

The POSTEL “Continental surfaces” thematic unit

Introduction

The French policy regarding Earth observation satellite data recommends to set up thematic units. Their aim is to federate scientific expertise and to pool the means to be implemented in order to generate enhanced products derived from satellite data. Within these units, study results are bound to be developed and adapted to be made operational for the users by creating prototypes of services. These thematic units will therefore become the precursor elements of the future services of the GMES (Global Monitoring for the Environment and Security) European programme by 2008-2010.

Regarding the “Continental surfaces” theme, POSTEL (Pôle d’Observation des Surfaces continentales par TELEdétection¹) is the French enterprise to be integrated into the future GMES services that are being defined through projects financed by the European Space Agency and the European Commission.

The **geoland** integrated project funded by the 6th Framework Programme of the European Union indisputably represents the most structuring effort in this field. Infoterra GmbH (Germany) and MEDIAS-France are in charge of its coordination. This project aims at defining and testing the “observatories” that actually are prototypes of GMES services. It distinguishes two large scales, the European regional scale and the global scale. At the global scale, observatories are closely related to EU policies: land cover and forest change, food security and crop forecasting, carbon cycle. Most of these services will be based on data assimilation techniques in models of biosphere functioning. Such data will be derived from ground measurement networks and from generic biophysical products characterising continental surfaces originated in space-based observation.

As far as France is concerned, structuring its com-

munity through the POSTEL unit is a major stake that consists in preserving and valorising its know-how as well as its scientific and technical lead, not only regarding space-based infrastructures (among others, the follow-up of SPOT satellites) but also regarding the organisation of ground segments and services. Thanks to POSTEL and the situation of the French institutions within **geoland**, France should be in a position to claim an important part in the generic processing of space-based observation data associated with in situ data collection networks, as well as in one or several related services. POSTEL is consequently bound to cohabit with projects of the European Commission and ESA for several years, but should eventually be integrated into GMES services.

The consortium that is in charge of developing POSTEL at the French scale currently includes CNES, METEO-France, CNRS/INSU, IRD and INRA. As it is expected to quickly gain a European standing, other institutions are liable to join it.

The relationships between POSTEL and the EUMETSAT Land SAF (Satellite Application Facility) in Portugal will conceivably expand as well. Land SAF currently generates products derived from meteorological satellites (MSG today, EPS soon) in near real time for the operational needs of meteorology and weather forecasts. POSTEL has to issue satellite-derived products qualified to meet the needs of the GMES services at the global scale (food security, carbon fluxes, land cover change). The products

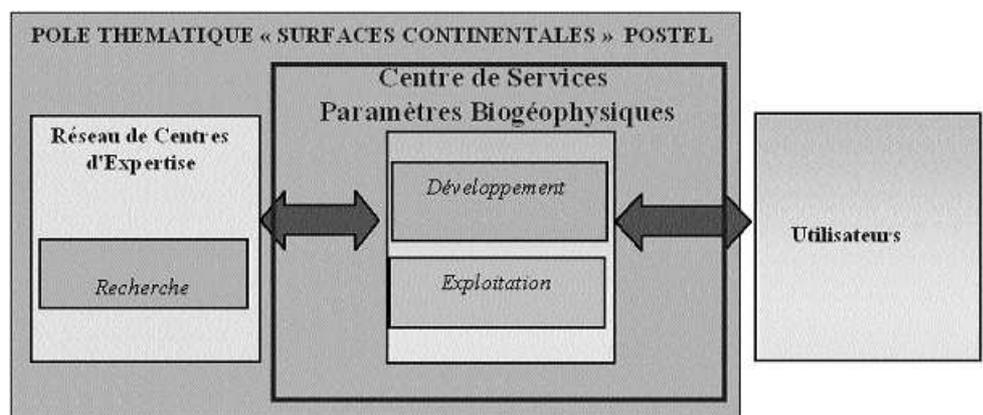
worked out by combining data obtained from different wide-swath sensors (100 m to 1000 m resolution) are delivered in delayed time and are archived to create long time series. The complementary nature of Land SAF and POSTEL may evolve according to the options of the European authorities regarding GMES services. The expansion of POSTEL to finer scales (typically 10 m) is another conceivable development.

Structure of the unit

The thematic expertise unit revolves around three types of bodies:

- a Core Service for Bio-geophysical Parameters (CSP). Its mission consists in supplying a set of technical assistance and mutual services allowing the users’ community to make the most of the data and products derived from space missions related to the “Continental surfaces” theme,
- upstream from the CSP, Scientific Expertise Centres. Expertise Centres are laboratories or research organisations that contribute to defining space missions and to designing and validating derived products. Such Expertise Centres manage all the scientific activities related to the thematic unit.
- downstream from the CSP, the users’ community.

Strictly speaking, POSTEL’s sphere of activity includes French Expertise Centres, the CSP and the interfaces between the CSP and users (see chart).



Organisation chart of the thematic unit

The CSP fulfils two functions:

- a developing function, i.e. setting up scientific processing chains and software for the analysis of satellite data, in accordance with the specifications defined and validated by the relevant scientific Expertise Centres,
- an operating function, i.e. generating, archiving and circulating products derived from space missions.

At the beginning of 2002, the MEDIAS-France GIP was commissioned to design and implement a prototype of CSP and its interfaces upstream and downstream.

The bodies acknowledged as Expertise Centres are laboratories or public organisations that are engaged in the development of products delivered by the CSP. They supply algorithm specifications and/or data allowing to validate the products, within the scope of opportunity projects named "precursor projects".

Programme of activities

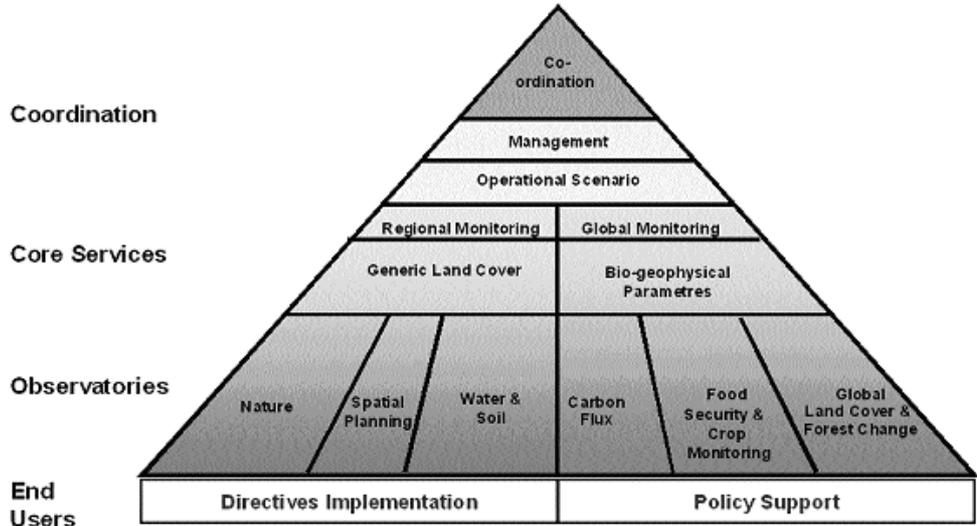
The activities that belong to the scope of POSTEL include:

- defining, designing and setting up a prototype of CSP and its interfaces upstream and downstream,
- taking part in French and European precursor projects that are as many stages in the creation of the operational CSP (see details hereafter),
- supplying users with products through these different projects.

A 6-person team made up of 3 theme experts and 3 computer scientists is currently working within the MEDIAS-France GIP in order to lead these various activities.

As already mentioned, POSTEL products are bio-physical products derived from observing satellites. Such products characterise continental surfaces: leaf area index, fraction of vegetation, albedo, land cover, downward radiative flux, surface moisture and temperature, burnt areas,...

The scales under consideration are regional to global scales, with time scales as long as possible.



Situation of the CSP in relation to Space Agencies, Operational Services and End-Users

Within this scope, priority is given to the use of low to medium spatial resolution satellites (typically from 100 to 1000 metres). However, extending this to finer scales (10 m) is a conceivable development.

Products will be more and more derived from multi-sensor data according to the scientific and technological progress in this field.

Value chain

The information chain designed from space agencies to end-users is shown in the following figure. The input received by the CSP consist of level-1 data (geocoded luminance) from space agencies (ESA, CNES, EUMETSAT, NASA,...). The CSP develops level-3 or -4 products aimed at operational services downstream (carbon & climate, food security, land cover change) and at the scientific community. The end-users (decision-making, application of European policies, assessment of international conventions) are downstream from these operational services.

The volume of data is strongly reduced from left to right, i.e. from space agencies (Tbytes) to end-users (Kbytes), while highly increasing the value added.

The setting-up of a structural link between space agencies and end-users

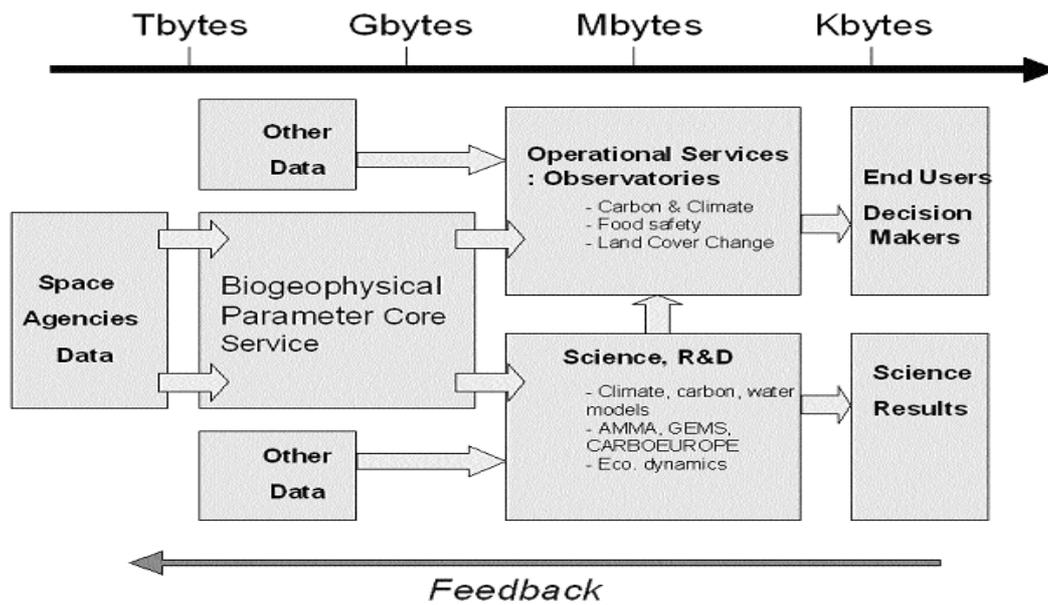
allows to introduce a mechanism of feedback and formalisation of users' needs, that is to result eventually in the implementation of operational observing satellite series, therefore ensuring time continuity.

Structures of leadership and co-ordination

POSTEL structures of leadership and co-ordination include a Management Committee, an Expert Committee and a Project Team.

The Management Committee consists of representatives of the French organisations involved in POSTEL. This Committee manages the POSTEL project by:

- establishing the orientations and objectives of the unit, defining strategic choices regarding scientific and industrial policies (partnership, co-operation, etc...),
- making sure that the needs of the users' community are taken into account and satisfied,
- taking any initiative intended to make the implementation of Expertise Centres and the links between Expertise Centres and the CSP easier, with the aim to make the most of the French research potentiality on this subject.



Two-level strategy: Core Services and Observatories

The Expert Committee includes representatives of Expertise Centres as well as delegates from the various users of POSTEL products and services. This Committee plays a part of expertise and support to the Management Committee regarding the orientations and priorities to be considered in order to meet users' needs.

Lastly, the Project Team gathers engineers and technicians attached to the CSP. It is in charge of managing the project as far as the CSP and its interfaces upstream and downstream are concerned.

Precursor projects

The POSTEL work programme follows the orientations defined by the European GMES programme, including two stages:

- 2002 – 2007: demonstration of pre-operational capacities,
- 2008 -: operational implementation of the CSP.

As stated above, the approach consists in joining precursor projects that contribute to the same global target of demonstrating pre-operational capacities.

Several precursor projects are already under way. They are briefly described hereafter.

GEOLAND

The GEOLAND project, already brought up in our introduction, gathers 56 partners from 15 European countries. Its objective is to prove the pre-operational

capacities of two Core Services (the first one on land cover, the second one on bio-geophysical parameters) and of six services downstream (Observatories). The latter are divided into 3 European regional services and 3 global services.

GEOLAND activities also include proposing scenarios for the implementation of operational services to be distributed over Europe after 2008.

The first two Core Services will provide the services downstream with the basic information they need. Maps of land cover will be designed at the regional and national scale in the "Generic Land Cover" Core Service. These maps will be used as reference for the activities of the three regional services whose goal is to support the application of European guidelines at the regional scale.

Global services are the ones already quoted above (Natural carbon fluxes, Crop monitoring and food security, Land cover and forest global change). They aim at supporting the European policies and international conventions that require a continental to global scale environmental monitoring. These services will be supplied with satellite products from the second Core Service, "Biogeophysical Parameters", that corresponds to the CSP already presented.

Within GEOLAND, the part of MEDIAS-France is to support Infoterra GmbH, Project Co-ordinator, by acting as Deputy Co-ordinator for the whole project (with special responsibility for global service monitoring), and to lead

the CSP.

The GEOLAND/CSP activity that started at the beginning of 2004, is jointly led by CNRM (France), NOVELTIS (France), IM Lisbon (Portugal), the University of Karlsruhe (Germany), VITO (Belgium), EARS (Holland), the University of Vienna (Austria), the University of Bonn (Germany) and MEDIAS-France. This activity consists in demonstrating that Europe owns the pre-operational capacities of providing the following continental or global products: leaf area index, vegetation cover, fraction of absorbed photosynthetically active radiation, albedo, downward radiation, temperature, surface moisture, burnt areas, rainfall. Various optical and micro-wave sensors are used to that effect: VEGETATION, MERIS, POLDER, MSG, AVHRR, ATSR, ERS / Scatt and AMSR.

CYCLOPES

The aim of CYCLOPES is to develop and validate biophysical products (albedo, leaf area index, vegetation cover) derived from wide-swath sensors (AVHRR, VEGETATION, POLDER, MERIS, MSG). The algorithms to be used will merge the available simultaneous observations; they will be designed to supply continuous long-term series.

CYCLOPES products are the global fields of these variables and their associated uncertainties over the period 1997-2003, with a 1-8 km and 10-day

spatio-temporal resolution. A first version of these products will be available from April 2004. The use of these products will then be demonstrated within the framework of two important applications related to climate change:

- detecting and categorising land use changes,
- assessing carbon fluxes in order to improve the description and understanding of vegetation-atmosphere interactions.

CYCLOPES is a project led by INRA Avignon, which is co-funded by the DG Research of the European Commission (within the 5th RDPF), the Terre & Espace network, the Midi-Pyrenees Region and the CNES.

A first global-scale output is scheduled as early as March 2004. A production cycle is then planned every six months, each cycle improving the algorithms and spatio-temporal coverage of the variables obtained.

POLDER

POLDER instruments are wide-swath visible & near-infrared radiometers developed by the CNES. These instruments were operated on the ADEOS-1 Japanese platform from November 1996 to June 1997, and on ADEOS-2 from April 2003 to October 2003. A third instrument is scheduled to fly on board the PARASOL micro-satellite to be launched at the beginning of 2005.

The level-3 "Surface lands" jobstring reproduces the characteristics of continental surfaces based on data derived from POLDER sensors. The algorithm employed uses the bi-directional reflectance distribution function measured by POLDER to generate biophysical products such as directional/hemispheric reflectance, leaf area index, and vegetation cover.

The tasks to be performed by POSTEL consist in setting up the operational configuration of the land surface level-3 algorithm chain, to deliver it to the POLDER Production Centre, to ensure computer and algorithmic servicing, and to check the products before distributing them to users. These various activities and related products are detailed in the paper by Roselyne Lacaze in the present Newsletter: "POLDER Land Surfaces biophysical parameters".

AMMASAT

As the name indicates, AMMA is a project devoted to the Multi-disciplinary Analysis of the African Monsoon. Regarding continental surfaces, the aims are to describe surface evolution over the last 50 years while distinguishing between anthropogenic and climatic forcing, and to study the possible impact of this evolution on monsoon.

Through the AMMASAT group, the remote-sensing community is supporting AMMA, especially by supplying the project with the satellite products required.

POSTEL serves as a gateway to the AMMA project and its AMMASAT component, regarding continental surface products at the West African and whole African scales over the period 2004-2007 and beyond. Such products are intended to hydrologists, ecology experts, and atmosphere scientists.

Outlook

The scope of POSTEL is bound to evolve quite appreciably in the years to come, before the operational implementation of services within the GMES framework after 2008.

For instance, POSTEL is contemplated to act as a service provider regarding the development of surface moisture products derived from the SMOS satellite, in close co-operation with the Expertise Centres in charge of specifying and validating the related algorithms. The SMOS (Soil Moisture and Ocean Salinity) satellite that will take on board a passive micro-wave radiometer is co-funded by ESA, CNES and Spain; it is scheduled to be launched in 2007.

The operational nature of POSTEL could be strengthened shortly by taking into account the operational production of the POLDER/PARASOL data related to continental surfaces as soon as 2005.

Moreover, other calls for tenders issued by the European Union and ESA are being prepared; they could expand the range of POSTEL activities in the forthcoming years. Products from POSTEL should respond to scientific needs from the MEDIAS network. ♦

¹ Unit for the observation of continental surfaces through remote sensing.

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