Food Security TEP - Supporting sustainable intensification of food production from Space

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Abstract. The Food Security Thematic Exploitation Platform (TEP) supported by ESA is a cloud platform for the extraction of information from EO data for services in the food security sector. To respond to the needs of its large user community, the platform is developed in an agile mode in close coordination with its users. Thereby it targets to foster smart, data-intensive agricultural and aquacultural applications in the scientific, private and public domain. During the first two years of platform development, the Food Security TEP project team has deployed a number of service pilot applications. This paper presents those focusing on the support of micro-financing and irrigation for African farmers and on supporting coastal aquaculture development in Africa.

1. A platform to support agriculture and aquaculture in Africa and elsewhere

The Food Security Thematic Exploitation Platform (TEP) is the youngest out of seven TEPs supported by ESA and is developed in an agile mode in close coordination with its users. It provides a platform for the extraction of information from EO data for services in the food security sector mainly in Europe & Africa. Thereby it targets to foster smart, data-intensive agricultural and aquacultural applications in the scientific, private and public domain [1].

The Food Security TEP builds on a large and heterogeneous user community, spanning from agriculture to aquaculture, from small-scale farmers to agricultural industry, from public science to app developers to the finance and insurance sectors, from local and national administration to international agencies. Its technical infrastructure is a web-based Platform-as-a-Service, developed by CGI Italy, which leverages the most advanced cloud computing technologies. This platform provides easy access to all Copernicus data and a wealth of additional data sources and facilitates implementation of specific services, by adding new processing algorithms and allowing their execution, monitoring and maintenance. The main point of access to the platform is the Open Expert Interface providing the main functionalities of the platform and access to a variety of tools and data sets. Furthermore, FS-TEP allows data visualization on mobile devices and the provision of customized products and services to selected users. Service pilots demonstrate the platform’s ability to support agriculture and aquaculture with tailored EO-based information services.

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2. Food Security TEP Service Pilots in Africa

Several service pilot applications in Africa were developed by the Food Security TEP project partners together with African users.

2.1. Supporting micro-insurance for smallholder farmers

Project partner VITO NV, Belgium, cooperates with the UN World Food Program (WFP) to improve crop insurance for farmers in Kenya. Their pilot application is successfully providing EO-based crop monitoring and productivity estimates to support pula-advisors to better conduct their field work for their crop cutting experiments. These experiments are inputs to the agricultural insurance program provided by WFP’s R4 Rural Resilience Initiative. A processing chain for Sentinel-2 data was embedded that uses iCOR for atmospheric corrections, SEN2COR for cloud/shadow masking and BIOPAR (as in the SNAP toolbox) for the retrieval of biophysical parameters. Time series of biophysical parameters are extracted at the parcel level, gap-filled and smoothed to estimate the crop’s growing stage. The information is provided through a co-designed jupyter notebook on the platform. The information helps to better understand differences between fields and helps to better coordinate and reduce field visits.

2.2. Supporting micro-credits and irrigation in Africa

EO service provider VISTA GmbH, Germany, is cooperating with the local company FarmDrive, with the aim of improving access to credits for smallholder farmers in Kenya. The resulting pilot service shows that continuous monitoring of agricultural fields at the regional scale allows objective assessment of crop development to better manage the company’s portfolio risk and hence support the sustainability of their mobile loan services to local farmers. The capability of EO-data to support African farmers’ management decisions is shown in another pilot for irrigation management in Zambia, also led by VISTA. Assimilation of multitemporal leaf area products into the crop growth model PROMET [2] helps to reduce the amount of irrigation water needed while maintaining stable or improved crop yields.

2.3. Supporting aquacultural development in Africa

Finally, a pilot application is being developed by Hatfield Consultants, Canada in conjunction with UN FAO and local partners in Tanzania. It focuses on mapping mangrove clearing potentially due to aquaculture development as well as assessing site suitability for moving seaweed production further offshore in Zanzibar. Mapping mangrove extents at 20 m was done over the entire coastline of Tanzania using pre-processed Sentinel-1 and Sentinel-2 data as input to a random-forest machine learning algorithm. Changes in mangroves potentially due to aquaculture development were analysed using interannual change detection algorithms validated through local experts. The site suitability model for moving seaweed production further offshore integrated GIS and remote sensing datasets, including satellite ocean products from Coastal TEP SAFI services [3] instead of replicating existing information.

3. Providing big data to remote areas

These use cases implemented in developing countries show that using a dedicated cloud-based platform for Earth Observation applications leads to an easier cooperation between international project partners and increases the available information for agricultural and aquacultural management in the target countries. In general, exchange of information in the cloud allows easier exploitation of data while securing data ownership for all partners. The Food Security TEP provides access to big data computing capabilities, which need not be built locally, allowing even remote areas with relatively poor infrastructure to reap the benefits of globally available data sets and tools like satellite imagery.

[Food Security TEP is funded by ESA under contract number 4000120074/17/I-EF.]

References

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