



# Copernicus Sentinel-2 Global Mosaic

ESA Phi week 2018

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- 3: GEOVILLE INFORMATION SYSTEMS GMBH









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#### Objective and scope





- Generating composites of scientifically sound Sentinel-2 L2A surface reflectance data on global scale
- Analysis-ready data for direct and convenient usage
- Use cases include but are not limited to REDD+<sup>1</sup> activities, i.e. monitoring land use and deforestation
- Expert support
- State-of-the art service provision

<sup>1</sup>Reducing Emissions from Deforestation and Forest Degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries,



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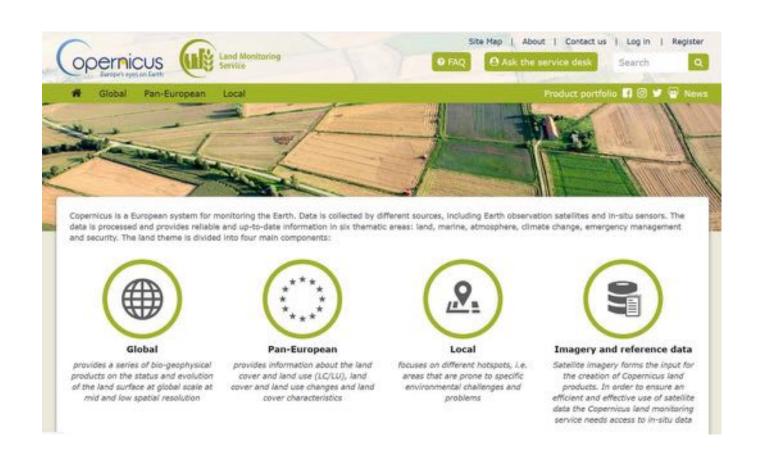


#### Offer in a nutshell





- User-tailored mosaics and composites of Sentinel-2 L2A, best representative pixel approach
- European coverage, global coverage expected soon, conditional to global availability of Sentinel-2 L2A
- Near real-time product availability, typically few days after observation
- Free, full, and open!



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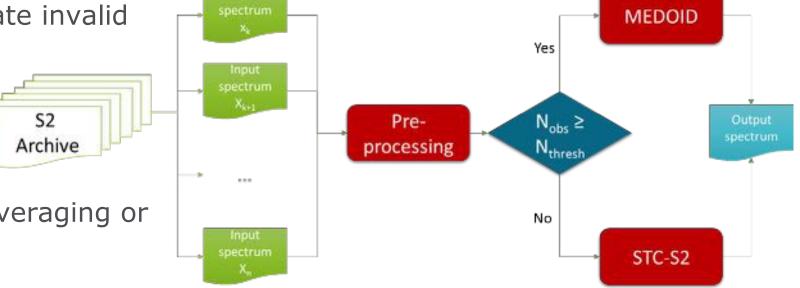


#### Two Compositing Algorithms





- **Short-term composite** < 5 valid observations: Decision-tree approach evaluating scene classification, similar to Landsat WELD
- **MEDOID** > 4 observations: Multidimensional median on entire spectrum
- Rigid pre-processing to eliminate invalid observations
- Generating mosaics pixel Archive by pixel from original observations, no spectrum averaging or other image blending applied



Spatial resampling of bands to non-native resolutions if needed

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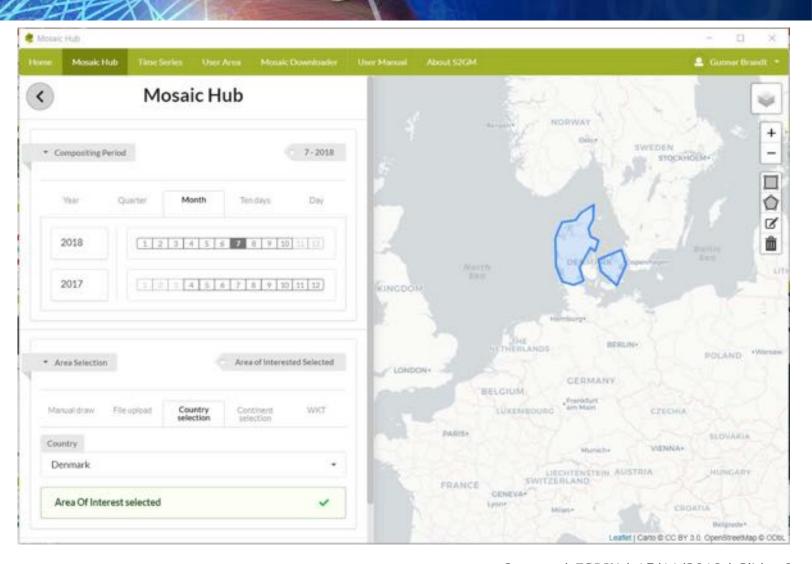




#### Ordering S2GM products via Mosaic Hub



- On-request generation of tailored mosaics leveraging on cloud resources and free availability of S-2 L2A
- Mosaic Hub as interactive user interface
- Website and desktop application with convenient download manager



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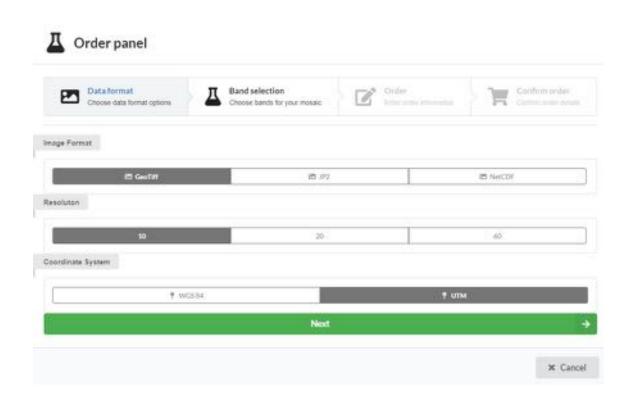
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European Space Agency

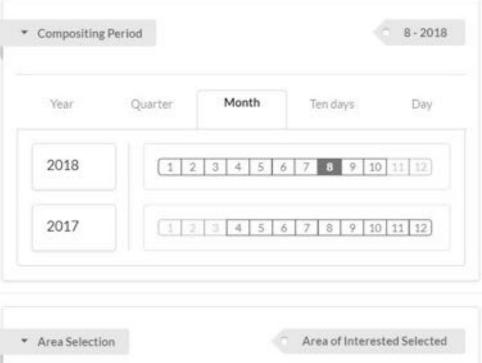


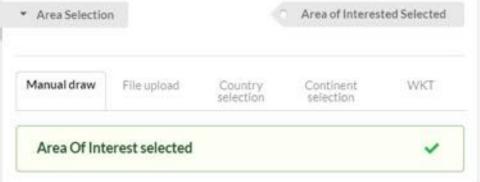
#### Tailoring & Requesting

#### **Dialogue-based Mosaic specification**





































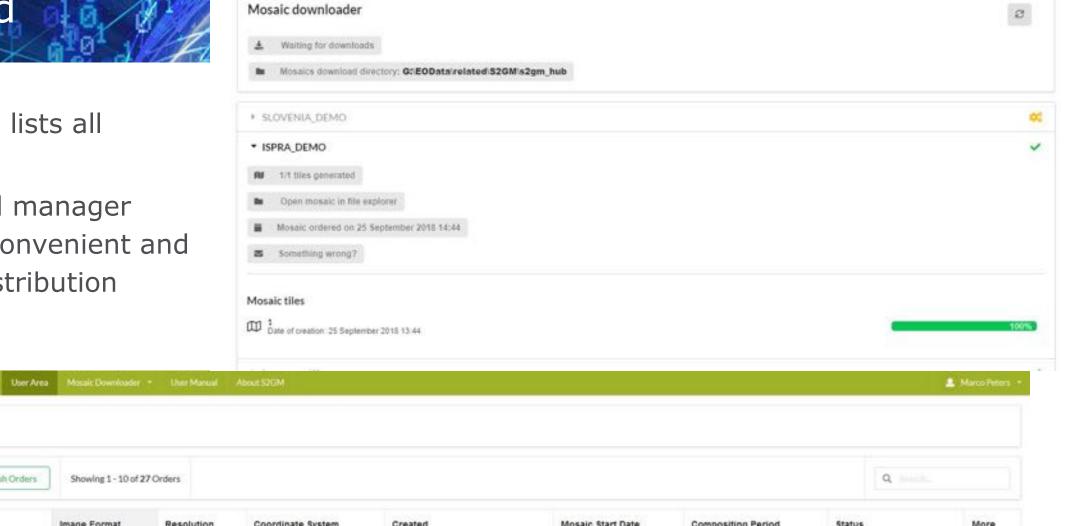


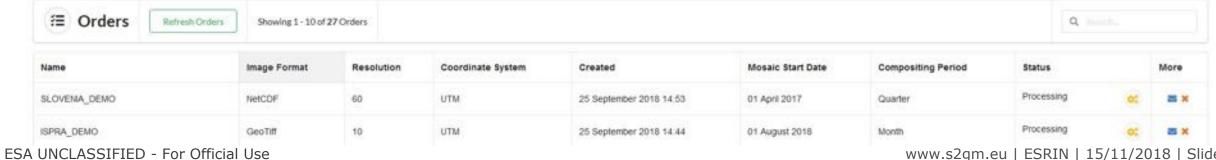




#### Download

- User area lists all requests
- Download manager ensures convenient and robust distribution





User Manual About S2GM

Mosaic Downloader

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⟨ To Mosaic Hub

























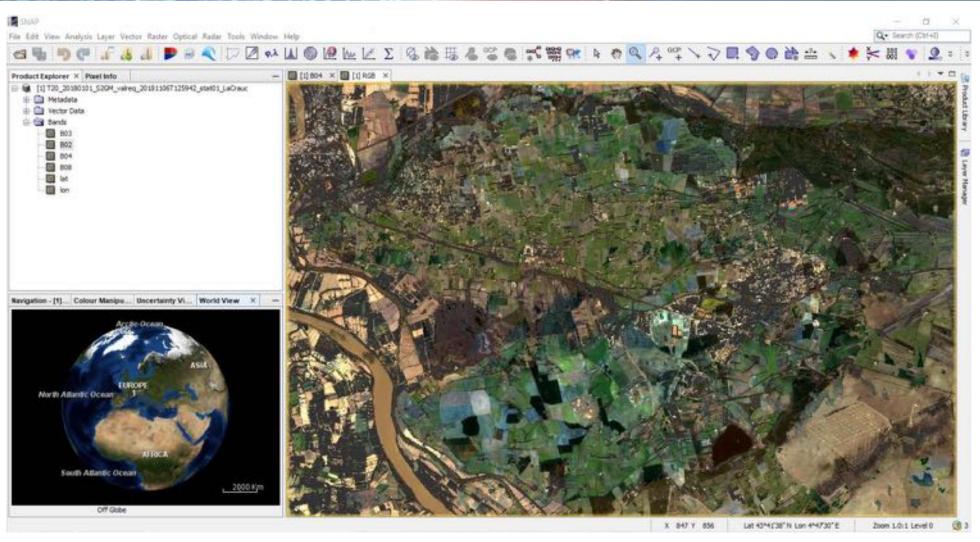








# Sentinel Application Platform



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#### Analysis Ready products





- Three file formats: jp2, GeoTIFF, NetCDF
- INSPIRE-compliant
- Accompanied by extensive metadata (xml, json, NetCDF Metadata)
- Atmospherically corrected, quality controlled, fixed grid, fixed periods
- Example:

   Exploit stack of S2GM
   products with Python's xarray

```
Jupyter S2GM_read_NetCDF Last Checkpoint: letzten Donnerstag um 11:02 Uhr (unsaved changes)
                                                         866
        : import xarray as xr
   In [2]: data = xr.open mfdataset(glob.glob("C:/Users/gunnar/src/data/S2GM/nc/2018 LaCrau/S2GM*/52GM*/*.nc"))
   In [4]: data
   Out [4]: <xarray.Dataset>
           Dimensions:
                           (bnds: 2, time: 28, x: 1327, y: 1112)
           Coordinates:
               lat
                           (y, x) float32 43.7429 43.7428 43.7428 43.7428 43.7428 ...
               lon
                           (y, x) float32 4.58284 4.58308 4.58333 4.58358 4.58383 ...
             * time
                           (time) datetime64[ns] 2018-01-06T00:59:03.750000128 ...
           Dimensions without coordinates: bnds, x, y
           Data variables:
               B03
                           (time, y, x) float32 dask.array<shape=(28, 1112, 1327), chunksize=(1, 1112, 1327)>
               B02
                           (time, y, x) float32 dask.array<shape=(28, 1112, 1327), chunksize=(1, 1112, 1327)>
               B04
                           (time, y, x) float32 dask.array<shape=(28, 1112, 1327), chunksize=(1, 1112, 1327)>
                           (time, y, x) float32 dask.array<shape=(28, 1112, 1327), chunksize=(1, 1112, 1327)>
                           (time, bnds) datetime64[ns] dask.array<shape=(28, 2), chunksize=(1, 2)>
               time bnds
           Attributes:
               id:
                                                S2GM T20 20180101 20180111 S2GM valreq 20...
               title:
                                                Copernicus Sentinel-2 Mosaic
                                                This is a Sentinel-2 Global Mosaic genera...
               summary:
                                                Copernicus Sentinel-2 Global Mosaic
               project:
               institution:
                                                Copenicus Sentinel-2 global Mosaic service
               references:
                                                https://s2gm.eu
                                                https://s2gm.eu
               contact:
               Conventions:
                                                CF-1.6
               keywords:
                                                LAND SURFACE, SURFACE RADIATIVE PROPERTIE...
```

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## Analysis Ready products



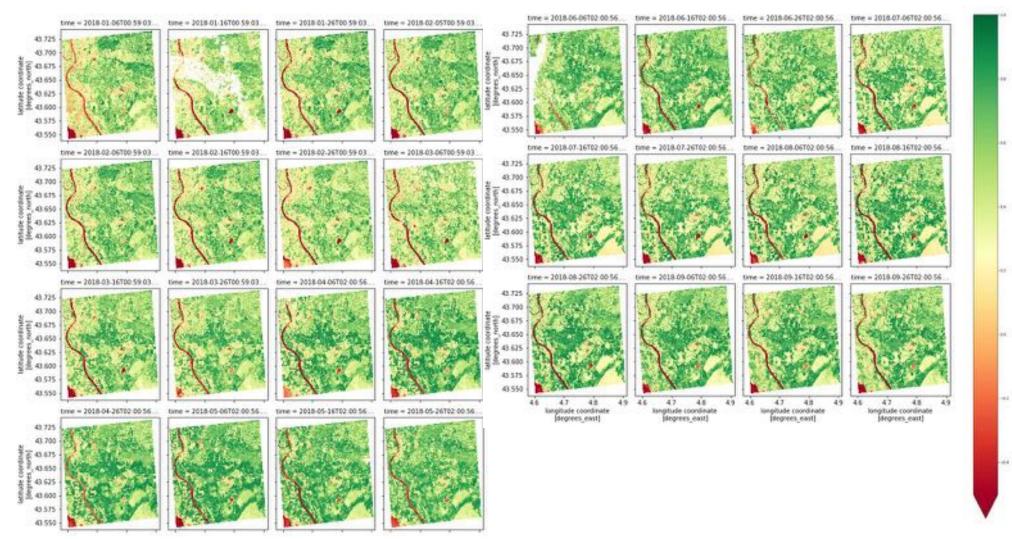












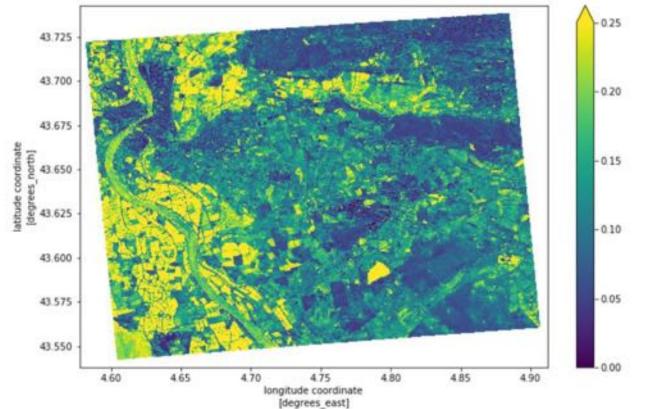
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### Analysis Ready products



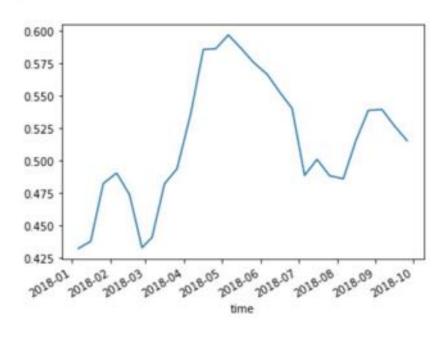








[<matplotlib.lines.Line2D at 0x1425280b518>]



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#### Time-series tool



- Generation of time-series at arbitrary locations
- Single pixels or 3x3
- Direct inspection of data in the Mosaic Hub
- Download as csv for further analysis







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#### S2GM website

# Central entry point to all service components:

- Mosaic Hub
- Documentation
- User support
- News

https://land.copernicus.eu/i magery-in-situ/globalimage-mosaics/



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Mosaic Hub

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About

Home - Home

#### The Sentinel-2 Global Mosaic service

The Sentinel-2 Global Mosaic (S2GM) service is a component of the Copernicus Land Monitoring Service providing composites from time-series of Sentinel-2 surface reflectance observations. S2GM comprises best representative pixels in three spatial resolutions and from different compositing periods ranging from one day to one year on a European scale. It primarily seeks to support the sustainable management of natural resources by offering Analysis Ready Data (ARD) through the interactive Mosaic Hub. Users can tailor mosaics to their specific requirements in terms of area of interest, compositing period, included bands, file format, and metadata content and conveniently manage product requests via the S2GM Hub or App.

#### Global Mosaic





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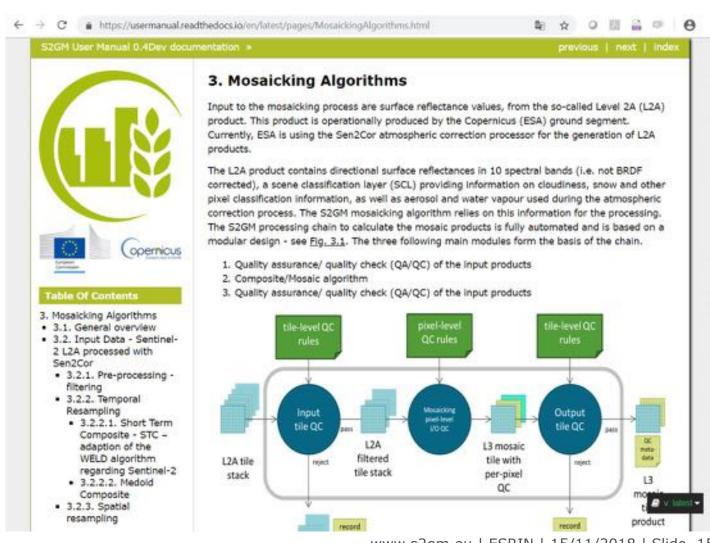
#### Documentation and support





- Algorithm Theoretical Basis Document (ATBD)
- Online User Manual
- Expert support via CLMS service desk

https://land.copernicus.eu/contact-form



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#### Consortium





- Three European SMEs with complementary expertise in Earth Observation since many years.
- Clearly defined roles in S2GM service



- Maintaining S2 L2A archive
- Mosaic Hub technology
- Distribution of products



- Managing contract and consortium
- Mosaicking algorithms
- Sentinel-2 (pre-) processing expertise



- Internal quality control
- Thematic expertise land

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## **Copernicus Sentinel-2 Global Mosaic service**

- provides scientifically sound mosaics of Sentinel-2 surface reflectance data on a global scale
- is fit for various applications
- is free to use by everyone
- is accessible via <u>www.s2gm.eu</u> and via CLMS
- is operated by a team of dedicated experts ready to support users



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# Contact <u>info@s2gm.eu</u> Or the Service desk of CLMS at <u>www.s2gm.eu</u> for more information!



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