

Introduction

MUSCATE, a production platform to process **Multi-satellite, multi-sensor** and **multi-temporal** data built under the supervision of CNES (1), is distributing products of Level 2A, which contain the cloud masks generated by the MAJA algorithm.

Those cloud masks have formed the basis for a new algorithm, called **WASP**. It is capable of creating **monthly cloud-free synthesis images** using the provided Sentinel-2A/B products.

Soon, this processing chain will be integrated into the existing framework of MUSCATE, allowing users to access cloud-free synthesis **for free**.

How the processor works

The processor incorporates three main steps in order to reach the final synthesis product. The algorithm loops over all images, so the following steps are performed each time:

- **Directional Correction**
Due to a difference of the mean reflectance values of the adjacent regions, a directional correction of each pixel ρ is performed using the sun zenith angle θ_s , the view zenith angle θ_v and the relative azimuth ϕ (2):

$$\rho(\theta_s, \theta_v, \phi) = \rho_0 \cdot (1 + V \cdot F_v(\theta_s, \theta_v, \phi) + R \cdot F_R(\theta_s, \theta_v, \phi))$$

- **Weight Calculation**
This part of the algorithm performs a weight calculation for three criteria:

- **Weight on Clouds**
Cloudy-pixels receive a lower weight
- **AOT Weight**
High AOT values result in a lower weight
- **Weight on Dates**
Dates further away from the center date receive a lower weight

The total weight is then:

$$W_{Total} = W_{AOT} \cdot W_{Date} \cdot W_{Cloud}$$

- **Synthesis Update**
The final part consists in applying the newly generated Weight-Raster to the existing one of the previous Update. This updates the whole image using a weighted average.

Product characteristics

- **Date fidelity:**
The resulting product will incorporate all products of a **45-day window** and will be generated **once every month**. This allows to have a minimum of clouds left while keeping fidelity to the center date.
- **Gap filling:**
Minimize data gaps using linear interpolation of dates before and after the central date
- **Artifacts:**
Minimize artifacts using a weighted average of all input products

Conclusions

Soon, WASP will be integrated into MUSCATE's distribution center to treat all tiles of Metropolitan France as well as the 20 most downloaded ones.

In the upcoming summer, the final integration step will be performed, which is to integrate it into the ongoing production. At this stage, all available tiles in MUSCATE will be processed once a month.

At the same time, the processing chain will include to run with products of VENUS, allowing for faster cycles due to its 2-day repetitivity.

References

1. Donadieu, J et al., **MUSCATE - A versatile Data and Services Infrastructure compatible with public cloud computing**, BiDS '17 Proceedings, p. 279, 2017.
2. Maignan, F.-M. Breon, et R. Lacaze, **Bidirectional reflectance of Earth targets: Evaluation of analytical models using a large set of spaceborne measurements with emphasis on the Hot Spot**, Remote Sensing of Environment, vol. 90, n 2, p. 210–220, 2004.

