The Regional Spatial Observatory (OSR) for a sustainable management of territories and their resources in the South-West of France

Created in 2000, supported by the CESBIO and labelled by INSU since 2007

Centre d’Etudes Spatiales de la BIOSphère, 18 avenue Edouard Belin, 31400 Toulouse, FRANCE

Tiphaine.tallec@cesbio.cnrs.fr

www.cesbio.ups-tlse.fr

Objectives, data use and collection strategies

- The OSR aims at documenting on the long term the climatic, hydrological, and agro-ecological evolutions in the South-West of France.
- It is based on a site covering an area of 50x50 km² in the South-West of Toulouse in which intensive, detailed and long-term monitoring is performed on agro-ecosystems.
- The data collected and internationally shared through OSR help in:
  1. Investigating the interactions between plant and atmospheric pressure on agronomical and environmental services of agro-ecosystems from plot to regional scale.
  2. Demonstrating the high potential of combining remote sensing, modeling, partnership and in situ data for interdisciplinary research themes covering: physics, ecology, meteorology, hydrology, agronomy.
  3. Showing the contribution of scientific innovation in the elaboration of territorial and resources management strategies.

OSR’s components and associated research activities

A unique remote sensing dataset covering the OSR footprint since 2002, with wide spectral ranges from optical to microwave, at moderate and high spatial & temporal resolutions (HSTR)

Optical images:
- SPOT
- LANDSAT
- FORMOSAT-2
- OSR

Radar images:
- RADARSAT-2

Remote sensing observations

Available through Kaldoesi, ESA and THEIA portals

In situ observations

Geodatabase & web services
- Processing chain for the integration, processing and distribution of the in situ data and of the modeling products
- Infrastructure management for archiving and safeguarding

Main Progress in 2016

Agronomical sciences:
- Early crop mapping and seasonal crop mask mapping with the joint use of optical and radar HSTR image time series[2][3][4][5].
- Retrieval of soil water holding capacity parameters (depth and porosity) using GAI dynamics from HSR optical image time series in an agro-hydrological model at plot scale[6].

Physical sciences: Availability of Sentinel-2A data corrected for atmospheric effects using SCAS code.

Hydrological sciences: Enhancing water cycle simulation using multi-temporal optical series (real GAI dynamics) to force a land surface model[7][8].

Ecological sciences: CO₂ fluxes and carbon budget estimates on winter wheat across a large climate gradient in Europe with a generic crop model[9], over large area combining remote sensing and a simple crop model .

Infrastructure and data distribution: Database with integration of the in situ data, land cover and GAI maps; crop model interfacing; updating of crop sites to ICOS standard.

OSR provides additional value products through the interfacing with existing models and the integration of the high end products into the database. Products include:
- Yield estimates
- Early forecast of sunflower yield
- Water use estimates
- CO₂ fluxes/C budgets

Associated Research, R&D activities

Partnership
- a key component for studies, methods and validation data sharing,
- to address different agronomical and environmental aspects.

Mapping for observatory and modeling

Biophysical products resulting from temporal synthesis, ex: Green area index map from SPOT and FORMOSAT-2 image time series.

Interfacing of models and algorithms

Scientific production in 2015

Involvement of OSR in:

Plans for 2017

- Estimate maize water needs at catchment scale.
- Simulate regional CO₂ fluxes and carbon budgets at crop rotation scale.
- Deepen combined use of radar and optical images (Sentinel-1 and 2) to improve both surface state[10] & land use mapping and crops functioning modeling (yield, biomass)[11][12].
- Introduce HSTR GAI and land use products in a land surface model to improve river discharge modeling.
- Monitor the database functioning, continue the updating of crop sites to ICOS standard.


Which data?
Meteorological, radiation, biometric (biomass, yield, green area index, etc.) and physico-chemical measurements on soil and vegetation, turbulent fluxes (CO₂, H₂O, N₂O, energy) following ICOS protocol, snow in the Pyrénées, Land cover and use.

A multi-scales monitoring network
- Long term continuous monitoring:
  Two ICOS crop sites (Lamasquère and Auradé site manager : B. Zawiski), with contrasted and well documented management since 2005, a low mountain range grassland site (Lannemezan) + a high altitude site for snow monitoring since 2013. About 500 plots annually monitored (surface state, land cover, etc.) since 2008.
- Mid-term monitoring (≤ 4 years):
  Measurements of key variables for adjusting and spatially validating remote sensing algorithms and/or models outputs.
  Experiments conducted on wider scales (watershed) with reinforced observations on several crop plots.
- Special campaigns:
  Occasional and wider intensive measurements, covering a few days to several months (Ex: MCM’10, SPOT-4 takes, 52-Agri).

Scientific production in 2015