

## → SENTINEL-2 FOR AGRICULTURE

Towards the exploitation of Sentinel-2 for local to global operational agriculture monitoring

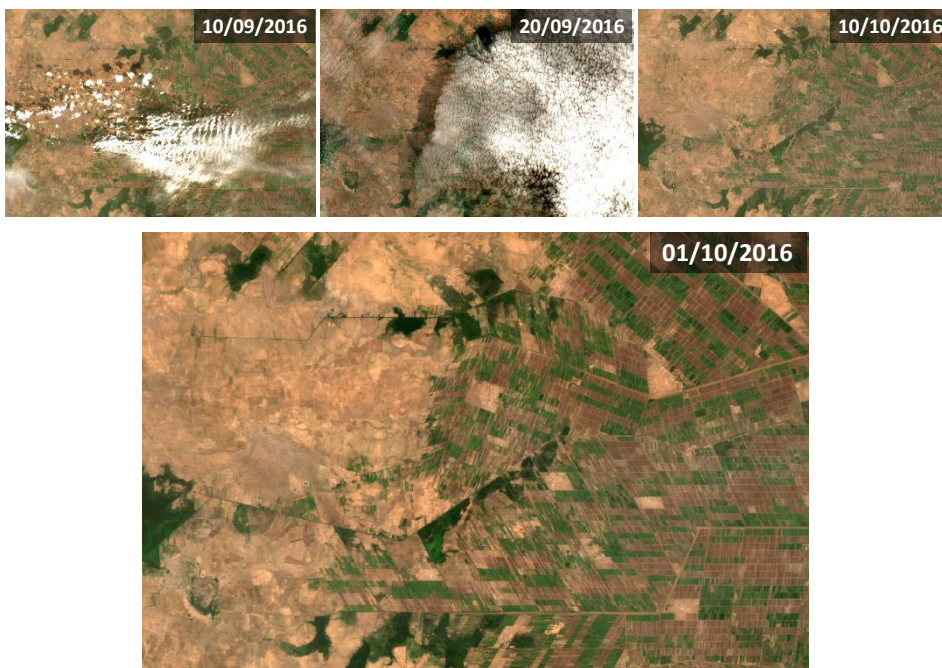


### Cloud-free Reflectance Composite: merging image time series to build a suitable synthetic product

The Cloud-free Reflectance Composite product provides a cloud-free temporal synthesis of surface reflectance values in the 10 Sentinel-2 bands designed for land observation. Sentinel-2 time series can be optionally complemented by an additional Landsat 8 time series. The composite is delivered with several masks that will help appraising its quality.

The compositing period can be selected between **30 and 50 days** for a given site. This provides flexibility with regard to local cloud coverage conditions and enables the production of a high quality information.

The product is delivered on a **monthly basis** to ensure a proper monitoring of the observed areas and includes relevant additional information to support future use and interpretation.



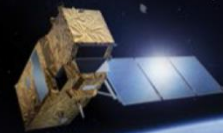
Images from the Sentinel-2 L2A time series over Sudan (top) and resulting Cloud-free Reflectance Composite obtained using 50 days of data (bottom)

#### *Product specifications*

- ▶ Local to national coverage
- ▶ Blue, green, red, near infrared, near infrared narrow, vegetation red-edge bands, shortwave infrared bands
- ▶ 10-meter spatial resolution for visible and near infrared bands and 20-meter for the other ones
- ▶ First version delivered after the duration of the first compositing period, then updated monthly
- ▶ Compositing period: 30 to 50 days moving window of EO data
- ▶ 3 days after the reception of the last acquisition of the compositing period
- ▶ Geometric accuracy inherited from L1C products accuracy
- ▶ DIMAP format including GeoTIFF raster images
- ▶ UTM-UPS/WGS84 projection, inherited from the L1C S2 tiles
- ▶ XML file metadata

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### Input data

❖ A **Sentinel-2 L1C image time series**, optionally completed by an additional **Landsat 8 L1T image time series**, automatically downloaded from ESA and USGS facilities. These data are first turned into **L2A products** (i.e. bottom of atmosphere reflectance products, with snow, water, cloud and cloud shadow masks) through a specific processor of the Sen2-Agri system based on the Multi-sensor Atmospheric Correction and Cloud Screening (MACCS) algorithm (Hagolle et al., 2015, 2010, 2008).

### Data volume

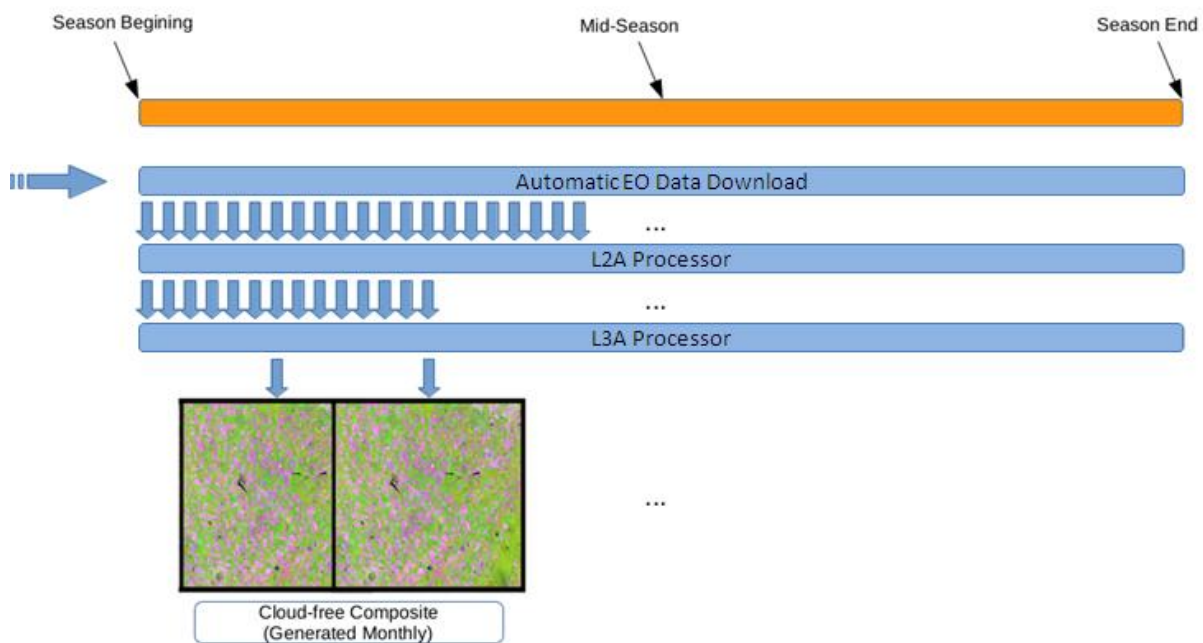
- ▶ **10 Gb** for a local coverage, i.e. an area corresponding to ~9 Sentinel-2 tiles (300 x 300 km<sup>2</sup>)
- ▶ **80 Gb** for a national coverage, i.e. an area of 500 000 km<sup>2</sup>

### Processing methodology

The processing, based on the **Weighted Average** composite approach, includes the correction of directional effects to take into account changes in observation angles and therefore in reflectances among the different images that are stitched to create the product.

Ancillary layers provide the weighted average of the dates used in the synthesis as well as **quality flags**, indicating the number of valid observations over the compositing period and the status of the pixel over this period (cloud, snow, water, land). Such information may be useful to discard irrelevant pixels for future analysis.

The Composite product has been developed within the Sen2-Agri project under the scientific lead of CESBIO whose work is co-funded by CNES/THEIA.



Delivery schedule of the Cloud-free Reflectance Composite product with regard to the user-defined growing season



**Sentinel-2 for Agriculture** is a 3 year project which aims at demonstrating the benefit of the Sentinel-2 mission for agriculture across a range of crops and agricultural practices. The intention is to provide the international user community with validated algorithms and an open source processing system to derive in an operational way Earth Observation products relevant for crop monitoring using Sentinel-2 data.



The project, funded by ESA, is carried out by a consortium involving the **Université Catholique de Louvain** (BE), the **Centre d'Études Spatiales de la Biosphère** (FR) and the companies **CS - Systèmes d'Information** (FR) and **CS Romania** (ROU), working in close collaboration with 18 organizations, centers, universities or companies belonging to the agriculture monitoring communities.

