BULLETIN
Theia Land Data Service Centre

n° 14- February 2021

Content

A word

from the Scientific & Technical directors

2020 has been a peculiar year for Theia as for all of us with fewer face-to-face events and therefore fewer meetings between members. In this context, the hosting of the 2020 AppSpace (co-organised by Theia) on 17 September in Montpelier will remain an even stronger moment with its 191 motivated participants and very rich exchanges

Nevertheless, Theia's production continued to be sustained even during the lockdown periods, and the Theia family of products continues to grow and diversify: determination of landscape units, measurement of root zone humidity, mapping of humidity on a plot scale on numerous sites, 38 years of vegetation variables on a global scale, etc.

At the same time, despite the constraints inherent in the pandemic, Theia regional animation network's fieldwork with users continues. The Land Occupation workshops in New Caledonia, the improvement of OpenIG's IDG or the thematic fact sheets proposed by GeoDEV are evidence of this.

This issue of Theia Bulletin illustrates the commitment and constant motivation of the research, production and animation teams composing Theia consortium, and we will rely on this dynamic in 2021 to continue Theia's activities. So keep your agendas close at hand: many thematic meetings should be offered to you in the coming months! ■

News

New Caledonia : A second successful rendezvous with space

The 2nd "Space observation serving New Caledonia" (OSS NC) seminar was held from 16 to 18 November 2020. It gathered more than a hundred participants, both physically and remotely.

Organized by the Theia GeoDEV New Caledonian RAN over three days, with free initiation sessions, plenary presentations and thematic workshops, this seminar was attended by nearly 125 participants from all sectors (public, private, associations, etc.), including 14 videoconference participants and 7 French experts from the continent.

After an official opening by the Government of New Caledonia, the University of New Caledonia and IRD-New Caledonia, the event was held in two major stages:

- Plenary sessions with, in particular, contributions from metropolitan referents, including CNES (Gilles Rabin), Theia (Nicolas Baghdadi and Arnaud Sellé), Aerospace Valley (Philippe Lattes) and SHOM (Yvan Lubac);
- Thematic workshops dealing with drought, land use, maritime space monitoring and biomass, with interventions notably from CESBIO, under the Soil Moisture and Biomass SECs.

The presentations were particularly interesting, the exchanges were very constructive and some actions has been identified over short, medium and long term, offering nice perspectives about the different topics discussed.

The event was also an opportunity for the co-leaders -- INSIGHT and the IRD-NC -- to sign an agreement, committing to the process of setting up an agreement formalising the creation of the New Caledonian RAN! ■

Marc DESPINOY (IRD)
& Jean MASSENET (INSIGHT),
Facilitators of Theia GeoDEV New CaledoniaN RAN

(Re)live AppSpace 2020

All the presentations and videos from the AppSpace 2020 conference held in Montpellier in September 2020 are now available on the OpenIG website.

► www.openig.org/evenements/appspace-2020

Developing an adapted cartography of land occupation in New Caledonia

In its role of support to the New Caledonian GIS &RS community, Theia NC-GeoDEV RAN has organised several workshops aiming at defining collegially a layer of land occupation and use fully adapted to the territory. The approach was initiated during the OSS NC 2019 seminar, with a half-day thematic workshop dedicated to Land Occupation allowing a global situation review of the topic in New Caledonia.

Building an accurate representation of needs and pooling resources

No less than five workshops were then led by the RAN with different colleges (Territory, Divisions, Municipalities, Research Offices...). These workshops made it possible to construct the most exhaustive representation of needs possible, with the participation of several different but complementary professional experts, including both current and potential users. A workshop was then organised to present and exchange on the various results, with the aim of defining collegialy the most suitable layer of information in terms of typology, temporality and scale of use. Finally, on the occasion of OSS NC 2020 seminar and the dedicated Thematic Workshop, a presentation of the finalised work was made, mainly focusing on short and medium term actions.

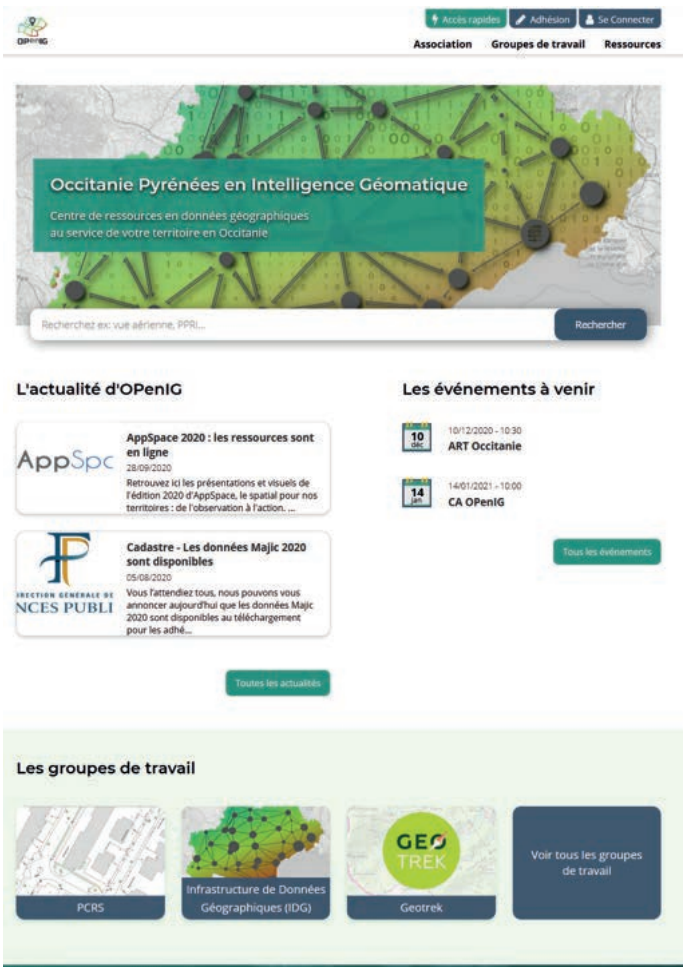
his global approach will enable the spreading of a more insightful vision for decision makers, thanks to a regular production of land occupation and use reference layer adapted to New Caledonia and local uses, according to both concrete needs and allocated budgets. Pooling resources will thus make it possible to answer as many expectations from the various users and financiers as possible. ■

Five workshops contributed to building the most exhaustive and accurate representation of New-Caledonian needs in land occupation cartography.

Marc DESPINOY (IRD)
& Jean MASSENET (INSIGHT),

Co-facilitators of Theia NC GeoDEV
► www.theia-land.fr/artlist/art-geodev-nouvelle-caledonie/

Occitanie: a new Geographic Data Infrastructure for OPenIG



After the launch of a beta version in the spring of 2020, OPenIG, the regional platform for geographic information in Occitanie (France) and co-facilitator of Theia Occitanie RAN (►Read Bulletin n°13), realeased a first stabilised version of its new web portal for the end of 2020.

Functionalities designed with users

Developed by the Toulouse-based company Neogeo with the participation of OPenIG members, the openig.org portal offers:

- A more user-friendly website to find all the information on the association's activities;
- A new generation Geographic Data Infrastructure to make the data more accessible, from the most sensitive to those in Open Data. Thanks to the download and WMS flow functionalities, users can enrich their GIS and business applications. With its ergonomic interface, a member can easily catalogue and distribute his or her data in a simplified form but also in INSPIRE format. OPenIG also ensures data feedback and makes them available to national infrastructures such as data.gouv.fr.
- A search engine to access data referenced in other regional portals (open data of the Region and state services).

New services are planned in 2021, join the association and its working groups to build them with us. The team is at your disposal to answer all your questions. ■

Myriam CROS (OPenIG)
►www.openig.org

Occitanie RAN
►www.theia-land.fr/en/artlist/theia-regional-coordination-network-ran/

GeoDEv: six thematic sheets for users in the South

with the support of La Téléscop, Theia GeoDEV RAN has started the drafting of a series of educational sheets designed with the expectations of users of Theia thematic products in mind. The aim is to list the offered Theia products and their answer to major concrete questions - monitoring of forests, urbanisation, flooding, prevention of vectorial diseases, floods, etc.

The sheets, drawn up with the researchers who developed the products, provide synthetic and accessible information on the concrete use of the products. In line with Theia GeoDEV RAN's geographical focus, these sheets favour examples of use in Southern countries and overseas territories.

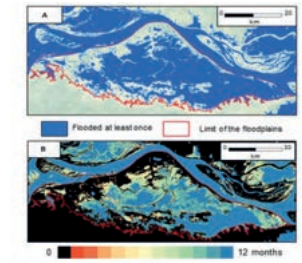
Six sheets have already been produced:

- Floods GeoDEV sheet: «Detecting and monitoring water bodies and volumes».
- Artificial Spot GeoDEV sheet : «Monitoring and identifying vulnerable housing».
- Forest resource management GeoDEV sheet : «Monitoring forests and biodiversity indices».
- Vector-borne diseases GeoDEV sheet : «Monitoring the epidemiological risk of dengue fever in urban areas».
- Agricultural Irrigation GeoDEV sheet : «Measuring and managing water use in cultivated areas».
- Land use & landscape GeoDEV sheet : «Segmenting space through landscapes».

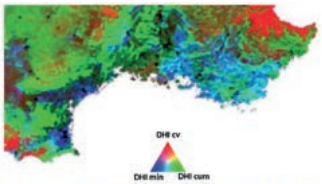
All the sheets are available for download in French in the Resources area of the GeoDEV website.

►www.theia-land.art-geodev.fr/ressources/ ■

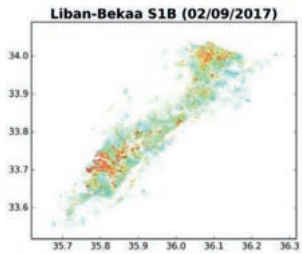
Surface water volumes of floodplains, DHI, Soil moisture, artificial spot, mosquito densities, etc.
Some examples of products presented in the GeoDEV sheets.

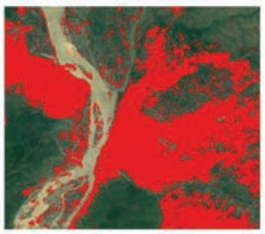


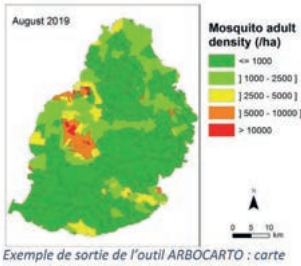
Cartographie Sentinel 1 de l'extension maximale d'inondation et de la durée annuelle d'inondation en 2017 pour la plaine de Curuai, bassin amazonien, Brésil.



Composition colorée intégrant les trois composantes du DHI calculé sur le bassin méditerranéen, France.




Tâche artificialisée de la ville de Onithsa (Nigeria) produite par Urba-Opt à partir de données Sentinel 2



Exemple de sortie de l'outil ARBOCARTO : carte de densité de moustique tigre, Août 2019, Maurice

Women in Copernicus: a European project to reinvent the place of women in the space sector

The Women in Copernicus project conducted a survey between July and October 2020 on the place of women in space and in the Copernicus programme.

460 responses

Without being representative of the entire ecosystem, the 460 responses received provide a first glimpse of a subject that deserves more attention in the future.

These women, mostly from the academic world (43%) and the private sector (25%), want to be visible: they are proud of their jobs and want to talk about them. The results confirm the existence of gender bias in the Copernicus sector. Half of the women who responded perceived it both during their studies and during their careers, where they are in the minority compared to men. This imbalance is less pronounced in the younger age groups, without it being possible to distinguish between a trend reduction in this imbalance or an illustration of a «leaky pipeline», a metaphor for the high proportion of women not pursuing their academic careers.

Women claim to constantly have to prove their abilities in the workplace. For half of them, lack of self-confidence is responsible for missed opportunities in their careers, and was also identified as a major obstacle in girls' choice of career guidance.

Proposing solutions

The women interviewed propose solutions to make Copernicus more inclusive, such as identifying and highlighting role models, but also all women working in the sector; putting in place policies

to achieve parity in the Copernicus sector, especially in hierarchical positions; creating and fostering a professional environment with more empathy and listening, for example by setting up mentoring/tutoring systems and networks for sharing experience and/or knowledge.

The Women in Copernicus project has benefited from funding from CoRdiNet and the voluntary commitment of a team of European women. The first phase ends with the distribution of the results. The reflection on the continuation of the project is open to all. The continuation of the project will require human and financial resources. ■

Marie JAGAILLE
(GIS BRETEL, Bretagne RAN)

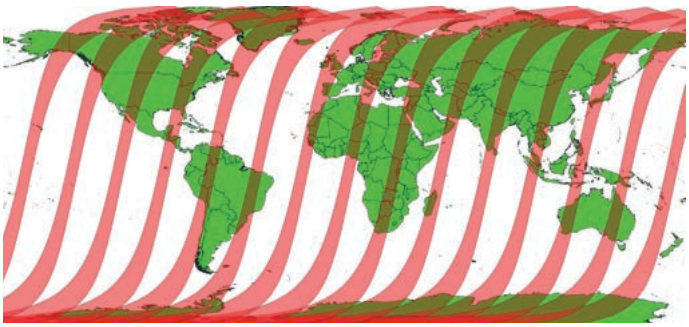
To go further
►womenincopernicus.eu/

Follow onTwitter
►twitter.com/WomenCopernicus

Venµs: propose your daily observation sites

From November 2021 and for at least one year, the Franco-Israeli Earth observation satellite VENµS, launched in 2017, will will function in its daily acquisition phase.

Every day, images with a resolution of 4 m in 12 spectral bands will be acquired for the scientific community on sites measuring 21x21 or 21x42 km^2. Daily and multi-angle (front, nadir, rear) acquisitions during the same pass will be possible for a limited number of sites.



Pink area corresponds to the corridors in which the sites can be selected.

In order to select the sites to be observed, CNES and the Israeli Space Agency have launched a joint call for proposals. Responses must be submitted by 15 February 2021.

The call is open to researchers from educational and research institutions, public bodies, non-profit organisations and any type of organisation, including commercial companies, provided that they comply with the Creative Commons BY-NC 4.0 licence.

Although VENµS was primarily designed for the study of vegetation, the results of the first phase have shown its value in monitoring a wide range of topics, such as water quality, glacier movements, erosion monitoring, and the atmosphere. There is therefore no a priori thematic limitation to the expected proposals. ■

Gérard DEDIEU (CESBIO)

Download the call for proposal, orbits (.kml), as well as the answer files on Theia website.
►www.theia-land.fr/en/venµs-call-for-site-proposals-for-daily-observations/

Citizens and satellites together watching lakes

Financed by the Adour-Garonne Water Agency, and with the technical support of CNES, the "Observations des Eaux continentales par des Citoyens et des Satellites*" (OECS) the Citizen Scientist project is now under way. The project's objective is to promote a «Citizen Scientist» approach in the region managed by the Adour Garonne Water Agency, in order to raise awareness of water management issues. The project is inspired by an American initiative, the LOCSS project, headed up by T.Pavelsky (SWOT/NASA Principal - PI) with the contribution of J.F.Crétaux (SWOT/CNES PI) in France.

Validating satellite data for water bodies

To date, this equipment has been installed on twelve lakes in the Pyrénées (see Green Flags on the map) as part of the LOCSS project, with many measurements collected on the lakes every day. As part of the OECS project, 50 gauges will be put in place in the region managed by the Adour-Garonne Water Agency (see Blue Flags on the map), in close collaboration with the local stakeholders concerned (rowing clubs, water-sports bases, fishing federations, associations, secondary schools, etc.) and in synergy with the measurement points covered by the various satellites (in particular the SWOT mission).

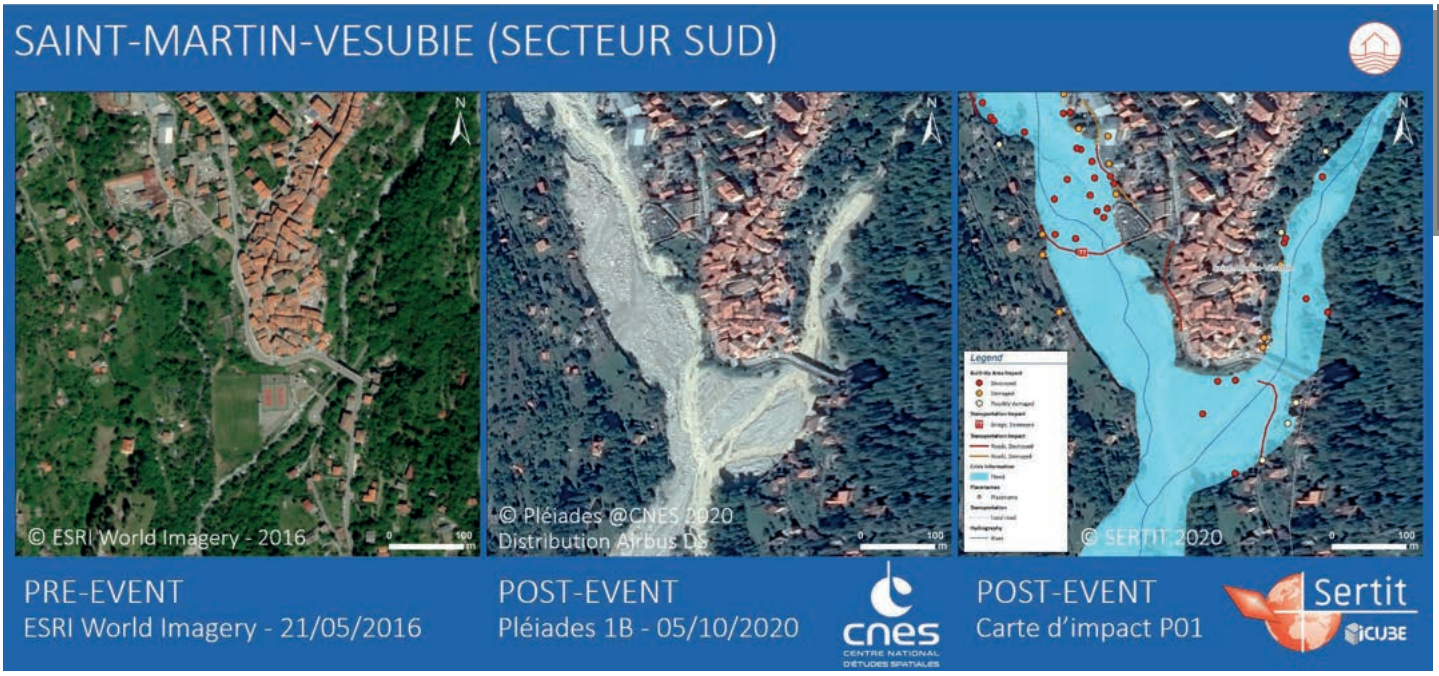
Region managed by the Water Agency, SWOT 1-day orbit swath.
Green Flags: sites equipped on the lakes in the Pyrénées
Blue Flags: Water Sports Bases under 1-day orbit.
Credits J.F. Crétaux, LOCSS.

Example of a gauge installed in Trebens lake in the Pyrénées.
Credits J.F. Crétaux, LOCSS

This project will play a particularly valuable role in validating the satellite data concerning these hydrological surfaces, whether from the Sentinel-3A/B or Jason-3/Jason-CS satellites or the future French-American SWOT satellite, which will take daily measurements across this region in 2022. ■

Jean-François CRÉTAUX (Legos) and Nicolas PICOT (CNES)

Water levels of lakes and rivers SEC
►www.theia-land.fr/en/ceslist/water-levels-of-lakes-and-rivers-sec/



Cartography of the extent and the impact of the flash floods of 3 October 2020 in Saint-Martin-Vésubie; observation on a Pléiades image acquired 2 days after the event.

Alex Storm and flash floods in the French Maritime Alps: Spatial imagery for crisis management

After having swept over western France, Storm Alex led to an exceptional Mediterranean rainfall episode in the Maritime Alps during the night of the 2nd to 3rd October 2020. Flash floods of a rare force devastated several valleys, notably those of Vésubie, Roya and Tinée. The human and material damage was considerable, with many dead or missing, as well as villages left ravaged and isolated due to disrupted communication and transport networks.

As soon as the event occurred, the COGIC, Centre Opérationnel de Gestion Interministérielle des Crises (Operational Centre for Inter-ministerial Crisis Management), called on space-based resources to obtain useful information for the implementation of relief operations, both on the location of the affected areas and on their accessibility. The European Copernicus Emergency Management Service - Rapid Mapping system was launched on 3 October to map flooding and damage to urban infrastructure. At the same time, the CNES activated the Pleiades satellites in order to image the various affected areas. The Pleiades system has demonstrated on numerous occasions its effectiveness in monitoring natural disasters and assessing urban damage, thanks to its very high spatial resolution and revisit frequency.

ICube-SERTIT's (University of Strasbourg) operational 24/7 Rapid Mapping Service, was immediately asked by the CNES to use the Pleiades images to produce maps of the extent and impact of the event and to deliver the results in a few hours to the civil security services. SERTIT was also involved in the Copernicus EMS Rapid Mapping system, complementing the work carried out at the request of the CNES.

The analysis of damage linked to a disaster is carried out systematically by comparing a pre-event imagery with that of crisis or post-event imagery in order to identify changes specific to the event. Indeed, in long-term events, such as lowland flooding, it is necessary to monitor during an event. Depending on event-types, the use of particular spectral bands can also help interpretation. In the case of the Maritime Alps, the flash floods were so intense and devastating that the before-after comparison leaves little doubt about the damage and the difficulty of access to the affected sites.

The Pléiades images acquired on 5 October 2020 were used to produce several maps highlighting the flooded and eroded areas, the destroyed, damaged or probably affected buildings, roads and bridges in the devastated valleys, notably close to the villages of Saint-Martin-Vésubie, Breil-sur-Roya, Roquebillière, Saint-Dalmas de Tende, and Fontan. This information also makes it possible to identify unaffected areas where aid posts could be set up, and possible alternative routes to access the villages.

The products are delivered in the form of maps, in several formats and printing resolutions, and vector files, which can be directly integrated into users' Geographic Information Systems. Satellite images can also be supplied on request, with the agreement of the CNES for Pleiades data. The products were urgently delivered to COGIC and CNES once they were produced. Pierre Chastanet, head of the TI2G Cluster (Crisis Planning and Management Department, Transversal Geographic Information and Geomatics Cluster, COGIC), congratulated the emergency mapping systems and space assets for their valuable assistance. These maps were used by a wide range of actors and widely disseminated in the media after the event. The Pléiades images, also a tool to assist in the management of relief operations, were distributed to the COGIC, as well as to the emergency services, prefectures, DREAL (Regional Directorates for the Environment, Planning and Housing), network managers (ENEDIS) and other state services (ONF, Cerema, etc.). ■

Stéphanie BATTISTON, Stephen CLANDILLON, Mathilde CASPARD
ICube-SERTIT, Rapid Mapping Service
► sertit.unistra.fr/

Claire TINEL
CNES representative for the International Charter "Space and Major Disasters"

To find these mappings:
► sertit.unistra.fr/cartographie-rapide/
► emergency.copernicus.eu/mapping/list-of-components/EMSR467

Objectifying Landscape: Mapping Land Units at a National Scale

More and more sustainable development programs are integrating a landscape approach to improve land management (Tonneau et al., 2020. ► Read box on next page). The Land Units (LUs), on which most of these programs are based, are intended to provide a spatial framework for management and planning actions: subsidies for agriculture, protection of natural areas, implementation of agro-ecological practices, etc.. However, to date there is no consensus on the delineation of these LUs because the synthesis of information from various sources can be subject to different interpretations, or because the subjectivity of the maps produced «by expert opinion» makes them difficult to transfer to managers. We therefore propose an original "objective" approach based essentially on Earth Observation data.

Semi-automatic delimitation of landscape units

The spatial (global coverage and completeness), temporal (archive depth, seasonal information) and physical (measurements comparable in time and space) characteristics of Earth Observation data make it unique for mapping LUs. Indeed, the temporal satellite signal is characteristic of surface conditions, the latter depending on climate, soil, topography and human activities which are also the main determinants of landscapes. The semi-automatic delineation of landscape units from time series of vegetation index images (*via* the principal components of the time series, and possibly a texture index) is a robust, generic (a statistical test is used to select the segmentation scale) and easily transferable approach.

Three first test cases

This approach has been tested at the scale of France (Bisquert et al., 2015), Burkina Faso (Bellon, 2018) and the Tocantins State in Brazil (Bellon et al., 2017) using MODIS time series (NDVI or EVI). In the case of France (Bisquert et al., 2017) and the Tocantins (Bellon et al., 2017), the relevance of these units in terms of environmental and human variables has been demonstrated.

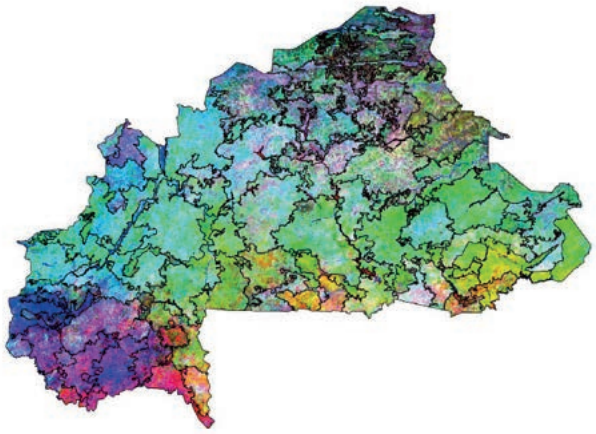
300 Land Units derived from MODIS EVI time series between 2007 and 2011 (Background used: Theia Land Cover Map 2015).

Reference
Bisquert M., Bégué A., Deshayes M., Ducrot D., 2017. Environmental evaluation of MODIS-derived land units. GIScience & Remote Sensing (TGRS), 54:64-77.
Bisquert M., Bégué A., Deshayes M., 2015. Object-based delineation of homogeneous landscape units at regional scale based on MODIS time series. International Journal of Applied Earth Observation & Geoinformation, 37:72-82.

The development and provision of a time series processing chain (MODIS; Sentinel-2) for an automatic delineation of landscape units is planned within the framework of the CNES APR TOSCA project run by Theia Landscape SEC (2021-2023). ■

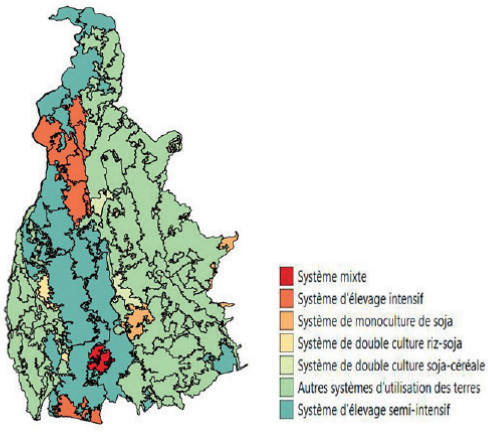
Agnès BÉGUÉ
CIRAD, Tetis
Landscape SEC
►www.theia-land.fr/en/ceslist/landscape-sec/

Land Units at National Scale
►www.theia-land.fr/en/product/land-units-at-national-scale//



80 Land Units for Burkina Faso (Background used: Coloured composition of the Main Components 2, 3 and 4 of the 2016 MODIS NDVI time series)

Reference
Bellon Beatriz (2018). « *L'agronomie des paysages des Suds : analyse régionale par télédétection de la sécurité alimentaire et des risques environnementaux liés à l'agriculture* ». Thèse de Doctorat de AgroParisTech, Montpellier (FR), soutenue le 24 mai 2018 à Montpellier (FR), 192 p. + annexes.



Delimitation of Land Units for the State of Mato Grosso (Brazil) extracted from MODIS NDVI time series for the crop year 2013-2014; labelling of units as agricultural systems.

Reference
Bellón B., Bégué A., Lo Seen D., de Almeida C.A. and M. Simões, 2017. A remote sensing approach for regional-scale mapping of agricultural land-use systems based on NDVI time series. *Remote Sensing*, 9:600.
►dx.doi.org/10.3390/rs9060600

A Landscape Approach to Agricultural Planning in Madagascar: a Guide

Madagascar has adopted a landscape approach for planning its agricultural development. Funded by the World Bank and AFD, the French Development Agency, the Sustainable Agriculture through a Landscape Approach Project (Projet Agriculture Durable par une Approche Paysage - PADAP) has been asked to test the landscape approach in five of the country's watersheds (Andapa, Bealanana, Iazafo, Marovoay and Soaniera Ivongo), by developing a Landscape planning and sustainable management project (in French, plan d'aménagement et de gestion durable du Paysage – PAGDP).

Identifying the issues

Developing a PAGDP raises many questions: What is a landscape? Why the landscape approach? What are the steps to follow? What tools should be used? How can a complex approach be managed? How can stakeholders be involved? How to define the role of each actor? What are the risks to be avoided? What are the good practices?

Ricefield landscape in steep valleys. Analanjirofo (Toamasina province), Madagascar.

To answer these questions, the PADAP has entrusted CIRAD with producing a guide to drawing up a Landscape planning and sustainable management project (PAGDP).

Proposing operational responses

The guide is intended primarily for design office professionals in charge of leading the process of drawing up PAGDPs. However, it has also been written for government officials and elected representatives involved in the drafting process.

The guide proposes operational responses, mainly methodological elements (volume 2) and tools (volume 3). However, the skills required are also "theoretical" skills enabling the mastery of the concepts of landscape and the landscape approach. This mastery is necessary in order to give meaning to the approach implemented and not to be trapped in readymade recipes. The difficulty was that the landscape approach was not very formalized and not very operational. Consequently, the guide specifies the theoretical references concerning landscape and the landscape approach used (volume 1). ■

Jean-Philippe TONNEAU

Reference

Tonneau J.P., Bouvet J.M., Burnod P., Herimandimby H., Raharinjanahary H., Queste J., Rakotondrainibe J.H., Ratsima Arimino T., Labeyrie V., 2020. *Guide pour l'élaboration du PAGDP Plan d'Aménagement et de Gestion Durable d'un Paysage. L'approche paysage.* Montpellier : CIRAD.

3 volumes.

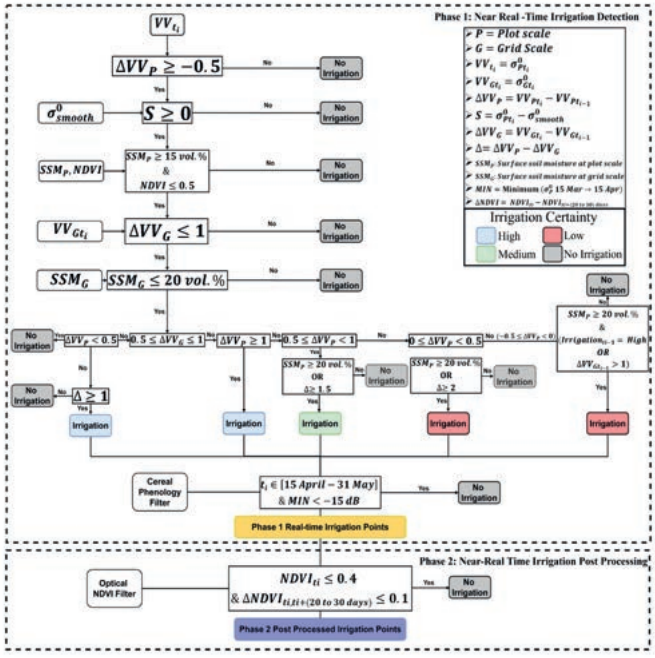
On-Demand Access via Agritop
►agritrop.cirad.fr/596614/

Detection of Irrigation Events at Agricultural Plots

The agricultural sector is the main consumer of fresh water resources. With the increase of the global population, irrigating agricultural crops is essential to achieve higher crop production for food security. However, efficient management of water resources is required to achieve sustainable development in the water sector especially under changing climatic conditions and limited water resources.

In a recent study of the Theia irrigation Scientific Expertise Center (SEC) within the UMR TETIS team, and in the context of water resource management, we have developed an operational tool capable of detecting the irrigation events at plot scale using the Sentinel-1 (S1) time series called the IDM (Irrigation Detection Model).

The IDM is a decision tree-based approach that mainly relies on the change detection in the S1 backscattering coefficients at plot scale. Auxiliary data such as the normalized differential vegetation index (NDVI) derived from the Sentinel-2 images and the soil moisture estimation acquired from the Theia Soil Moisture at very high spatial resolution (S2MP) product were also used in the proposed tool.



A simple and operational indicator, to be combined with a Machine Learning model

The IDM offers, at each S1 acquisition, information about the existence or absence of irrigation events at each agricultural plot. It provides an irrigation indicator showing the irrigation chance that occurred on the plot between two S1 acquisition dates as: no irrigation occurred, low chance of irrigation, moderate chance of irrigation or high chance of irrigation.

The importance of the IDM is its simplicity and ability to be operationally applied over several geographical contexts with no need for a new calibration step.

The IDM was tested and successfully applied over three regions in Montpellier in the south France, in the Adour-Amont basin in the west of France and over the Catalonia region in the north of Spain. In addition to its importance in detecting the irrigation events at plot scale, this tool could be a powerful tool in the operational mapping of irrigated areas. Since mapping irrigated areas using machine-learning models still requires an extensive dataset with costly terrain measurements, the IDM could be used to create a dataset of irrigated/non-irrigated labelled plots in order to use them in a machine-learning model to map irrigated areas. The combination of the IDM and a machine learning model can help in the operational mapping of irrigated areas at plot scale. ■

Nicolas BAGHDADI & Hassan BAZZI
INRAE, Tetis

Irrigation SEC
► www.theia-land.fr/ceslist/ces-irrigation/

SMOS L4RZSM, an operational product dedicated to root zone humidity

Determining the water stock in the root zone

Measuring the moisture content of the first metre of soil is of major use for many ecosystem services and downstream applications. This layer of soil is the main water reservoir for crops. A lack of water in the root zone triggers water stress in vegetation and reduces yield. The root zone in wetlands is also a place overflowing with life with sustained biological activity. From a hydrological point of view, it is at the interface of the processes of runoff, vegetation transpiration and groundwater recharge. It is therefore a component of the critical zone par excellence.

Root zone is critical for vegetation development as well as monitoring its humidity.

An operational product

CESBIO has implemented an algorithm that allows the root zone humidity to be deduced from the surface humidity (0-5 cm) estimated from data from the SMOS satellite (CNES, ESA). SMOS is the first Earth observation satellite dedicated to measuring soil moisture using its 2D L-band interferometric radiometer (1.4 GHz). Since January 2010, SMOS has made it possible to observe surface soil moisture (0-5 cm) twice (in descending and ascending orbit) every three days (at the equator) on a global scale.

The algorithm for estimating root zone moisture has the characteristic of taking only the surface soil moisture as input. Also, the algorithm takes into account the soil texture in the transfer function from the surface to the different soil layers. The resulting product contains the root zone humidity in m3/m3 with a quality indicator taking into account the presence of radio interference, the presence of dense forest and the period between product updates. This period is impacted by various phenomena, for example, ground frost. A processor based on the algorithm in question has been prepared by CESBIO engineers for operational implementation at the SMOS Data Processing Centre (CATDS). It was

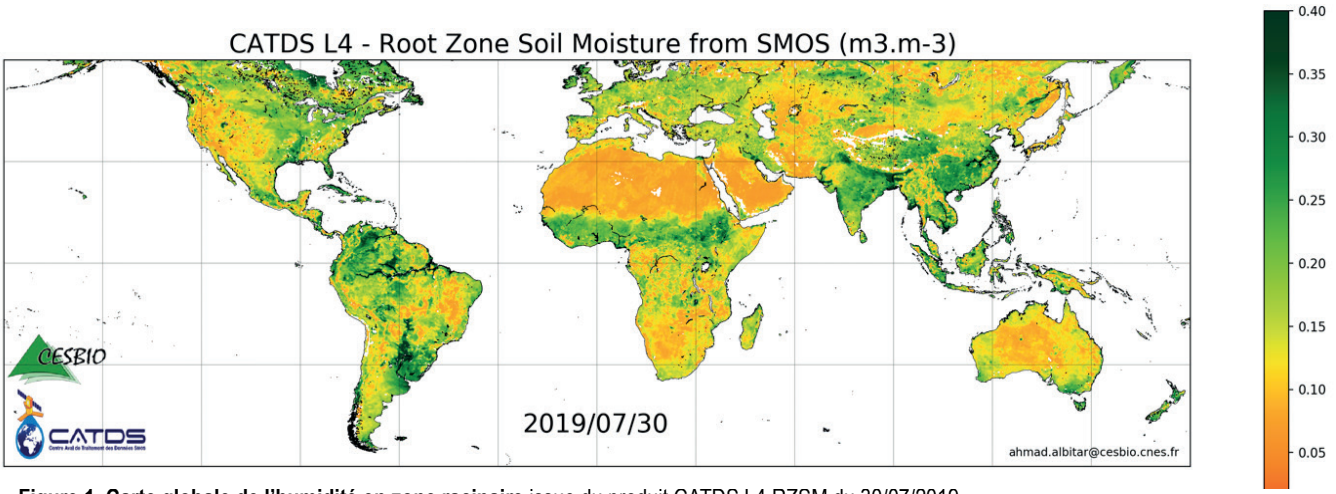


Figure 1. Carte globale de l'humidité en zone racinaire issue du produit CATDS L4 RZSM du 30/07/2019

configured by the engineers of the Production Centre (C-PDC) of the Back End SMOS Data Processing Centre (CATDS) at Ifremer. Today, the L4RZSM daily product (Figure 1) is available to users via the CATDS website:

► www.catds.fr/Products/Available-products-from-CPDC/Catalogue/Catds-products-from-Sextant#/metadata/316e77af-cb72-4312-96a3-3011cc5068d4

Users also have access to a base of ten years' root zone humidity via the research product while awaiting homogeneous reprocessing of the entire SMOS series in 2021:

► ftp://ext-catds-cecsm:catds2010@ftp.ifremer.fr/Land_products/L4_Root_Zone_Soil_Moisture/MIR_CLF4RD/

The product is supplied on the EASE2 grid at 25 km, consistent with the product's input surface moisture sampling. The high revisit of SMOS allows the moisture in the root zone layers to be updated frequently.

This product incorporates Theia Soil Moisture SEC giving access to root zone moisture. It is distributed with a license (Creative Common) like all CATDS products. In the next step, application to higher resolution surface moisture data from the multi-sensor fusion would provide a root zone moisture product at sub-kilometre resolution.

Applications around the root zone

The applications are multiple. First of all, we will mention the monitoring of agricultural drought. As agriculture alone uses 70% of the water extracted from the environment according to the FAO, monitoring agricultural drought is essential. Moreover, as drought generally occurs on a regional scale, this product is particularly suitable.

A database of moisture anomalies in the root zone is already available to users:

► www.catds.fr/Products/Available-products-from-CEC-SM/L4-Land-research-products

The analysis of these anomalies makes it possible to show the intensity of the droughts in 2019 in Brazil and Australia, which led to huge forest fires (Figure 2).

Other applications concern the evaluation of the denitrification capacity of wet soils (ECOLAB/CESBIO/WMO). Indeed, soil plays a major role in the biogeochemical transformation of water and a global assessment of these processes is necessary.

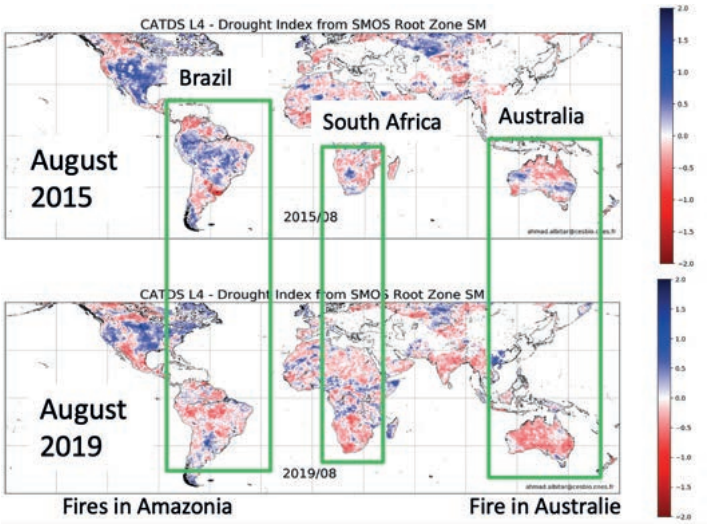


Figure 2. 2019 Drought ilustrated by CATDS L4RZSM data

CESBIO is currently working in collaboration with international institutes (IPH, Brazil; IISc Bangalore, India) on the contribution of these data to the calibration of large-scale hydrological models and operational drought monitoring. ■

Ahmad AL BITAR
CESBIO/CNRS

Contributors
Ali MAHMOODI (CESBIO), Yann KERR (CNES)
& Stéphane TAROT (Ifremer)

Product Soil Moisture Root Zone
► www.theia-land.fr/product/soil-moisture-in-the-root-zone//

CATDS L4RZSM product
► www.catds.fr/Products/Available-products-from-CPDC/Catalogue/Catds-products-from-Sextant#/metadata/316e77af-cb72-4312-96a3-3011cc5068d4

Drought SEC: from Hazard to Risk

Teams from the CESBIO and CNRM in Toulouse, the IGE in Grenoble and Hydroscience Montpellier (IRD) have just joined forces to create Theia Drought Scientific Expertise Centre (SEC). Its aim is to develop a drought monitoring tool combining quantification of the hazard (lack of water) with vulnerability (impacts) based on Earth Observation data.

In the first phase, the objective is to build a drought index. A database covering a period of at least ten years will be set up and systematically updated as data becomes available. It will include several drought indices: in particular, deviations from the mean, normalized by the maximum amplitude or by the standard deviation of the variable, informed by soil moisture products (SMOS CATDS Theia Moisture of the root zone, ASCAT,...) the Normalized Difference Vegetation Index (NDVI) as an indicator of vegetation vigour and the difference between air temperature and soil temperature (Ts-Ta); and precipitation products such as PrISM products. All drought indices will be compared with indices from the outputs of the SIM model (Météo-France).

The second phase will be initiated during the first year through meetings with partners within Theia Drought SEC and consultation with potential users. Depending on the needs expressed and the progress of the research work, certain avenues will be explored such as, for example, temporal and spatial resolutions, the notion of a tailor-made drought indicator, the dichotomisation of the space to be qualified, duration and intensity of the drought, surface area affected, etc.

The SEC will provide global and regional products on hazard, and will quantify the risks in areas for which it already has expertise: the Mediterranean basin, the state of Karnataka (India) and the Sahelian zone in the first instance. ■

Ahmad AL BITAR (CESBIO/CNRS)
& Michel LE PAGE (CESBIO/IRD)
Theia Drought SEC Co-facilitators
► www.theia-land.fr/en/ceslist/drought-sec/

Estimating Canopy Height and Wood Volume Using Lidar Data from the GEDI Sensor

The increase in the atmospheric concentration of greenhouse gases such as CO_2 has emerged as a global concern over the last two decades. Quantifying the state and evolution of forest resources due to the key role of forests in the global carbon cycle has thus become a priority.

Carbon stocks or above-ground biomass (AGB) can be monitored by different methods. The most accurate remains the direct weighing of living biomass after harvesting and drying. However, this method, in addition to being destructive, is restrictive, time-consuming and expensive and often impractical in hard-to-reach areas. Another method of estimating AGB is based on field measurements from forest inventories (e.g. tree height and diameter at breast height). These data are used in allometric relationships to estimate the AGB. While the method is accurate, it is also expensive and time-consuming to implement, especially in remote and inaccessible tropical forests. Recent advances in satellite sensors have provided a robust alternative for measuring tropical forest AGB with global coverage and low or no acquisition costs for the end user.

Three main data sources - optical, radar and LiDAR - provide these assessments. Each has limitations. The saturation of sensors at certain biomass levels with radar and optical data makes it necessary to limit the measurement to areas where AGB has a low density (<150 Mg/ha) or to favour a limited spatial coverage using LiDAR data. Furthermore, optical, radar and LiDAR instruments cannot provide direct biomass measurements. Biomass sampled in the field is still needed to establish relationships between remote sensing data and biomass in order to estimate AGB on a large scale.

Testing the contribution of the GEDI sensor

The new spatial LiDAR system 'Global Ecosystem Dynamics Investigation' (GEDI) from NASA opens up new perspectives. Since April 2019, the GEDI sensor on board the International Space Station (ISS) has been collecting high-density data from 25-metre wide footprints. To test the possible uses of these data for canopy height and biomass estimation, a study has just been conducted at TETIS in collaboration with CIRAD and the Brazilian company Suzano. The objective is to assess the capacity of GEDI data to estimate the dominant heights (Hdom) and wood volume (V) on eucalyptus plantations in Brazil (figure 1). These plantations are a valuable case study because their canopy has a homogeneous coverage and high quality ground measurements are available.

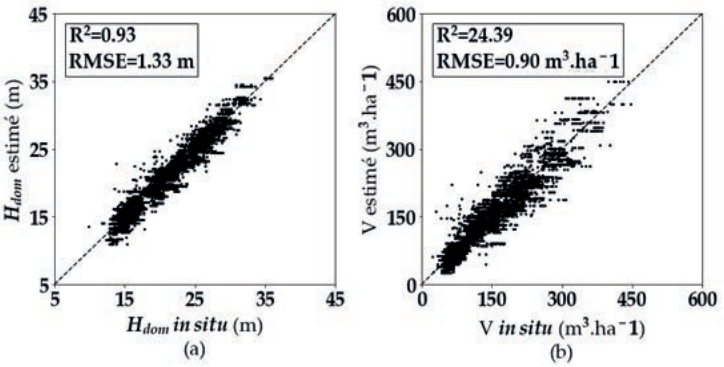


Figure 2. Validation of GEDI accuracy to estimate dominant heights (H_{dom}) and wood volume (V)

The accuracy of GEDI on the estimation of Hdom and V was evaluated using several linear and non-linear regression models applied on metrics extracted from GEDI waveforms. The results thus show that, in low slope terrain, the GEDI sensor is capable of estimating both H_{dom} and V with a root mean square error (RMSE) of no more than 1.33 m (R2 of 0.93) for H_{dom}, and 24.39 m^3.ha-1 (R2 of 0.90) for V (Figure 2). These results have just been submitted for publication. ■

.

**Ibrahim Fayad & Nicolas Baghdadi (INRAE, Tetis)
in collaboration with Guerric Le Maire (CIRAD)
and the Brazilian partners of the Suzano company.**

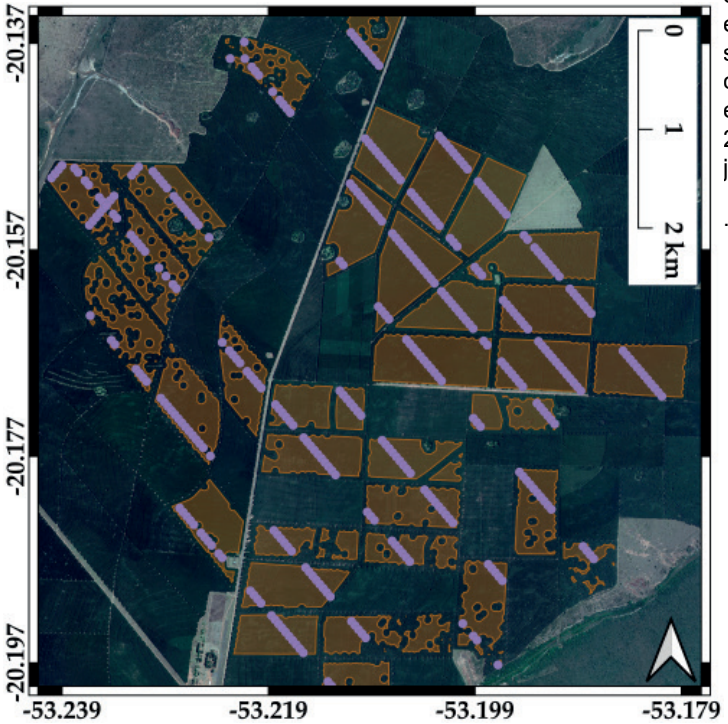


Figure 1. Example of GEDI footprints over some eucalyptus plots in Brazil..

Reference

Ibrahim Fayad, Nicolas Baghdadi, Clayton Alcarde Alvares, Jose Luiz Stape, Jean Stéphane Bailly, Henrique Ferraço Scolforo, Mehrez Zribi, and Guerric Le Maire "Assessment of GEDI's Lidar Data for the Estimation of Canopy Heights and Wood Volume", submitted to *JSTARS - IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing.*

GEOV2-AVHRR : Monitoring Changes in Vegetation on a Global Scale over the last 38 Years

Long-term global monitoring of the terrestrial biosphere has raised an increasing interest in recent years. The Global Climate Observing System (GCOS 2010) identified a set of Essential Climate Variables (ECV) accessible from remote sensing observations including Leaf Area Index (LAI) and the fraction of Absorbed Photosynthetic Active Radiation (fAPAR). These ECVs play a key role in several processes, including photosynthesis, respiration and transpiration.

LAI is defined as one half the total green leaf area per unit horizontal ground surface area. It controls the exchanges of energy, water and greenhouse gases between the land surface and the atmosphere.

fAPAR is defined as the fraction of photosynthetically active radiation that is absorbed by the green parts of the canopy.

The cover fraction (FCover) defined as the fraction of background covered by green vegetation as seen from nadir is used in surface energy balance models to separate the contribution of the soil from that of the canopy.

Going back in time

Version 2 of Copernicus Global Land Service 1km products of LAI, fAPAR and FCover (called hereafter GEOV2-CGLS) was recently developed from SPOT/VEGETATION and PROBA-V data for the period 1999-present.

Because of the good performances of the GEOV2-CGLS products it was decided to extend the time series back in time using the Advanced Very High Resolution Radiometers (AVHRR) Long Term Data Record (LTDR). CNES and CREAF have developed GEOV2-AVHRR: long term (1981-2019) global LAI, fAPAR and FCover products consistently with GEOV2-CGLS. We are pleased to announce that the GEOV2-AVHRR products are now available on the Theia download platform

► postel.theia.cnes.fr/atdistrib/postel/client/#/products?instrument=AVHRR#top

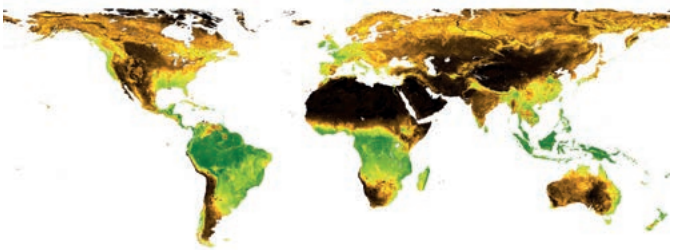
An improvement in terms of temporal consistency and continuity is achieved in GEOV2-AVHRR products as compared to the other existing products derived from AVHRR data. Their main interest is to provide continuously expanding time series for the last forty years at the global scale to document the changes in vegetation occurring over the globe under both the direct impact of human activities and the effect of climate change.

All the documentation about the GEOV2-AVHRR product is available on the Theia web site ■

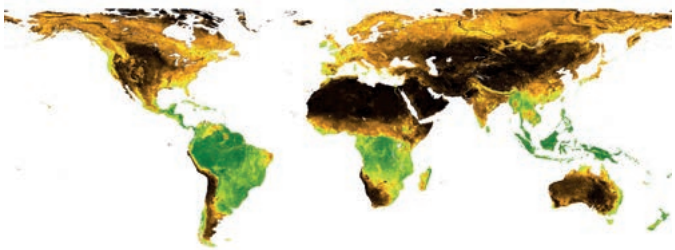
Philippe PACHOLCZYK
CNES, THEIA

Series of vegetation variables AVHRR
► www.theia-land.fr/product/series-of-vegetation-variables-avhrr/

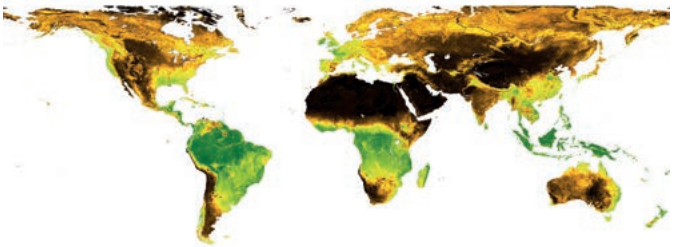
Vegetation Biophysics Variables SEC
► www.theia-land.fr/en/ceslist/vegetation-biophysics-variables-sec/



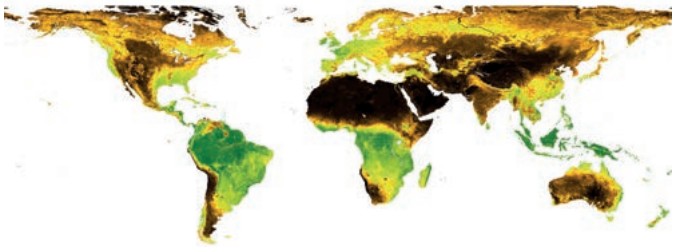
January 1981



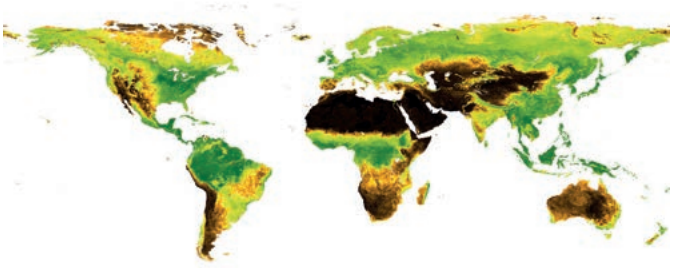
January 2019



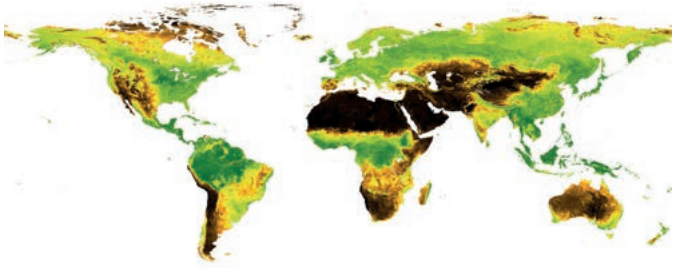
May 1981



May 2019



August 1981



August 2019

Thermal Infrared: Understanding Practices and Assessing Needs

Theia Scientific Expertise Centre Surface (SEC) Temperature and Emissivity aims to federate national laboratories working on the estimation of Land Surface Temperature (LST) and Land Surface Emissivity (LSE) from available thermal infrared data to improve the accuracy of these products and to offer them to the community. In this framework, a survey was conducted at the beginning of 2020 to better identify user needs, the difficulties encountered and to specify which improvements should be made in order to provide adapted and better quality products.

A small IRT community

41 people with varying levels of knowledge of thermal infrared (TIR) data and from different professional sectors responded to the survey (Figure 1). Perhaps as a result of a bias related to the survey's dissemination network, academic research is the most represented sector (60%) and urban environment is the predominant field of application (47%). However, the range of uses mentioned by the participants is very wide. It covers both very upstream research activities such as improving estimates and developing processing chains, as well as more downstream or even commercial applications. The responses highlight the great diversity of applications and confirm the interest and need for TIR data and products in all sectors.

Figure 1. Profile of survey respondents

Nearly 80% of the respondents are already TIR data users : mainly satellite data downloaded online and, to a lesser extent, airborne and ground data. Unmanned aerial vehicle (UAV) data are still seldom used. Furthermore, it is common for one person to use several types of data. Although Top Of Atmosphere (TOA) radiance and LST are the most popular products, others with different processing levels are also significantly used. 70% of the users reported performing post-processing on the data.

The main limitations encountered when using TIR products are insufficient spatial and temporal resolutions, as well as the lack of accuracy, information and validation of the estimates. These limitations are also mentioned by future users, in addition to the difficulties of access and use. (Figure 2)

Identifying user expectations

The responses gathered have enabled a better understanding of user expectations and the expression of specific needs for future TIR products. (Figure 3) Although LST is the most sought-after parameter, the demand for LSE maps, methods and processing chains, validation protocols and reference datasets is also significant. Preferences expressed for the specification of the LST/LSE products are a spatial resolution of less than 50 m and a weekly, daily or even hourly temporal resolution with local or regional coverage.

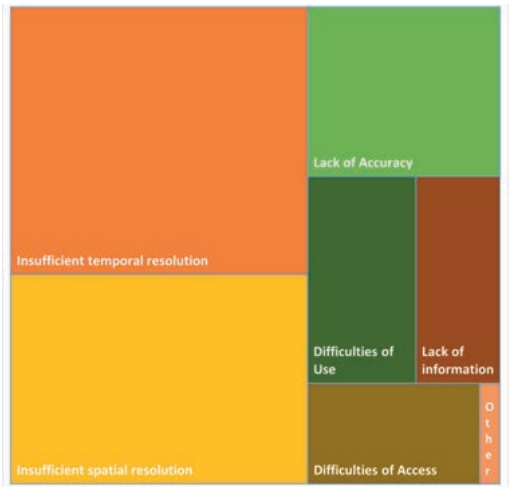


Figure 2. Main limitations cited by survey participants. Each area represents the share of each response in the total. Several answers were possible.

However, it should be pointed out that it is very unlikely that it will be possible to obtain LST deca-metric maps at hourly time steps from satellite data in the near future. The large number of applications on urban environment explains such demand for fine spatial resolution, but other fields of applications are also interested (agriculture and forestry in particular). Concerning the accuracy of future products, half of the respondents expressed an opinion for LST, the majority of which recommending an accuracy of 1 K. The importance of the relative error for this parameter, which should ideally be around 0.1 K, was also mentioned. For the LSE, only 20% responded indicating an accuracy between 0.5 and 1%. Overall, these results underline the large gap between expectations and available TIR products.

Future TIR satellite missions such as TRISHNA (►Read Theia Bulletin n°13), LSTM or HyspIRI, could potentially address this gap, involving the preparation of future products and the development of data disaggregation and fusion techniques to achieve expected accuracies and resolutions.

A roadmap for the development of adapted products

In conclusion, there is a strong demand for LST and, to a lesser extent, LSE products at fine spatial and temporal resolutions for a wide variety of applications in different sectors. To meet this demand, it is essential to develop techniques to estimate and disaggregate TIR data, especially for future TIR missions. It is also essential to work on the improvement of the accuracy of the retrieved parameters and to clearly evaluate and document the products provided. This translates into in-depth work on improving retrieval methods, particularly in heterogeneous environments, and, above all, on providing protocols and data to carry out reliable validations. In this context, acquisitions by UAVs and the processing of related data could be exploited further.

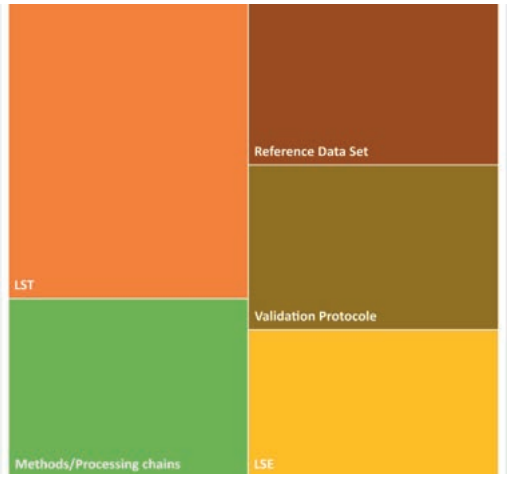


Figure 3. Products expected by the survey participants. Each area represents the share of each response in the total. Several answers were possible.

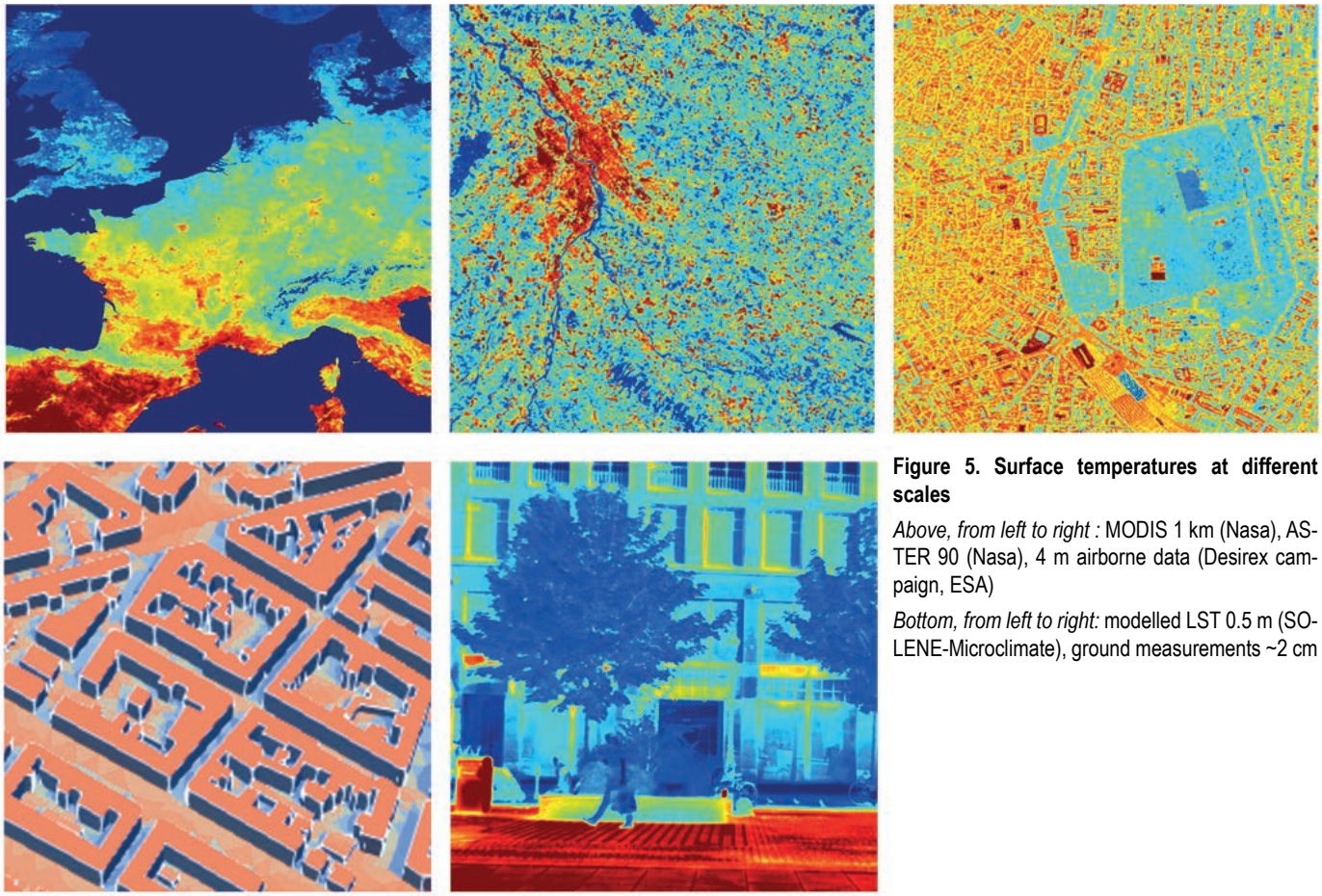


Figure 5. Surface temperatures at different scales

Above, from left to right : MODIS 1 km (Nasa), ASTER 90 (Nasa), 4 m airborne data (Desirex campaign, ESA)

Bottom, from left to right: modelled LST 0.5 m (SOLENE-Microclimate), ground measurements ~2 cm

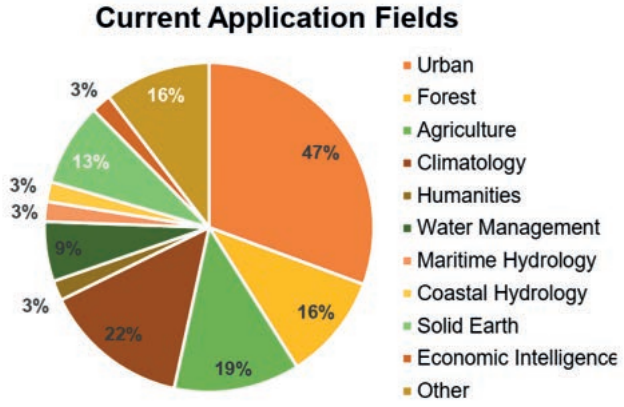
In addition, there are already several thermal datasets available on which to rely and a willingness from the users to share and pool the efforts. A final point highlighted by this survey is the importance of informing and raising awareness among users regarding the specificities of TIR data in order to facilitate their understanding and use. All these observations are fully in line with the role of the SEC following four main axes: Products, Improvements, Awareness raising, Federation. ■

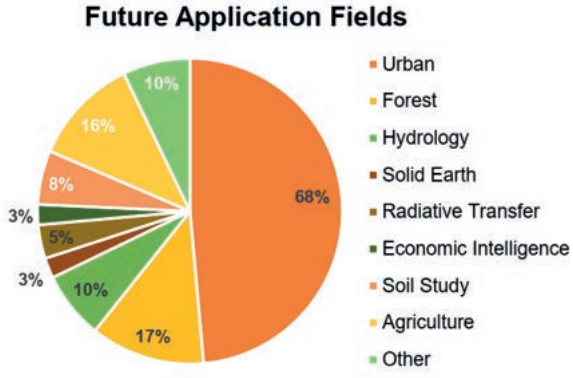
Laure ROUPIOZ & Aurélie MICHEL
Onera

Co-facilitators du Surface temperature and emissivity SEC
►www.theia-land.fr/en/ceslist/surface-temperature-and-emissivity-sec/

The full results of the study (in French) can be downloaded from the SEC page

Figure 4. Current and future fields of application.





I-SEA: Imagining Services Based on Research Serving Uses Defined by their Users

I-Sea was created almost six years ago thanks to a technology transfer unit, a device that has existed in Aquitaine for almost thirty years to help the emergence of start-ups from the academic world. Our unit, GEO-transfer, still exists, backed by the EPOC oceanography laboratory at the University of Bordeaux. The idea was to move away from the traditional professions of oceanography to put forward mapping and observation services based on satellite data: bathymetry for mapping the seabed; water quality and biodiversity mapping. Our team was convinced of the capacity of satellite applications to grow and find a client-base.

Services for users

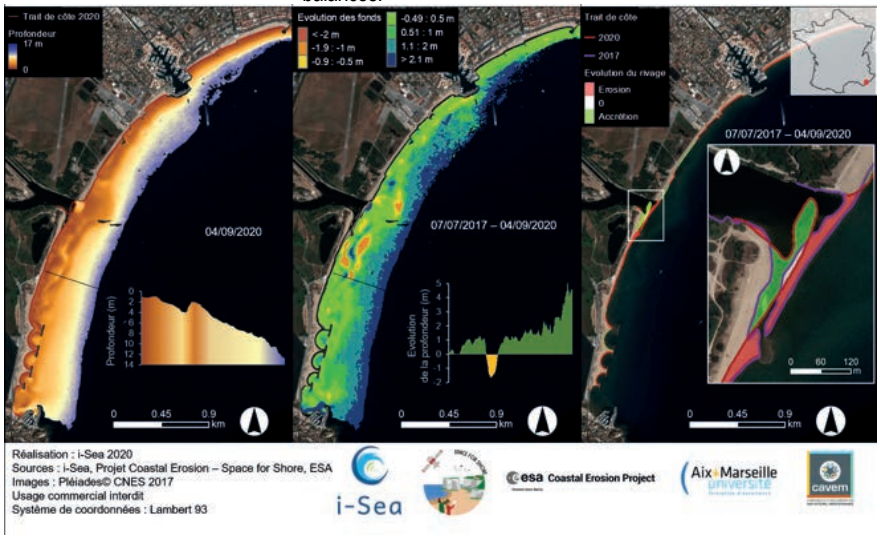
The i-Sea offer has been designed for end products each corresponding to a family of users. For biodiversity, I-Sea had robust methods for mapping coastal habitats thanks to the SYNIHAL programme funded by CNES for the 2012-2014 period. The research project had shown that with the new satellites, the new calculation capacities and the evolution of the learning machine, things that seemed very similar in the field could be discriminated radiometrically. I-Sea proposed to all marine environment managers to support the development and, very quickly, five pilot sites and a pool of field experts were identified. The users themselves directed our work towards the solution best suited to their needs.

Like biodiversity, I-Sea's water quality offer is based on research projects carried out before its creation with the support of CNES. They provided the first building blocks for a water turbidity (suspended matter) monitoring service. Today, with the support of ESA, the uses are being developed. I-Sea is thus involved in the impact studies and monitoring of the expansion of the Port-La-Nouvelle (Occitanie) facilities by providing, on a large spatial scale, consistent indicators on water transparency, which has a direct impact on the health of animal and plant species in the area.

Mapping of coastal seabeds and delimitation of the coastline for an exhaustive reading of the morphology of sandy and micro tidal coasts.

Seasonal, annual or decennial bathymetric evolution: example of a differential between two recent years for the analysis of redistributions and sediment budget balances.

Changes in coastline position to locate critical areas of erosion, morphological changes, seasonal fluctuations and multi-year trends

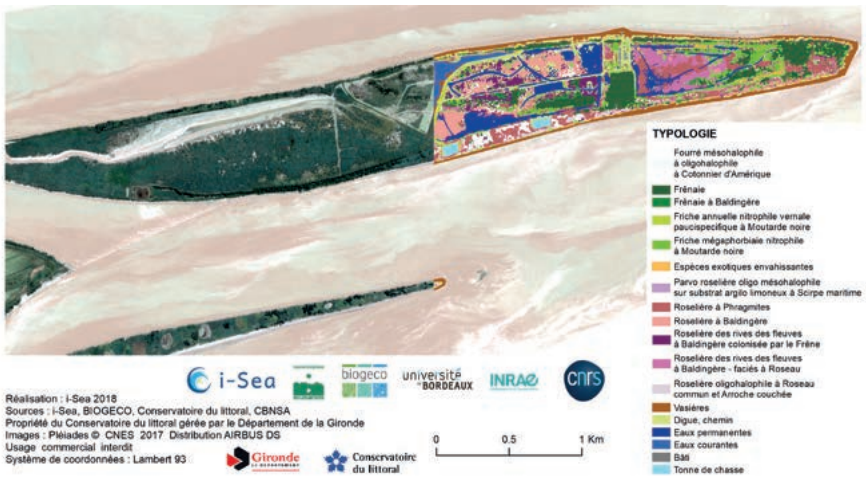


Finally, I-Sea is also interested in coastal risks. Thanks to the Coastal Erosion contract (ESA), I-Sea leads a European consortium of companies and research laboratories and is working to offer environmental and territorial managers and decision-makers a service covering all European seas and all types of façades. At the end of the project next January, the consortium hopes to interest Europe and other institutions, such as the World Bank, and develop a large-scale satellite-based erosion anticipation service.

One of our latest projects is algae monitoring mapping. At the request of DREAL Guadeloupe, I-Sea has mapped the algae in the Sargasso Sea in Guadeloupe. Since then, I-Sea has developed an operational system of toxic micro-algae in the Baltic Sea, in response to a Mercator Ocean call for tenders.

Our clients are actors of environmental health monitoring. In France, these actors are above all public actors and we seek to meet their needs. Platforms such as Google Earth make satellite imagery affordable to ordinary people with astonishing uses. A form of citizen surveillance of the environment is thus developing with tools that are not very precise but have a strong impact on the imagination. It is becoming important for institutions to be able to justify their activities with satellite images. By offering them tools for global monitoring of their environment, we also enable them to prevent, inform and respond to this type of questioning. ■

Vegetation mapping for the Ile-Nouvelle site, south-west of France - 2017



Virginie Lafon
i-Sea
►**i-sea.fr/**

« Meeting effectively not only current production needs but also those of the future

Interview with
Bernard SPECHT

CNES Operation Manager
for Theia-MUSCATE DSI

► www.theia.cnes.fr

Who are you and what is your role within Theia?

Bernard Specht: At CNES for the last twenty years or so, I have worked in various control and data production centres. I held several positions in these centres before taking on the role of Operations Manager.

My involvement in the Theia consortium began in 2013 with, in particular, the development and implementation of the first versions of the Theia communication portal. Then I prepared and launched the entire operation of the Venμs Mission Production Centre. Finally, I returned to Theia at the end of 2018 to take on the role of Operations Manager for the Theia-MUSCATE Data and Services Infrastructure (DSI).

This role is very central, interfacing with the various stakeholders. Keeping the users happy while meeting the project or consortium requirements as well as possible often constitutes real challenges. The balance between satisfaction and the needs of each individual is constantly in our minds. We therefore need to be a facilitator for all these stakeholders. Finding a solution, solving problems, exchanging with the right people, improving production, being a source of proposals, maintaining a quality service are the daily activities to be carried out by the operations manager and his team.

If my first experience in the centre was somewhat distant, my involvement today feels a little different. Theia-MUSCATE SDI exists with clear and important objectives and this Mass Production Centre is a major and driving force within the Theia consortium.

What is different about exploitation within Theia compared to your past experiences?

Bernard Specht: Together with all the teams involved in Theia-MUSCATE operation, we manage a whole daily production defined by the consortium. More precisely, exploitation consists of recovering data from source catalogues (PEPS, USGS...) then processing them with THEIA treatment chains (MAJA, WASP, Neige...) and finally making them available by making them accessible. This operation aims to provide our users with the best possible supply of high quality products.

We are also here to inject new products without disturbing our current production too much, as any new production must process the entire archive typically since 2015. This activity follows a validation and qualification process that is sometimes long but essential in order to secure the existing system and maintain the expected quality of service.

In each of my past experiences, exploitation did not exist. I had to set it up and start it up. On the other hand, THEIA-MUSCATE was deployed and operational when I arrived at the end of 2018 but had encountered difficulties from a bad image because it encountered difficulties as soon as it had to carry out mass production.

My first objective was to improve all the operating procedures in order to automate tasks as much as possible and improve the image of Theia DSI. By communicating with all the teams, exposing problems and proposing solutions that were validated by everyone, we have gradually changed this bas image.

With a production covering the objectives of the Theia consortium (notably a regular and daily Sentinel-2 production representing ten times France since the end of 2019), Theia-MUSCATE operations have now reached cruising speed. I know that everything is not yet perfect, but with this objective achieved, we are making positive progress in terms of CNES's contribution to Theia.

In your opinion, what are Theia's greatest achievements and what is the biggest challenge for the cluster in the future?

Bernard Specht: I don't know all the great achievements that exist. However, we can highlight the achievements of Theia-MUSCATE since 2019: 650,000 products made available; more than 420,000 downloads since the opening of the site; 6,700 different users, 50% of whom are French, having downloaded at least one product. It seems legitimate to consider the production of Theia-MUSCATE as a great achievement within the consortium.

In the immediate future, the challenge is to prepare Theia-MUSCATE for the mass reprocessing envisaged, in particular that of all the products from Sentinel-2 (because ESA will also reprocess them with better geometric correction) without disrupting the production of the stream. This is well under way, notably with the renewal of the IT infrastructure.

In the more distant future, but already in our minds, the team will have to prepare for operation on a new Theia-MUSCATE-NG, HYSOPE II (►Read Theia Bulletin n°13). With our knowledge and feedback on current operations, we hope to effectively meet the production needs of the new Theia-MUSCATE-NG DSI.

»

Working on putting products and services related to spatial imagery within reach of all and on the creation of synergies between stakeholders for the common good

Interview with Jean MASSENET

INSIGHT NC CEO, structure co-facilitating Theia GeoDEV New-Caledonian RAN

INSIGHT SAS
► insight.nc/

GeoDEV NC RAN
► www.theia-land.fr/artlist/art-geodev-nouvelle-caledonie/

You are the CEO of INSIGHT, a company actively participating in the facilitation of Theia GeoDEV New Caledonian Regional Animation Network (RAN). What motivates your company's involvement in Theia?

Jean MASSENET: Alongside Marc DESPINOY from IRD-NC/UMR EspaceDEV, I am the co-facilitator of Theia GeoDEV New Caledonian RAN. My role within Theia is to ensure our overall mission to facilitate, structure and federate the New Caledonian GIS & RS community through the regional animation network that we set up.

We particularly aim at strengthening links between Theia and New Caledonia, taking advantage of our annual OSS NC (*Observation Spatiale au Service de la Nouvelle-Calédonie*) seminar (Read p.1) in order to create opportunities with Theia technical and thematic experts according to the orientations taken by the local community and the needs of users.

Before being a commitment in Theia, it is a commitment for the benefit of the New Caledonian GIS&RS community. Marc and I were already working on putting products and services related to spatial imagery within reach of all and on the creation of synergies between stakeholders for the common good So, when we discovered the existence of Theia animations (RAN), it seemed obvious to us that New Caledonia needed one!

How does your activity as facilitator and company manager in the satellite sector fit in?

Jean MASSENET: As Operations Director of the innovative New Caledonian start-up INSIGHT SAS, my primary objective remains the most complete possible understanding of the various contributions of space imagery for a sustainable management of territories and resources. My main role is then to act as a facilitator between my technical team and the potential users, and also to try to create synergies between the users themselves in order to work on collegial reflections on a territorial scale and to enable the pooling of resources.

As the representative of Airbus DS within the South Pacific region, INSIGHT SAS has been working for several years now to offer the best to both local and regional GIS&RS communities, with as much adaptation as possible to the specific needs of island territories. We therefore spend a lot of time and energy working for the community, sometimes at the expense of our own activity as a private entity with an inescapable need for profitability.

In your opinion, what are Theia's greatest achievements, and what is the biggest challenge for the consortium in the future?

Jean MASSENET: As far as I'm concerned, Theia's best achievements are on the one hand, the synergy of different actors via the Scientific Expertise Centres (SECs) for the development of operational and available products and services; and, on the other hand, the fact that with its regional animation network, Theia proposes an integrated approach from data producers to users and thus allowing the necessary feedback of information as to the relevance of the products in relation to operational needs.

This global approach seems to me to be particularly relevant and sustainable, fully adapted from producer to user, allowing a virtuous circle for the production of products and services derived from Earth observation and based on spatial imagery data. INSIGHT, via GeoDEV NC RAN, works in particular to promote this dynamic among the various geomatics communities within the South Pacific region.

Theia Bulletin

Publication directors: N. Baghdadi (INRAE) - A. Sellé (Cnes)

Edition, translation & realisation: I. Biagiotti (Theia)

Proofreading: Leigh Ferguson (COSPAR)

Contributors to this issue: A. Al Bitar, N. Baghdadi, S. Battiston, H. Bazzi, A. Bégué, M. Caspard, S. Clandillon, J.-F. Crétaux, M. Cros, G. Dedieu, M. Despinoy, I. Fayad, J.-F. Faure, M. Jagaille, Y. Kerr, V. Lafon, G. Le Maire, M. Le Page, A. Mahmoodi, J. Massenet, A. Michel, P. Pacholczyk, N. Picot, L. Roupioz, B. Specht, S. Tarot, C. Tinel, J.-P. Tonneau

Follow Us :
► www.theia-land.fr | ► @PoleTheia | ► linkedin.com/company/pole-theia

Cover photo credit : The effects of storm Alex in France and Italy, 4 October 2020, European Union, Copernicus Sentinel-2 imagery