

→ SENTINEL-2 FOR AGRICULTURE

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



Newsletter 6 - April 2016

Final stretch towards the Sen2-Agri system real-life demonstration

With the acceptance of the full Sen2-Agri system currently under process, the second phase of our project is coming to its end. By the same time, the third and last phase has already been put on track with the launch of several preliminary tasks such as the development of the Demonstration Plan, the selection of the corresponding sites and the starting of training and capacity building activities.

This newsletter therefore puts the emphasis on demonstration and validation of the Sen2-Agri system in real-life conditions. This work is critical to prepare the actual integration of Sentinel-2 and Landsat-8 data for agricultural monitoring at regional and national level in close collaboration with our Champion Users.

Implementing the demonstration phase: from theory to practice

The demonstration use cases correspond to the third and last phase of the Sentinel-2 for Agriculture project. They will start in spring 2016 for a 15-month period. Their objective is to carry out several pioneer experiences aiming full exploitation of the Sentinel-2 mission through large scale applications of the Sen2-Agri system.

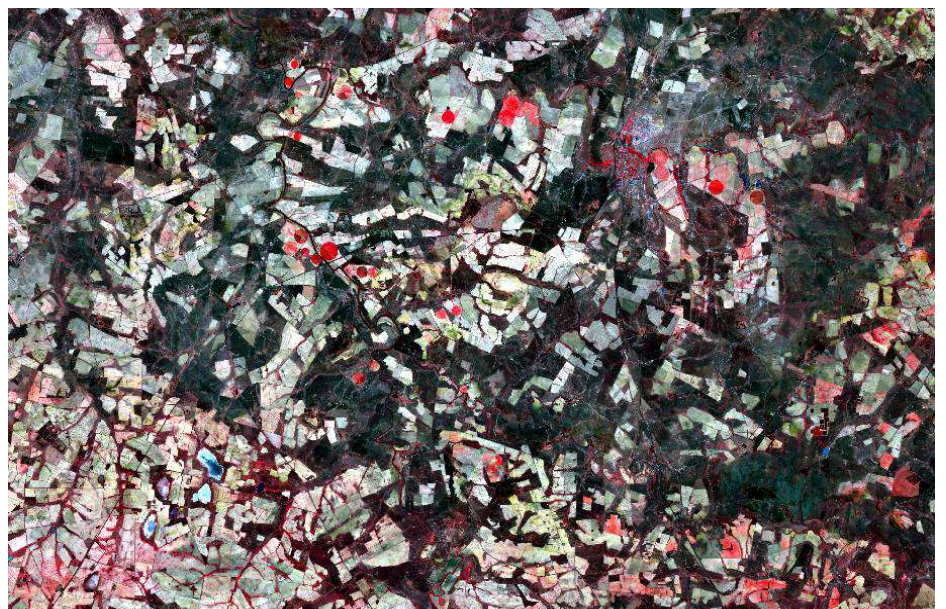
They will begin with capacity building and training activities to make the project users self-sufficient in the use of the system and encourage the development of a network between the users themselves, as well as with research bodies or service providers.

The Sen2-Agri system will then be installed at the premises of the Champion Users concerned by the national demonstration use cases. These organisations will run the Sen2-Agri system in real life conditions using Sentinel-2 imagery with the support of our consortium.

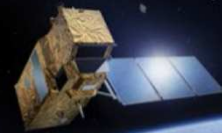
By the same time, the project will generate internally the products related to the local demonstration use cases and deliver them to the corresponding Champion Users.

In both cases, the active involvement and the experience of operational local partners will be sought after to collect appropriate in situ data and to analyse and validate each of the products.

All the detailed results will then be synthesised by the project partners to perform a global assessment and establish the final performance of the Sen2-Agri system before it is released on a wider basis.



Sentinel-2 image acquired on December 19, 2015 depicts precisely the impact of the South Africa's worst drought in over a century : the irrigated fields and some thin bottoms of valleys show well developed green vegetation (in red) in the landscape of Warden, Free State province, sharply contrasting with the bare soil of most fields planted very late this year and the surrounding natural vegetation (in brown) strongly water stressed since weeks.



Working at national and local levels for a comprehensive assessment

The demonstration phase plans to work at two different levels through the integration of:

- ❖ 5 **local use cases** corresponding to a 300 x 300 km² area, selected from the original project test sites, plus possibly some voluntary test sites interested to join the demonstration effort;
- ❖ 3 **national use cases** covering a whole country (typically 500.000 km²) or at least its cultivated part, also chosen among the original test sites using an appropriate set of criteria.

For each use case, the 4 Sen2-Agri products (Cloud-free surface reflectance composites, Dynamic cropland masks, Crop type maps and Vegetation status indicators) will be generated along the growing season with the Sen2-Agri system run both by the consortium and, if interested, by the users themselves.

This dual approach has many advantages:

- ❖ The involved users may have an operational mandate for crop statistics or agriculture monitoring or be only interested in the system for scientific use;
- ❖ The Sen2-Agri system will be deployed and tested in different conditions, either as **standalone** or using a **server-based solution**;
- ❖ A user body may even opt for a centralized installation of the system in a given country, followed by an actual implementation in different sub-regions.

Taking into account all these elements, a selection process was carried out leading to the following results:

- ❖ The national use cases will cover **Mali, Ukraine and South Africa**;
- ❖ The local use cases will concern **Southern France**, the area of Tensift in **Morocco**, the Shandong province in **China**, the area of Antsirabe in **Madagascar** and the White Nile area in **Sudan and South Sudan**. Additional demonstration sites will cover the **Czech Republic and Belgium**.

The recipe to choose the national demonstration sites

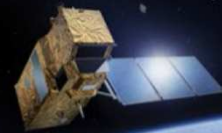
At the last user workshop, the different options for demonstration sites have been discussed with the Champion User group. For the final decision the following selection criteria have been applied:

- ▶ The commitment, mandate and current remote sensing activities of the candidate entity with regards to agriculture monitoring;
- ▶ Its available technical and remote sensing expertise, as well as its experience in field data campaign;
- ▶ The representativeness of the country with regard to a large demonstration ambition;
- ▶ The agro-climatic conditions constraining the availability of valid observations at the critical periods of the growing season;
- ▶ The feasibility and chance of success related to political stability, technical capabilities and institutional capacity;
- ▶ The expected added-value of the Sen2-Agri products with regards to the products currently accessible.

An implicit geographic criteria was also added, as at least 2 national use cases should concern Africa.



Sentinel-2 for Agriculture demonstration sites and related Champion Users and sites managers



Helping our Champions Users to gain ownership of the Sen2-Agri system

The success of the Sentinel-2 for Agriculture project, and more particularly of the demonstration phase, lies in the ability of the users to become self-sufficient in the implementation of the Sen2-Agri system to reach an efficient and sustainable exploitation matching their needs.

To reach this objective, the consortium plans to carry out two types of activities targeted at the Champion Users:

❖ **Training activities**, to help the site managers to fully understand and run efficiently the Sen2-Agri system for their applications using Sentinel-2 data.

❖ **Capacity building activities** which concern more specifically the national use cases to complement the local installation of hardware and software infrastructure for large scale Sen2-Agri system applications.

The training target audience is the remote sensing specialists in charge of one of the Sen2-Agri sites. A first session is planned at the beginning of the demonstration phase to support the upcoming activities (see box below) and a second one at the end of the project to train all the partners about the Sen2-Agri system installation and the latest improvements. Additional training could also be organized by regional training centers in close collaboration with the project consortium, capitalizing on the material prepared for the training modules supported by the project itself.



On the other side, the capacity building plan will be fine-tuned to strengthen the available skills in the national teams. This will allow to cover the 3 main topics required to operate the Sen2-Agri system: **remote sensing** and the related agriculture applications, **in situ data collection** and **validation protocols**, and at last the **software and technical aspects of the system**.

Furthermore, preliminary user feedback collected during the 2nd User Workshop suggested that a single training could not be enough. In order to answer this concern, the project consortium is currently thinking on the best solution to ensure advise and technical support to the Sen2-Agri user community during the whole demonstration phase. More information will be given in due time about the means selected to provide this support (help desk, blog, forum, FAQ, etc.).

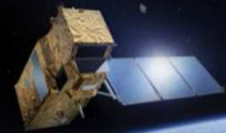
Let's talk about it

- ▶ The **2016 ESA Living Planet Symposium (LPS16)** will take place in **Prague**, Czech Republic, from **9 to 13 May**. A total of 2700 abstracts have been submitted in the frame of this event.

Agriculture being a key issue, 5 sessions will be exclusively dedicated to this topic among those concerning land applications. The Sentinel-2 for Agriculture project will be advertised through **4 different papers** presented during these sessions and focusing on the whole project in relation with the GEOGLAM initiative, on the development and validation of the Sen2-Agri system, on the use of SPOT 5 Take 5 data to anticipate Sentinel-2 exploitation and on the synergy between Sentinel-2 and Landsat 8 imagery for operational applications in the field of agriculture.

- ▶ Taking the opportunity of the LPS16 symposium, our consortium will also organise between **May 12 and 14** the **2nd Training Session** of the project. This session will be open to our Champion Users, the project site managers and the teams actively involved in the demonstration process.

The planned content is a mix of lectures and hands-on presenting the scientific and technical bases of the project methods, the in situ data collection process, the Sen2-Agri system organisation and parametrisation and the operational use and handling of the resulting products. The detailed session agenda is currently under definition and will be released soon.



Sentinel-2 for Agriculture at a glance

Achieving sustainable food security for all people is a priority highlighted during the Millennium Summit of the United Nations in 2000, which defined the eradication of extreme poverty and hunger as one of the eight Millennium Development Goals. In response to such growing pressure, the development of agriculture applications is becoming a strategic target for the remote sensing community.

In this context, **ESA** has launched the **Sentinel-2 for Agriculture** project, as a major contribution to the R&D component of the GEOGLAM initiative and to the JECAM network activities. This 3-year project 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 open source algorithms and software to process Sentinel-2 data in an operational manner and derive Earth Observation products relevant for crop monitoring in the major worldwide representative agriculture systems.

The project is carried out in close collaboration with 20 organizations, centers, universities or companies belonging to the agriculture monitoring communities. They are our Champion Users, involved in the project since its very beginning.

The activities are split into several steps for coming to national and local demonstration:

- ▶ During **Phase 1**, now over, user requirements have been collected and consolidated to set up relevant products and system specifications. Simulated test datasets representative of Sentinel-2 imagery were acquired over 12 test sites to benchmark algorithms and design the system.
- ▶ **Phase 2**, currently under progress, is devoted to the development of an open source processing system and the generation of prototype products based on the Phase 1 outcomes.
- ▶ Starting right after the Sentinel-2 commissioning phase, **Phase 3** will demonstrate and validate the developed system with actual Sentinel-2 time series, with the additional objective to transfer the system to the Champion Users at operational level.

The Sentinel-2 for Agriculture project is carried out by a consortium led by the **Université Catholique de Louvain** (BE) and involving the **Centre d'Études Spatiales de la Biosphère** (FR) and the companies **CS - Systèmes d'Information** (FR) and **CS Romania** (ROU).



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