Focus on

- Update on Copernicus Space Segment

- ESA's contribution to FDA activities

  - Copernicus Data Access

  - Data and Information Access Services (DIAS)

- ESA's contribution to ARD activities

  - Current data products over land

  - Future developments

- Further ARD consultations

  - Land Product Validation and Evolution Workshop

  - IGARSS 2018

Copernicus Space Segment – update

Sentinel-1 overall mission status

- Sentinel-1 **nominal routine operations on-going**
  - Overall mission in a very good shape
  - The mission provides: global and routine coverage, with a systematic production scenario,
  - Sentinel-1A and -1B data routinely provided to Copernicus Services and users worldwide
  - On-going support to various activations from the Copernicus Emergency Management Service and International Charter Space and Major Disasters
- **Sentinel-1 constellation generates now 11 TB of products daily** (against a specification of 3 TB)

- **Sentinel-1 is operated close to its full mission capacity** (i.e difficulty to accommodate additional observations)

- **Upcoming activities**
  - Identify and implement mission evolution to support new user needs, assess an increased system capacity enabling further mission exploitation, etc.
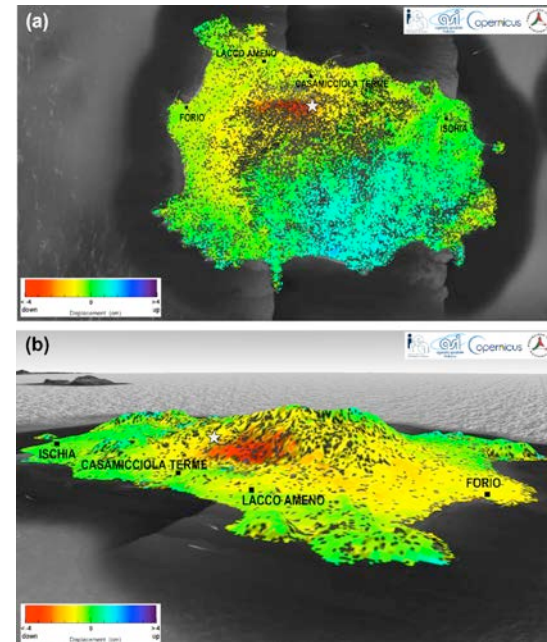
Md 4.0 Earthquake in Ischia, Italy, 21/08/2017.
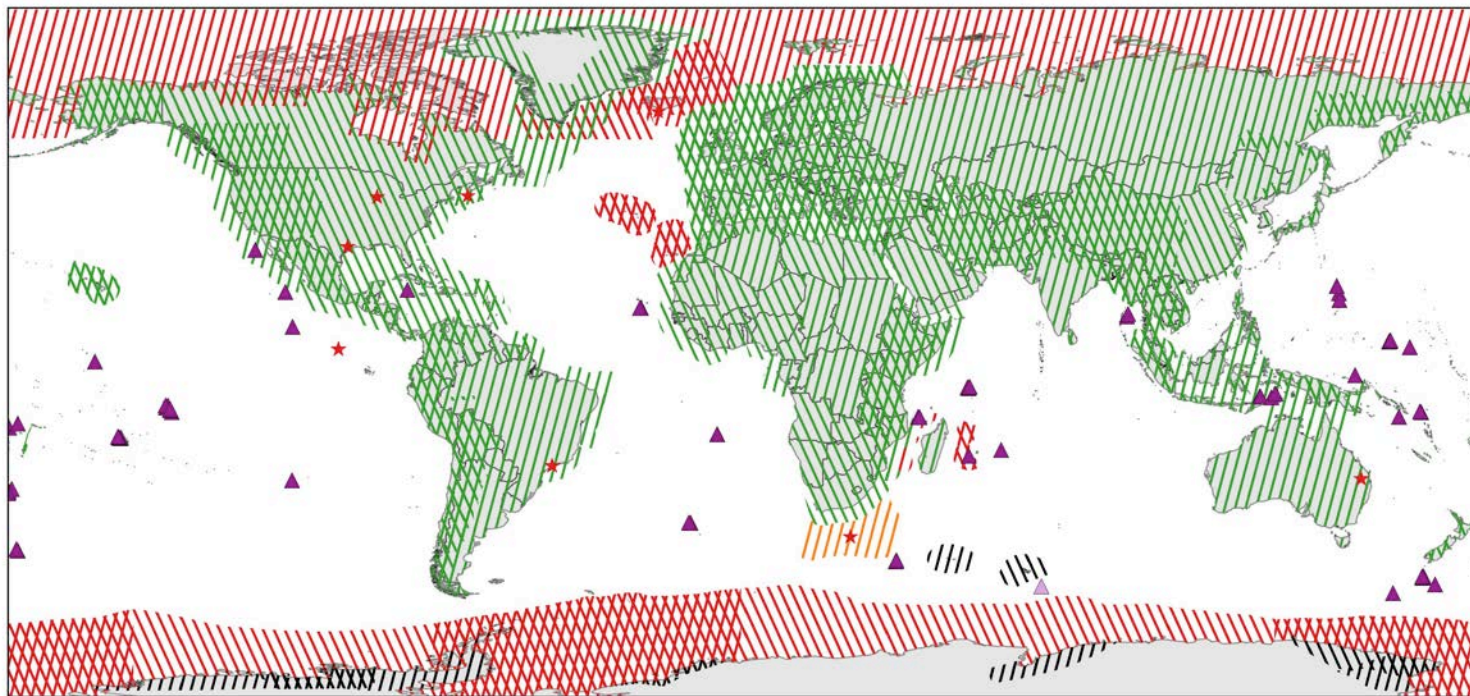Ground deformation measured by Sentinel-1

© Contains Copernicus Sentinel Data (2017) / CNR-IREA

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Sentinel-1 Constellation Observation Scenario: Mode - Polarisation - Observation Geometry

sentinel-1

esa

validity start: 05/2017

POLARISATION SCHEMA

HH or HH-HV

VV or VV-VH

HH or HH-HV

MODE / POLARISATION

- IW mode / dual polarisation
- IW mode / single polarisation
- EW mode / dual polarisation
- EW mode / single polarisation

PASS

- ASCENDING
- DESCENDING

▲ SM mode / dual-polarisation
▲ SM mode / single-polarisation

★ Calibration Site

(locally different modes or polarisations possible)

European Space Agency
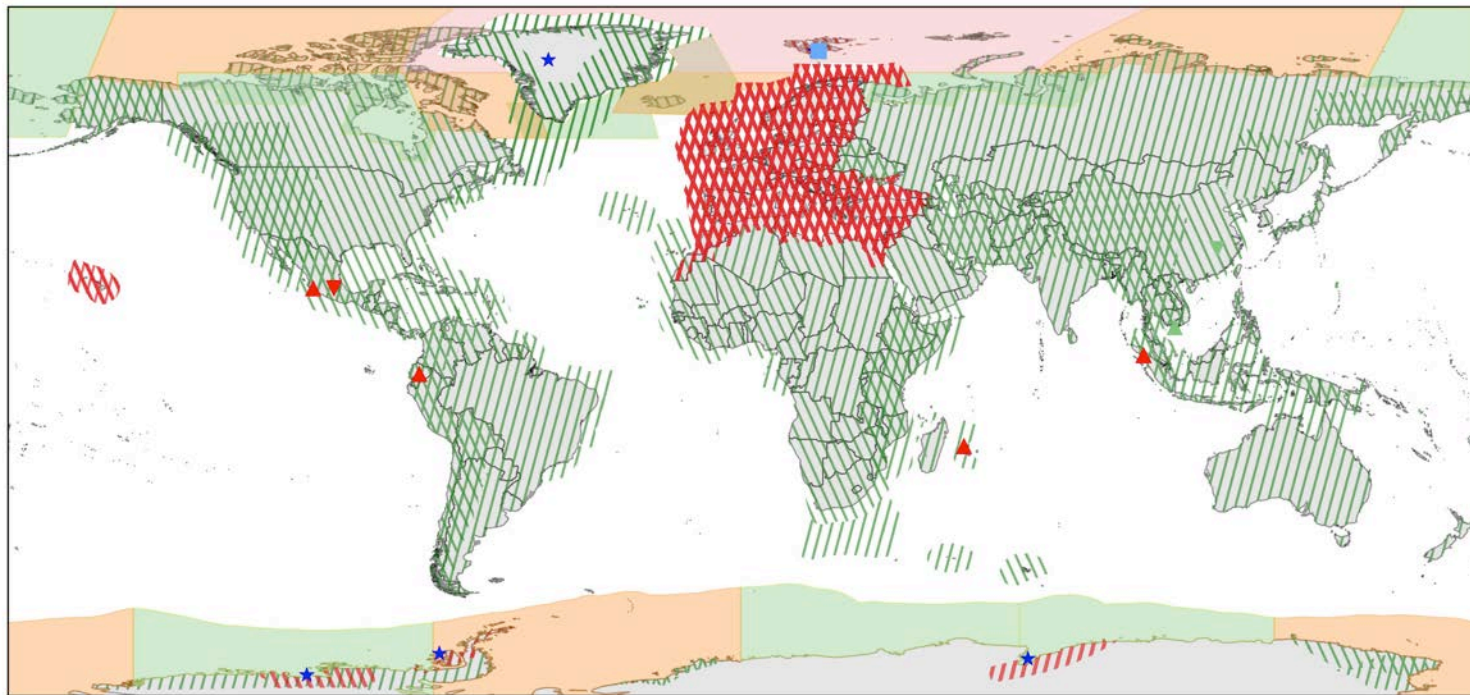
Sentinel-1 Constellation Observation Scenario: Revisit & Coverage Frequency

sentinel-1

esa

validity start: 05/2017

PASS	REVISIT	FREQUENCY *		COVERAGE	FREQUENCY **		REFERENCE DATA SITES (6d repeat)	
ASCENDING	6 days	12 days		1 days		▲	Highly active volcanism	
DESCENDING				1-3 days		▼	Fast subsidence	
				2-4 days		▲	Short growth cycle, intensive agriculture	
						▼	Fast changing wetlands	
						★	Fast moving outlet glaciers	
						■	Permafrost & glaciers	

* coverage ensured from same, repetitive relative orbits
** coverage not considering repetitiveness of relative orbits

cklenburg | 06/02/2018 | Slide 6

European Space Agency

Sentinel-2 mission status

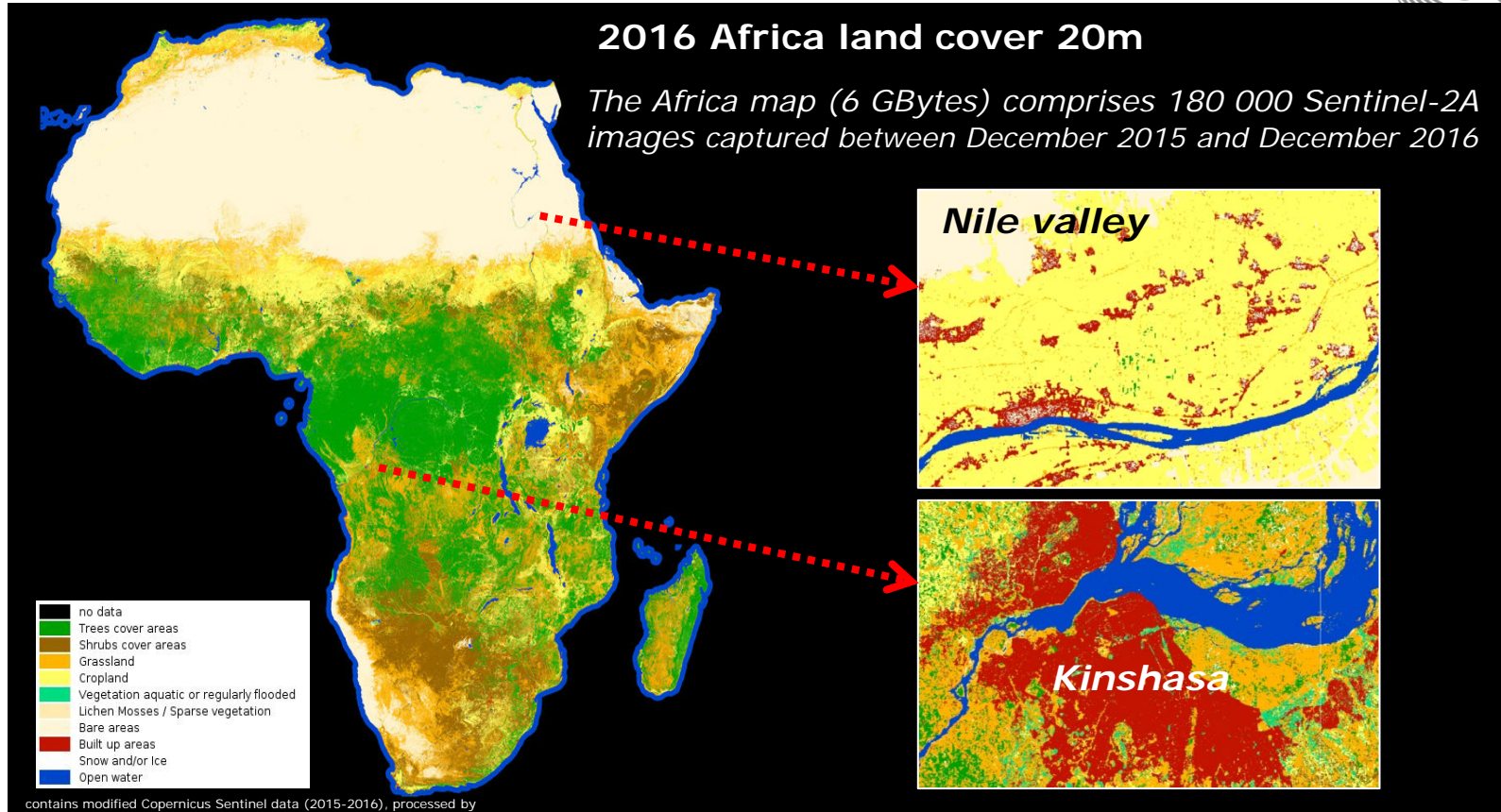- Sentinel-2A and -2B are together acquiring Europe, Africa and Greenland with 5-day revisit and the rest of the World is revisited every 6.6 days in average. Global systematic 5-day revisit will be reached once EDRS or the 4th ground station (Inuvik) become fully operational.

- In addition to the baseline acquisition areas, Antarctica is being imaged every 10 days.

- A new version of the Sentinel-2A spectral response functions has been released. These updated Sentinel-2A spectral responses are mainly changing the responses for bands B01 and B02, correcting inaccurate spectral responses provided previously.

- The systematic global production of Level 2A core products is being implemented in the ground segment. Systematic production using Sen2Cor algorithm is planned to start in Q1 2018 for Europe, and reach full global coverage in mid 2018.

Sentinel-2 Constellation Observation Scenario: Revisit Frequency

Validity start: Jan 2018

- 5 days
- 7 days
- 10 days

Sentinel-2 mission status

2016 Africa land cover 20m

The Africa map (6 GBytes) comprises 180 000 Sentinel-2A images captured between December 2015 and December 2016

Nile valley

Kinshasa

■	no data
■	Trees cover areas
■	Shrubs cover areas
■	Grassland
■	Cropland
■	Vegetation aquatic or regularly flooded
■	Lichen Mosses / Sparse vegetation
■	Bare areas
■	Built up areas
■	Snow and/or Ice
■	Open water

contains modified Copernicus Sentinel data (2015-2016), processed by

Sentinel-3 mission status

- Sentinel-3A is now in **routine operations phase** and has reached full operational capacity: ESA-EUMETSAT Joint Routine Operations Readiness Review – successfully completed in October 2017.

- Overall status of Sentinel-3A is **nominal**, with all space and ground subsystems and instruments (OLCI, SLSTR, SRAL, MWR) performing nominally.

- **All Level 1 and Level 2 Land and Marine core data product have been released.**

- Definition and implementation of **new core data products** (AOD and FRP, EC change request) on-going; sample products expected in Q1/Q2 2018

- **Reprocessing** campaigns, including data from commissioning phase are ongoing for optical and altimetry data.

- Intense on ground **validation activities** are on-going to ensure the best possible user acceptance of the Sentinel-3A products.

- Preparations for **Sentinel-3B launch, planned for April 2018, on-going**, including implementation of the Tandem Phase and orbit phase shift to 140 degree between Sentinel-3A and –B
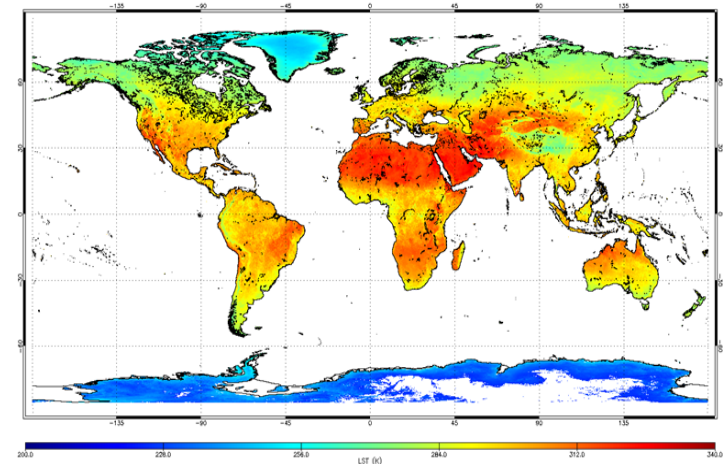
Land Surface Temperature monthly composite for September 2016; Credit: D. Ghent, University of Leicester

European Space Agency

CSC Development Status: Space Segment

Sentinel-1

★ With the authorization of the Satellite Production Review (SPR) Board, Sentinel-1C and -1D procurement programme progressed well with the production of flight units and with the successful closure of the AIS Receiver PDR (Preliminary Design Review).

★ The satellite platform, the SAR instrument and the Optical Communication Payload (OCP) are progressing according to plan.

Sentinel-2

★ The production of flight units progressed well at platform and instrument level. With regards to the Sentinel-2C/-2D platform procurements, all delivery dates are still in line with the project need dates.

★ The Multi-Spectral Instrument (MSI) equipment manufacturing is progressing as planned, except for the SOFRADIR SWIR detectors. Mitigation actions are in place to reduce schedule impact.

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CSC Development Status: Space Segment

Sentinel-3

★ The Sentinel-3B satellite is fully integrated with all flight units. The Assembly, Integration and Test Phase has been completed in Quarter 4/2017, which comprised platform tests, System Validation Test and launch adapter fit checks for both Rockot and Vega.

★ The Sentinel-3B Flight Acceptance Review (FAR) closed successfully with the Board meeting on 12 December 2017.

★ Following the request from EC to maintain the launch activities with Eurockot as per nominal launch service contract, the Agency proceeded with the launch preparations for Rockot. The present Sentinel-3B launch slot is from 30 March to 30 April 2018, with tentative launch date starting from mid April 2018 (tbc).

Sentinel-3B during the Rockot Launcher Fit Check Test

★ The Sentinel-3C and -3D development activities are proceeding as planned at platform/instruments level. The Sea and Land Surface Temperature Radiometer (SLSTR) and the Ocean and Land Colour Instrument (OLCI) remain the main drivers of the Sentinel-3C schedule, as such followed-up closely by the project team.

A Long Term Scenario (LTS)

- Fundamental aspects of a LTS:
  - **assure user-driven continuity** and increase the **robustness** of the existing CSC in the future (Priority)
  - **increase the quality and quantity** of the existing measurements
  - **expand observation** types according to policies and user needs
  - employ **latest technologies** for maximum efficiency
  - **Partnerships and cooperation** are essential to success

- **Key driver is the evolving needs of the services prioritized by EC** through various consultative processes over the last year

Copernicus Space Component Evolution

★ **November 2017 => Draft CSC Long-Term Scenario** submitted to ESA's Earth Observation Programme Board

★ **December 2017 =>** ESA released the Invitation To Tenders for **Copernicus Space Component Phases A/B1 of Potential Expansion Sentinels**:

  ★ Phase A/B1 of Anthropogenic CO_2 Monitoring Mission

  ★ Phase A/B1 of High Spatio-Temporal Resolution Land Surface Temperature (LST) Monitoring Mission

  ★ Phase A/B1 of Polar Ice and Snow Topographic Mission

  ★ Phase A/B1 of Passive Microwave Imaging Mission

  ★ Phase A/B1 of HyperSpectral Imaging Mission

  ★ Phase A/B1 L-Band SAR Mission

★ Activities related to the above are expected to start by mid 2018.
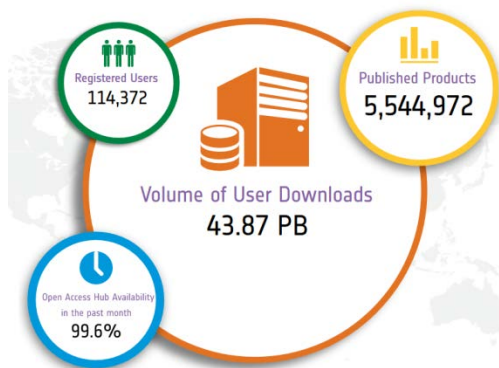
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ESA FDA activities – Data Access

European Space Agency

Sentinels Data Access at ESA - Configuration

4 Sentinel data access hubs operated by ESA

Copernicus Open Access Hub

LATEST NEWS

114,155   Self registered Users

31,349,923 Products Downloaded
24.32 PB Volume Downloaded

No Rolling Policy

Sentinel-1 NTC
Sentinel-2
Sentinel-3 (preops)

Max 2 concurrent Downloads

Collaborative Hub

LATEST NEWS

15 Collaborative GS
6 Data Hub Relays

13,524,825 Products Downloaded
12.53 PB Volume Downloaded

Node1: 30 days
Node2: 14 days

Sentinel-1 NRT & NTC
Sentinel-2
Sentinel-3 SRAL

Max 10 concurrent downloads per Node

International Hub

LATEST NEWS

4   International Agreements

4,812,426 Products Downloaded
4.05 PB Volume Downloaded

30 days

Sentinel-1 NTC
Sentinel-2 L1C

Max 10 concurrent downloads

Copernicus Services Hub

LATEST NEWS

190 Registered Users

1,495,096 Products Downloaded
1.19 PB Volume Downloaded

No Rolling Policy

Sentinel-1 NTC
Sentinel-2
Sentinel-3 SRAL

Max 10 concurrent downloads

Statistics at end December 2017

European Space Agency

Sentinels Data Access at ESA - Statistics

Registered Users
114,372

Published Products
5,544,972

Volume of User Downloads
43.87 PB

Open Access Hub Availability in the past month
99.6%

Some evidences of the success of Copernicus:

1. **A continuous increase of users registered on Open Access Hub (+ 100% in 1 year)**

2. **A weekly average of 0.7 PB of data downloaded by users**

Statistics at end December 2017

Registered Users
114,372
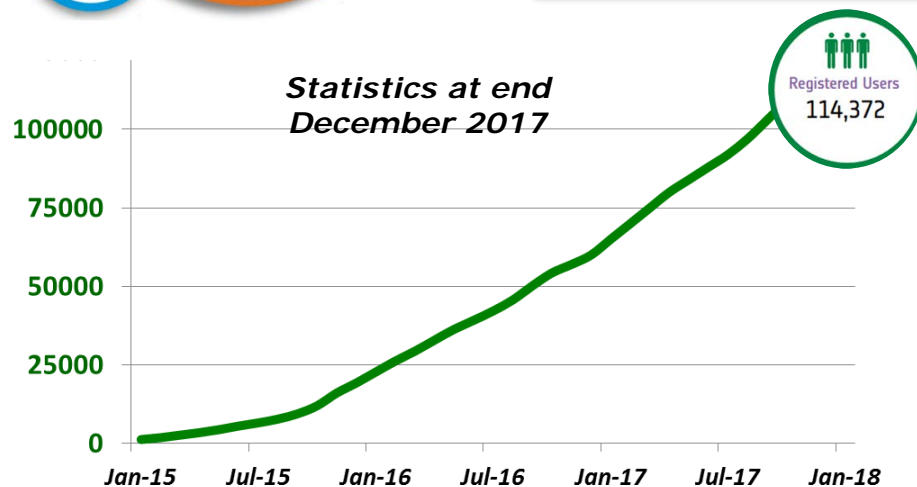
Total volume of data downloads during *last 3 months* → 8.3 PBytes

Volume [TB]

Week start date

S1   S2   S3
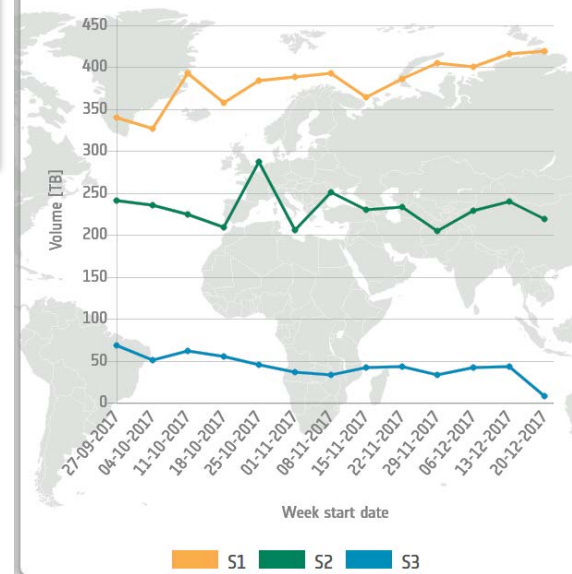
Sentinels Data Access – Open Access Hub

Distribution of active users on ESA Open Access Hub (i.e. downloading data) during *last 3 months*

Last month	Last 3 months			
Europe		Active Users 7,059	**45 %**	
Asia		Active Users 3,484	**22 %**	
North America		Active Users 1,713	**11 %**	
South America and Antarctica		Active Users 2,372	**15 %**	
Africa		Active Users 670	**4 %**	
Australia		Active Users 250	**2 %**	

Statistics at end December 2017
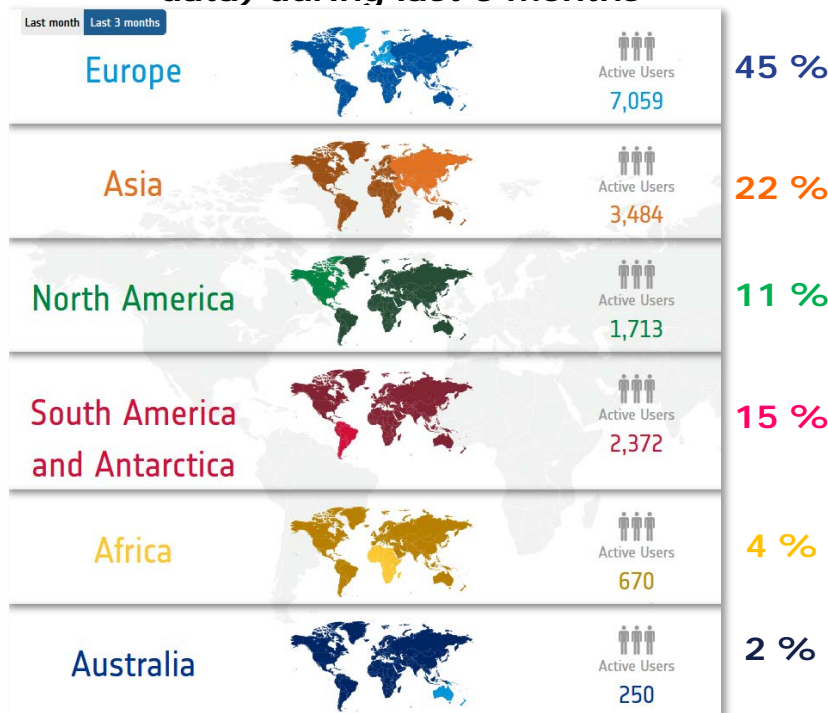
Statistics of ESA Open Access Hub do not include active users <u>downloading</u> Sentinel data through :

- *Eumetsat (Sentinel-3)*
- *Partners within national collaborative ground segment (in Europe)*
- *Partners within international ground segment (e.g. US or Australia)*

Statistics of ESA Open Access Hub do not include active users <u>using</u> Sentinel data (without downloading products) through image visualisation and handling tools:

- *"EO Browser" (see next slide)*

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Sentinels Data Access – Image visualisation

Sentinel-2
Forest fire in Corsica (2 January 2018)
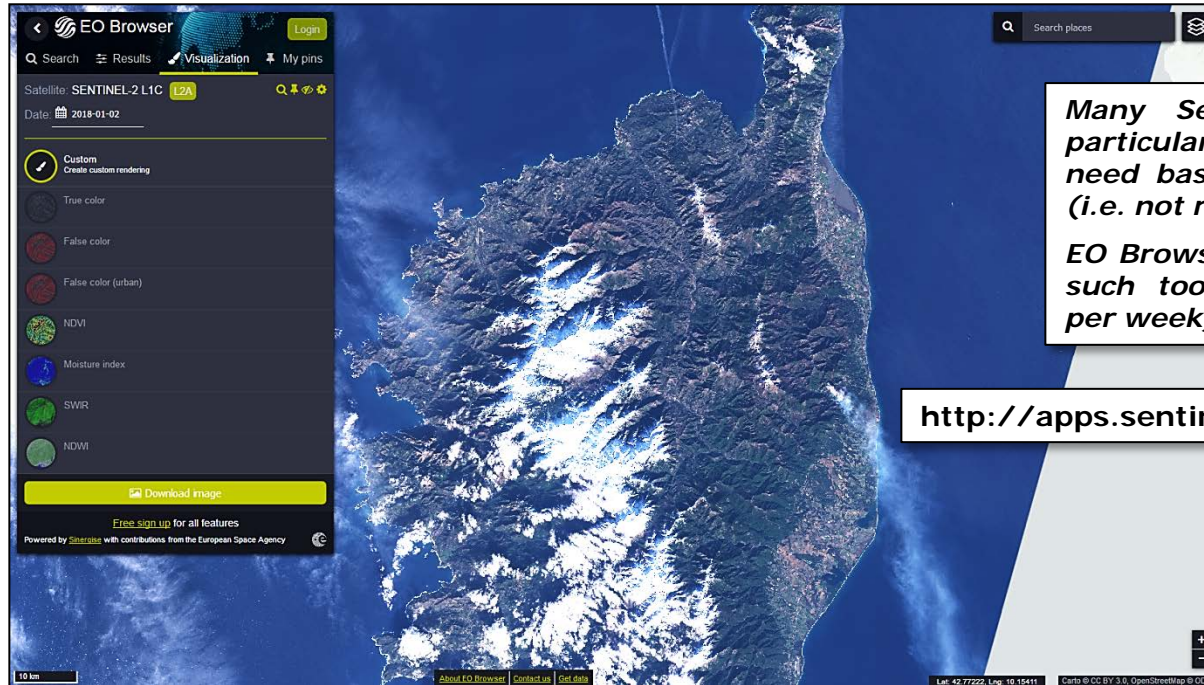
Many Sentinel data users (in particular general public) only need basic image handling tools (i.e. not requiring data download)

EO Browser is a good example of such tool (~2300 unique users per week)
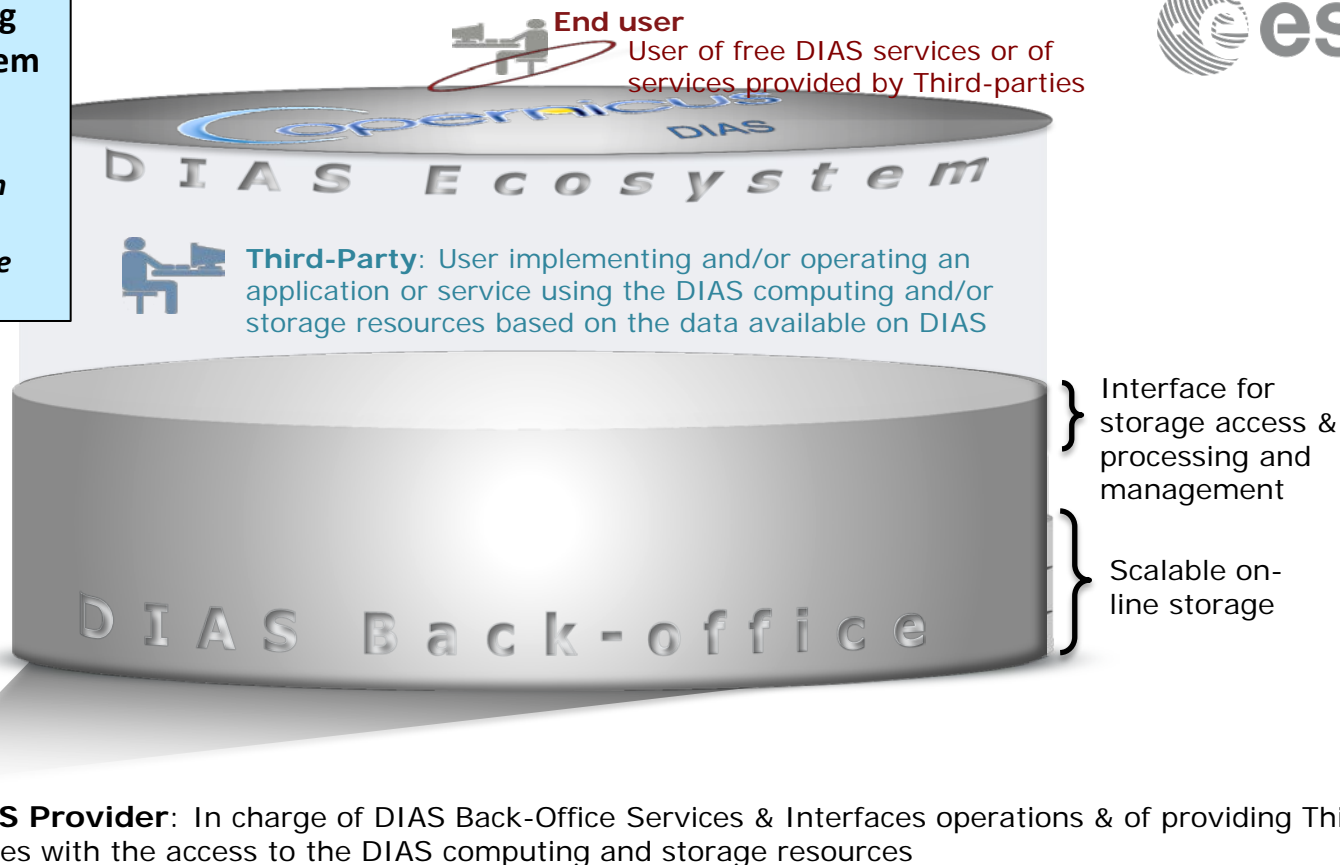
http://apps.sentinel-hub.com/eo-browser

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ESA FDA activities –
Data and Information Access Services (DIAS)

European Space Agency

DIAS: Creating and enabling a European EO Data ecosystem for research and business

A common European approach to EO data exploitation with Copernicus data at its core

esa

End user
User of free DIAS services or of services provided by Third-parties

Copernicus DIAS

D I A S   E c o s y s t e m

Third-Party: User implementing and/or operating an application or service using the DIAS computing and/or storage resources based on the data available on DIAS

Interface for storage access & processing and management

Scalable on-line storage

D I A S   B a c k - o f f i c e

DIAS Provider: In charge of DIAS Back-Office Services & Interfaces operations & of providing Third-parties with the access to the DIAS computing and storage resources

Data and Information Access Services (DIAS) - Status

- Following an Invitation to Tender issued by ESA in January 2017, **4 DIAS contracts** were signed by ESA and the respective DIAS providers on 14 December 2017 in Brussels in the presence of the EC;

- The 4 DIAS contracts were effectively kicked-off on 15 December 2017;

- The foreseen 6 months of preparatory activities (phase-in), before opening the operations, are now on going;

- The **start of operations** is planned for **June 2018**;

- **Data and service offer** form part of the DIAS concept

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DIAS ecosystem
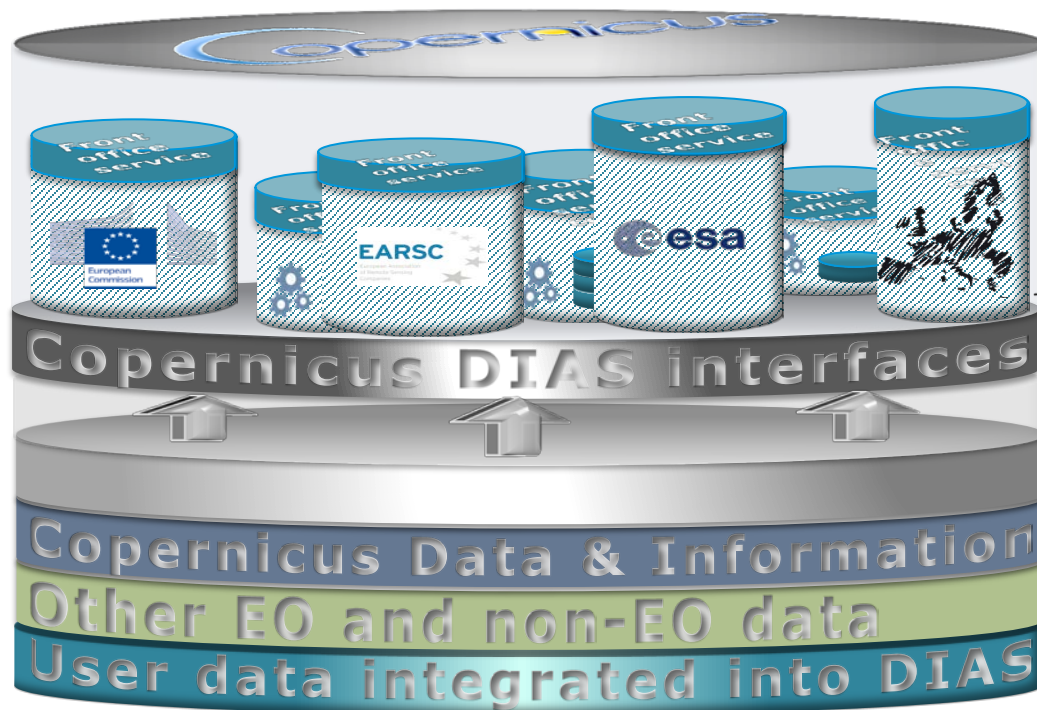
ALL DIAS

- offer access to *Copernicus Data and Information*, including Sentinel **data** and the Copernicus services **information**.

- may provide access to additional EO & non-EO data according to the respective DIAS business models.

- allow users (end users and Third-parties) to freely **discover, view and download available data & information**

- offer **cloud computing & storage resources** to be procured by Third-parties for further data processing

- Provide additional interfaces and services available to **store and integrate "user data" into the DIAS** "data offer".

- Provide **interfaces for local processing**, offering standard OGC interfaces, popular cloud APIs (e.g. swift), and/or new innovative solutions (e.g. ENS, data cube, etc.) to access the Data Offer.

ESA's contribution to ARD activities

ESA ARD data products over land

Current

- Sentinel-2 Surface Reflectance
- Sentinel-3
  - Land Surface Temperature
  - Synergy products
- GlobTemperature
- Proba-V

Future

- Sentinel-1 SAR: ESA Study to develop and consolidate SAR ARD demonstrator and definition → for update see dedicated presentation in session 4
- Sentinel-2/Landsat ARD **Prototype** Products / Level-3 HS2L8
- Sentinel-2/Sentinel-3 ARD **Prototype** Products / Level-3 HS2S3

Sentinel-2 ARD Products / Level-2A Surface Reflectance

General	Sentinel-2 Surface reflectances provided on UTM-WGS84 projection and a MRPG-based tiling grid.
External reference datasets	• DEM (PlanetDEM90) for orthorectification and topographic correction • O_3 (ECMWF) for atmospheric correction • Land Cover (CCI) for cloud masking improvement
Processing approach	Sen2Cor processor (Louis et al., 2017) including Dark Dense Vegetation (DDV) algorithm for aerosol optical thickness (AOT) estimation and APDA (Atmospheric Precorrected Differential Absorption) for water vapour estimation.
Input data	Level-1C products
Coverage	European coverage every 5 days since May 2017. Worldwide coverage every 5 days by mid-2018.
Spatial/temporal resolution	10/20/60m
Distribution channels	• Copernicus Open Access Hub: https://scihub.copernicus.eu/

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Sentinel-2 ARD Products / Level-2A Surface Reflectance

- Systematic production over EEA39 areas started since May 2017.
- Expansion to worldwide coverage by mid 2018.

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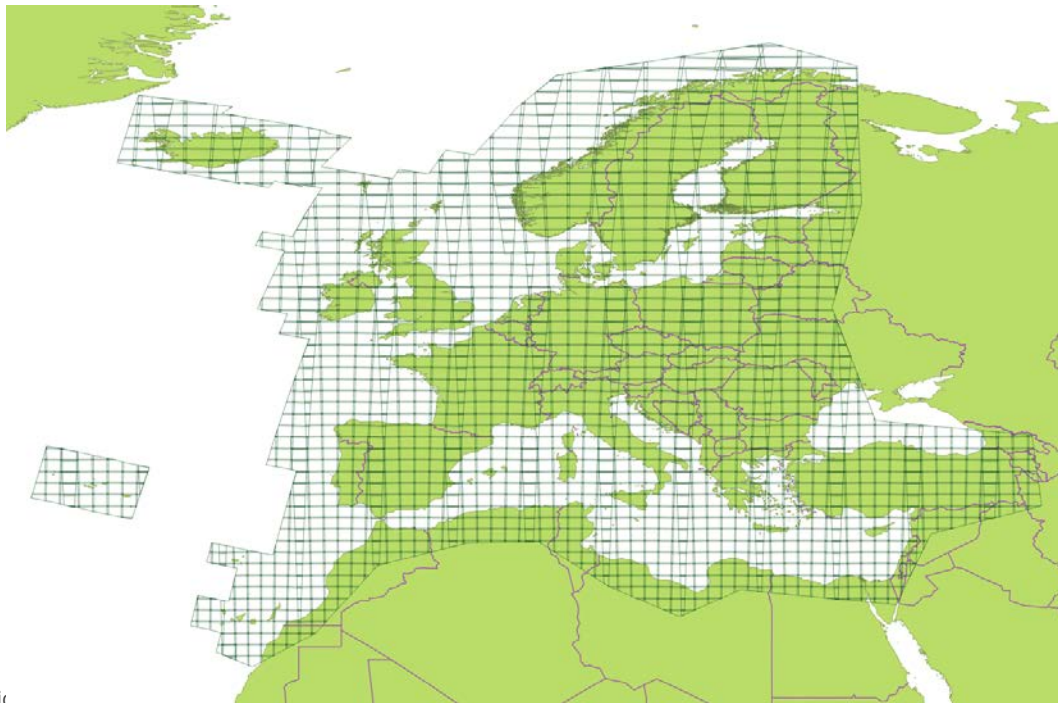
New Sen2Cor 2.5

✓ New version of Sen2Cor released (v2.5) supporting Sentinel-2B

→ Several Bugs fixed.

→ Full compatibility to PSD 14.3

→ Backward PSD compatibility assured.

→ Improvement of Ozone selection.

→ Improvement of AOT retrieval

→ Improvement of Cloud Screening and Scene Classification over coastal/inland/muddy waters, urban areas/bright surfaces.

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Feedback from Sentinel-2 Validation Team on S2 L2A

Level-2A Product

L1C

L2A

Scene Classification

AOT

WV

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Level-1C versus Level-2A Example
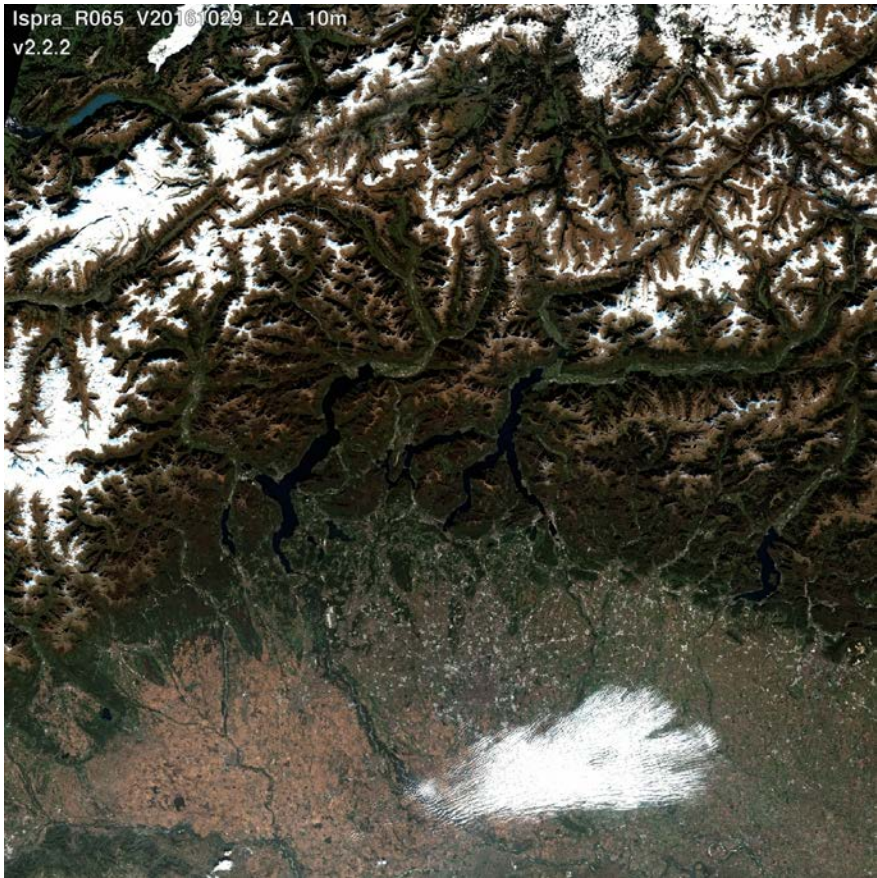
Ispra_R065_V20161029_L2A_10m
v2.2.2

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ICIPE-Mbita_R135_V20170313_L2A_10m
v2.4.0
S2A

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Level-2A Usage Example

✓ Seoul National University: Agriculture

Soybean

✓ Sen2Coral project for coral reefs monitoring

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Level-2A Usage Example
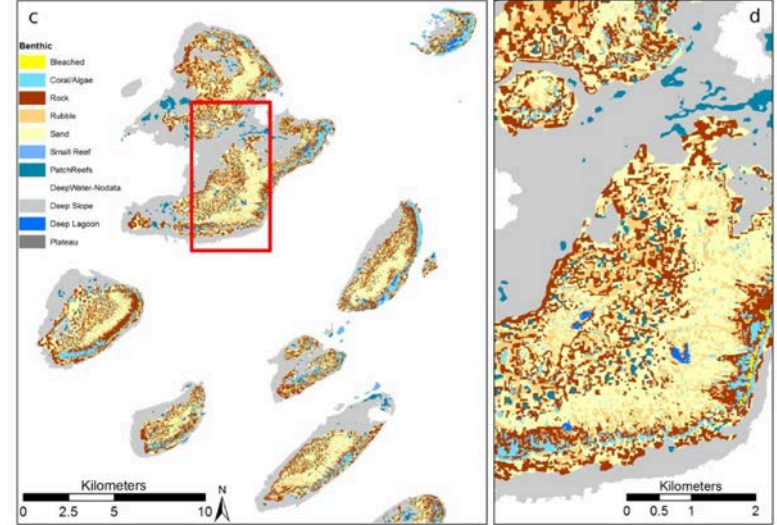
Level-2A performances from ACIX
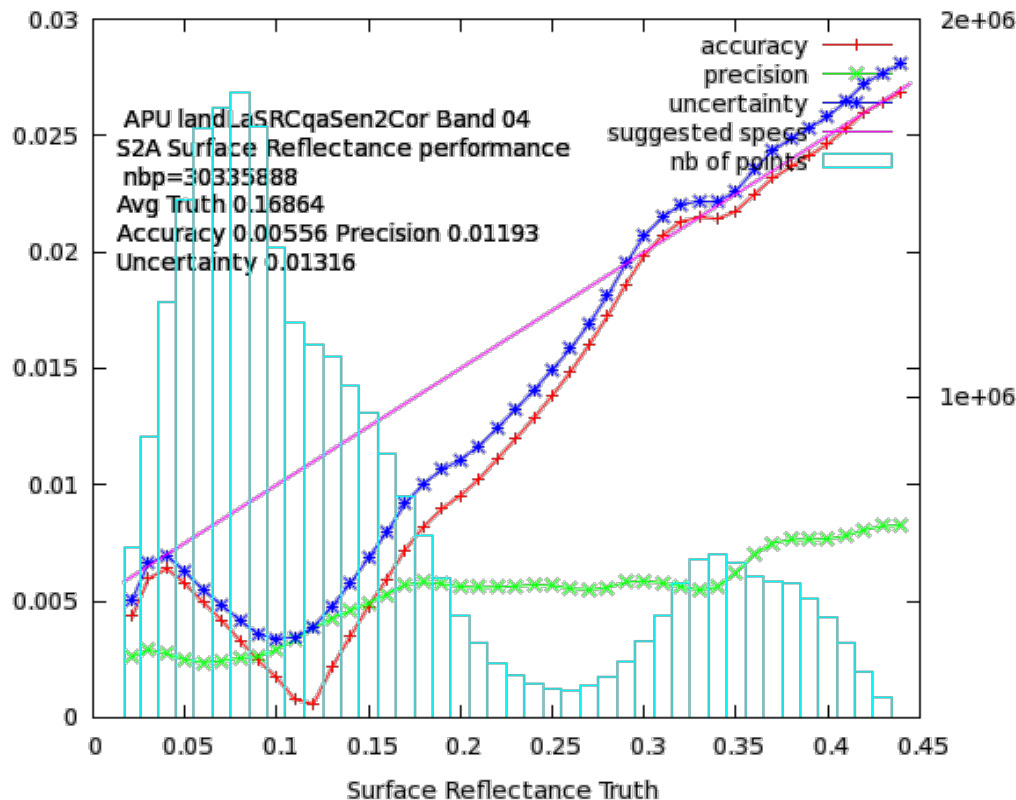
**MSI Band 4
Red, 665 nm**

Sentinel-2/Landsat ARD **Prototype** Products
Level-3 HS2L8

General	**Prototype products** HS2L8 (Harmonisation Sentinel-2 and Landsat-8) combining both missions in a single fused product on the common bands of both missions and at the spatial resolution of Sentinel-2 bands.
External reference datasets	• DEM (PlanetDEM90) for orthorectification and topographic correction • O_3 (ECMWF) for atmospheric correction. • AOT(ECMWF) for atmospheric correction. • WV (ECMWF) for atmospheric correction.
Processing approach	• Atmospheric corrections short-term solution with SMAC (Rahman & Dedieu, 1994) and mid-term solution with Sen2Cor (expanded to correct Landsat-8 data). • Fusion approach based on STAR-FM method (Gao et al., 2006). • BRDF correction (Roy et al., 2016).
Input data	Sentinel-2 Level-2A and Landsat-8 Level-1T products.
Coverage	N/A
Spatial/temporal resolution	10/20/60m
Distribution channels	N/A

S2 ARD **Prototype** Products / Level-3 HS2S3

General	**Prototype products** HS2S3 (Harmonisation Sentinel-2 and Sentinel-3 OLCI) combining both missions in a single fused product on Sentinel-2 VNIR bands and using the spectral and spatial resolution of Sentinel-2 VNIR bands and the temporal resolution of Sentinel-3.
External reference datasets	• DEM (PlanetDEM90) for orthorectification and topographic correction • O_3 (ECMWF) for atmospheric correction. • AOT(Aeronet) for atmospheric correction. • WV (ECMWF) for atmospheric correction.
Processing approach	• Atmospheric corrections with SMAC (Rahman & Dedieu, 1994). • Fusion approach based on STAR-FM method (Gao et al., 2006).
Input data	Sentinel-2 Level-1C and Sentinel-3 OLCI Level-1B.
Coverage	N/A
Spatial/temporal resolution	10m
Distribution channels	N/A

Sentinel-3 Land Surface Temperature (LST) "quasi ARD-ready"

General	Land Surface Temperature (LST) is retrieved from thermal radiances measured by the Sea and Land Surface Temperature Radiometer (SLSTR)
External reference datasets	• Pressure, temperature, and water vapour (ECMWF – Atmospheric HRES-10 day dataset) • Carbon dioxide, nitric acid, chlorofluorocarbons (CFCs) and ozone (RAMIgclim; Remedios et al, 2007) • Globcover Land Cover (reduced-resolution ~1 km) • Fractional vegetation cover climatology
Processing approach	Evolution of the LST algorithm developed for the Advanced Along track Radiometer (AATSR) by CSIRO (Prata 2002) (*Ref: S3-L2-SD-03-T03-ULNILU-ATBD_L2LST, 2012*)
Input data	11 and 12 µm channels brightness temperature of the SLSTR nadir view
Coverage	• Global coverage
Spatial/temporal resolution	• 1 km • 2 days at the equator
Distribution channels	Sentinel data Hub: https://scihub.copernicus.eu/dhus/#/home

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Sentinel-3 Synergy "quasi ARD-ready"

General	Sentinel-3 Synergy products are obtained combining information from the OLCI and SRTL instruments. The standard product is a 300m SDR product. Moreover we provide SPOT VGT-like products in Plate Carrée projection to be consistent with standard 1 km SPOT Vegetation products consisting of instantaneous acquisition, daily and 10 day composites.
External reference datasets	• Auxiliary data: O_3, Water vapour, and surface pressure (ECMWF) • OLCI and SLSTR Lev-1B ortho-geolocated using GETASSE30 DEM
Processing approach	• AOT estimation (North et al., 2010) • Level-1C resampling adopting OLCI as reference image grid • Currently cloud detection based on operational OLCI cloud mask • Ice/snow detection uses the results of the OLCI L2 Pixel classification • Level-2 SDR retrieval *(Sentinel-3 Synergy products ATBD – North, Heckel, 2010)*
Input data	• TOA reflectance data for the 6 solar reflective SLSTR at both nadir and forward views an 18 OLCI bands at all non-absorbing channels (bands 14,15,20)
Coverage	• Common part of the OLCI and SLSTR nadir view swaths for the daylight part of the SENTINEL-3 orbit, i.e. the entire OLCI swath: ~1 270 km. Two days at the equator
Spatial/temporal resolution	• 300 m for Synergy L2 SDR and 1 km for VGT-like products (Daily and 10 day)
Distribution channels	Sentinel data Hub: https://scihub.copernicus.eu/dhus/#/home (Currently only Exp. Hub)

Globe Temperature "quasi ARD-ready"

General	The aim of ESA's GlobTemperature project is to promote the wider uptake of global-scale satellite LST, to merge LST data set from thermal infrared (geostationary & polar orbiter) and passive microwave satellite data to provide best possible coverage, including information on the diurnal cycle and clear-sky bias.
External reference datasets	All datasets used at single sensor level for generating L2-LST products
Processing approach	• Level-2: geophysical variables derived from the Level 1b source data from a single orbit of a sensor at the same resolution and location as the Level 1b data • Level-3: "uncollated" – single sensor data regridded and/or spatially averaged onto a spatial grid without combination of observations from overlapping orbits; "collated" - multiple orbits from a single sensor have been combined onto a spatial/temporal grid • Level-4: datasets constructed from multiple orbits and sensor • Complete description of all processing variables at L2-4 in *GlobT-WP3-DEL-11, 2018* (Globtemp Product user Guide)
Input data	Land Surface Temperature (LST) data sets from: (A)ATSR; SEVIRI; SSM/I; AMSR-E, MODIS, JAMI, GOES, MTSAT, ATSR-CDR; SLSTR
Coverage	• Global coverage
Spatial/temporal resolution	• 1 km for merged dataset • 3 hourly daily for merged dataset
Distribution channels	GlobTemperature Project portal: http://data.globtemperature.info/

Proba-V Surface Reflectances "quasi ARD-ready"

| General	Proba-V Top-Of-Canopy (TOC) Reflectances provided as synthesis products in Plate Carrée projection for different compositing period: 1-day, 5-days (for 100m), 10-days [*Specs in continuity with SPOT-VGT data record*]
External reference datasets	• DEM (GLSDEM) for hortorectification and surf pressure • WV (ECMWF) and O3 (TOMS climatology) for A/C • Surface Reflectance climatology (MERIS) and Land Cover (CCI) for cloud masking
Processing approach	• Cloud/Shadow/Snow masking (*Wolters et al. 2017*) • AOT estimation (*Maisongrande et al., 2004*) • A/C using SMAC (*Rahman et al., 1994*) • Compositing using MVC (*Holben, 1986*)
Input data	• L2-B (intermediate product, not for users): atmospherically corrected segment files to be combined in the synthesis products
Coverage	• Global quasi-daily coverage, two days for [-35°:35°]
Spatial/temporal resolution	• 1km and 333m with quasi-daily revisit • 100 m 5-days revisit
Distribution channels	• VITO PDF portal: http://www.vito-eodata.be/PDF/ • Proba-V MEP: https://proba-v-mep.esa.int

ESA's contribution to ARD - outlook

- **"Quasi" compliant to ARD** Product Family Specifications

- **DOI planned** for product type (e.g. LST) and in future also algorithm (e.g. LST retrieval) identification

- **New ARD activities**
    - Prototype products over land being developed
    - ESA Study to develop and consolidate SAR ARD demonstrator and definition

- **On-going evaluation for the Evolution of the Digital Elevation Model (DEM)** used in the Copernicus Space Component Data Processing; ESA performing study to provide recommendations for the evolution of the DEM to be used for the generation of Copernicus Space Component (CSC) core products:
    - Collect DEM requirements from the different CSC elements (i.e. Sentinel missions and Copernicus Contributing Missions).
    - Identify different candidate DEM available.
    - Provide preliminary quantitative assessment of the impact of the pre-selected DEMs on the different missions' products data quality and on the production operational set-up.
    - Financial assessment (cost, license, maintenance ...).
    - Final conclusions and recommendations for the choice of the DEMs (by April 2018).

Day 3: Thursday, 1 March 2018	
Session 3: Harmonization and Consistency	
09:00 – 09:30	**Keynote: Reaching new users through the CEOS Analysis Ready Data for Land (CARD4L) Framework** **Steven Hosford, ESA, Italy**
09:30 – 09:50	Quality assessment of the Level-2 Sentinel-2 products through the Harmonized Landsat and Sentinel-2 (HLS) data set Martin Claverie, UCLouvain, Belgium
09:50 – 10:10	Towards achieving continental scale field validation and multi-sensor interoperability of satellite derived surface reflectance in Australia Medhavy Thankappan, Geoscience Australia, Australia
10:10 – 10:30	Validating PCI ARD data with Sen2Cor and LaSRC including BRDF correction and Topographic Normalization. Wolfgang Lück, Pci Geomatics, Canada
10:30 – 10:50	A new 'system state vector' of optical, thermal and microwave EO data for terrestrial change detection Mathias Disney, UCL Geography, UK

European Space Agency
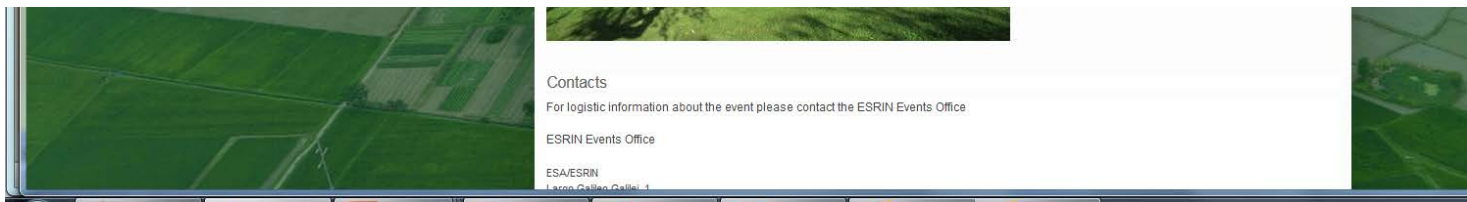
Take home messages

- The **Copernicus Space Component delivers high quality and timely data** to the user community

    - Current fleet of missions: nominal operations and all core data products released

    - C/D units in preparation

    - Long-term Scenario/ future Sentinel extension and expansion/ consolidated

- **ESA's provides important contribution to FDA activities**

    - Excellent Copernicus data access service provided, including data provision working in partnership in international environment

    - DIAS contracts now up and running

- **ESA's data products over land** provide a considerable contribution to the CEOS ARD portfolio and are **"quasi" compliant to ARD** principles

- **New ARD activities triggered by ESA**

- **ESA lead for MRI activities has been appointed**: Ferran Gascon (Sentinel-2 mission manager)

European Space Agency