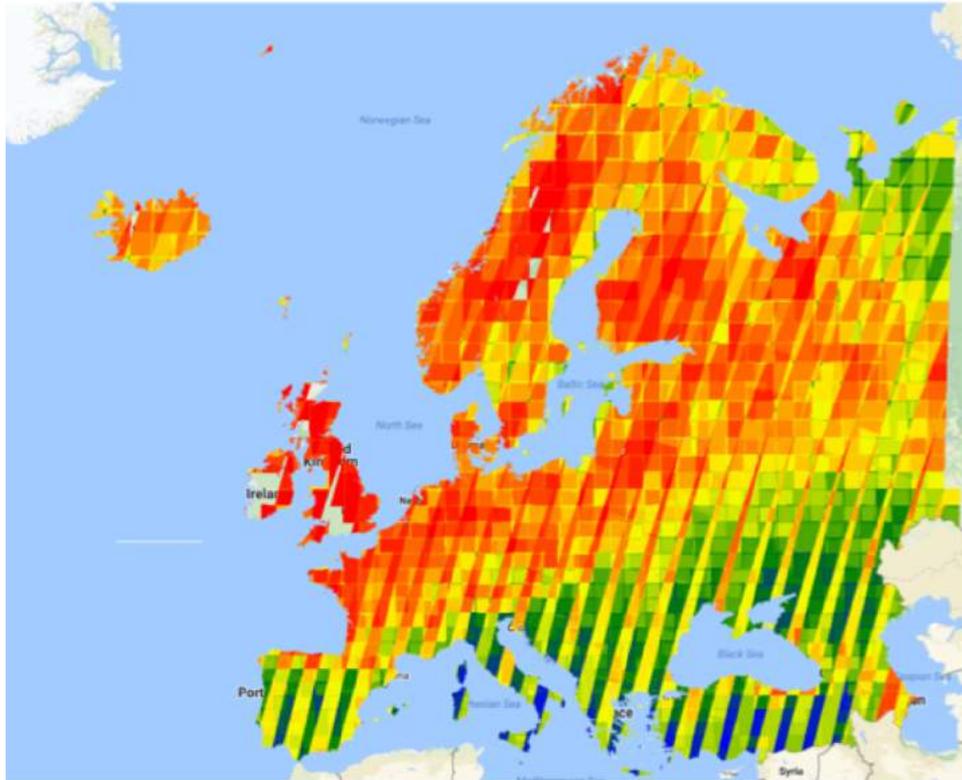
Observation Scenario



Coverage



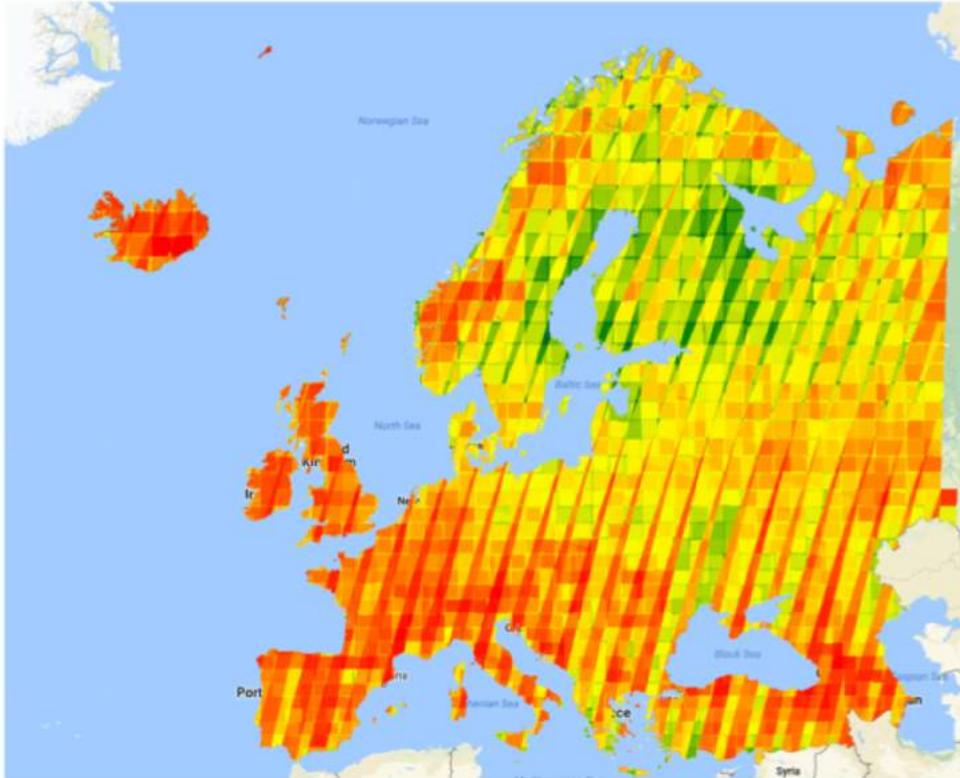
Effective Coverage (cloud-free)



- Period July-August 2017 (2 months)
- Average number of days between cloud-free acquisitions (defined as tiles with <20% cloud covered).



Effective Coverage (cloud-free)

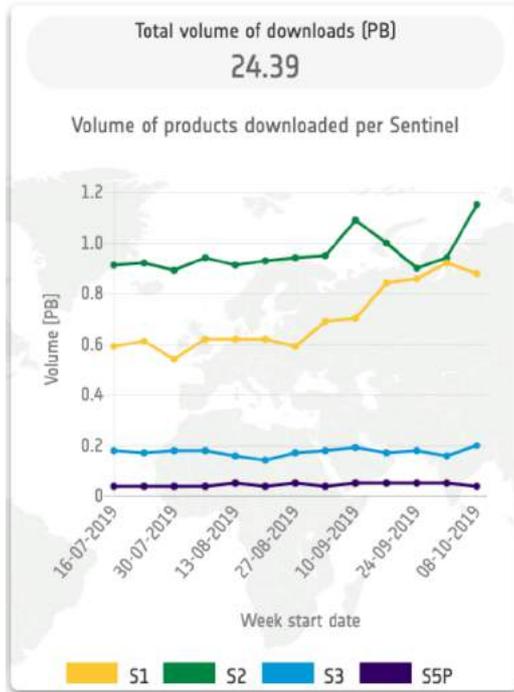


- Period March-April-May 2018 (3 months)
- Average number of days between cloud-free acquisitions (i.e. with tiles <20% cloudy).



Data Access

Copernicus Data Hubs



Private companies re-distributing Sentinel products through free and pay-per-use schemes

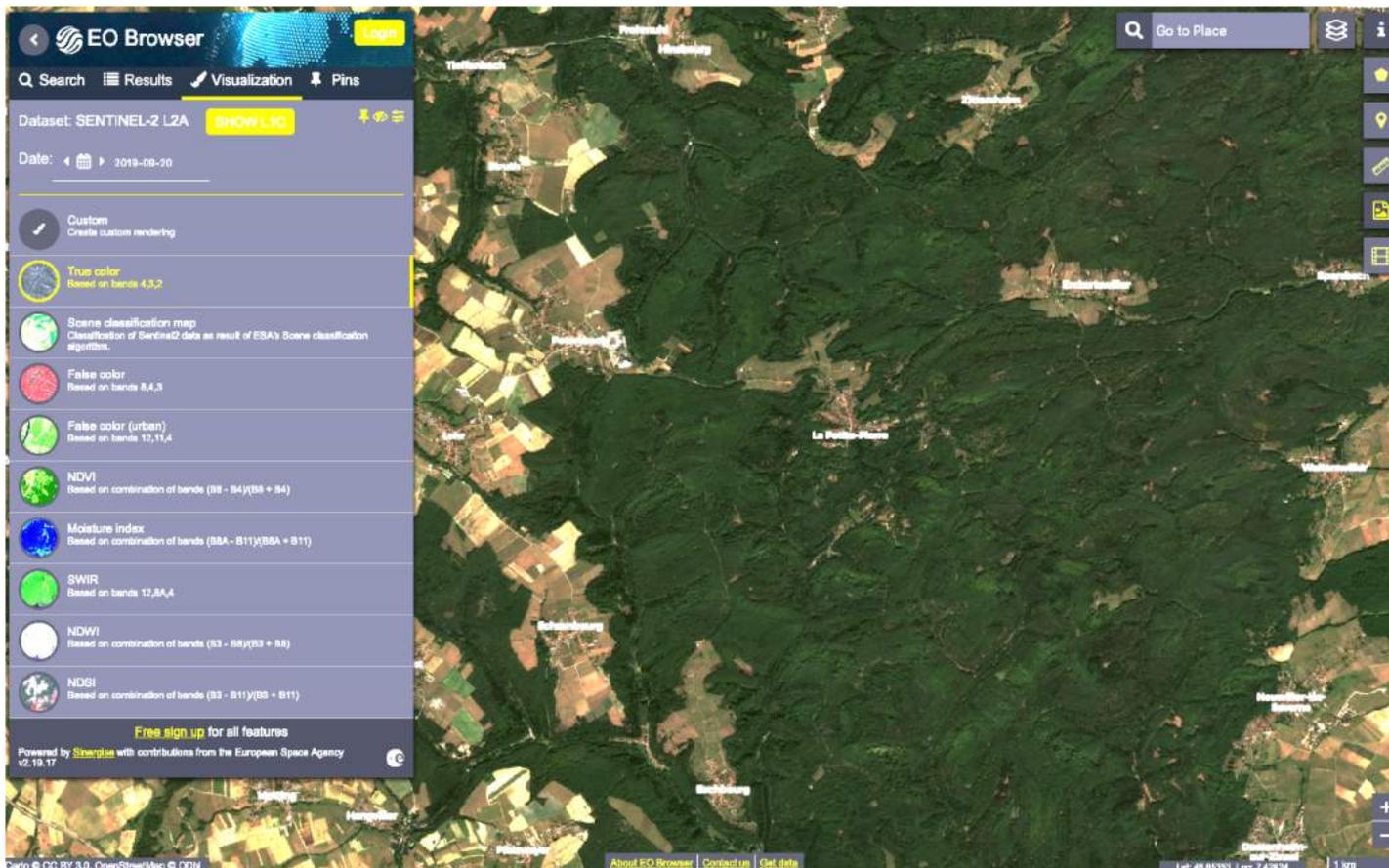


Collaborative mirror sites



International partners mirror sites disseminating towards own national communities



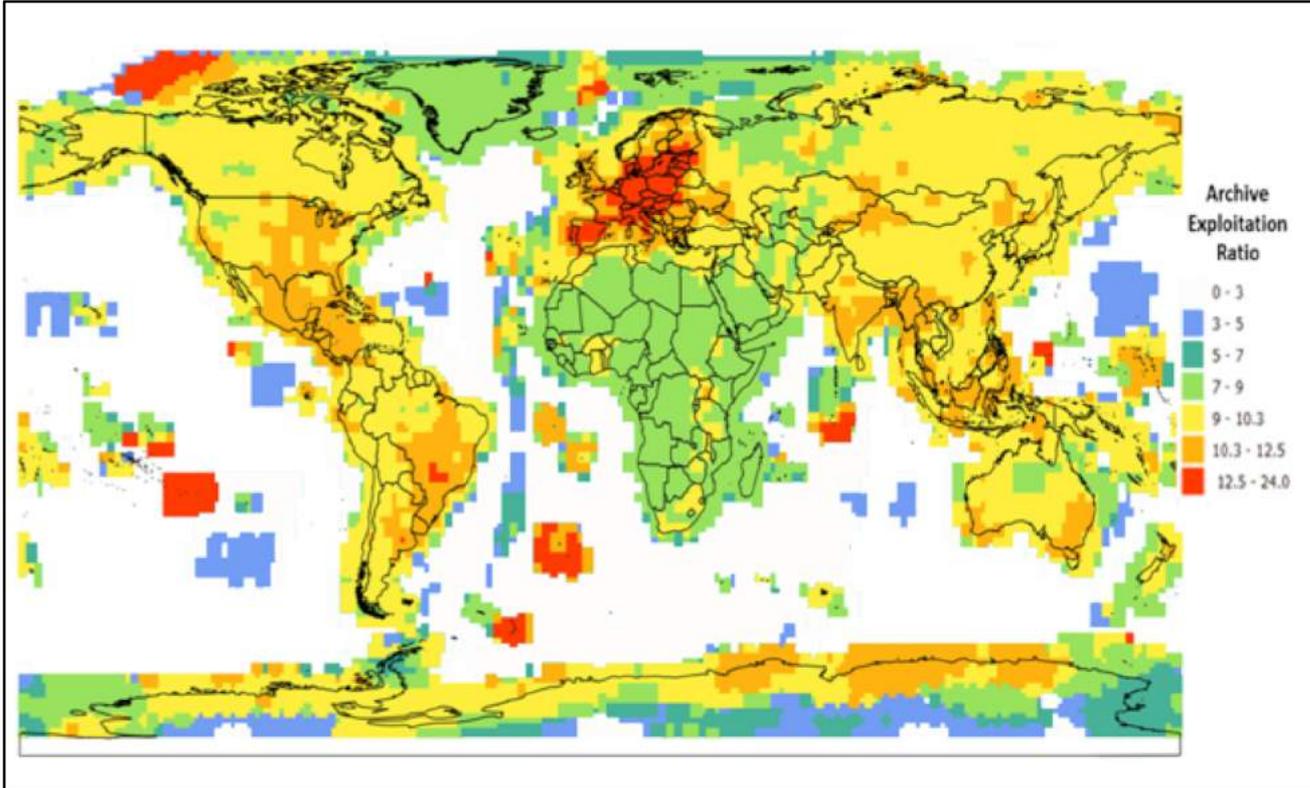


The screenshot displays the EO Browser application interface. The main map shows a satellite view of a rural landscape with fields and forests. The left sidebar contains the following options:

- Dataset: SENTINEL-2 L2A
- Date: 2019-09-20
- Custom: Create custom rendering
- True color: Based on bands 4,3,2
- Scene classification map: Classification of Sentinel2 data as result of ESA's Scene classification algorithm.
- False color: Based on bands 8,4,3
- False color (urban): Based on bands 12,11,4
- NDVI: Based on combination of bands (B8 - B4)/(B8 + B4)
- Moisture index: Based on combination of bands (B8A - B11)/(B8A + B11)
- SWIR: Based on bands 12,8A,4
- NDWI: Based on combination of bands (B3 - B8)/(B3 + B8)
- NDSI: Based on combination of bands (B3 - B11)/(B3 + B11)

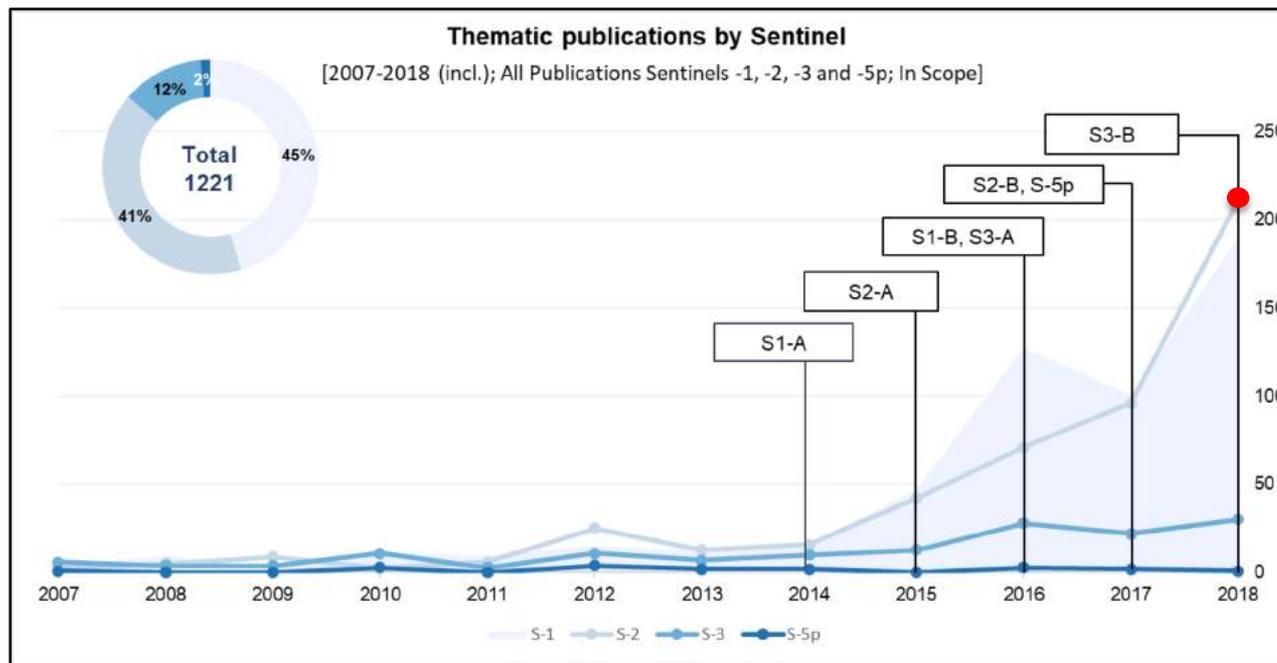
At the bottom of the sidebar, it says "Free sign up for all features" and "Powered by Starline with contributions from the European Space Agency v2.19.17".

Data Access / Archive Exploitation Ratio



Available online

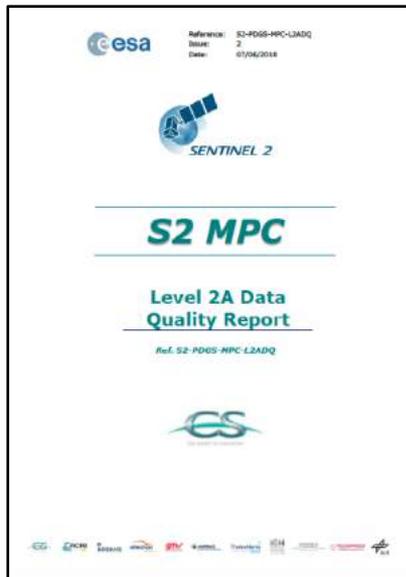
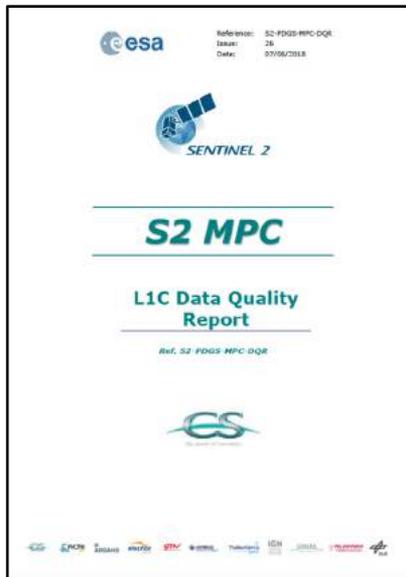
Sentinel-2 Thematic Journal Publications



For Sentinel-2, the bulk of the publications focus on Agriculture and Land Ecosystems, followed by Forests and Inland Water.

Copernicus study by EARSC "Exploring sectoral uptake of Sentinel data within academic publications"

Sentinel-2 products performance status



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You are here Home > User Guides > Sentinel-2 MSI > S2-MSI Document Library

Sentinel 2 Document Library

Sentinel-2 L1C Data Quality Report Issue 26 (June 2018)
This document provides the status of the Sentinel-2 Level-1C product quality as it stands in June 2018. It updates the information supplied in previously issued Reports.
[Read more...](#) [PDF](#)

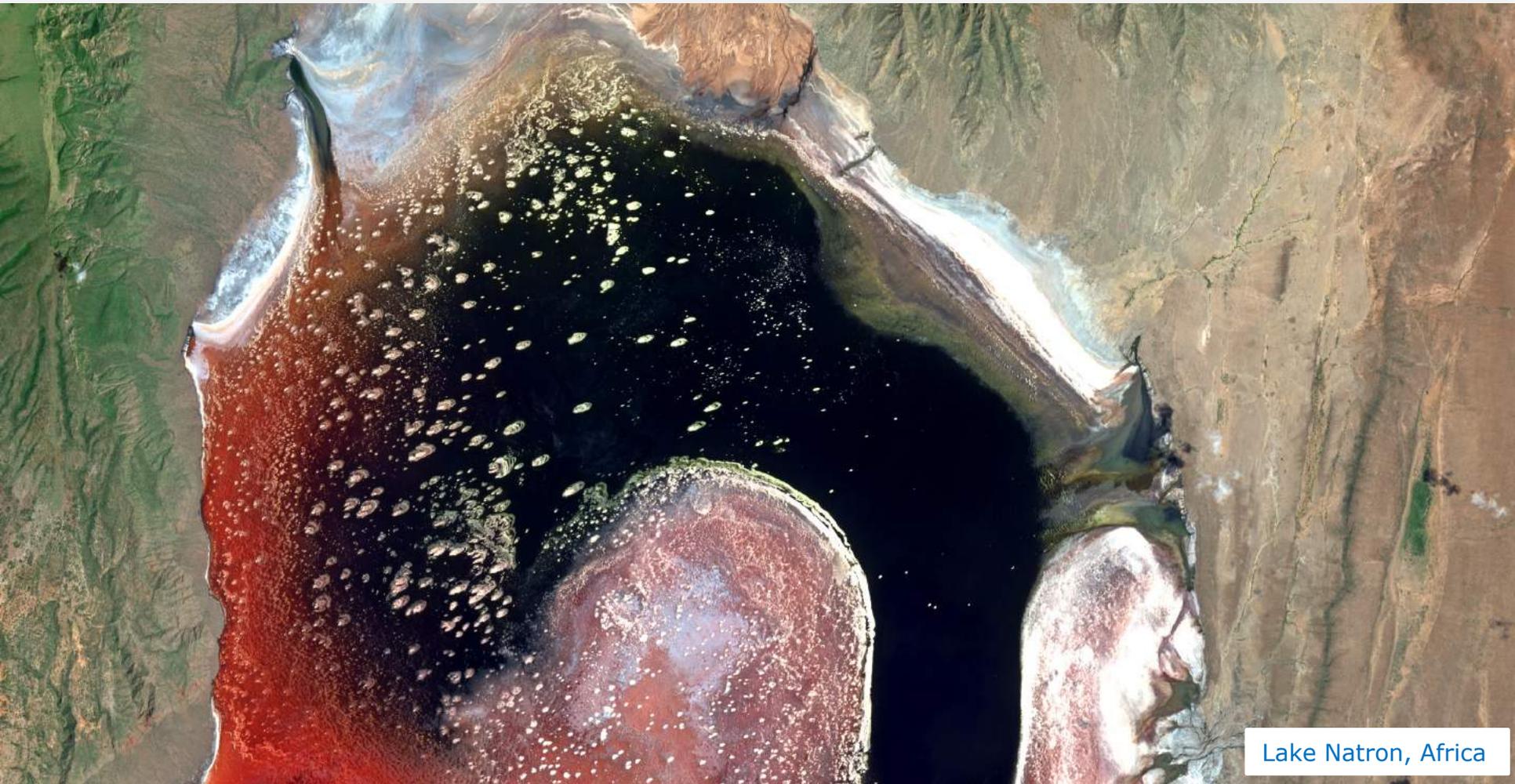
Sentinel-2 L2A Data Quality Report Issue 02 (June 2018)
This document provides the status of the Sentinel-2 Level-2A product quality as it stands in June 2018. It updates the information supplied in previously issued Reports.
[Read more...](#) [PDF](#)

<https://earth.esa.int/web/sentinel/user-guides/sentinel-2-msi/document-library>

API for Anomalies Checking: <https://sentinels.copernicus.eu/web/sentinel/user-guides/sentinel-2-msi/sentinel-2-anomalies/>



Level-1C Products Geometric Performances



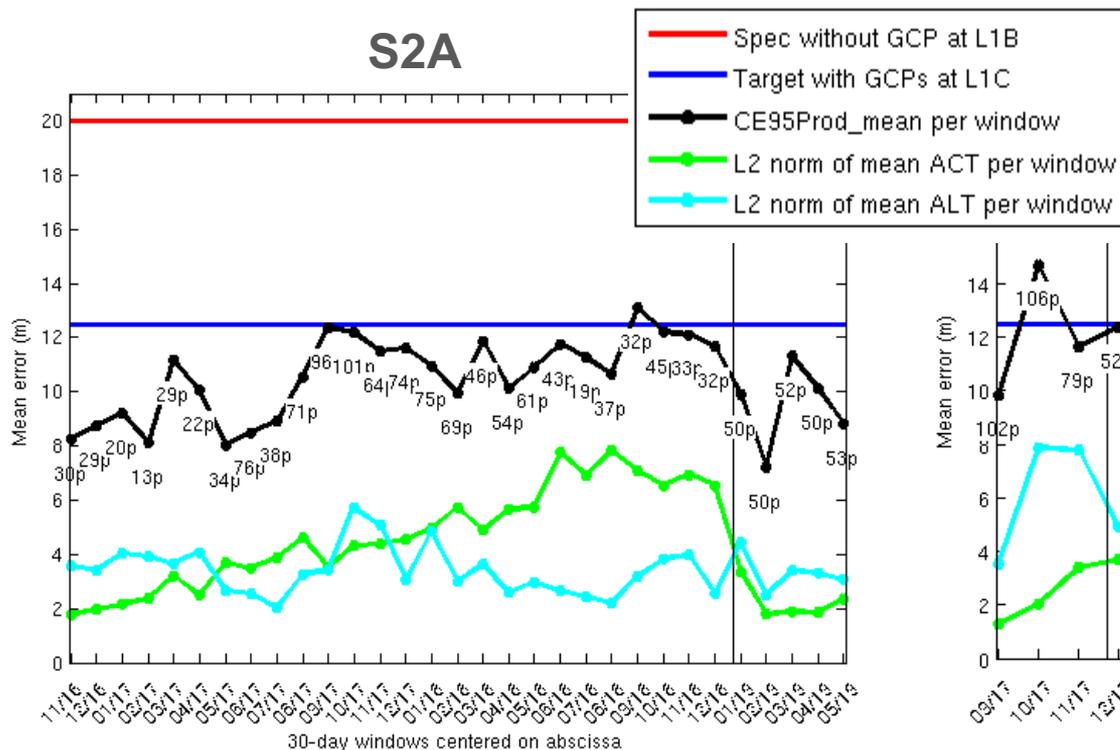
Lake Natron, Africa

Level-1C - Geolocation accuracy

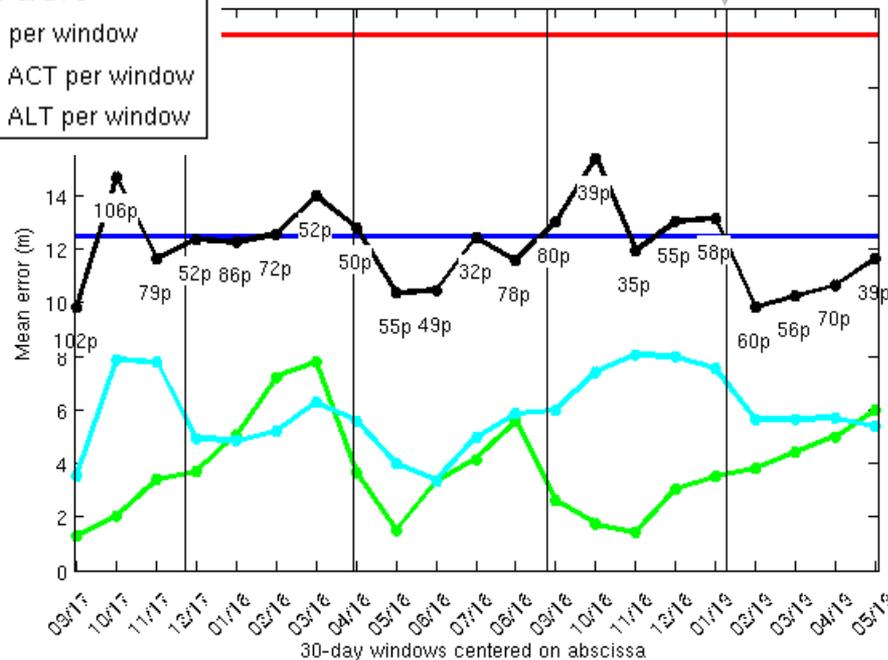


calibrations

S2A



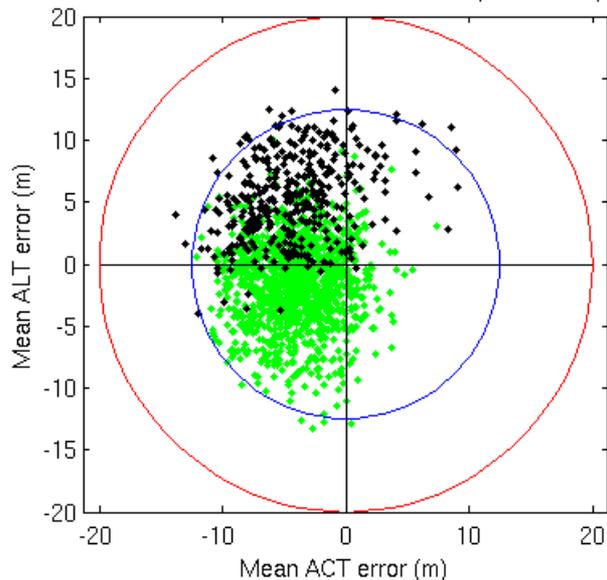
S2B



Level-1C - Geolocation accuracy

S2A

Mean ACT/ALT error measured in each hemisphere over products

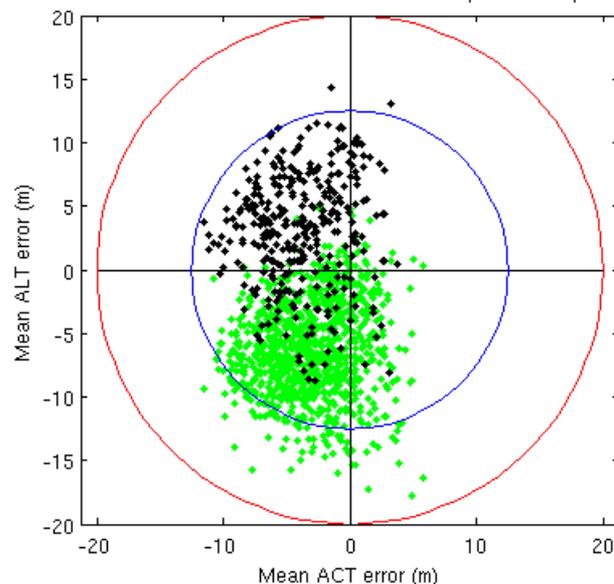


1602 L1C products

Circular error @95.45% conf. level: 11.40 m

S2B

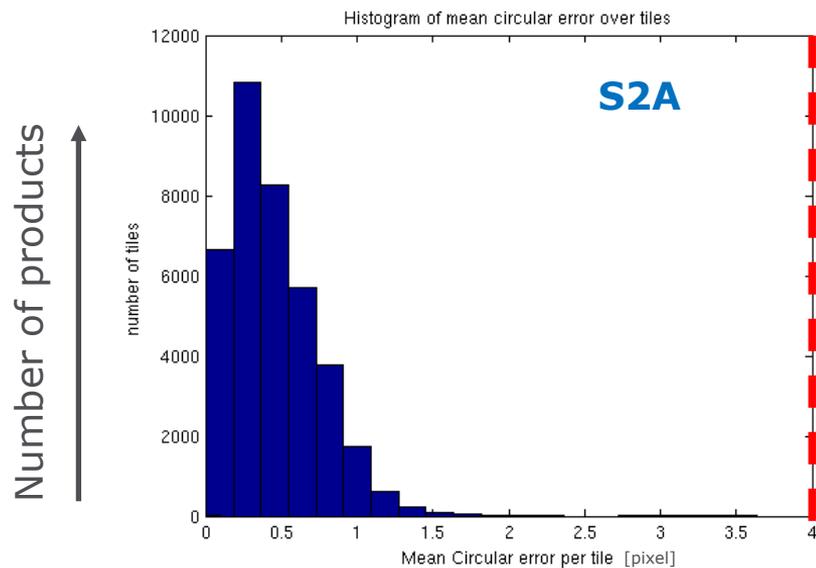
Mean ACT/ALT error measured in each hemisphere over products



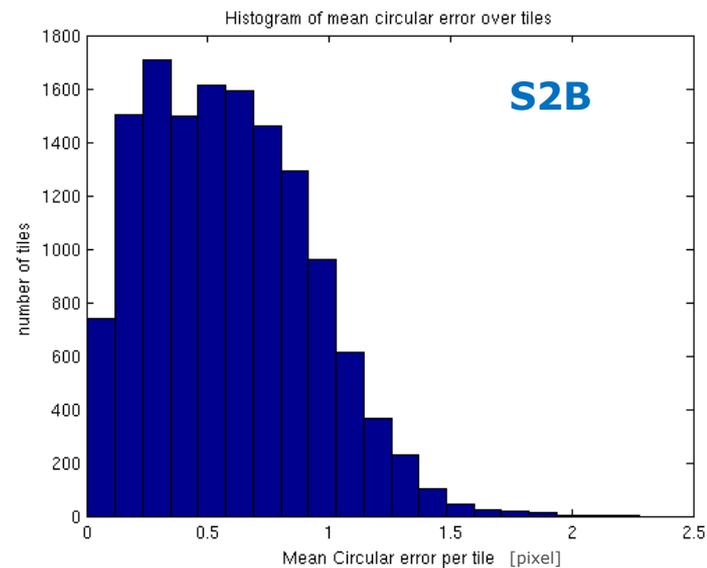
1338 L1C products

Circular error @95.45% conf. level: 12.93 m

Level-1C - Multi-temporal co-registration



Mean Circular Error at 2σ : 1 pixel
1430 products (06/2016 - 05/2019)



Mean Circular Error at 2σ : 1.19 pixel
922 products (05/2017 - 05/2019)

Level-1C - Multi-spectral registration

BAD multi-spectral registration



GOOD multi-spectral registration



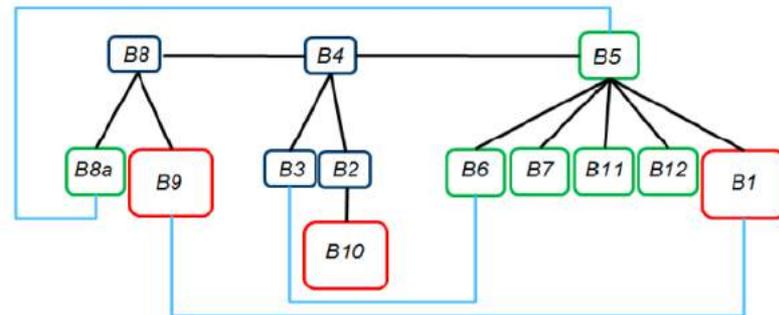
Example

Level-1C - Multi-spectral registration

CE@99,73%	B01	B04	B05	B11
B02		0,152		
B03		0,122		
B06			0,070	
B07			0,088	
B08		0,121		
B8A			0,096	
B09	0,221			
B11			0,179	
B12			0,166	0,124

CE@99,73%	B01	B04	B05	B11
B02		0,141		
B03		0,094		
B06			0,068	
B07			0,076	
B08		0,130		
B8A			0,089	
B09	0,167			
B11			0,146	
B12			0,161	0,118

S2A



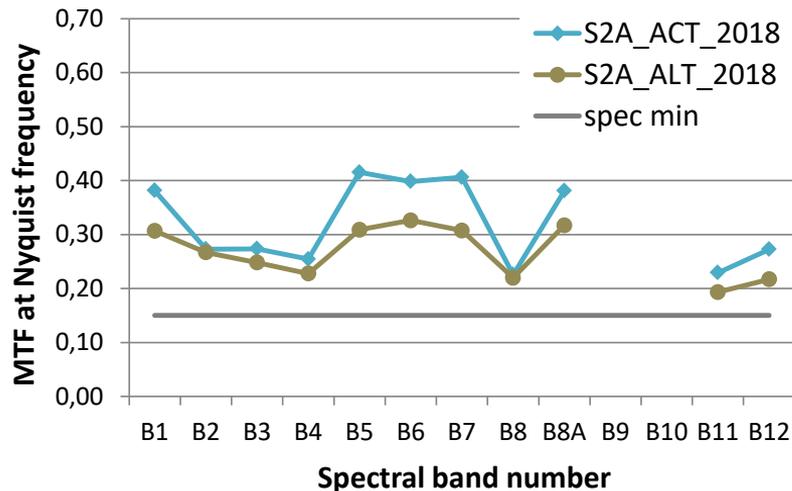
Requirement met for all the tested band couples: <0.3 pixel at 99.7% conf. level

S2B

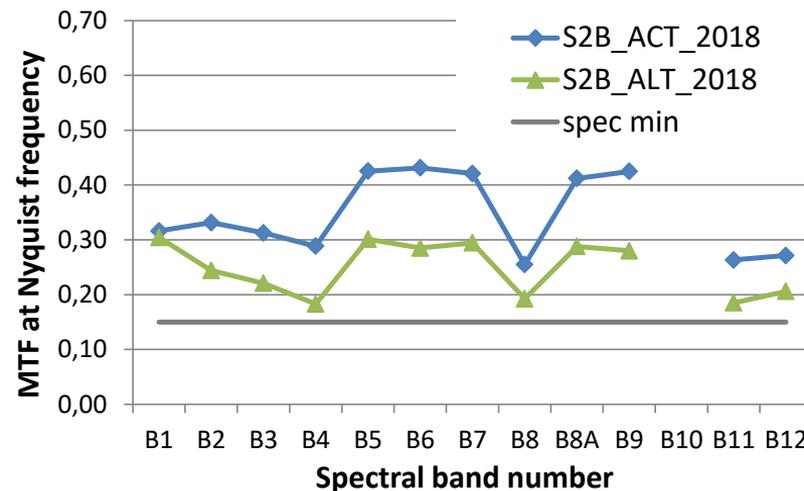
Level-1C - Spatial Resolution

Band	1	2	3	4	5	6	7	8	8a	9	10	11	12
Spatial Resolution [m]	60	10	10	10	20	20	20	10	20	60	60	20	20

S2A



S2B



Mission Outlook



Lake Mackay, western Australia

Mission Outlook (up to 2020)



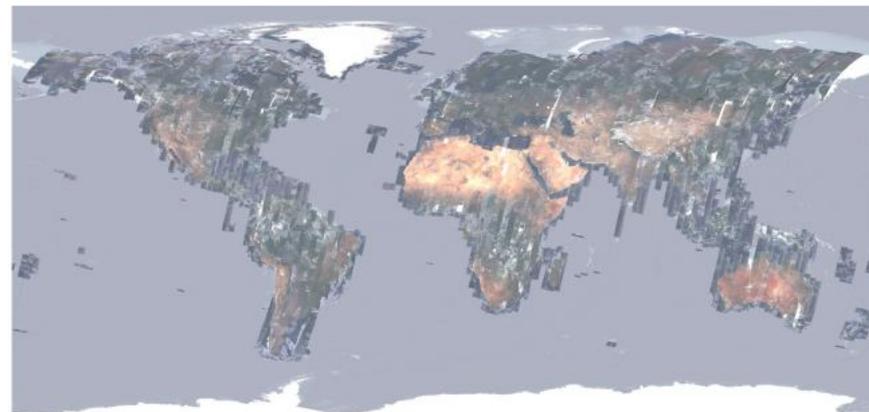
- ✧ Expansion of Observation Scenario starting on 20 October 2019.
- ✧ Level-2A on-demand service for Copernicus Services before end 2019, and later to all users.
- ✧ Sentinel-2 Level-1B products will be distributed in a rolling-archive before the end of 2019.
- ✧ On-line products anomaly database with Application Program Interface (API) by Q4 2019.
- ✧ Start of the geometry-refined production using the Global Reference Image (GRI) in Q1 2020.
- ✧ Usage of Copernicus DEM for Level-1C and Level-2A productions (Q1 2020 for 90m resolution DEM, and Q4 2020 for 30m resolution DEM).
- ✧ Definition of the orbital configuration when including Sentinel-2C.
- ✧ Collection of new user requirements from EC / Copernicus Services.
- ✧ Improvement of Level-1C and Level-2A products (in particular for cloud screening).
- ✧ Generation of Level-2H (harmonised) and Level-2F (fused) demonstration products.

- L1 processor is being upgraded to improve geolocation and multi-temporal co-registration beyond the initial mission requirements.
- Processing based on the usage of a **GRI (Global Reference Image)** as a source of Ground Control Points (GCPs).



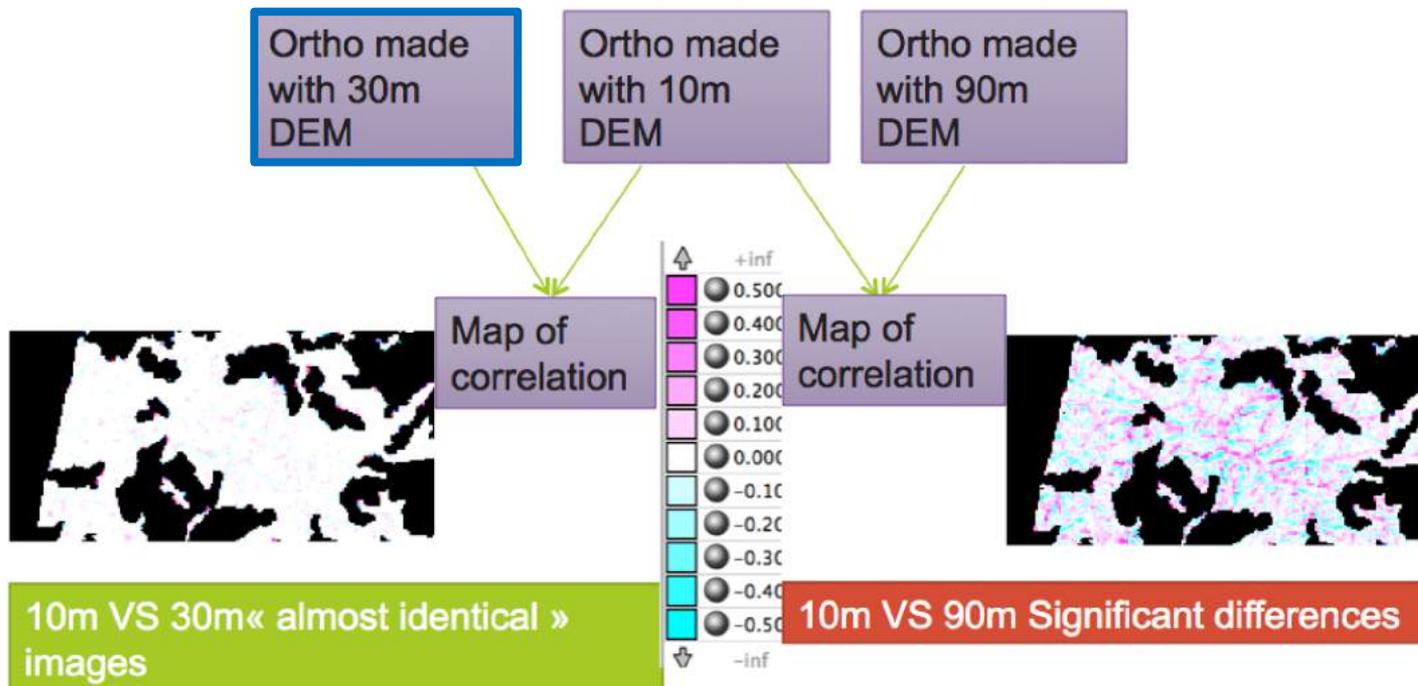
GRI is a full repeat cycle dataset of well-localized and as cloud-free as possible mono-spectral (band 4) Level-1B products

- Elaboration of the GRI has been completed.
- Final validation steps are on going.



Mission Outlook / Digital Elevation Model (DEM)

- DEM will be upgraded (with Copernicus DEM) to improve geolocation over mountainous regions.



- ✧ Following an open tender, ESA selected WorldDEM™ (derived from TerraSAR-X / TanDEM-X mission).
- ✧ “Copernicus DEM” project with Airbus was kicked-off on 5th August 2019.

DEM instance	Geographical coverage	Horizontal sampling	DEM licence
Global (GLO-90-F)	Global	90 m	Full, free and open
Global (GLO-30-R)	Global	30 m	Restricted
Europe (EEA-10-R)	EEA39	10 m	Restricted

- ✧ The delivery of all Copernicus DEM instances to users will start before end 2019 through the following website: <https://spacedata.copernicus.eu/>



Licence for the use of Copernicus DEM instances COP-DEM-GLO-30-R and COP-DEM-EEA-10-R

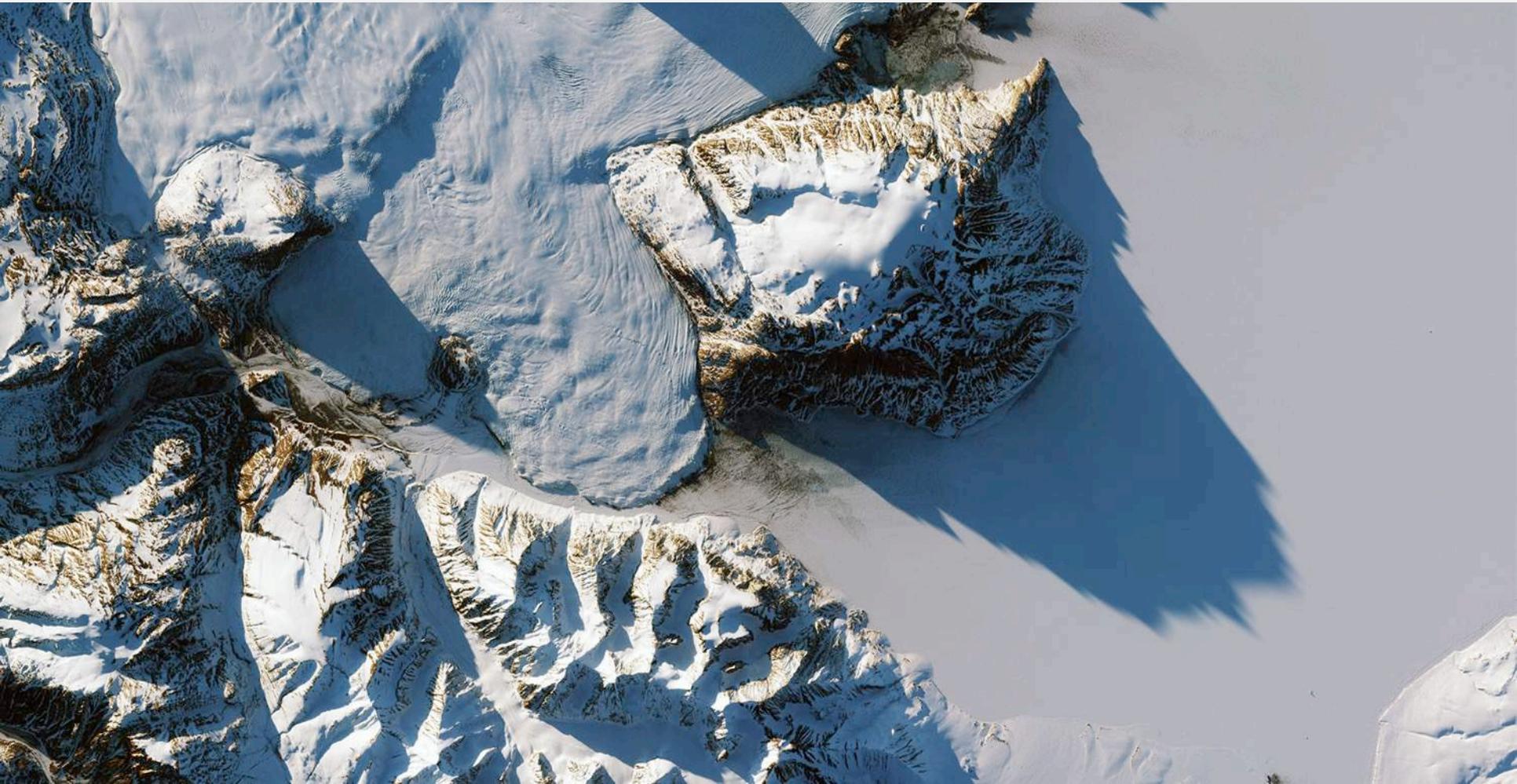
- 3.2. Purpose of Use
- 3.2.1. The 'Institutions and Bodies of the EU', as well as the contractors of those entities may use (DOWNLOAD) the Primary Products and Altered Products for activities whose purpose is within the EU Public Tasks.
 - 3.2.2. 'Operators of Copernicus Space Infrastructure and Copernicus Services', as well as the contractors of those entities may use (DOWNLOAD) the Primary Products for activities whose purpose is within the EU Public Tasks or relate to Copernicus, including testing and demonstration activities.
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 - 3.2.4. Participants in a project financed under the Union research programmes or other EU grant support programme may use (DOWNLOAD) the Primary Products and Altered Products for the purpose of their project.
 - 3.2.5. Participants in a project financed by the 'Operators of Copernicus Space Infrastructure or Copernicus Services' may use (DOWNLOAD) the Primary Products and Altered Products for the purpose of their project.
 - 3.2.6. Any natural or legal person (General Public) may trigger the use of the Primary Products to generate on-demand Copernicus data and Copernicus information to download them or use them in the on-demand computing environment without effectively having access to the values contained in the Primary Products themselves.

Mission Outlook / Level-2F demonstration product

Objective: To combine S2 with Landsat in a single fused data stream with S2 characteristics in terms of spatial resolution and spectral response.

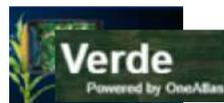


Applications

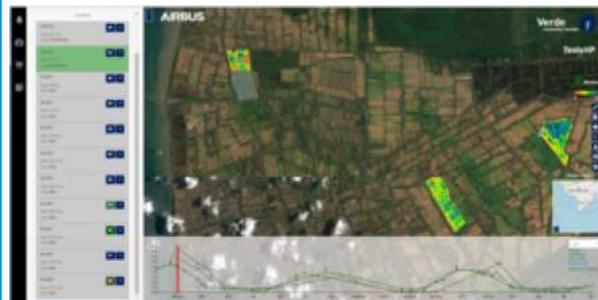


Large range of applications...

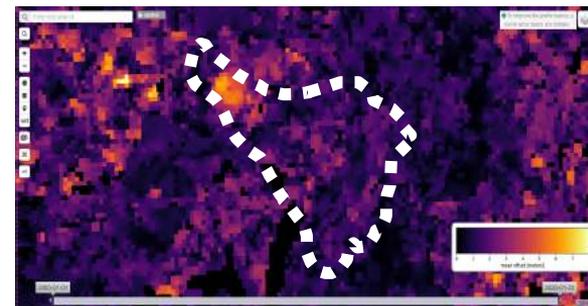
Iceberg Monitoring



Smart Farming



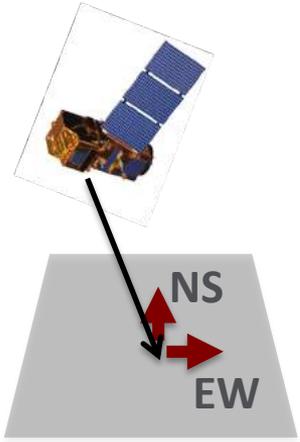
Ground motion



Space borne InSAR

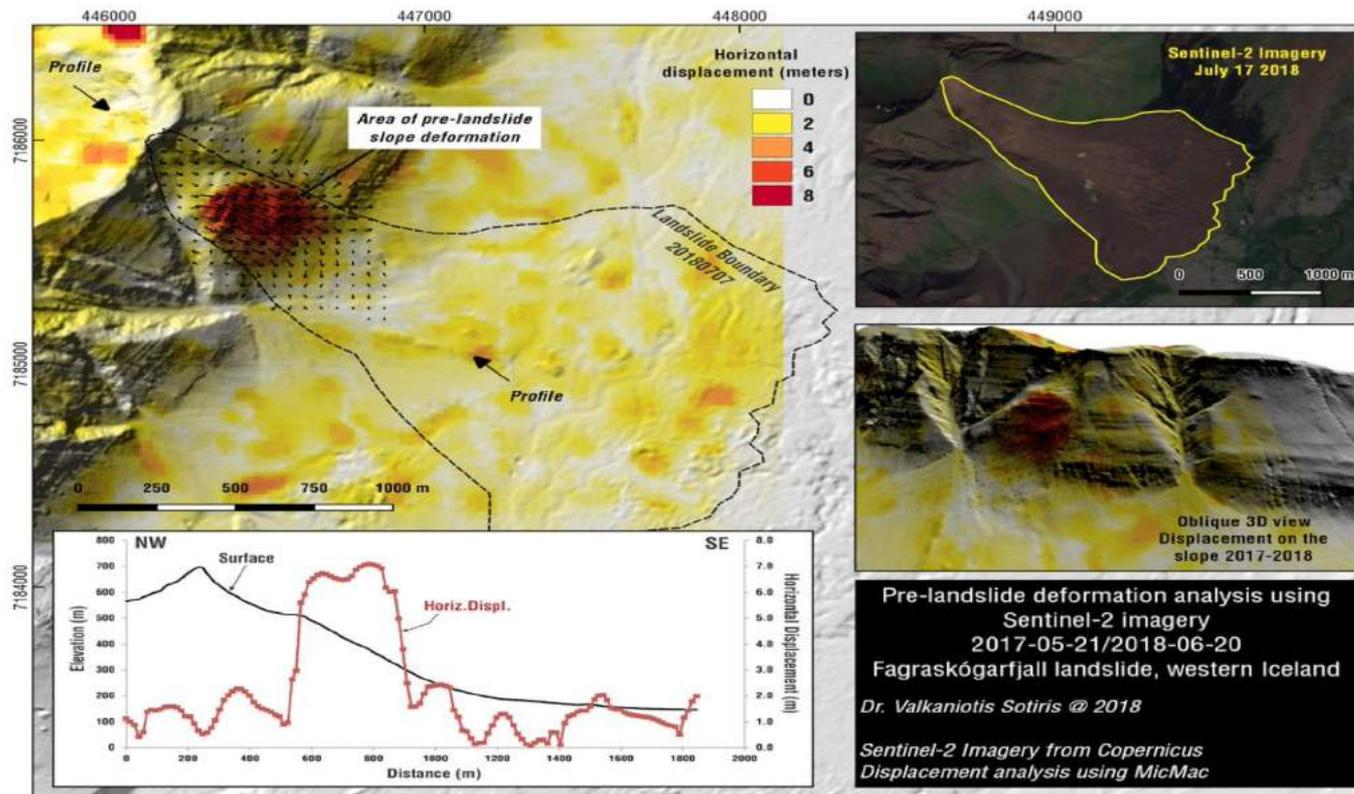
- 
- Sensitive to motion in the LOS i.e. sensitive to EW and vertical motion. Poorly sensitive to NS motion.
 - Millimetric accuracy.
 - Monitoring of very small (mm) to cm motion. In cas of larger motion, decorrelation usually prevents to monitor the deformation.
 - Non sensitive to cloud cover.

Space borne Optical Image Correlation

- 
- Sensitive to Horizontal movement, Non sensitive to vertical motion.
 - Sup-pixel accuracy (in general metric to cm).
 - Monitoring of large movement (metric). Smaller movement can also be measured depending on satellite pixel size.
 - Sensitive to cloud cover.

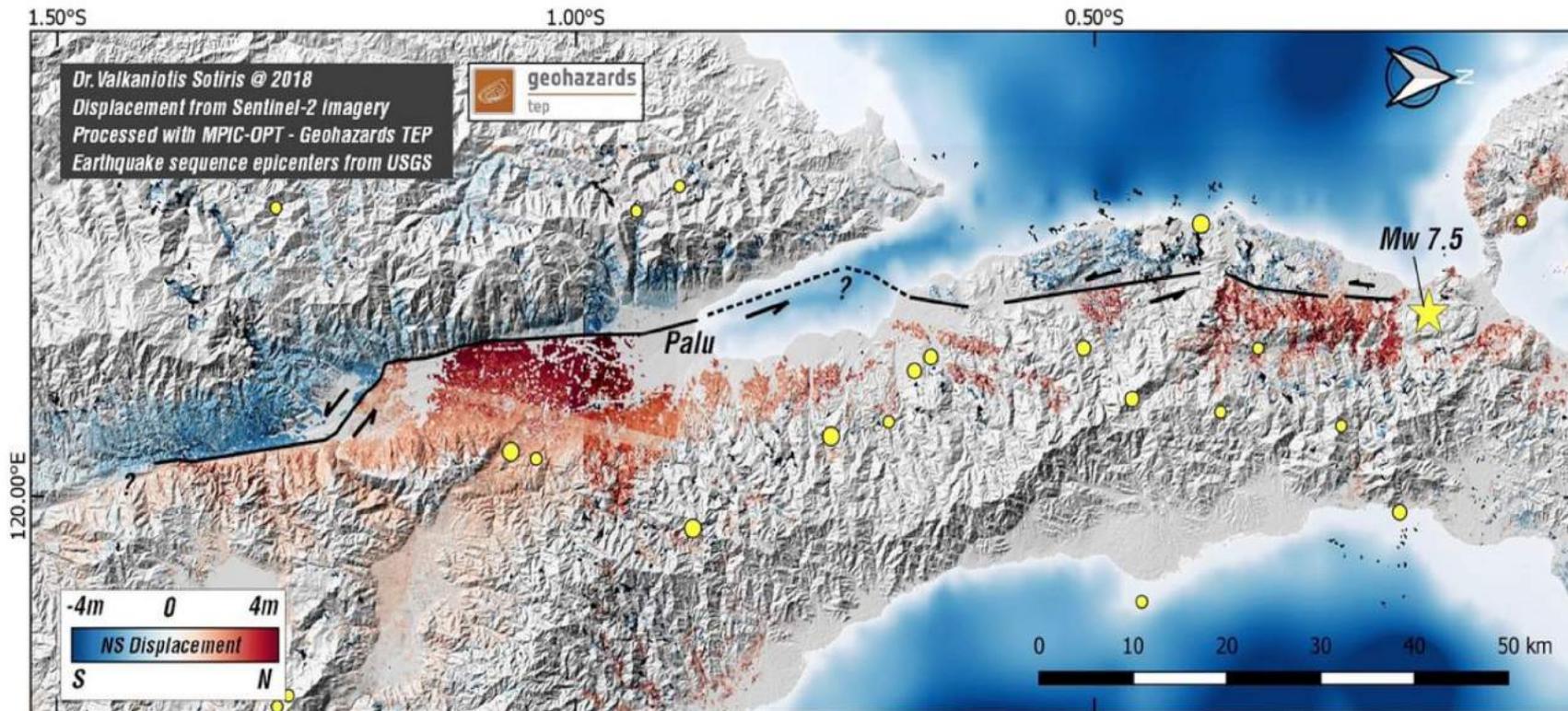
- This two techniques are complementary to retrieve the complete 3D displacement for different magnitude of deformation

Ground Motion (Landslides)

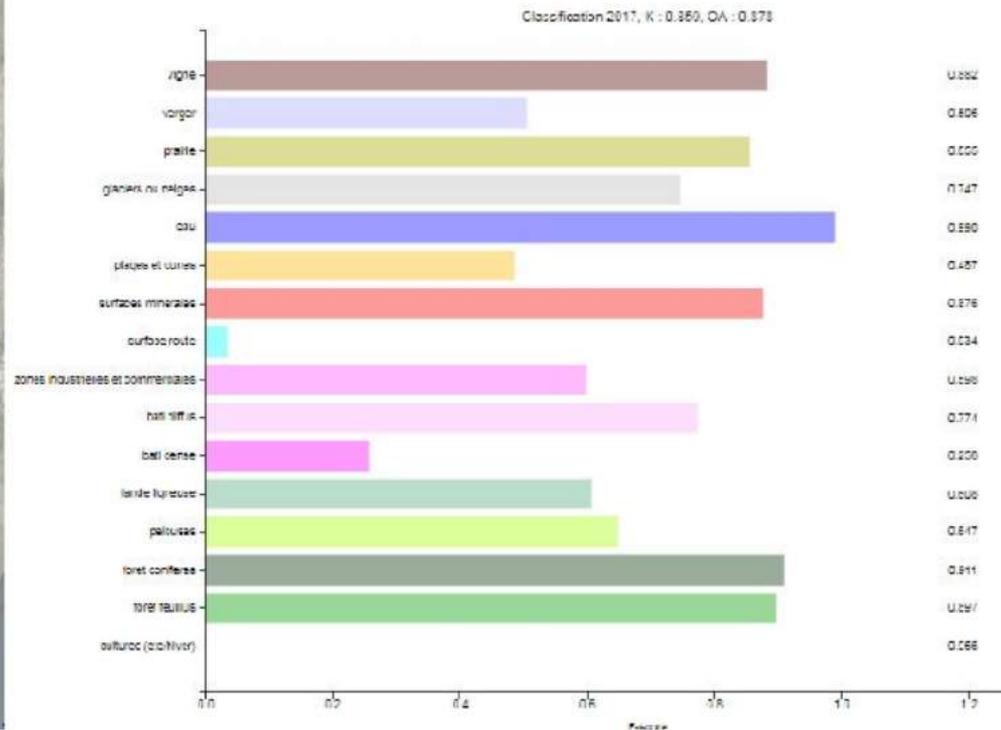


Pre-landslide deformation analysis using Sentinel-2 imagery
2017-05-21/2018-06-20
Fagraskógarfjall landslide, western Iceland
Dr. Valkaniotis Sotiris @ 2018
Sentinel-2 Imagery from Copernicus
Displacement analysis using MicMac

Ground Motion (Strong Earthquakes)



Land cover/use classification



Deforestation Monitoring



**3 years of deforestation
(Mato Grosso, Brazil)**

Water Quality Monitoring

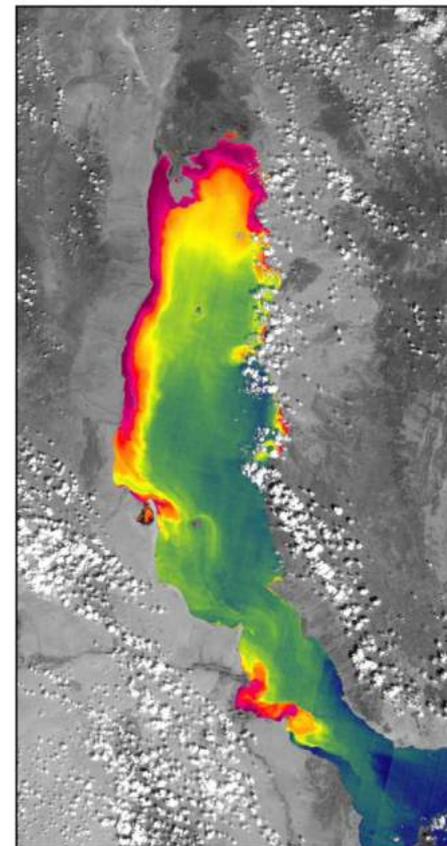
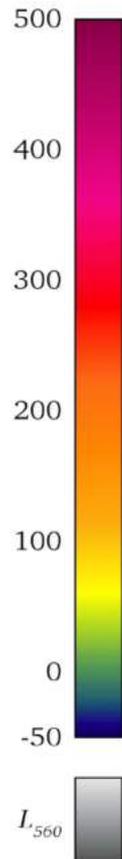
Lake Turkana

— 2015-12-09

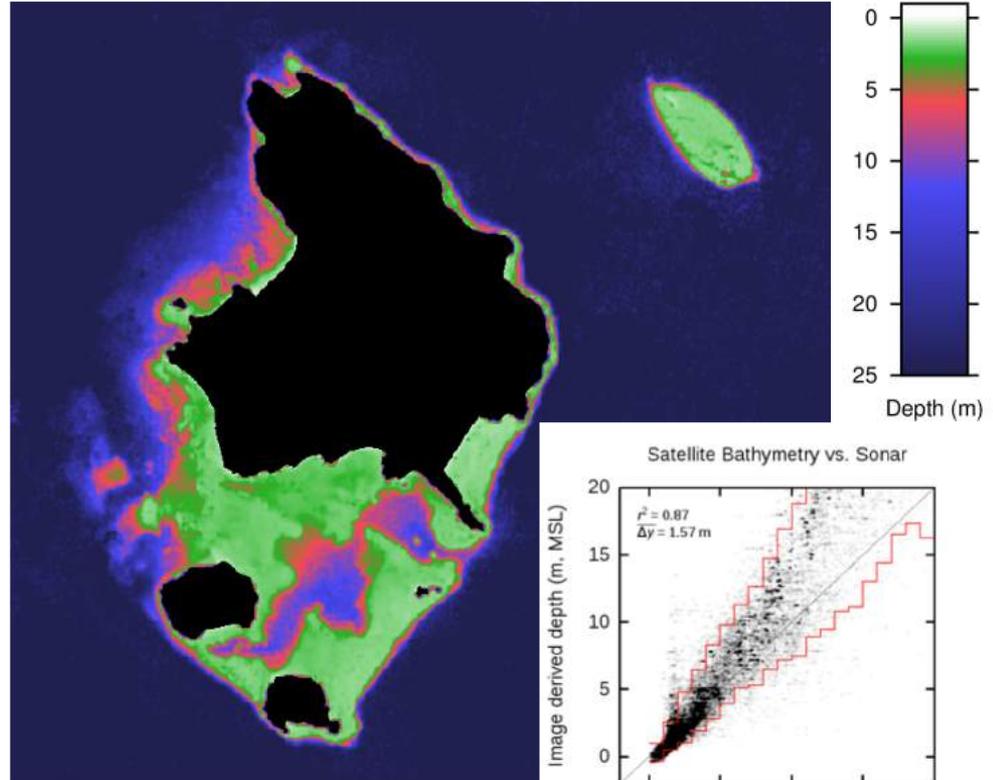


Getintravel

S-2 Maximum Chlorophyll Index [dl]

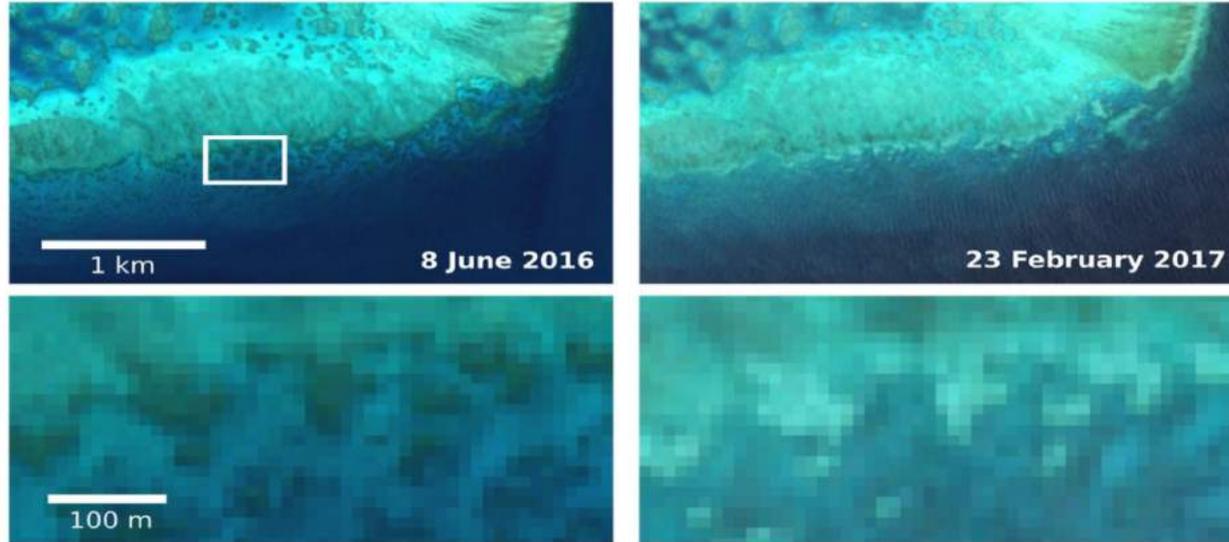


Bathymetry

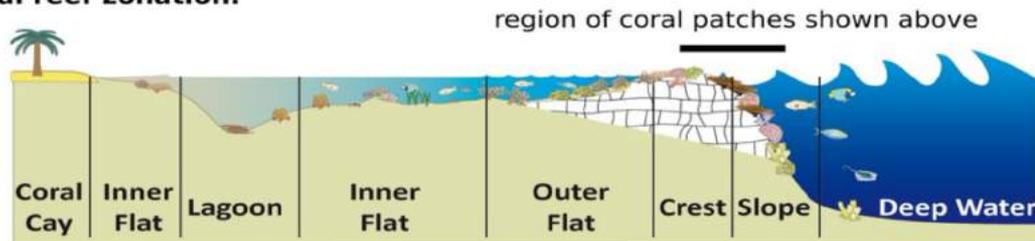


Lizard Island, Great Barrier Reef

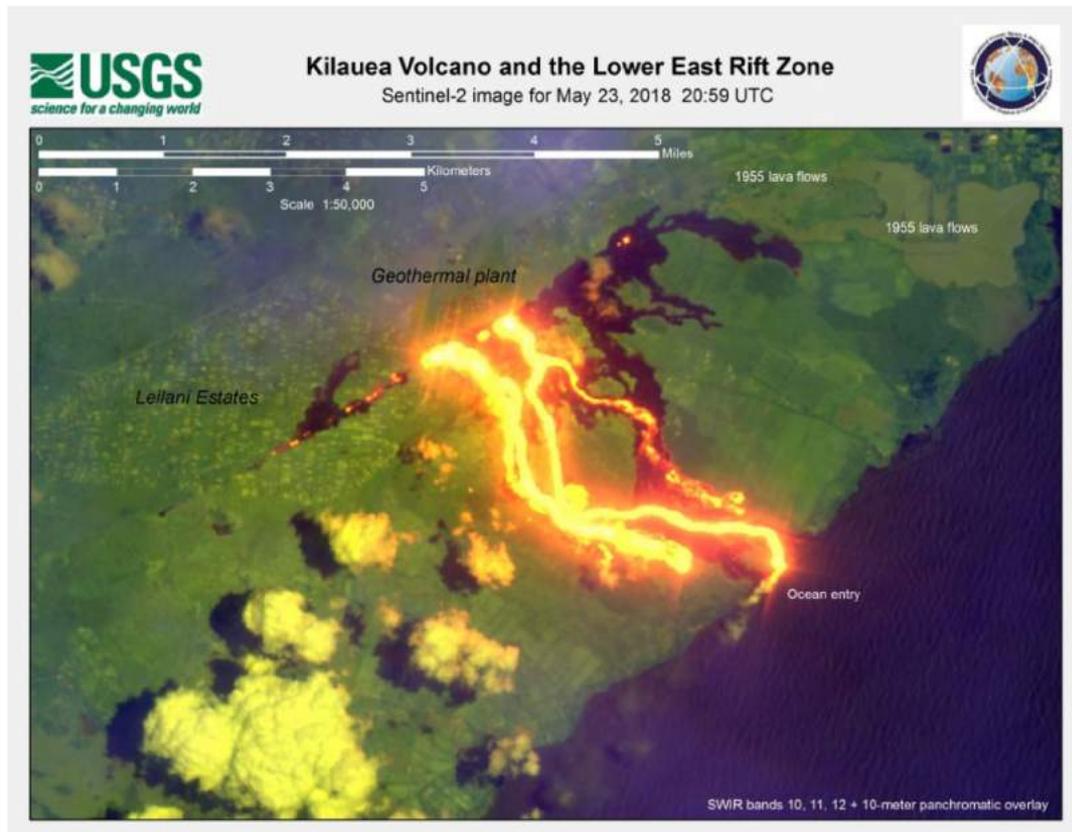
Coral reefs bleaching seen by Sentinel-2



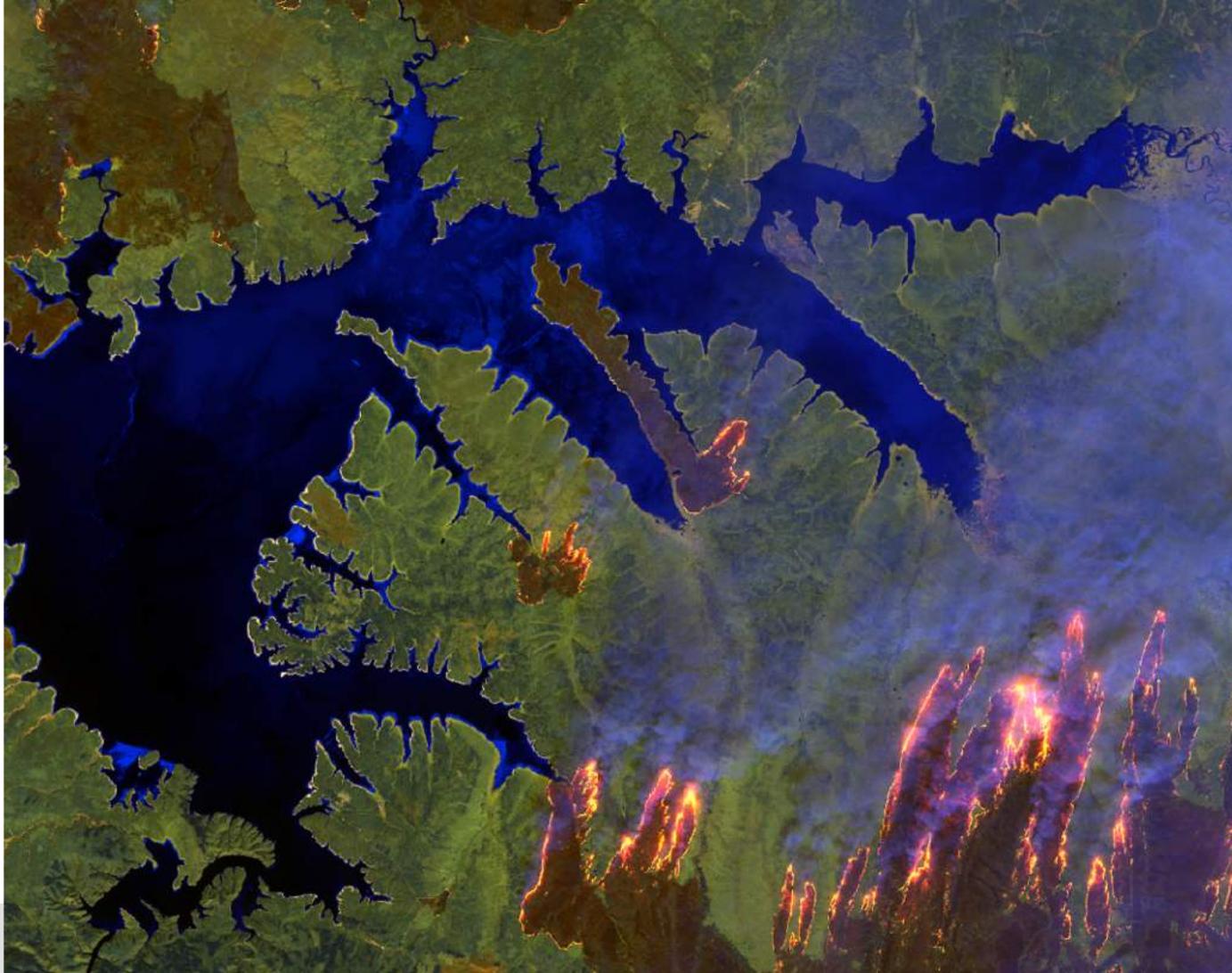
Typical reef zonation:



Emergencies







Many thanks for your attention!

