The Theia "Digital Soil Mapping" Scientific Expertise Centre of France

Anne Richer-De-Forges, Philippe Lagacherie, Dominique Arrouays, Anne Bialkowski, Hocine Bourennane, Xavier Briottet, Vincent Bustillo, Youssef Fouad, Cécile Gomez, Stéphane Jacquemoud, et al.

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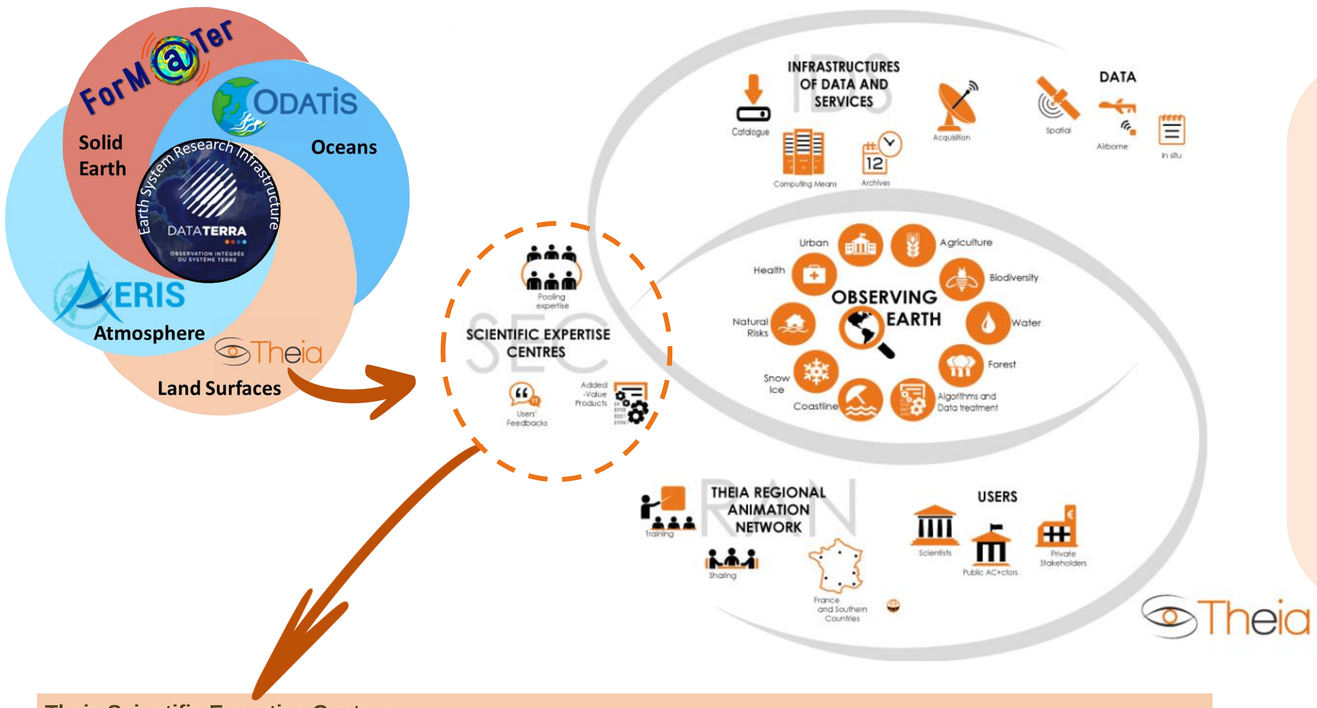


Theia Land data centre

The THEIA Data and Services Centre (www.theia-land.fr) is a consortium of 10 French public institutions involved in Earth observation and environmental sciences (CEA, CEREMA, CIRAD, CNES, IGN, INRAE, CNRS, IRD, Météo France, and ONERA). THEIA was created in 2012 with the objective of increasing the use of Earth Observation data (spatial, by the scientific community and the public actors.

Theia provides national and international scientific communities, as well as public actors aiming to monitor and manage environmental resources, with a wide range of freely available images at different scales, products, methods and training related to the observation of continental surfaces, especially from space.

The consortium is based on three pillars:

1. A Spatial Data Infrastructure distributed among several actors;
2. A network of Scientific Expertise Centres (SECs);
3. Regional Theia Animation Centres in the metropolitan regions and overseas territories of France, as well as in southern countries.

Theia is now one of the active members or so-called "data hubs" of the Earth System Research Infrastructure, an integrated Earth system observation named Data Terra (https://www.data-terra.org/) initiated in 2016.

Theia Scientific Expertise Centres

Theia's Scientific Expertise Centres (SECs) bring together researchers from French laboratories who conduct research and develop innovative methods to analyze satellite, airborne and in situ data acquired on continental surfaces.

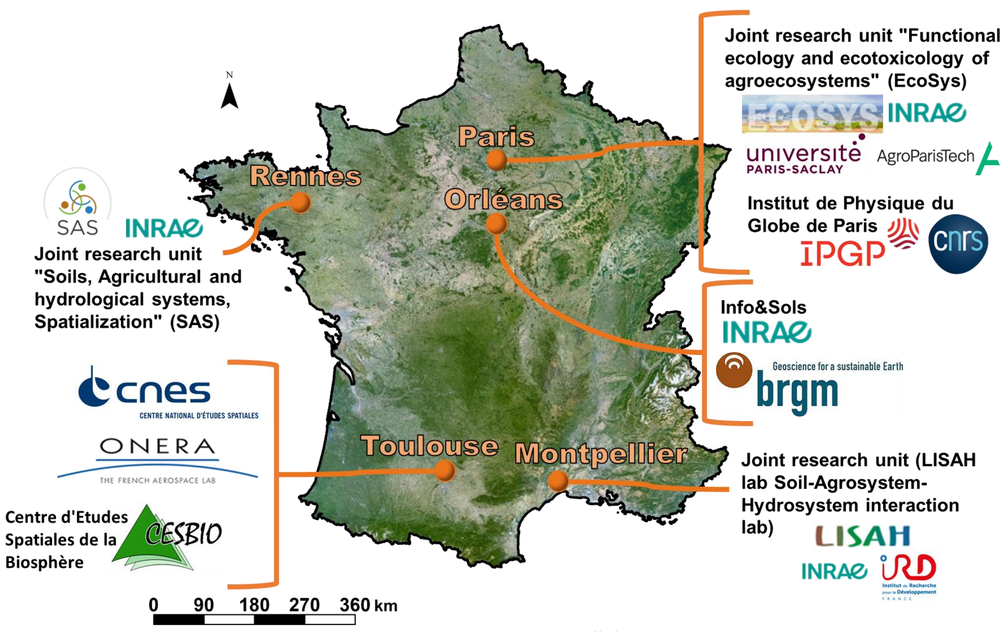
These SECs are focused on value-added products, possibly with services associated with these products. They are single or multi-team and spread over one or more regions, pursuing three main objectives:

- to network and federate scientific actors at the national or even international level around thematic fields (agriculture, forest, urban areas, coastal, surface/atmosphere exchanges, etc.);
- To collect users' needs;
- To design and validate innovative methods, develop products and train users.

The "Digital Soil Mapping" Scientific Expertise Centre (SEC)

Founded in 2015, the Theia SEC called "*Cartographie Numérique des Sols*" (DSM for Digital Soil Mapping) was coordinated by Philippe Lagacherie until 2022. It is currently coordinated by Anne Richer-de-Forges. It aims to federate the efforts of French research laboratories developing digital mapping approaches for perennial soil properties.

This SEC is a multidisciplinary team bringing together French digital soil mappers, geologists, and remote sensing specialists from several regions.



The SEC "Digital Soil Mapping" develops a mapping of soil properties for scientists and public policy makers. The main data used are multispectral optical images (SPOT6, Pléiades), optical (Sentinel-2, Landsat8) and radar (Sentinel-1) time series, airborne hyperspectral images (Hymap), soil data, digital elevation models (DEM), airborne gamma-spectrometric data and near-surface geological data.

These objectives are:

- To federate and capitalize on the efforts made by the teams involved in terms of methodologies and algorithms applied to digital soil mapping and soil remote sensing;
- To produce the first spatialized estimates of soil properties at the national scale according to *GlobalSoilMap* specifications;
- To transfer and disseminate skills in the field of digital mapping and remote sensing of soils to actors operating at regional or local scales and in the southern countries.

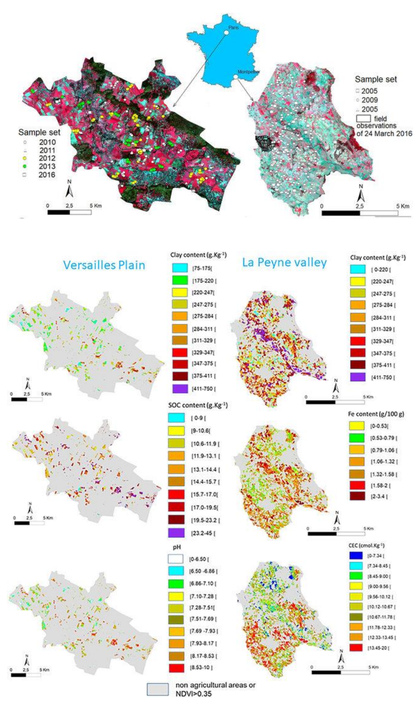
Main collaborations:

Stimulating novel technologies from earth remote observation to predict european soil carbon

Products

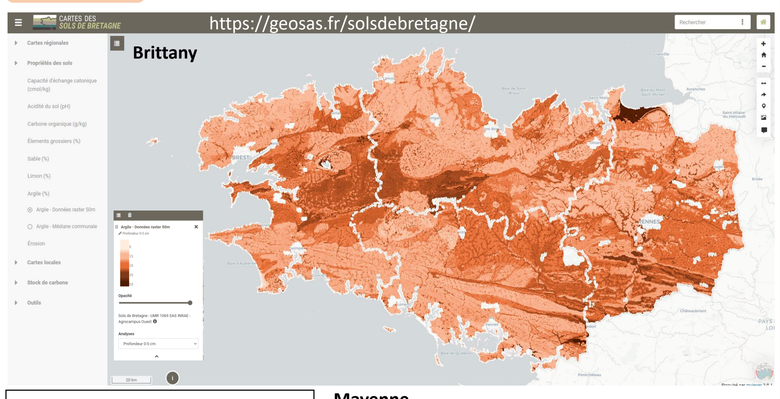
The CES CNS ("Digital Soil Mapping") has allowed the co-supervision of about 20 master students and 10 PhD students. We published more than 30 scientific articles and produced maps of soil properties according to the specifications of the GlobalSoilMap project. Examples of products:

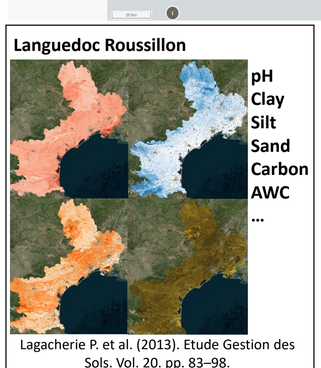
Local level



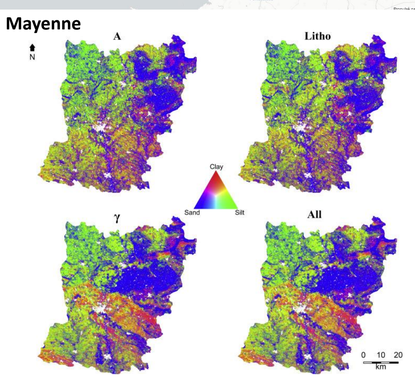
Vaudour E. et al., 2019, RSE 10.1016/j.rse.2019.01.006

Regional level



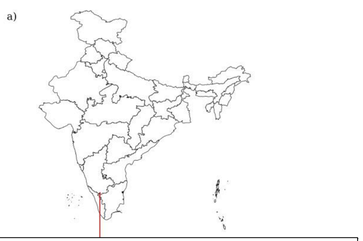


Lagacherie P. et al. (2013). Etude Gestion des Sols. Vol. 20. pp. 83–98.

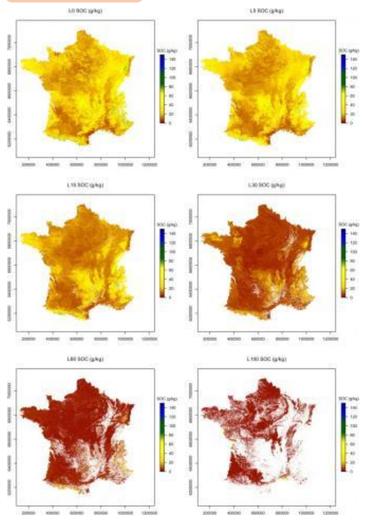


Loiseau T. et al. (2020) Geoderma Regional. 10.1016/j.geodrs.2020.e00295

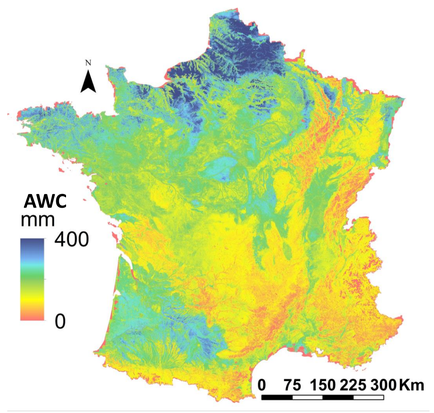
National level



Gomez C. et al., (2021). Geoderma Regional doi.org/10.1016/j.geodrs.2021.e00389



Mulder V.L. et al. 2016. Geoderma. 10.1016/j.geoderma.2015.08.035



Román Dobarco M. et al. 2019. Geoderma. 10.1016/j.geoderma.2019.02.036

Beyond the production of data, the CES CNS has also set as an objective the dissemination of methods and tools used to produce soil maps. This is now materialized by the "Cartograph-e" website, whose ambition is to provide users with basic knowledge about DSM products such as maps of soil properties.

To know more:

https://www.theia-land.fr/en/ceslist/digital-soil-mapping-sec/

Contact: anne.richer-de-forges@inrae.fr

https://www.theia-land.fr/en/homepage-en/