# HALO

## WP 3210/ 3310 "Infrastructure candidate solutions overview"

Harmonised coordination
of the Atmosphere, Land and Ocean integrated projects of the GMES backbone

| ***Written by*** | ***Responsibility-Office-Company*** | **Date** | **Signature** |
|---|---|---|---|
| Fabrice LEVY<br>Jean-Marc PECHINOT | ASTRIUM Project Manager<br>ASP Project Manager | 30/11/05 | |
| ***Verified by*** | | | |
| Johannes Kaiser | ECMWF | | |
| ***Approved*** | | | |
| | | | |

# REGISTRE DES EDITIONS

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# 1 INTRODUCTION

This document is focused on the "candidate solutions" part of the Work Packages 3210/ 3310. The objective is to analyze interfaces (data acquisition, sharing, dissemination) concerning Ocean/Atmosphere WP 3310 (resp. Land/Atmosphere WP 3210) and, by successive iterations, to propose **candidate solutions** to support the transition of the so called IPs to operational **systems** status.

The work to be performed is twofold :

- Analysis of data and users requirements (inputs coming from AD5)
- Propose candidate solutions

The WP 3210/ 3310 mainly focuses on both common data needs provision and products exchanges interface between systems.

## 1.1 STRUCTURE OF THE DOCUMENT

The document is divided in five chapters:

1. Introduction
2. Study logic
3. General scope HALO
4. Requirements Synthesis
5. Candidate solutions

## 1.2 APPLICABLE DOCUMENTS

| Ref | Title | Author | Date |
|---|---|---|---|
| AD1 | HALO Part B Forms | HALO team | |
| AD2 | MERSEA Information Management (MIM)<br>High level requirements | IFREMER | 11 Oct 2004 |
| AD3 | MERSEA data and products for GMES | MERSEA Team | 15 Nov 2004 |
| AD4 | HALO draft report on interacting parts of GEMS, MERSEA and geoland | ECMWF | 7 Jan 2005 |
| AD5 | HALO Guideline WP3210 and WP3310 | ASTRIUM, ASP, ECMWF | 3 March 2005 |

## 1.3 REFERENCE DOCUMENTS

| Ref | Title | Author | Date |
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## 2 STUDY LOGIC

The logic of work for the WP 3210/3310 follows the figure below, the present document is focused on the fourth and final part:

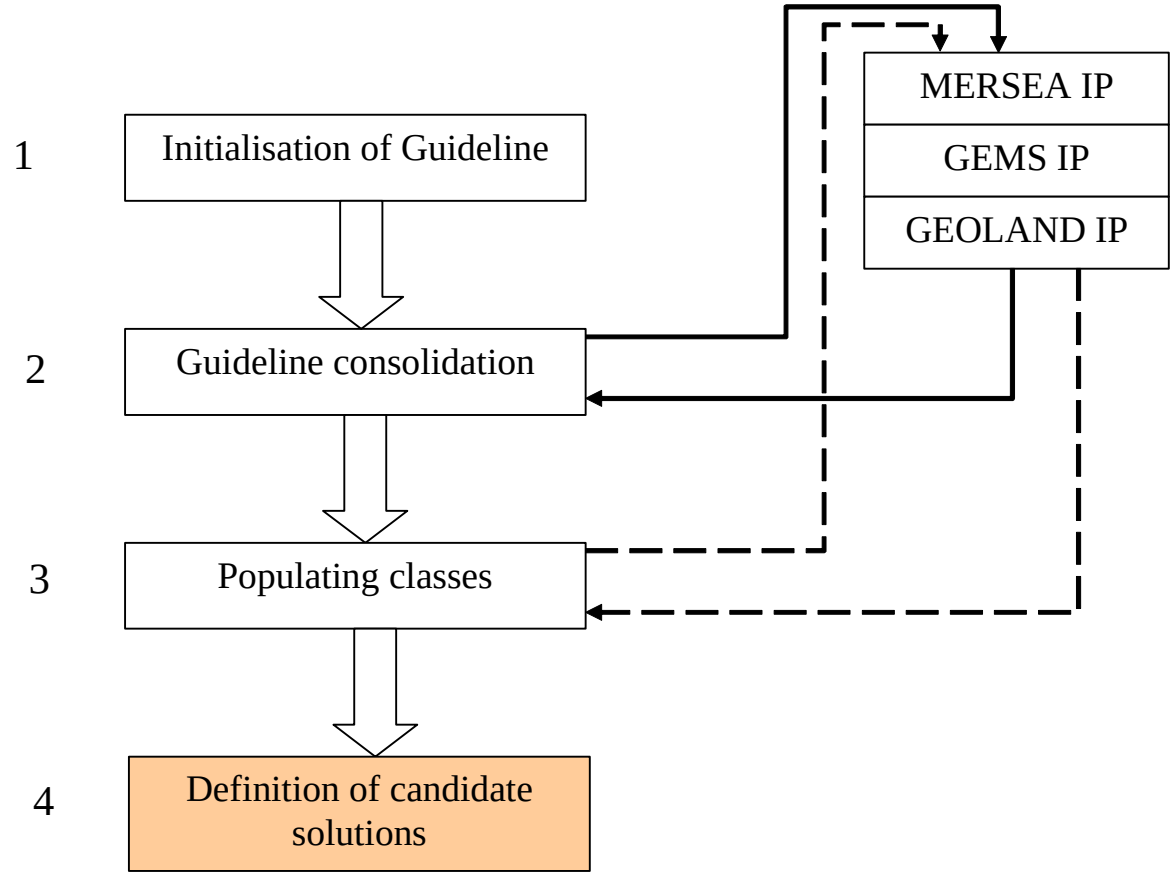


**Figure 2-1 : Logic of work for HALO WP 3210/3310**

1. Initialization of Guideline

   Three documents presenting the basic components for each Integrated Projects have been issued.

2. Guideline consolidation

   The three previous documents have been used to issue the present coherent document, that synthesize as templates or tables, data flows, data and product, functions to be populated.

3. Populating classes

   The "Guidelines consolidation" will be populated by representatives of each IP. The objective is to take into account as exhaustively as possible, the existing components, the non-existing and required components.

4. **Definition of candidate solution**

   The last stage will consist from the previous populated document to infer some appropriate candidate solutions at functional and system level.

# 3 GENERAL HALO SCOPE

This chapter synthesize the HALO WP 3210/ WP3310 overall objectives.

HALO wants to support the transition of the IPs to operational system status. Indeed, operational commitment imposes time constrains of the data production, transfer and storage. Common data needs or product exchanges are a strong link between the systems and a **shared solution** could be beneficial for all.

Therefore, WP 3210/3310 aims at defining candidate solutions for both common data needs provision and products exchanges interface between systems. The definition will start from analysis of the requirements inventory tables populated by IPs representatives in the AD5 document. These tables give a clear overview of all potential common data needs and inter systems product exchanges.

The AD4 document "HALO draft report on interacting parts of GEMS, MERSEA and GEOLAND" present the various criteria and categories for data and products characterisation:

**Interaction and communality** categories:

- ✓ Direct product exchange,
- ✓ Common data,
- ✓ un-accomplished data

The data groups is then classified in terms of their **origin:**

- ✓ Observation (In-situ, Satellite),
- ✓ Model and assimilation products (global, regional )

And their associated **operational constraint:**

- ✓ Operational mode - real time (RT) and near real time (NRT)
- ✓ Off-line or Re-analysis mode
- ✓ Research mode

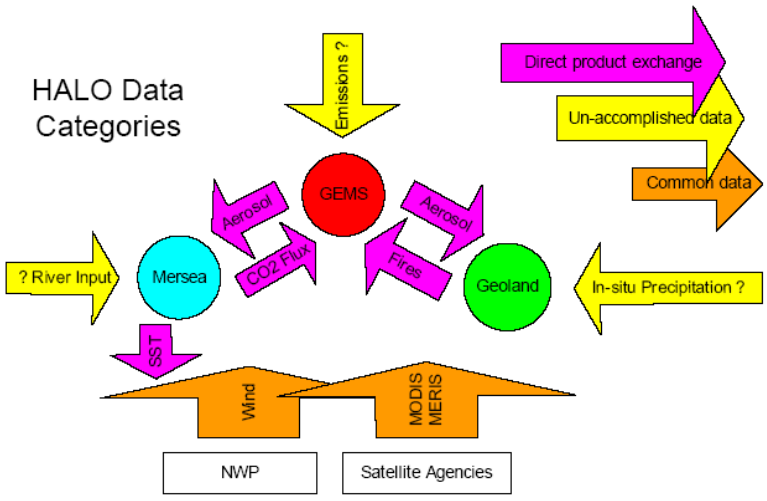


**Figure 3-1: Flow structure of different data categories covered by HALO**

According to definition of the HALO work scope, only the global and continental or basin scale model and data activities with operational commitment will be considered (e.g: Geolands - ONC and CSP; MERSEA global and ocean scale model; GEMS global production system), **regional activities are not covered so far**.

Moreover, the exchange between the IPs will be mainly between GEMS and GEOLAND (ONC and CSP). **Since both ONC and GEMS models will be hosted at ECMWF, no external link will have to be established**.

Nevertheless, direct exchange between CSP and GEMS will have to be established.

It must be stressed that the objective of those three *projects* is to develop operational components of the GMES system. Thus the *projects* run preliminary versions of their final deliverable *system*, which are evolving with time. The design considerations of the HALO project are based partly on the current versions of the fledgling systems and in the perspective of their final operational version. It is in that sense that references to the **IP** must be understood in this document.

# 4 REQUIREMENTS SYNTHESIS

As mentioned previously, the populated tables in AD5 document give a clear overview of all potential common data needs and inter systems product exchanges provided by MERSEA, GEMS and GEOLAND representatives, resulting from: Data Flow Analysis; Data and Product Analysis.

The tables in Annexe 1: Data flows analysis Synthesis of the present document synthesises these populated tables but classifying information by data categories i.e: Meteorological data, Remote sensing data and in-situ data.

Graphical representations are also given in Figure 4-1 and Figure 4-2 which underlines the complexity and diversity of the external data flows (i.e: data sources) .

An other table (Table 4-1) here below, present the results issued from the populated tables both classified by "operational" constraints categories (Real Time Access, Secured Data Access, …. ) and data categories.

The following nomenclature is used :

- For Meteo Data and products
- [ ] For remote sensing Data
- For in-situ Data

The index of the requirement are defined in Annexe 1: Data flows analysis Synthesis :

- Mxx for MERSEA requirement
- Gxx for GEOLAND requirement
- Axx for GEMS (Atmosphere) Requirement

The six operational constraint are defined as follow:

- **Real time Access**: data or observations for which the reporting or recording of events is nearly simultaneous with their occurrence
- **Regular access distribution**: user specifies once a specific information product to be delivered on a regular basis
- **On-demand access**: response to a specific user request such as a particular time composite product, historic or long time series of a particular geophysical parameter, statistical figure.
- **Research mode only**: like "on-demand access" except for limited support, possibly long delivery time, and less standardisation of data transfer and data format.
- **Operational services**: In the meteorological and oceanographic worlds an operational service delivers a range of observations and/or information products on a regular schedule with the resilience to provide all products reliably on 24/7/365 basis.
- **Off-line services**: On-demand access to archived products

| | Operational Constraints | Direct Product Exchange | In-situ | Remote sensing data | Meteorological |
|---|---|---|---|---|---|
| 1 | Real Time Access | M13, M14, M15, M16, M17, M18 | M6, M7, M8 | | |
| 2 | Regular Access, Distribution | G1, M1, A5, A6, G19 | M5, G7, G8, A9 | M3, M4, G10 | M1, G1, G2, G6, G13, G14, A5, A6, A7 |
| 3 | On-demand Access | G2, A7, A18, A20 | M5, G7, G11, G12 | G10, G9, G10 | G2, G6,,G13, A7, A10, A11, A12 |
| 4 | Research Mode only | M2, G3, G4, G5, A1, A2, A3, A4, A7, M9, M10, M11, M12, G15, G16, G17, G18, G20, G21, G26 | | | M2, G3, G4, G5, A1, A2, A3, A4 |
| 5 | Operational Service | A14 A17, A19, A21 | | A8, A11 | M19, M21, M23, M25, M27 |
| 6 | Off-line Service | G25, A15, A16, A18, A20, A22 | | | M20, M22, M24, M26 |

**Table 4-1 : Architecture REQ Synthesis**

This table is complementary to the graphical representations as it is more "operational mode" oriented. However, in an operational system perspective, the level of information synthesized so far is not sufficient as neither information related to the current **operational** capacities to deliver the service are given nor bottlenecks and gaps are identified.

Therefore, three complementary tables (Annexe 2: Operational infrastructure status) have been submitted to and populated by systems representatives in order to collect information related to the existing and required infrastructure elements and their status quo (bottlenecks & gaps) with respect to operational service use.

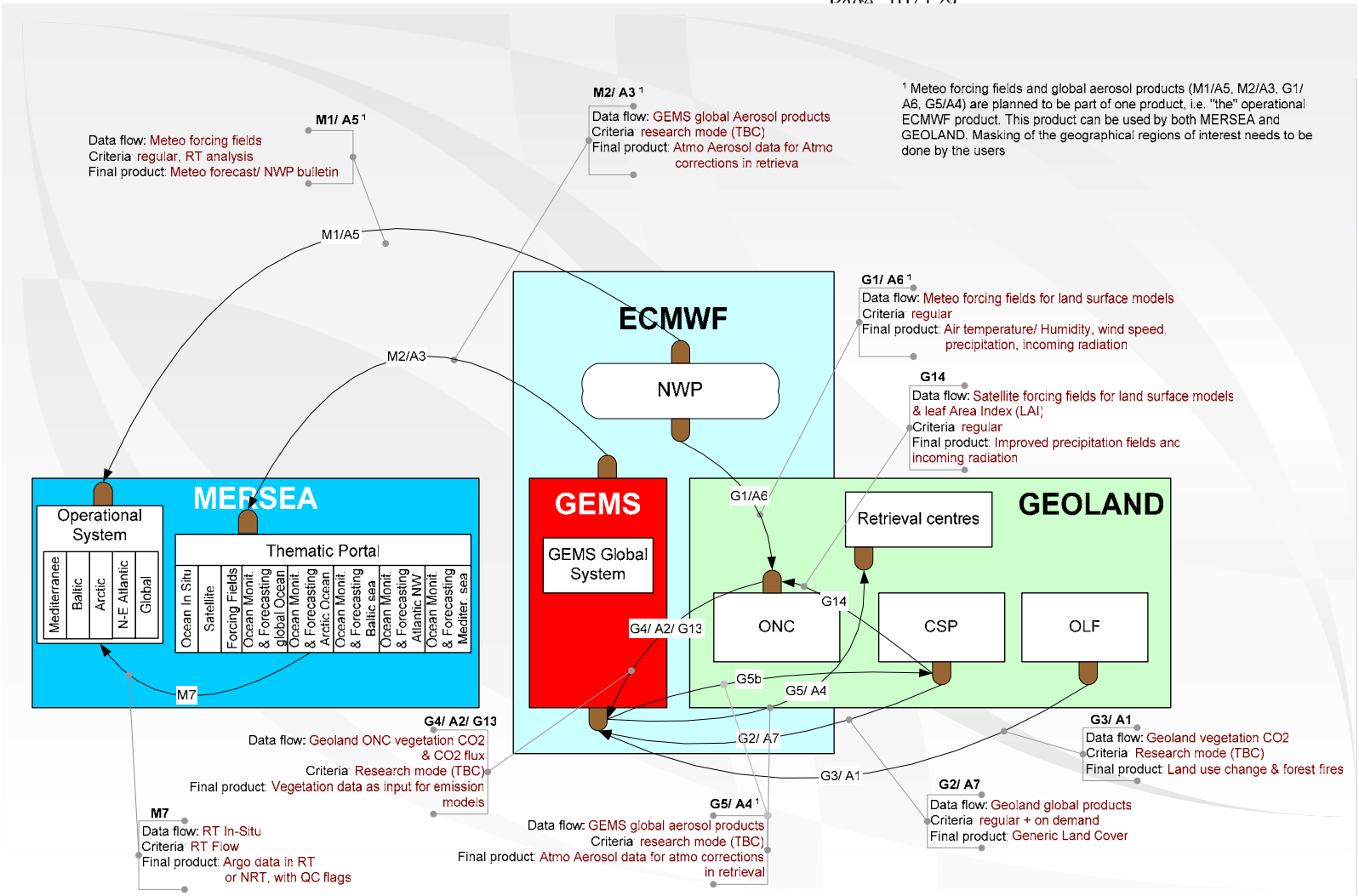


**Figure 4-1: Interacting and Internal Data Flow**

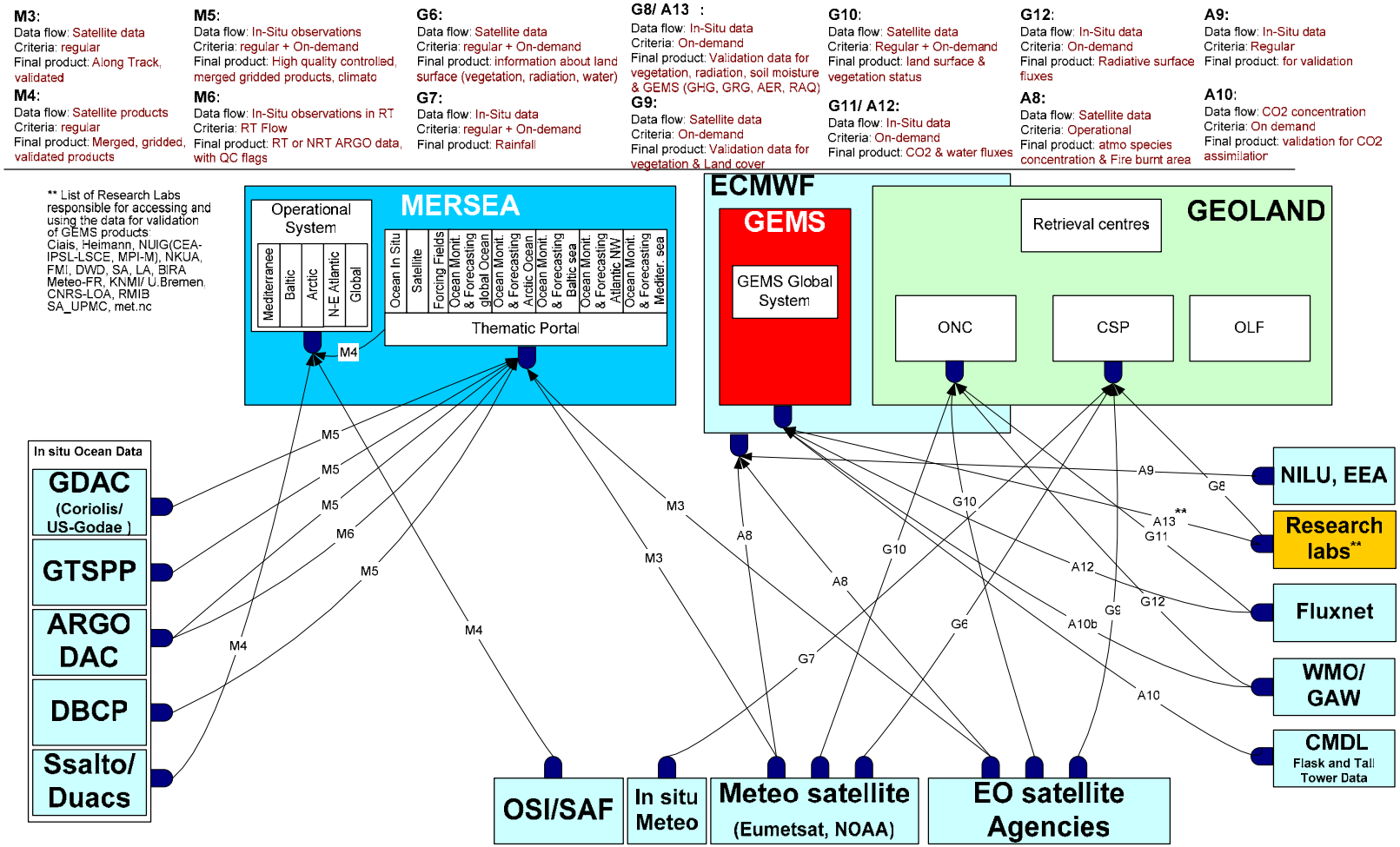


**Figure 4-2: External Data Flow**

# 5 CANDIDATE SOLUTIONS

## 5.1 KEY ISSUES

### 5.1.1 General infrastructure issues

Key infrastructure issues are identified in analysing the following driving factors:

#### 5.1.1.1 End-to-end service provision

The targeted infrastructure shall enable the provision of services in a end-to-end perspective comprising so-called space, in-situ, service and user infrastructures. This implies ensuring optimal "communication" between the main infrastructure elements. The More the system is complex and distributed, the more the **communication** between the different elements can be difficult for a variety of reasons (unsatisfactory or undefined quality of exchanged data, gap in availability of data, proprietary formats, incompatible interfaces, increasing complexity of the systems, etc).

Along with significant efforts made in Europe through the INSPIRE or Oxygen initiatives, the **harmonisation and interoperability** of data and services are key issues for HALO.

#### 5.1.1.2 Distributed versus centralized architecture

The overall GMES service is envisaged as a network of distributed services facilities. Therefore, the infrastructure will mainly rely on a distributed architecture. The infrastructure is to be built in networking service providers (from GEMS, MERSEA and GEOLAND) at European, national or regional level. For instance, the "virtual" catalogue (if any) will be built upon a distributed set of catalogues, each being specific to a line of service or to an organisation. For instance, for what concern Carbon cycle GMES might provides users with a unified **centralized access** (e.g. single point of access) to a distributed set of combine services.

Thus, the proposed infrastructure should well balance what facilities should be distributed and what functions should be centralised.

#### 5.1.1.3 Facilitate information exchange, sharing and dissemination

Production of "integrated" information generally imply to merge, to aggregate or to combine different types of data sets, coming from different sources. Attention is to be paid to the following :

- **Ingestion and handling** of wide range of heterogeneous data sets.
- **Formatting and harmonisation**, since format, representation, quality, etc. may change depending on the data source.
- **Open design**, in order to easily include a new source of data (e.g. new instrument, new data base).

The proposed infrastructure should therefore supply effective access to the input data, including data sets produced by other services (interacting). Therefore, the following topics are to be addressed :

- **Improve the data sources accessibility**, i.e. to provide common and harmonised interfaces to handle the input data in coherent formats.
- **Improve seamless handling of input data** coming from different sources, raising need for standardisation, harmonisation and conversion tools.

#### 5.1.1.4 Enable multi-level service access

As mentioned previously, the infrastructure is to be built in networking service providers at European, national or regional level. The service access will also be multi-level: *European, national or regional.* For instance, a local user can access to the information locally, at the regional level and at the national level, while a national user is interested in consulting national information

Therefore, the way **to structure, to network and to hierarchy** the available information enables to work at different scales in a consistent manner, and should facilitate exchanges of information between different areas.

### 5.1.2 Key design issues

#### 5.1.2.1 Infrastructure adapted to service characteristics

The goal of the proposed infrastructure is to provide operational services at different scales (from the local level to the global level), in an interoperable way for a variety of uses.

HALO addresses different types of services:

- GEMS (atmosphere theme, trace gases and aerosol)
- Geoland (land and vegetation theme)
- MERSEA (ocean theme)

These services are delivered under different conditions and the infrastructure design should integrate the specific characteristics of services.

- **Regular delivery**, i.e. user requests once a specific information product to be delivered on a regular basis.
- **On-demand delivery**, i.e. in response to a specific user request such as a particular time composite product, historic or long time series of a particular geophysical parameter, statistical figures.
- **NRT & RT delivery,** services expected to be deliver in NRT may require to combine different information, to apply local models and to integrate hexogen information such as meteorological data.

The following table lists the main technical/infrastructure issues and presents the corresponding priority level for implementation. Three priority levels are proposed :

⊕ this requirement may be implemented, but could be considered as optional under particular circumstances.

⊕⊕ this requirement should be implemented. There may exist valid reasons to ignore it, however they must be justified

⊕⊕⊕ this requirement must be implemented and is crucial for the set-up of the service

| Infrastructure issues | Regular delivery | NRT & RT delivery | On-demand delivery |
|---|---|---|---|
| **Easy access to heterogeneous data sets** | ⊕⊕⊕ | | |
| Data sets can be located at remote and dispersed providers sites. Key infrastructure requirement whatever the nature of the service. | | | |
| **Flexibility, scalability** | ⊕⊕ | ⊕⊕ | ⊕⊕⊕ |
| Enables the integration of new data sets and of new services. | | | |
| **Standardisation** | ⊕⊕ | ⊕⊕ | ⊕⊕ |
| Ensures a cohesion in accessing data and services, in running models. Harmonisation and standardisation are required to ensure interoperability of data, services and models. | | | |
| **Open infrastructure** | ⊕ | ⊕ | ⊕⊕⊕ |
| Enables a link to third parties | | | |
| **Robustness of the system** | ⊕⊕ | ⊕⊕⊕ | ⊕⊕ |
| Ensures a fault tolerant, highly available and continuous service, sensible system components can be clustered or replicated. | | | |
| **Performances** | ⊕⊕ | ⊕⊕⊕ | ⊕⊕ |
| Applies to different points:<br>• Response time for the user access.<br>• Data access performances to large amount of data.<br>• Global performances to generate the requested product. | | | |
| **Product formatting and delivery** | ⊕⊕⊕ | ⊕⊕⊕ | ⊕⊕ |

| Infrastructure issues | Regular delivery | NRT & RT delivery | On-demand delivery |
|---|---|---|---|
| Supplies multiple formatting functions and delivery options (e.g. numerical delivery such as FTP, automatic email, bulletin edition, etc) | | | |
| **User profile management** | ⊕⊕⊕ | ⊕ | ⊕⊕ |
| Supplies user authorisation functions to ensure a secure access to the system. Also supports the user profile management in order to offer a customised access to the user, e.g. automatic delivery of products tailored according to the user profile. | | | |
| **Interactive manipulation tools** | ⊕ | ⊕ | ⊕⊕⊕ |
| Offers interactive access of data to foster the interpretation of information. The portal shall support multidimensional representations of data, advanced functions of data visualisation. | | | |

**Table 5-1 : relevance of infrastructure issues w.r.t. service characteristics**

#### 5.1.2.2 Relevant standards and protocols to ensure interoperability

The infrastructure will be built on a network of service facilities and has to be seen as a "virtual centre". This implies to set-up full interoperability between services facilities in order to establish communication and share data.

Interoperability is achieved by linking the services facilities by common standards and protocols. In coherence with the INSPIRE, OGC…approach, actions of **standardisation, harmonisation and integration of data and services** are required during the infrastructure design.

Interoperability is a key issue for the success of the infrastructure to access heterogeneous datasets, integrate and combine different data and services, ensure the scaling-up of the system.

Beyond these objectives directly linked to the HALO infrastructure design, the activities about interoperability intend to contribute to the global European initiatives such as INSPIRE, to build a European Spatial Data Infrastructure.

#### 5.1.2.3 Scalable solution

One of the main objective of HALO is to define an open, flexible, scalable infrastructure that shall ensure a gradual set-up of GMES services. Moreover, sustainability shall be obtained only if the infrastructure is built upon evolution and scaling-up capacities. The proposed infrastructure shall be designed to be able to:

- Respond to future needs of users.

  Users expectations are likely to evolve according to the policy changes. Therefore, the infrastructure shall be capable to enhance existing services, integrate new data sources, develop new services.

- Follow the technological evolution.

  It is worth to consider right now the growth path of the information technologies. The infrastructure should be able to evolve in order to follow and take advantage of the technology evolution.

#### 5.1.2.4 Synergy with other initiatives

HALO shall take benefit from and provide material to ongoing close related initiatives (ORCHESTRA, OASIS, WIN, INSPIRE,….).

- Review of external projects proposed architectures. Inventory of the relevant components and concepts for HALO
- Provide possible requirements or external constraints to external projects

### 5.1.3 Carbon cycle illustration

The main issues presented above are well illustrated by the typical carbon cycle use case.

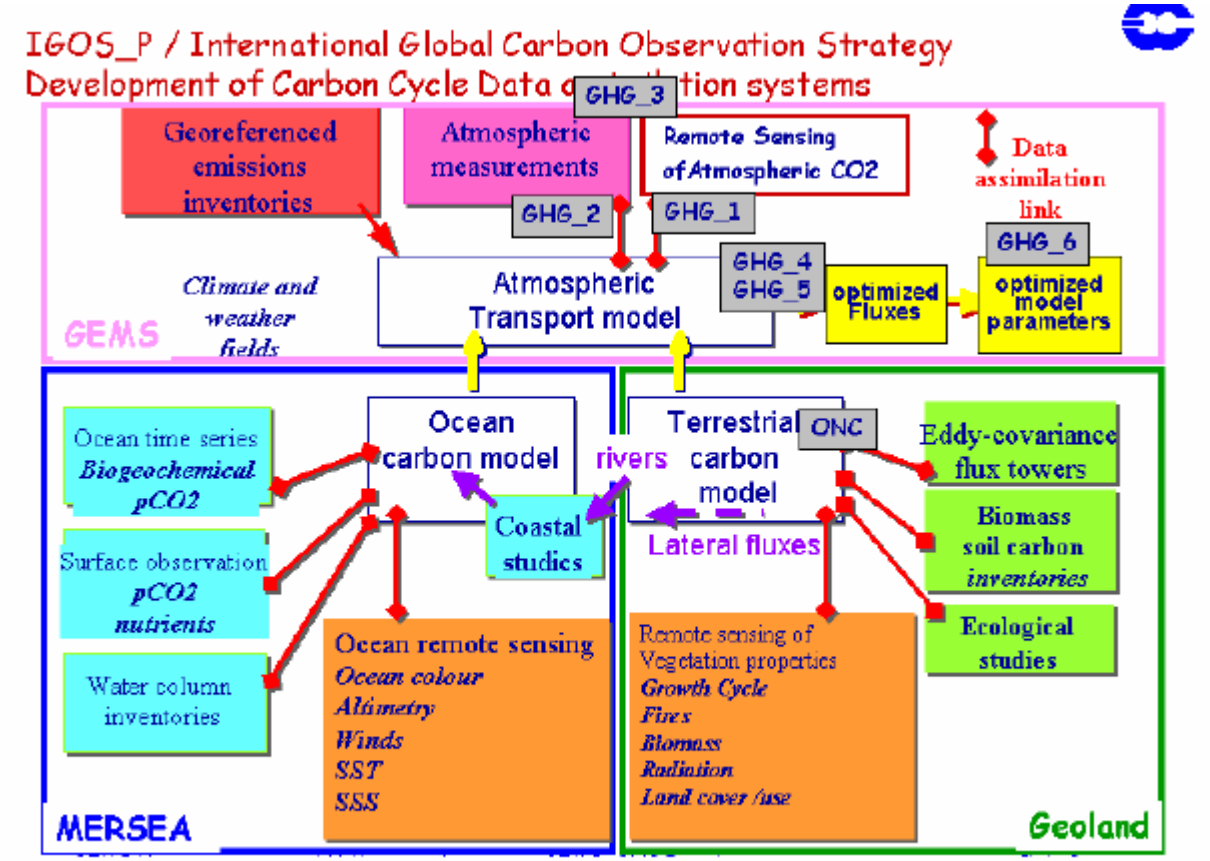


**Figure 3 Schematic of Carbon Cycle data assimilation system proposed by IGOS-P annotated by specific GEMS work package activities (GHG 1 to 6) and by the ONC activity of GEOLAND.**

TBD

### 5.1.4 Synthesis

The main infrastructure issues identified for HALO can be summarised under three different perspectives;

- The "User perspective" :
  - Unified access to data and services
  - Access to integrated information
- The "Service perspective" :
  - Data harmonisation
  - Service interoperability
  - Service discovery through a unified access
- The "System design perspective" :
  - Handling of heterogeneous data (EO and non-EO data, models)

- Data and service standardisation
- Flexibility, scalability
- Link to close related initiatives
- Access to distributed facilities through centralised functions

An additional global considerations must be taken into account for the whole infrastructure design: **validation** is a key issue for all the system, users should be confident in the quality of the data/ product delivered. The system should therefore offer complete visibility about the quality assessment and the validation process.

## 5.2 INFRASTRUCTURE MODEL & USE CASES

### 5.2.1 Infrastructure model

To achieve the infrastructure requirements, HALO envisages to design the infrastructure by a model-based approach. The rationale is to propose a conceptual framework which defines generic components. The model does not imply any constraints on the implementation choices, e.g. a component can be deployed through multiple implementations on different remote machines.

#### 5.2.1.1 Introduction

The **HALO infrastructure model is designed as a conceptual framework** in order to define a consistent and useful set of terms and concepts for the provision of the services.

The HALO infrastructure model does not define any method of implementation of the concepts. No assumption is done regarding computing platform, system environment, system development technology, databases, etc. However, it is responsible to use the most relevant mechanisms or technologies for the specific service development. Moreover, the model can be implemented by multiple distributed instances depending on the nature and characteristics of the service.

#### 5.2.1.2 Conceptual model

The HALO model identifies two main components:

1. The Service Facility

   The service facility groups all the functions involved in the service adding-value chain, such as the ingestion of data, the processing, the delivery of products. There are several instances of the service facility (one per operational service) in the HALO infrastructure, each of the instance can be deployed at a remote site (e.g. at the provider premises). Therefore, the service facility is defined as a distributed component.

2. The Common Facility

The common facility supplies the added-values functions with: the unified access to data, the aggregation of services, etc. It is responsible to connect to the different lines of services and ensure a coherent access to services. It shall be implemented once and shall constitute the main operation unit. It is defined as a centralised component.

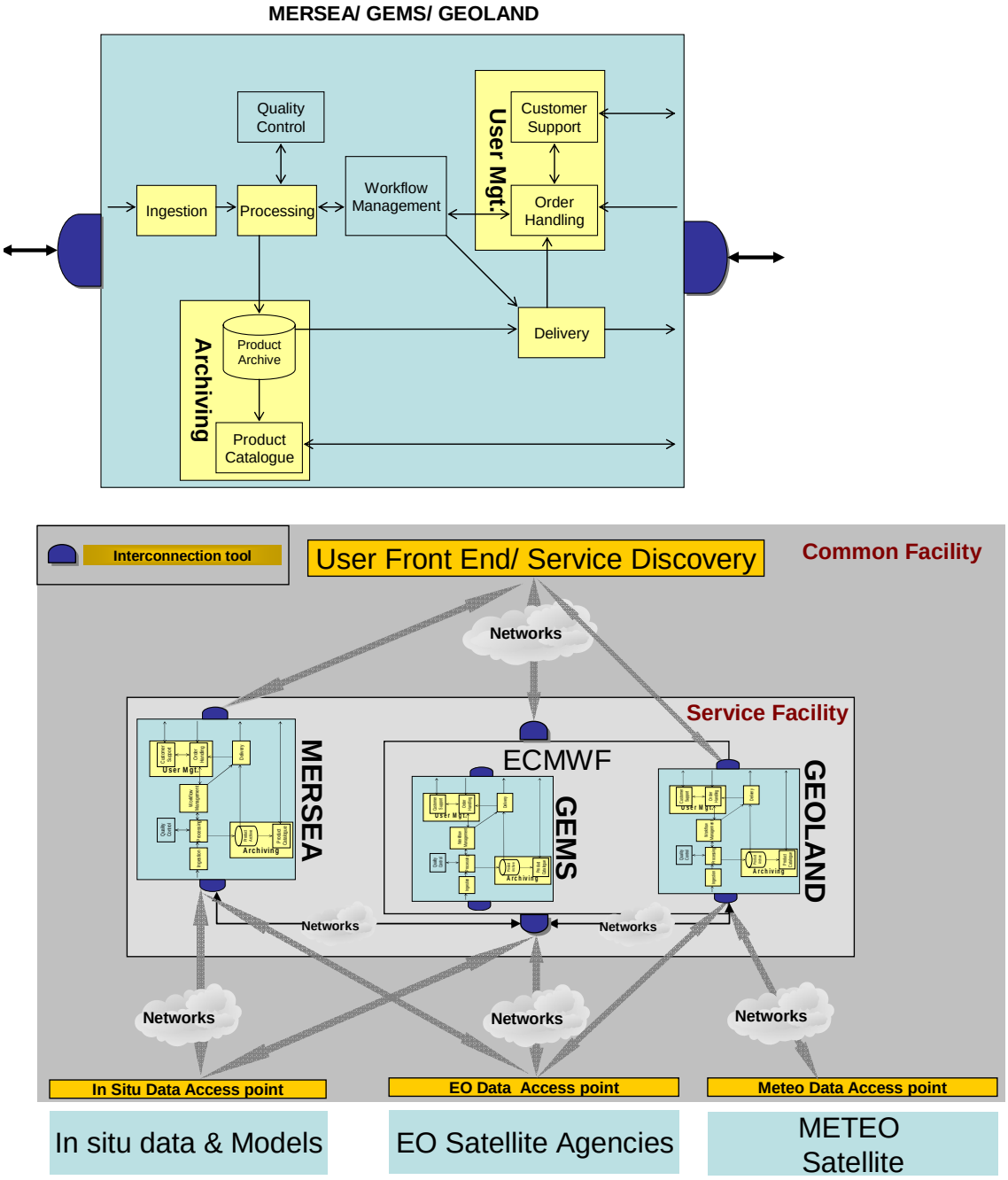


**Figure 5-1 : HALO infrastructure model**

The reference model is designed according to a modular approach. It addresses a wide range of functions for the provision of operational end-to-end services, including acquisition, archival storage, processing, information dissemination.

Depending on the operational scenario of the service, a function can be required or not. The goal is to provide an open and flexible model in order to ensure a scalable infrastructure.

The identified elements are described below. They are grouped into the Service facility and the Common facility.

#### 5.2.1.2.1 Service facility

**Ingestion**

This element includes the data reception from distributed and heterogeneous data producers (EO and non-EO data and models). The reception function addresses two use-cases :

- Direct acquisition of the raw data, e.g. direct reception of satellite data from the antenna.
- Interface with a remote acquisition system, e.g. reception of EO raw data from satellite ground segment, or interface to a buoys network system.

After the data reception, the Ingestion element ensures the operations to identify and store data: quality control, metadata extraction, browse or sample generation.

The Ingestion element induces the establishment of standardised interfaces with the data providers, it strongly encourages the documentation and harmonisation of datasets.

**Archiving & Cataloguing**

This element is in charge of storing and archiving all data handled by the service facility.

It provides the functions for submitting data or querying archived data. The archiving is a generic element which is common to all facilities and does not depend on the type of service.

This element also includes the catalogue, which contains metadata. The catalogue shall proposes discovery and access functions by which intelligent search can be performed. For example, it shall allow thematic search by thesaurus terms.

In order to facilitate the data exchange, it is required that the catalogue provide a standardised view on metadata. There are two major standardisation initiatives regarding data management: ISO/TC211 and OpenGis Consortium (OGC).

**Processing**

This element is in charge of the adding-value processing functions.

**Product delivery**

This element ensures the formatting and the delivery of generated products. Products can be delivered by numerical means (FTP, email attachment, HTTP download). Heavy products are available on off-line media (DVD, CD-ROM, etc). It can be defined as a generic element.

**User & Orders management**

This function handles information on registered users. It contains the registration, the profiling of the user. It is designed as a generic element.

This element also includes the reception and validation of the user orders. The validated order is then transmitted to the processing facility. It is worth mentioning that an order can be broken into several submissions to different processing centres. The ordering element supports interfaces with the archiving to check the data availability.

**Interconnection tool**

The interconnection tool will implement interconnection standards and components to manage of service chaining (Workflow, DRM, Security, …).

The interconnection tool will be usable by any service provider to organise and manage locally its interfaces with its customers and suppliers. The tool will allow, in particular, service provider to manage the exchanges workflows with its customers and suppliers. At the global level, from a service chain point of view, the global process execution will rely on the coordination of individual nodes interconnected through the various "interconnection tool".

#### 5.2.1.2.2 Common facility

**Networks**

TBD

**User front-end/ service discovery**

This element provides a unified access to operational services for the user point of view. It corresponds to a thematic GMES portal which offers an integrated, transparent and user-friendly web interface to GEMS/ GEOLAND/MERSEA services.

This element plays a role of broker, it helps to find a specific service among the list of available services. It can be considered as the Yellow pages of the atmosphere, ocean and land services.

**In-situ/ EO data/ meteo data access point**

Inputs data are provided through a wide variety of networks, depending on the application fields and on the sensor categories.

The dedicated access points will provide an harmonised and homogeneous way to access all inputs data by sensor type, i.e: in situ, EO, meteo .

For instance, the ESA EO DAIL (Data Access Integration Layer, see section 5.4.2) could provide easy and fast access to all EO missions' data.

### 5.2.2 Use cases

The following use cases shows the application of the infrastructure model to an operational scenario. They represent different levels of complexity.

TBD

## 5.3 DATA FLOWS ANALYSIS AND GAPS IDENTIFICATION

As mentioned in section 3 the challenge for HALO will be to propose a sufficient link between GEMS and MERSEA's activities as well as between GEMS and an operational follow up on geolands CSP. A smooth interaction of ONC and GEMS activities in the framework of ECMWFs model has to be ensured.

The figure below present the structure and transfer lines of the interacting parts of the three IP extracted from the "interacting part of GEMS, MERSEA and Geoland" AD4 report. Input data is provided by satellite agencies, weather services and in-situ observation systems. The raw in-put data is process and retrieved by data centres within the IP, symbolized by a star-like shape, and passed over to the model centres, symbolized by circles.

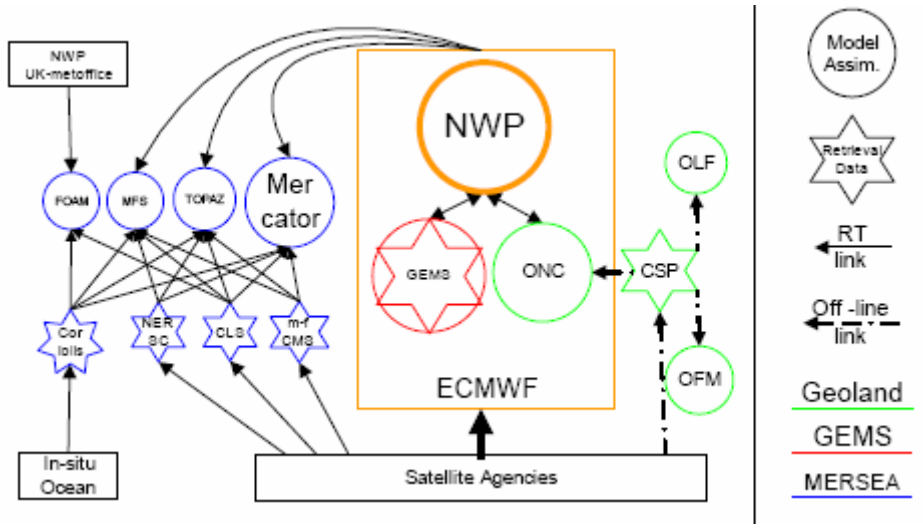


**Figure 5-2: Data flow of the operational model activities in MERSEA, GEOLAND and GEMS.**

Interaction flows could be separate into two main categories:

1. **Common data needs**: satellite, in-situ
   Although Systems use often the same instruments, the approach of the IPs towards satellite data processing differs.

   For instance, a common approach for the use of operational meteorological satellites of the MSG, MetOp, MTG, NPP and NPOESS series might be beneficial.

   All IPs use in situ data to validate the modelling and retrieval activities. The challenge of the in-situ data is their collection from a **large variety of data providers** with different operational commitment.

   (The HALO report on GEMS lists about 40 different sources for in-situ data used in GEMS.)
2. **Direct product exchange** between IPs
   Coordinating envisaged direct product exchange between IPs has the highest priority within the HALO activities. Direct product exchange solutions should be scalable to enable creation of new multi-IP products/services in the future.

   A good example of the inter-dependencies of the IPs is their contribution to the carbon cycle as presented in the interacting part of GEMS, MERSEA and Geoland" report.

Therefore, candidate solutions aim at simplifying and coordinating the interaction flows so that it could be beneficial for all IPs in their future GMES operational perspective.

Simplifying and coordinating data flows implies using both interoperability mechanisms together with federate access point (when technically and economically relevant).

In this context, a synthetic representation (derived from the Figure 5-1) of the considered mechanisms to simplify data flow is presented here below.

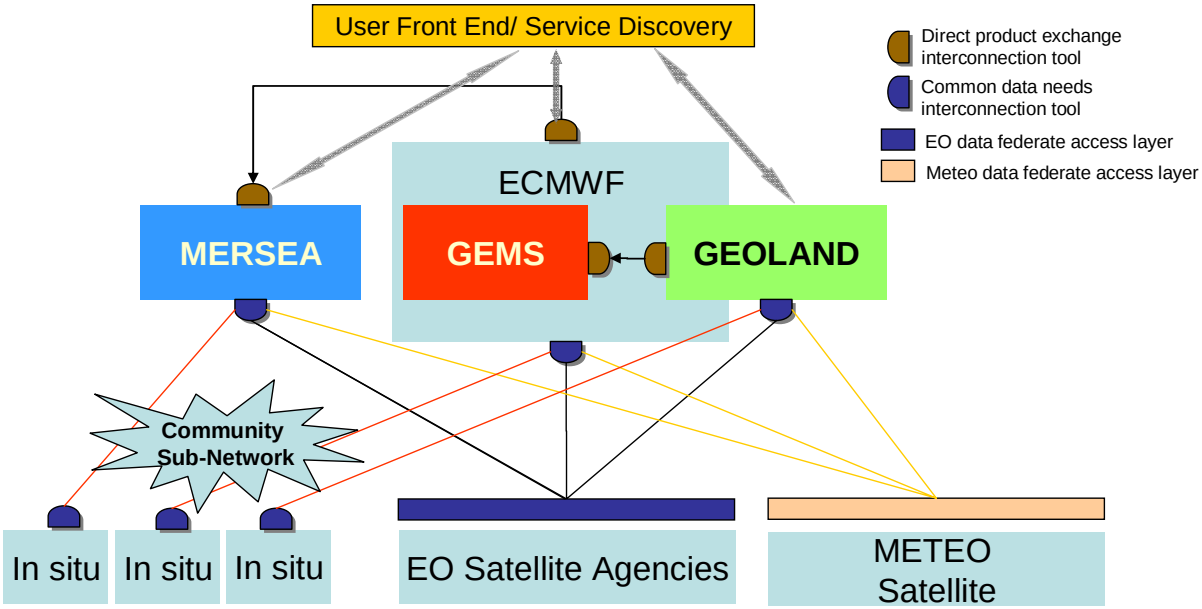


**Figure 5-3: interconnection tools & layers to manage data flow between IPs**

The identified tools and layers will be designed taking into account every specific requirements expressed by IPs representatives within the dedicated tables (Annexe 1: Data flows analysis Synthesis; Annexe 2: Operational infrastructure status) and summarised in the following figures:

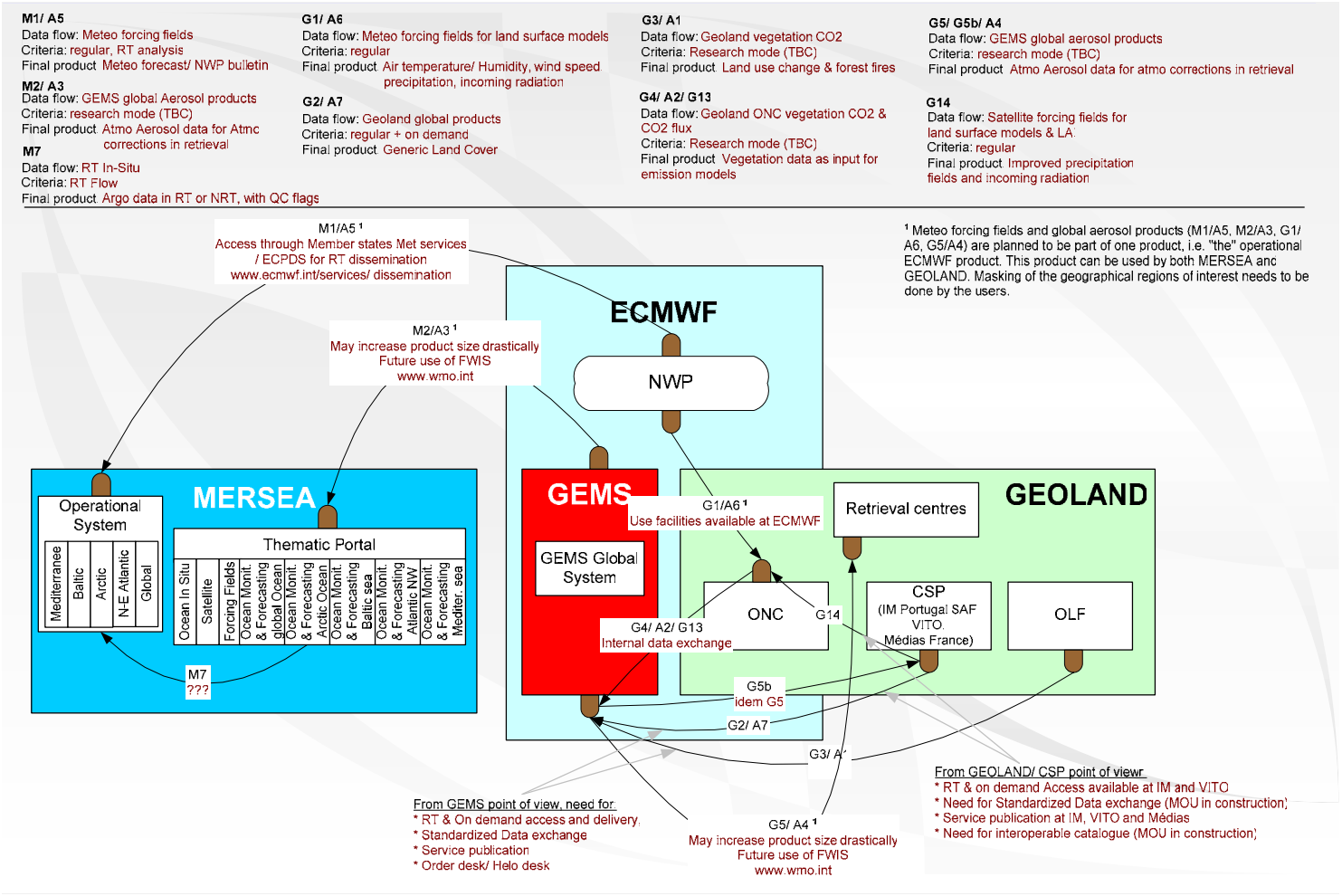


**Figure 5-4 : Interacting and Internal data flows gaps & bottlenecks**

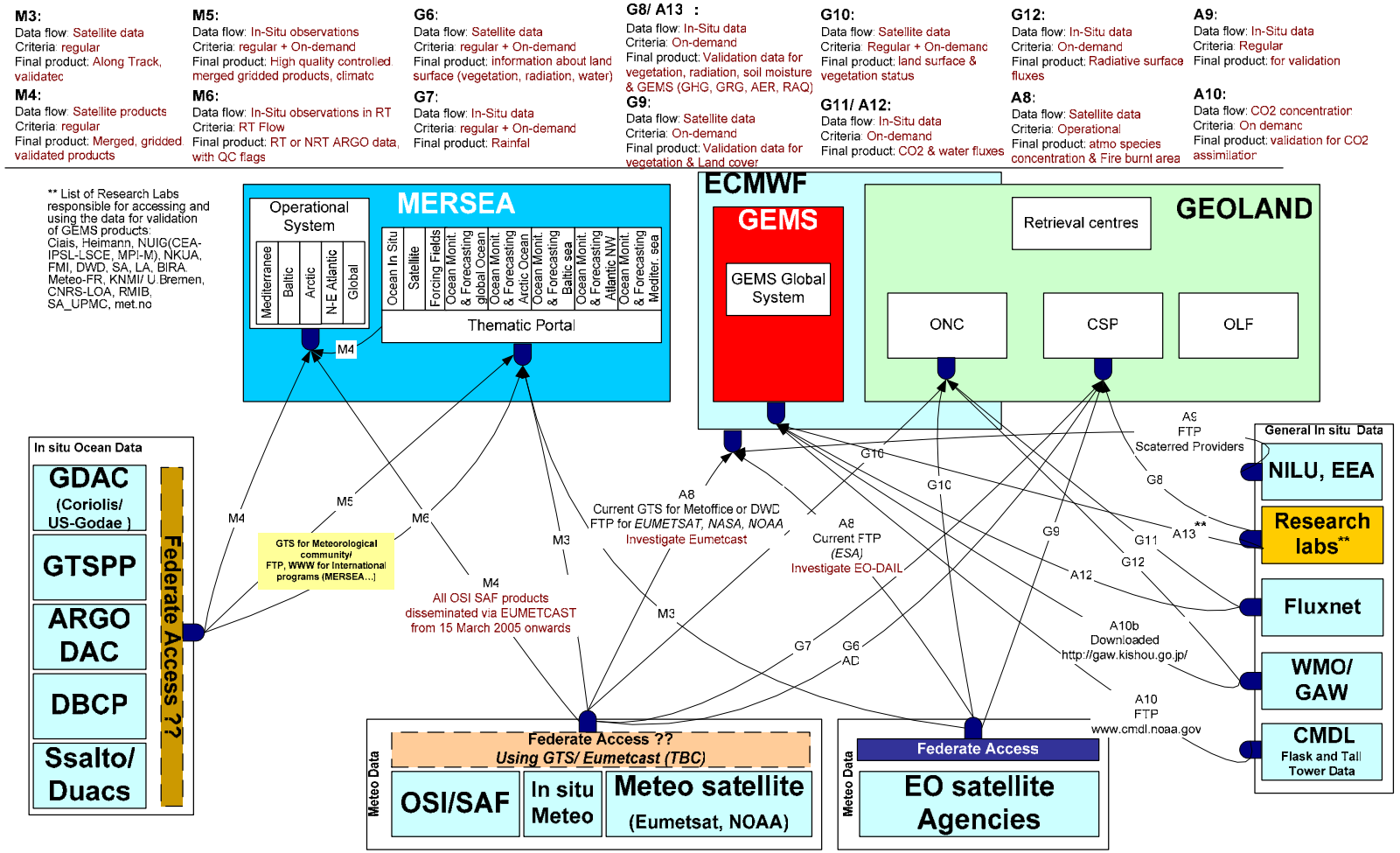


**Figure 5-5 : External data flows gaps & bottlenecks**

For what concern interacting and internal data flows we can notice that :

1. GEMS and ECMWF will use the future **FWIS** (The Future WMO Information System) for none real time dissemination and the **ECPDS** (ECMWF Product Distribution System) for real time.

   Regional, Specialized, National and World Meteorological Centres, as well as, Meteorological Satellite Operator Centres currently exchange with the WWW GTS (Global telecommunication system, see section 5.4.1.1). However, due to the current situation presented in Figure 5-6 (restricted access, multiplicity of procedures for information exchange, multiplicity of data formats; uncoordinated metadata and catalogues…)

   Congress approved the concept of the Future WMO Information System (FWIS), which will provide a single coordinated global infrastructure for the collection and sharing of information in support of all WMO and related international programmes.

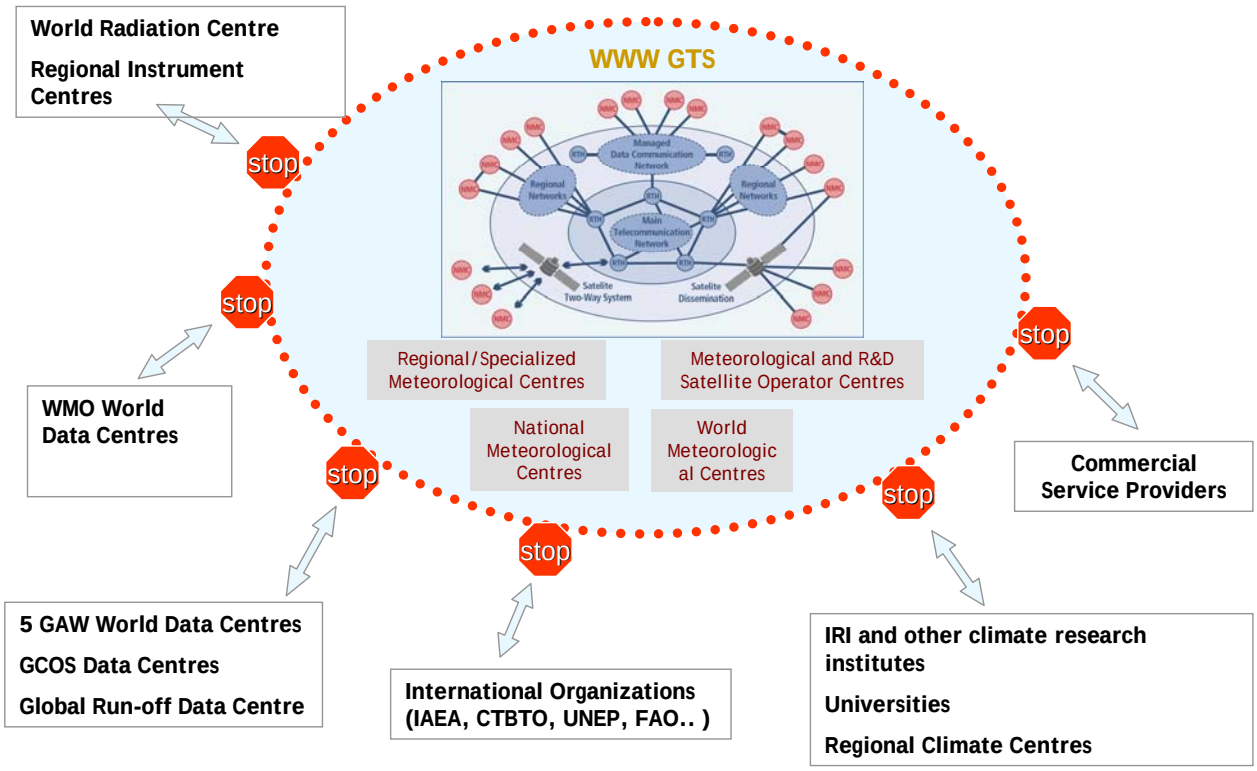


**Figure 5-6 : The GTS Network current situation**

FWIS (http://www.wmo.int/index-en.html ) is an overarching approach and a single coordinated global infrastructure for the collection, distribution retrieval of and access to data and information of all WMO and related Programmes. It would bring savings to the meteorological-hydrological community as a whole and increase the efficiency of their operations.

ECPDS (http://www.ecmwf.int/services/dissemination/ ) is a general purpose data transmission system developed, deployed, and configured at ECMWF to deliver meteorological products to Member States, cooperating Member States, and other authorised sites. Users are allowed to monitor transfers of data to their destination and to manage the queue of disseminated products.

2. For what concern MERSEA interacting or internal data flows are foreseen but using the existing meteorological circuits (GTS/ RMDCN).
3. Geoland ONC interacting and internal data flows will be exclusively toward GEMS or ECMWF. Therefore, as ONC and GEMS are both running in the same environment at ECMWF, link between Geoland ONC and GEMS can be considered as internal to ECMWF infrastructure and out of the scope of HALO.
4. GEOLAND CSP and OLF interacting and internal data flows mechanisms (i.e: G3/A1, G14, G2/A7) shall be improved in order to reach fully operational services (standardized data exchange, interoperable catalogues…).

| |
|---|
| One of the main objective of the candidate solution will then be to find out if there are any existing solutions that could be accommodate for the Geoland CSP and OLF interacting data flows purpose. |

For what concern external data flows we can notice that :

1. The Meteorological data (M4, M3, A8, G10, G6) could be transferred using GTS or Eumetcast (TBC). Nevertheless, the access to GTS is restricted and governed by WMO rules (see section 5.4.1.1) and Eumetcast is primarily used for the distribution of image data and derived products from **EUMETSAT's own satellites** (EUMETCast also provides access to data and services provided by several external data providers (see section 5.4.1.2)).

| |
|---|
| The use of the Future WMO Information System (FWIS) must be studied as a standard and homogeneous way to transfer all meteorological data to the various HALO service providers. |

2. For what concern Earth Observation Satellite data (M3, G9, G10) interoperability between different Earth Observation missions to achieve a harmonised and homogeneous access to their data would be beneficial for all IPs.

   ESA has initiate a specific "Heterogeneous Mission Accessibility (**HMA**)"study that aims at specifying, designing and prototyping the EO Data Access Integration Layer (**EO DAIL**) of the future European Earth Observation Ground Segment (G/S). This layer will provide a harmonised interface between the GMES Service Users and the EO data providers.

   The harmonisation of interfaces as part of the development of multi-mission user interfaces has been an integral part of ESA's strategy for more than 10 years, and recently ESA has joined OGC to promote the standardization work performed during that period.

   The EO DAIL will allow a user to communicate with the G/Ss of several missions through a single set of interfaces.

The use of the Future ESA EO-DAIL must be studied as a federated way to access all EO data for the various HALO service providers.

3. In-situ data are provided through a wide variety of networks, depending on the application fields. No federating In-situ Network do exist nowadays.

   Therefore, it would be beneficial to define methodology and concepts for a federated access to all in-situ data through access to existing and on-going in-situ networks.

   Several In-situ Networks exist, that are dedicated to various themes, generic such as GTS for Meteorology, ARGOS Network for Marine,

   as well as specific such as

   - NDSC Network for the Detection of Stratospheric Change
   - GAW for Global Atmosphere Watch of the WMO
   - And so on…

   Given the huge number and the variety of in-situ data, as well as the number of already existing operational networks, the problem is mainly an interoperability problem. How to cope with existing standards and procedures ? How to cope with the habits in various themes ? How to automate the access to in-situ data ? How to define standard, commonly agreed standard protocols for in-situ data retrieval and publishing ?

   WIN offers suitable components and a methodology for data retrieval through the definition of an in-situ community sub-network. This community will cope with existing sub-networks under the condition their representatives accept to register to WIN community.

   This is only through this registration that each sub-network will be recognised, will access to WIN community services, through Service Oriented Architecture.

   The use of the Future WIN Community must be studied as a federated way to access all In-situ data for the various HALO service providers.

## 5.4 PROPOSED SOLUTIONS

GMES Services will be inter-connected and will interoperate in a **complex distributed service network.**

**The business model** can be compared to a typical manufacturer distributed business network. including

- User I/F (Order desk/ Help Desk)
- Manufacturer Infrastructure to schedule, purchase, receive, inventory, process, package and disseminate
- Suppliers network: receive orders, provide raw materials

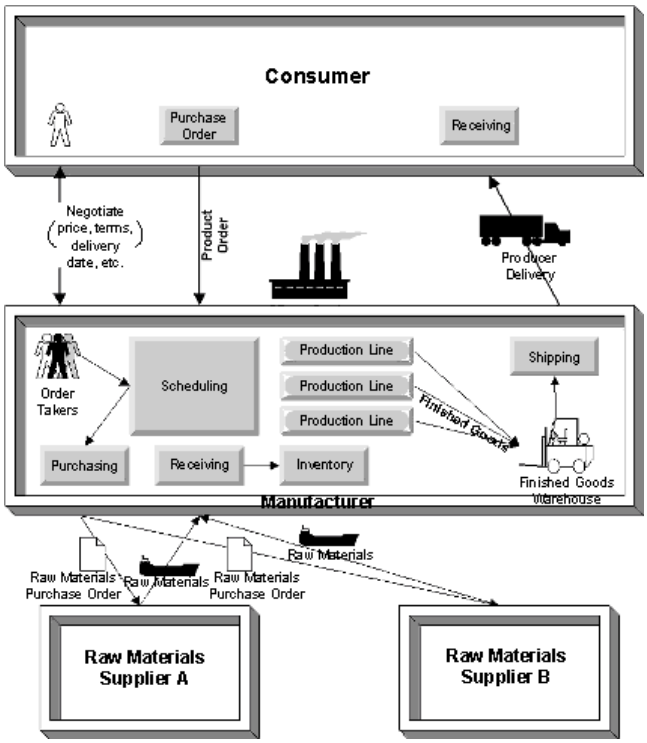


**Figure 5-7 : Typical manufacturer distributed business network (B2B, B2C….)**

A good example of a distributed business between the IPs is their contribution to the carbon cycle (presented in the interacting part of GEMS, MERSEA and Geoland" report).

Therefore, the infrastructure candidate solution must benefit from similar business model experience and assess currently used and proven solutions (e-business, BMP Business Process Management, EAI Enterprise Application Integration).

The idea is to complement and organize the existing service infrastructure (from input data access up to end users product delivery) with new Service Support Infrastructure (**SSI**) elements (including both Service and Common facilities; see section 5.2.1.2) which will allow the building-up of an integrated end-to-end operational system for the delivery of services.

Key drivers for the design of this Service Support Infrastructure (SSI) are:

- Ensure optimal "communication" between "actors" using interoperability standards issued by INSPIRE, OGC and other relevant initiatives
- Build a scalable solution to enable integration/ cooperation with new organisations.
- Solution based on existing system, rather than requiring a full scale system rewrite;
- Minimizes any impact on systems components other than those who manage external interfaces.
- Leverage the ongoing evolution of information technology (IT) toward design of complex systems as assemblies of components

The HALO candidate solutions will finally consist in defining and designing the necessary SSI components based on the key infrastructure issues (defined in section 5.1), the HALO infrastructure model (defined in section 5.2.1) and on the "data flows analysis and gaps identification" (defined in the previous section),

In this context, the proposed SSI solutions must answer to the following questions:

1. Which network for HALO data transfer (interacting and external) ?
2. Which Access to EO Data ?
3. Which Access to Meteo Data ?
4. Which Access to in-situ Data ?
5. Relevance of using Data Grid technology for data sharing ?
6. How to manage interconnection and interoperability ?
7. Which reusable relevant components or concepts issued by close related initiatives (ORCHESTRA, OASIS, WIN, INSPIRE,….) ?

### 5.4.1 Which network for HALO data transfer

Data transfer in HALO could be based on the following networks:

- Meteorological networks GTS/RMDCN (WMO) & Future WMO Information System (FWIS)
- Dedicated Networks such as EumetCast, ARGOS or GEANT
- Mobile networks such as Inmarsat, Iridium

#### 5.4.1.1 Overview of the GTS/RMDCN and FWIS networks

The meteorological community uses dedicated networks for the operational transfer of both observations and model output. The main advantages are bandwidth and availability guaranties. GTS (Global telecommunication system) is the network of the meteorological community.

The GTS consists of an integrated network of point-to-point circuits, and multi-point circuits which interconnect meteorological telecommunication centres. The circuits of the GTS are composed of a

combination of terrestrial and satellite telecommunication links. Figure 5-8 shows the structure of the GTS.

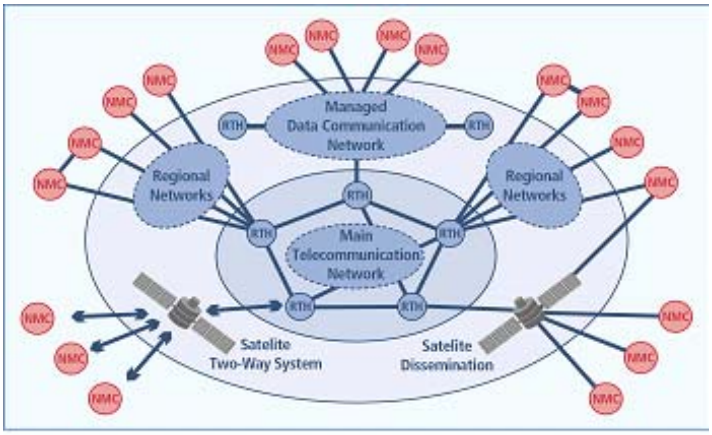


**Figure 5-8 : World Weather Watch GTS - Global Telecommunication System -**

The GTS is organised in three hierarchy levels, namely:

a. The Main Telecommunication Network (MTN);

b. The Regional Meteorological Telecommunication Networks (RMTNs);

c. The National Meteorological Telecommunication Networks (NMTNs);

### The Main Telecommunication Network (MTN)

**The Main Telecommunication Network (MTN)** is the core network of the GTS. It links together three World Meteorological Centres and 15 Regional Telecommunication Hubs. These are:

- NMCs: Melbourne, Moscow and Washington;
- RTHs: Algiers, Beijing, Bracknell, Brasilia, Buenos Aires, Cairo, Dakar, Jeddah, Nairobi, New Delhi, Offenbach, Toulouse, Prague, Sofia and Tokyo.

The MTN has the function of providing an efficient and reliable communication service between its centres, in order to ensure the rapid and reliable global and interregional exchange of observational data, processed information and other data required by Members.

### The Regional Meteorological Telecommunication Networks (RMTN)

**The Regional Meteorological Telecommunication Networks (RMTN)** consist of an integrated network of circuits interconnecting meteorological centres, which are complemented by radio broadcasts where necessary. The Regional Meteorological Telecommunication Networks are to ensure the collection of observational data and the regional selective distribution of meteorological and other related information to Members. The RTHs on the MTN perform an interface function between the Regional Meteorological Telecommunication Networks and the MTN. There are six Regional Meteorological

Telecommunication Networks: Africa, Asia, South America, North America, Central America & the Caribbean, South-West Pacific and Europe.

### The National Meteorological Telecommunication Networks (NMTN)

**The National Meteorological Telecommunication Networks (NMTN)** enable the National Meteorological Centres to collect observational data and to receive and distribute meteorological information on a national level.

Satellite-based data collection and/or data distribution systems are integrated in the GTS as an essential element of the global, regional and national levels of the GTS. Data collection systems operated via geostationary or near-polar orbiting meteorological/environmental satellites, including ARGOS, are widely used for the collection of observational data from *Data Collection Platforms*. Marine data are also collected through the International Maritime Mobile Service and through INMARSAT. International data distribution systems operated either via meteorological satellites such as the Meteorological Data Distribution (MDD) of METEOSAT, or via telecommunication satellites, such as RETIM or FAX-E via EUTELSAT are efficiently complementing the point-to-point GTS circuits. Several Countries, including Argentina, Canada, China, France, India, Indonesia, Mexico, Saudi Arabia, Thailand and the USA, have implemented satellite-based multi-point telecommunication systems for their national Meteorological Telecommunication Networks.

The RMDCN **E**uropean **R**egional **M**eteorological **D**ata **C**ommunications **N**etwork is part of WMO's Global Telecommunication System (GTS) as the regional network for region VI, Europe.

The RMDCN is a relevant network for HALO as it connects the European National Meteorological Services and **ECMWF**. The dissemination of operational products by ECMWF to its member states is one of the major tasks of the RMDCN. An overview of the connections is given in Figure 5-9. The commited data rates of the RMDCN in the context of France, the UK, and ECMWF are detailed in Figure 5-10 to Figure 5-12.

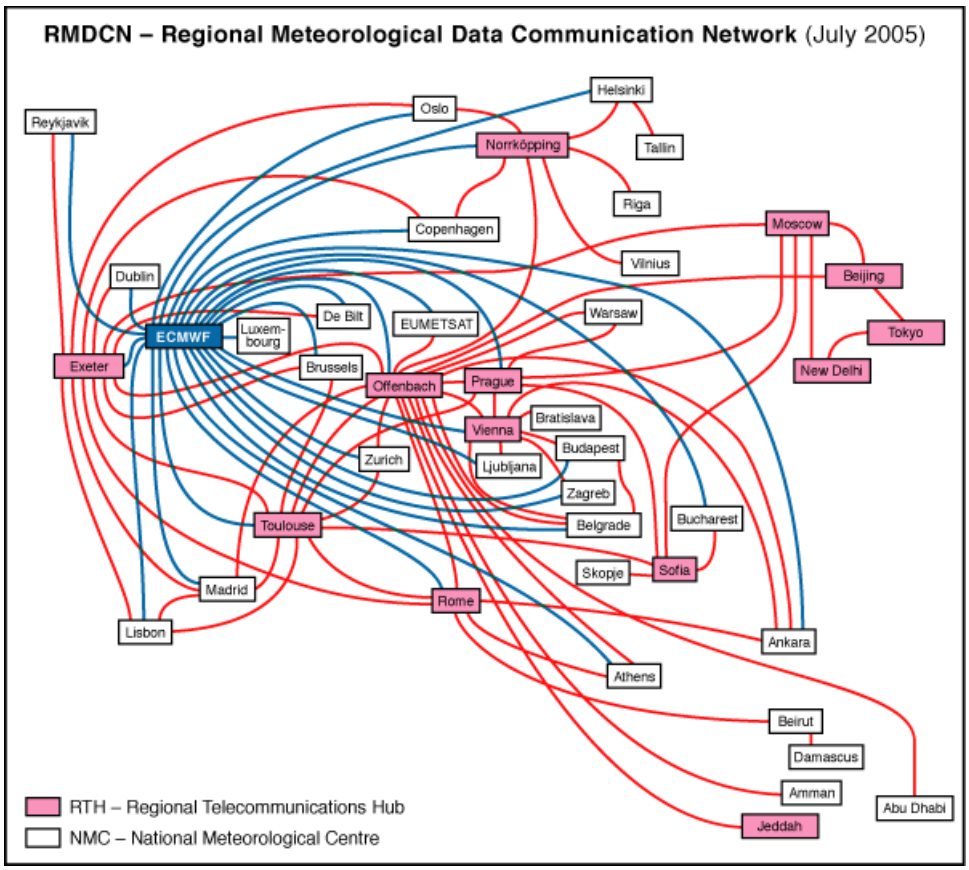


Figure 5-9: Overview of RMDCN connections (source: www.ecmwf.int)

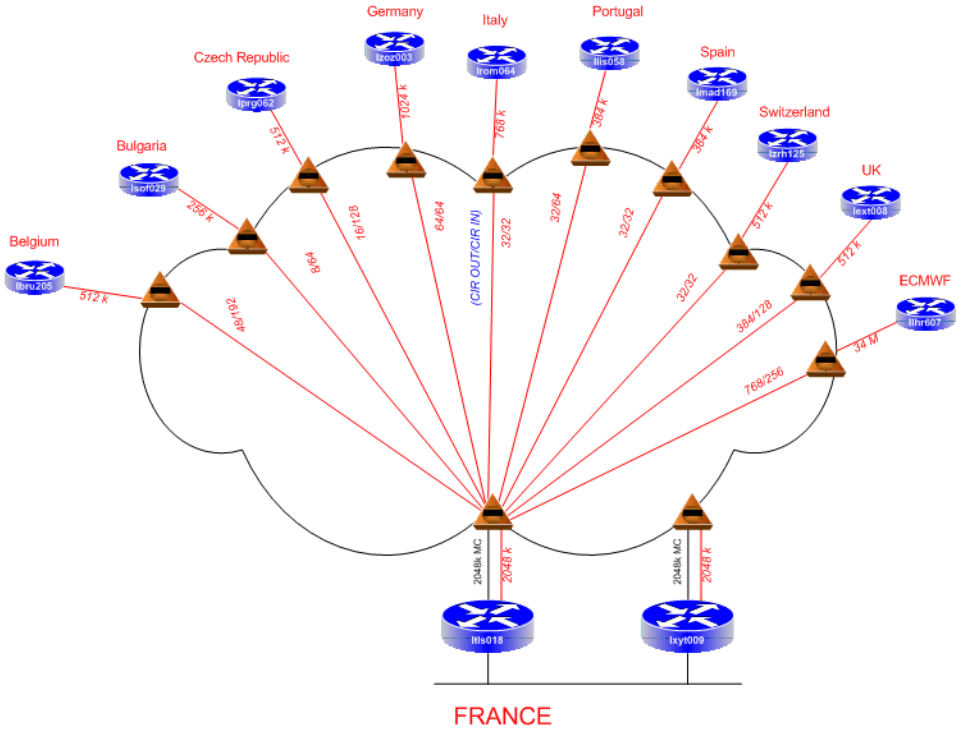


Figure 5-10: RMDCN Committed Information Rate (CIP) in France

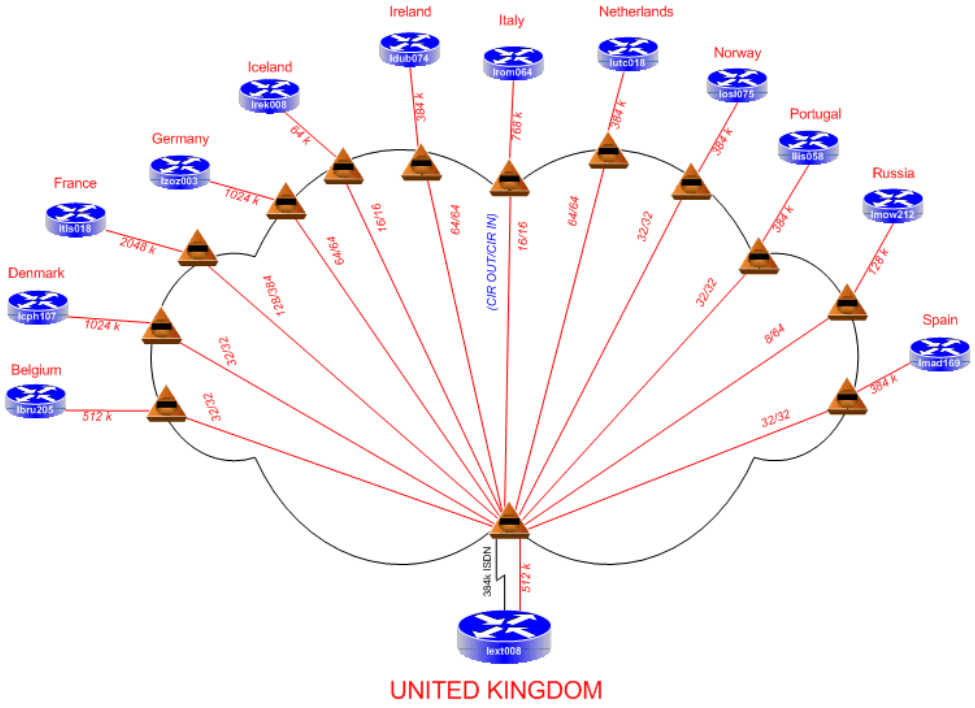


Figure 5-11: RMDCN Committed Information Rate (CIP) in the UK (source: www.ecmwf.int)

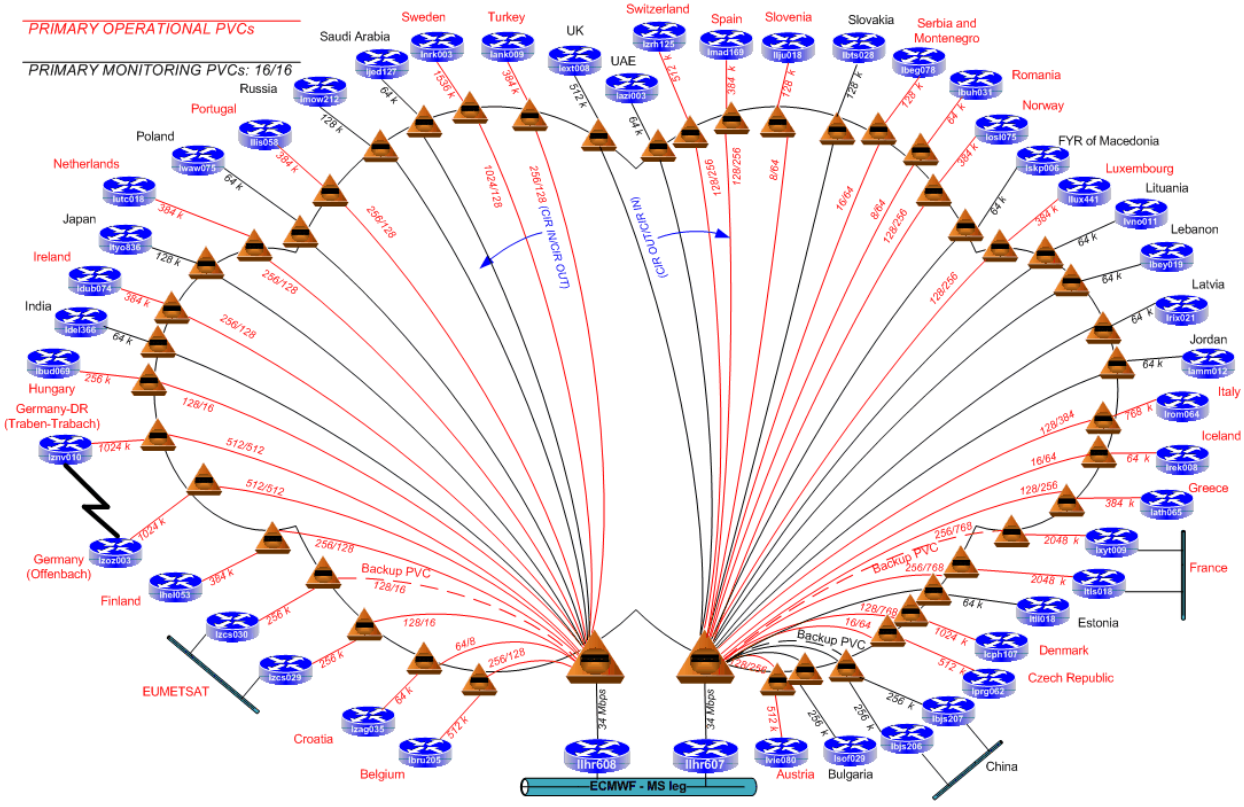


Figure 5-12: RMDCN Committed Information Rate (CIP) for the ECMWF

**The RMDCN may be a means of communication between the three IPs** involved in HALO. In particular, the dissemination of meteorological fields and other GEMS products belongs to the defining tasks of RMDCN. However, modifications, e.g. in bandwidths may become necessary.

Indeed, the access to GTS is restricted and governed by WMO rules. One needs authorization from one of the National Weather Services to access the data, or to inject it onto the system. Authorization must be renewed yearly; access is then on a ftp server. Data format is somewhat rigid and not practical for specific data extraction. Data accuracy is limited to two decimal point. There is no quality control on the data, although data providers are supposed to inject only QC 'ed data.

**The Future WMO Information System (FWIS)** will provide a single coordinated global infrastructure for the collection and sharing of information in support of all WMO and related international programmes. FWIS (http://www.wmo.int/index-en.html ) is an overarching approach and a single coordinated global infrastructure for the collection, distribution retrieval of and access to data and information of all WMO and related Programmes.

The ultimate implementation of FWIS will build upon the most successful components of existing WMO information systems. It will continue to rely upon the WMO communication system (initially the GTS) to provide highly reliable delivery of time-critical data and products. FWIS will be based on the use of Standards (e.g. ISO and ITU).

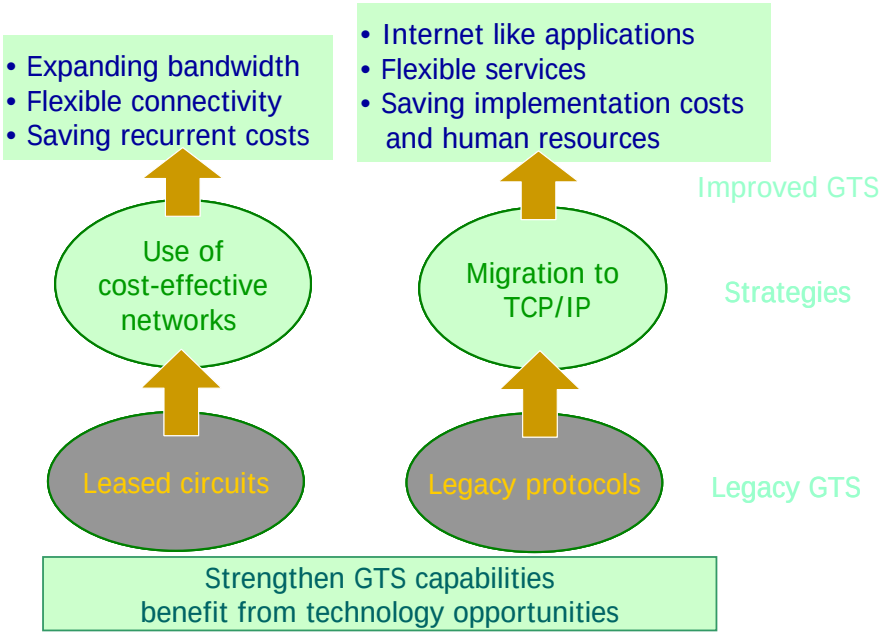


**Figure 5-13 : From the GTS towards the FWIS core network**

FWIS brings new features and opportunities

- Inter-disciplinary locating, retrieval and exchange of information in real and non-real time
- On-line catalogues using metadata based on ISO 19100 (geographic information standard)
- Industry standards and off-the-shelf hardware and software systems to ensure cost-effectiveness and inter-operability

These new FWIS features will allow further integration of extensive satellite-based multipoint telecommunications systems for the distribution of large volume of information, in complement to the dedicated connections. Each WMO Region is completely covered by at least one satellite-based data-distribution system, and several systems are implemented at national or sub-regional level. Satellite-based systems using digital video broadcasting (DVB) techniques are implemented in Region VI and extended to cover Regions I and II, including RETIM operated by France and **EUMETCast** operated by EUMETSAT and also supporting DWDSAT of Germany, and are planned in other Regions. Satellite-based systems using digital audio broadcasting (DAB) techniques for "data casting" are also used by the World Space Radio and Internet (RANET) experiment over Africa and the Pacific, and by the NMS of India (IMD) for replacing and upgrading the radiobroadcast from RTH New Delhi.

#### 5.4.1.2 Overview of the Eumetcast network

Eumetcast is primarily used for the distribution of image data and derived products from **EUMETSAT's own satellites**. In addition, EUMETCast provides access to data and services provided by several external data providers.

To gain access to these services, potential users are required to operate a **EUMETCast reception station**:

- A typical EUMETCast reception station comprises of a standard PC with DVB card inserted and a satellite off-set antenna fitted with a digital universal V/H LNB for Ku-band, or fitted with a circular polarisation feedhorn, bandpass filter and special LNB for C-band. To decode and decrypt the DVB signal, EUMETCast Client Software and in some instances, EUMETCast Key Unit (EKU) are also required.
- The cost of EUMETCast reception station is kept to a minimum by utilising industry open standards to the maximum extent possible thus resulting in an adaptable front-end solution to users' applications.

Within the current EUMETCast configuration, the multicast system is based upon a client/server system with the server side implemented at the EUMETCast uplink site and the client side installed on the individual EUMETCast reception stations.

Files are transferred via a dedicated communications line from EUMETSAT to the uplink facility. These files are encoded and transmitted to a geostationary communications satellite for broadcast to user receiving stations. Each receiving station decodes the signal and recreates the data/products according to a defined directory and file name structure.

A single reception station can receive any combination of the services provided on EUMETCast. Data, for which access is restricted in accordance with EUMETSAT Data Policy, is made secure by the USB decryption scheme.

The components involved in the system include:

- Data providers (DP)
- Service management (SM)
- Uplink service provider (USP)
- Turn around service provider (TSP)
- Satellites
- Reception stations

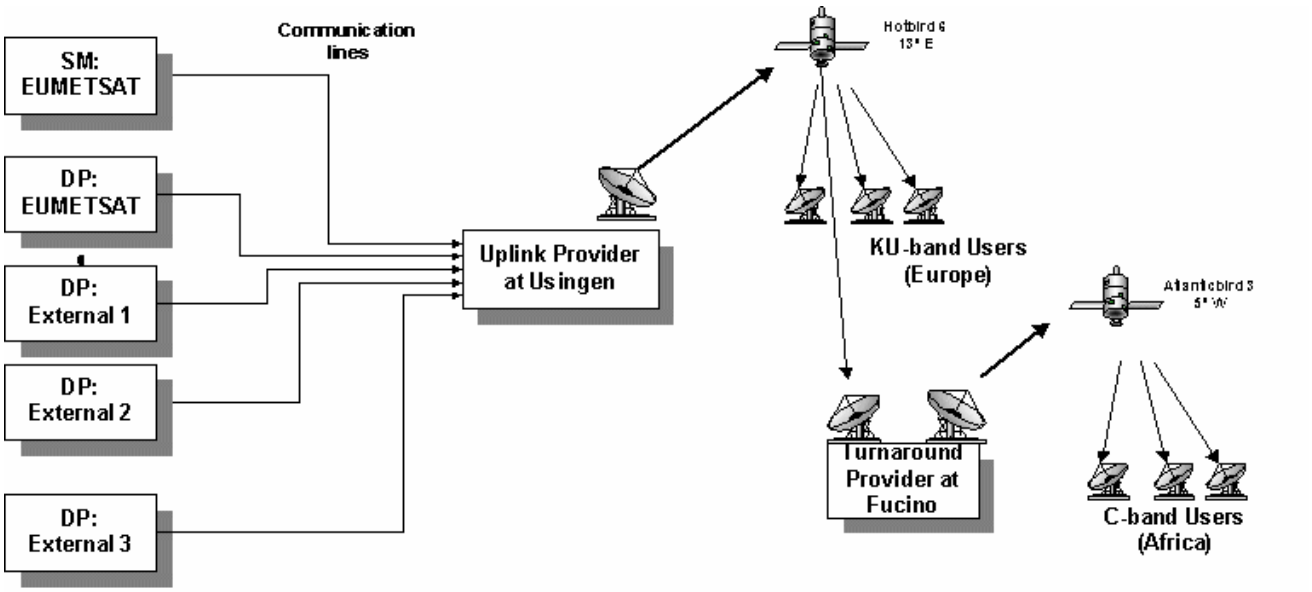


**Figure 5-14: Eumetcast system overview**

The table below provides a quick overview of the services currently available on EUMETCast.

| Service | Format | Originator/Satellite | EUMETCast band | Licensed/Essential/Restricted |
|---|---|---|---|---|
| High Rate SEVIRI | HRIT (PDF, 1661 KB) | Second Generation - Meteosat-8 onwards | Ku-band Europe & C-band Africa | Licensed for 15-min, 30-min, 1-hrly, & 3-hrly. Essential for 6-hourly. |
| linkLow Rate SEVIRI | linkLRIT (PDF, 1661 KB) | Second Generation - Meteosat-8 onwards | Ku-band Europe & C-band Africa | Licensed for 30-min, 1-hrly, & 3-hrly. Essential for 6 hourly. |
| High Resolution Image | OpenMTP (PDF, 180 KB) | First Generation - Meteosat-5,-7 | Ku-band Europe & C-band Africa | Licensed for 30-min, 1-hrly, & 3-hrly. Essential for 6 hourly. |
| Rapid Scanning | OpenMTP (PDF, 180 KB) | Meteosat-6 | Ku-band Europe only | Licensed |
| Meteorological Products | GRIB-2 / BUFR | Meteosat Second Generation - Meteosat-8 onwards | Ku-band Europe & C-band Africa | Essential |
| Satellite Application Facility (SAF) Products | Native[1] | Meteosat Second Generation - Meteosat-8 onwards | Ku-band Europe & C-band Africa | Essential |
| EUMETSAT Advanced Retransmission EARS-ATOVS | AAPP / BUFR | NOAA satellites | Ku-band Europe only | Essential |
| Basic Meteorological Data[2] | Native | WMO | Ku-band Europe only | Restricted |
| Meteorological Data Dissemination[2] | Native | WMO | Ku-band Europe & C-band Africa | Restricted |

| Service | Format | Originator/Satellite | EUMETCast band | Licensed/Essential/Restricted |
|---|---|---|---|---|
| Data Collection Service | Native | Authorised DCP operators | Ku-band & C-band | Restricted[3] |
| Other geostationary satellite data | Native | GOES -E/W & MT-SAT | Ku-band Europe & C-band Africa | Essential |
| DWDSAT[4] | Native | DWD | Ku-band Europe only | Licensed |
| VEGETATION[5] | HDF | VITO | Ku-band Europe & C-band Africa | Restricted |
| Service Messages[6] | Textual format (.txt) and XRIT (PDF, 1661 KB) | EUMETSAT | Ku-band Europe & C-band Africa | Essential |

**Table 5-2 : Overview of the services currently available on EUMETCast**

***Licensed Services***: The reception of licensed services is dependent upon operating a EUMETCast reception station fitted with a EUMETCast Key Unit (EKU).

***Essential Services***: For most essential services an EKU is not required, however, the reception of some essential services (e.g. EPS GDS) will be dependent upon operating a station fitted with an EKU.

***External Services***: Depending upon the requirements of the individual data provider, access to some external services is dependent upon operating a EUMETCast station fitted with an EKU.

[1] Native represents a variety of formats used by the external data/content providers, including WMO formats

[2] The content of this service is subject to change by the data provider the World Meteorological Organization (WMO), terms and conditions of access apply.

[3] DCP Retransmission service available to DCP operators and their partners only

[4] The content of this service is subject to change by Deutscher Wetterdienst (DWD), terms and conditions of access apply.

[5] The content of this service is subject to change by the data provider VITO, terms and conditions of access apply.

[6] EUMETSAT provides service news to support many of the data and product services delivered to users. We aim to keep our users informed when unforeseen service outages occur and to notify users of forthcoming, scheduled activities which may affect the operational services they use.

The 10-year strategic plan for the Global Earth Observation System of Systems (**GEOSS**) was formally approved by government delegates at the 3rd Earth Observation Summit on 16 February 2005 in Brussels.

Under the GEOSS plan, satellites and in-situ observations from different countries/regions will be linked and participants will share access to Earth observation data and model inputs. This will maximise the benefit of each satellite flying in space and all participants will gain from additional data and reduced costs.

GMES will be the European contribution to GEOSS.

Besides helping to draft the 10-year strategic plan for GEOSS, EUMETSAT has been proactive in shaping the GMES effort. EUMETSAT will provide its satellite data and products, including those from its Satellite Application Facilities (SAFs), to the GMES and GEOSS communities for the development of new applications. **In addition, access to the EUMETCast dissemination system and archives will be possible**.

Moreover, the GEOSS 10-Year Implementation Plan calls for a series of annual work plans to implement the GEOSS. The GEO 2006 Work Plan, sets forth a series of activities and tasks for the first year of GEOSS implementation.

**GEO 2006 Work plan special Initiative: GEONetcast**

GEO will design and launch "GEONetcast", a major initiative to develop a worldwide, operational, end-to-end Earth observation data collection and dissemination system, using existing commercial telecommunications infrastructure. GEONetcast will build on the success of such projects as Puma and **Eumetcast**, as well as other similar national and regional projects, and take advantage of emerging concepts such as the WMO's Integrated Global Data Dissemination System (IGDDS). GEONetcast will collect and disseminate space-based and in-situ derived data, metadata, and products for all GEO societal benefit areas. As a first step towards the development of GEONetcast, GEO will assess current data transfer & dissemination systems in all societal benefit areas.

#### 5.4.1.3 Overview of the Geant network

GÉANT is a pan-European multi-gigabit data communications network, reserved specifically for research and education use. It is creating the biggest interconnected community of scientists and academics in the world today, enabling them to share and distribute research data faster than ever before.

GÉANT supports researchers by allowing them to:

- Rapidly transfer large quantities of data at up to **10Gbps**
- Make use of advanced network applications such as **grid computing**
- Collaborate on research projects in real-time
- Perform previously unimaginable cutting-edge research

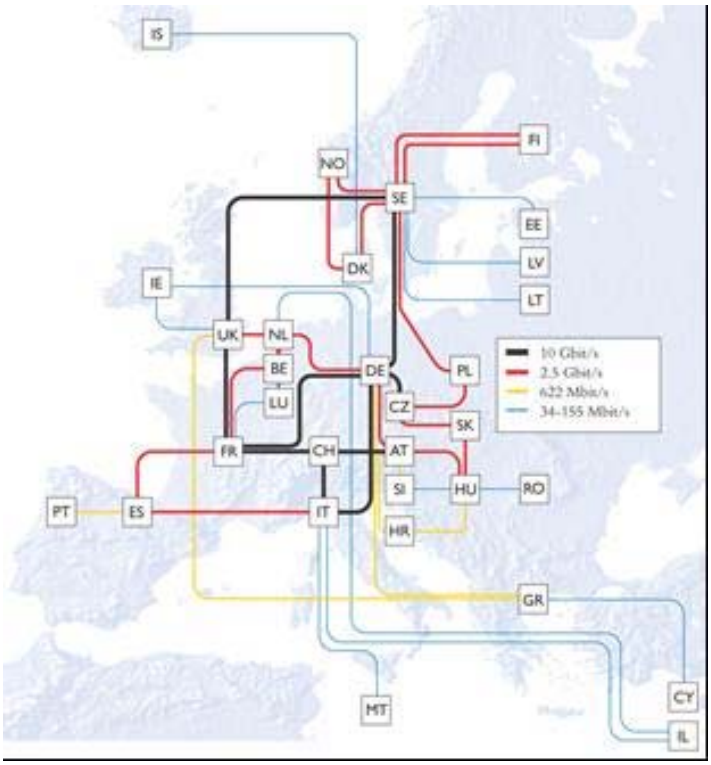


**Figure 5-15 : GÉANT Backbone Topology July 2002**

**Layer 2 Virtual Private Networks**

Layer 2 Virtual Private Networks (VPNs) are used on GÉANT to support projects that have a need for them, such as DataTag, KarBol and 6NET.

The Layer 2 VPNs currently used on GÉANT are point-to-point connections linking two sites. Typically, these will be two sites that belong to the same organisation or project, but which are each connected to a different network. Using a Layer 2 VPN, the two sites can communicate as though they were directly connected to each other. The Layer 2 VPN will appear as a '**tunnel**' for the two sites involved.

Use of a Layer 2 VPN on GÉANT must be requested in advance so it can be designed and configured. This is normally done via your **NREN** by contacting the person responsible for Layer 2 VPNs/MPLS. They will then request a Layer 2 VPN on behalf of your project.

You will need to provide the following information.

- Contact details for the two NRENs involved
- Contact details for the two end sites
- IP addresses of the routers at each end site
- Router model at each end site
- Bandwidth requirements
- A project description
- Applications to be used
- Start and end date for the when the Layer 2 VPN is required.

#### 5.4.1.4 Overview of the Iridium/ Inmarsat Communication network

**Inmarsat (http://www.inmarsat.com/home.aspx)**

Is a private telecom operator oriented towards platforms at sea (and airplanes). It operates as a telephone service. Can transmit voice, or e-mails with text. It requires large antenna and power so that it is not convenient for autonomous instruments.

Inmarsat data transfer solution

- Internet access:

  A dial-on-demand or always-on connection to the Internet. When using Inmarsat services, this gateway can be provided directly by Inmarsat Partners or through dialling the international access number of your current Internet Service Provider.

- E-mail

  Corporate or Internet-based electronic mail. E-mail is one of the most popular forms of corporate communications, easily allowing transfer of files and data around the globe. Inmarsat has several services that allow you to access this resource, as well as solutions to automatically compress attachments.

- File transfer

  The general exchange of files between PCs and networks. Typically the most efficient method for this is File Transfer Protocol, or FTP, applications. These attempt to best use the bandwidth available and minimize the application overhead transferred with requested data. Many applications also include additional features, such as automatic file compression and interrupted download recovery.

**Global Area Network (Gan)**

The Inmarsat Global Area Network (GAN) integrates, the corporate IT network with a global, mobile communications network. So business critical information can now be provided at both the bandwidth and speed that enterprises demand.

Solutions such as remote LAN access, e-mail, e-commerce, intranet access, image transfer, and store-and-forward video can now be used wherever they are needed - as well as, of course, high-quality voice and fax.

The Inmarsat Global Area Network offers two powerful and flexible services - Mobile ISDN and newly launched Mobile Packet Data Service. These high-speed services are delivered at speeds of up to **64kbit/s**, rapidly extending local and wide area networks (LANs and WANs) to where businesses need information.

All the end-user needs to access the Inmarsat Global Area Network is a mobile satcoms unit (MSU). A range of units is available from various manufacturers, each with generic features and applications. Each manufacturer gives the hardware its own product name, and adds some additional benefits of its own.

**Broadband Global Area Network (Bgan)**

Inmarsat's Regional Broadband Global Area Network (R-BGAN) provides mobile data connectivity at more than twice the speed of current terrestrial GPRS mobile phone networks, using a portable satellite IP modem the size of a notebook PC.

Applications made possible using the R-BGAN terminal include remote LAN and intranet access, as well as enabling dedicated, secure links to be set up over a virtual private network (VPN). It is also suitable for FTP, instant messaging, video streaming, e-commerce and transferring or sharing all kinds of data files with colleagues or clients.

This R-BGAN service transmits data via a **144kbps** shared channel and is the first product in the forthcoming BGAN range of mobile terminals, offering cost-effective always-on IP data connections at speeds up to half a megabit.

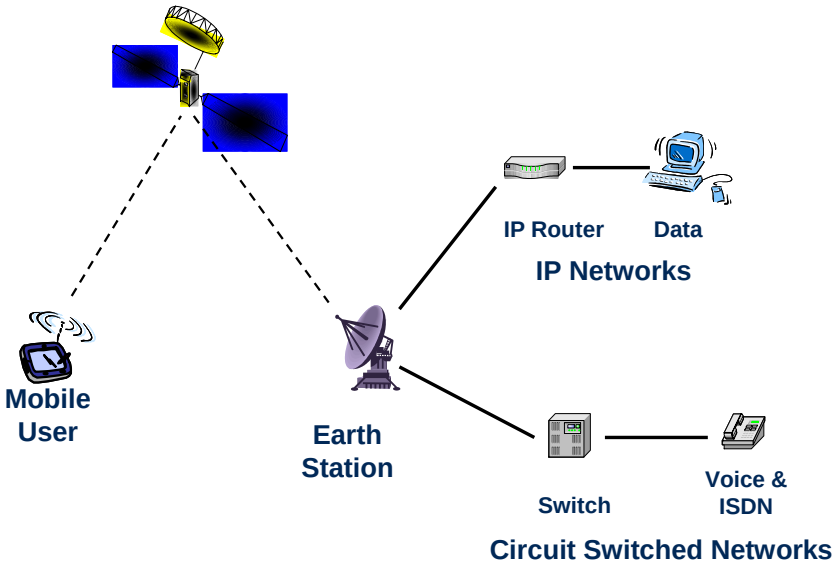


**Figure 5-16 : Broadband Global Area Network (Bgan)**

**Irridium (http://www.iridium.com/)**

Iridium Satellite LLC is a provider of global satellite voice and data solutions with complete coverage of the earth (including oceans, airways and Polar Regions). Iridium delivers essential communications services to and from remote areas where no other form of communication is available.

If you work, live, or travel in areas outside cellular coverage or in areas with inadequate landline service, Iridium provides an immediate solution. Iridium Satellite Solutions global service provides coverage across all ocean areas, air routes, and all landmasses, even the Poles.

The Iridium service is suited for industries such as maritime, aviation, government/military, emergency/humanitarian services, mining, forestry, oil and gas, heavy equipment, transportation and utilities.

The Iridium service has the advantage of low power, small antenna, which makes it suitable for small instrumental platforms on the ocean (e.g. ARGO floats, or gliders). Iridium offers high transmission rate for data, allowing full profiles to be transmitted.

**Iridium Data Services**

Using your computer and an Iridium satellite phone, you can connect to the Internet or a corporate network

from virtually anywhere in the world, allowing you to browse the web, send and receive email and transfer files.

| **Short Burst Data**<br>Iridium Short Burst Data (SBD) service is a new data service that enables value-added applications to send and receive short data transactions efficiently over the Iridium network. |
|---|

#### 5.4.1.5 Overview of the ARGOS network

The ARGOS network has been developed with ocean applications in mind, essentially for tracking (positioning). Very low data rate, low power requirements : data must be severely decimated and compressed. Only one way communication, so that the instrument must send messages repeatedly to ensure redundancy. The service is responsive to research needs which is not the case for the other systems, for which research is a very minor client.

**Argos satellite- system was set up by:**

- the French space agency (CNES)
- the US National Oceanic and Atmospheric Administration (NOAA)
- the US National Aeronautics and Space Administration (NASA)

The new partners to supply additional satellites from 2001, are:

- the Japanese space agency (NASDA)
- the European Meteorological Satellite Organization (EUMETSAT)

The Argos system is scheduled to operate through at least 2010 with more than 8000 platforms active worldwide

Argos is operated and managed by :

- CLS (Collect, Localisation, Satellites http://www.cls.fr/) a CNES subsidiary in Toulouse, France
- and Service Argos, Inc., a CLS North American subsidiary, in Largo, Maryland, near Washington, DC, USA.

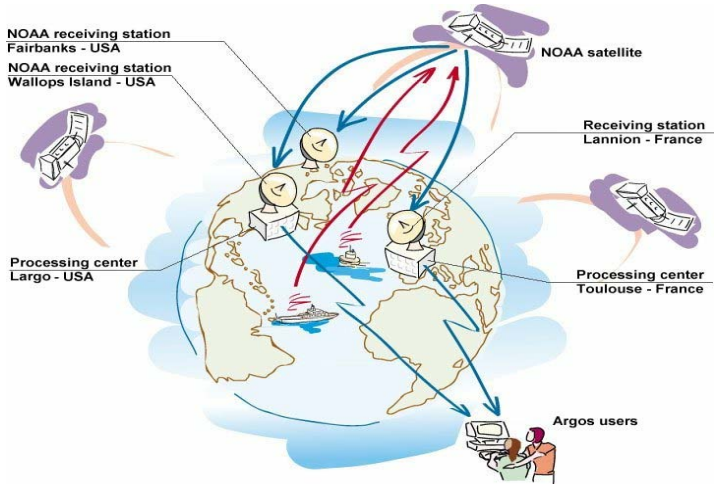


**Figure 5-17 : Argos system overview (global network)**

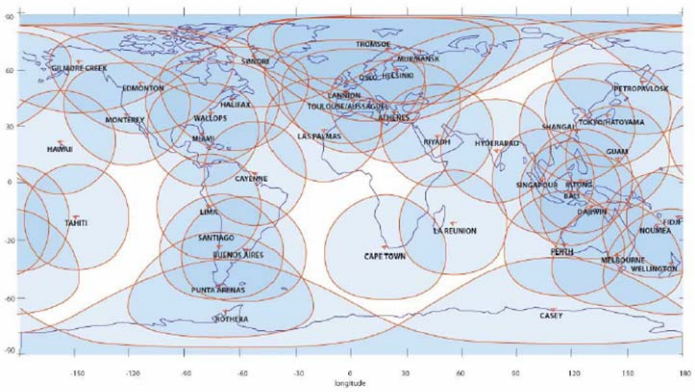

Figure 1: Argos network of regional receiving stations.

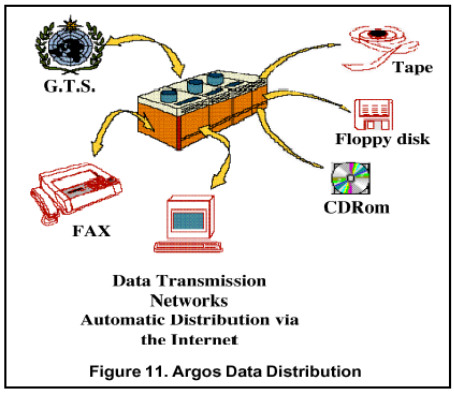


**Figure 5-18 : Argos local network of regional receiving stations & Data distribution process**

**Argos data distribution**

- **Automatic Distribution Service (ADS)**

  ADS supplies results automatically, either at fixed times, which are User-defined, or whenever new data become available. The User specifies the most appropriate distribution network. For example, in the US, many users are taking advantage of the Internet to receive their data via FTP or email. There is no need to interrogate Argos on-line since data is delivered automatically to the User's system.

- **Connecting on line**

  You can access results at any time by connecting to an Argos center via the Internet, the public telephone network, X.25, or other networks. Options include downloading results from the previous ten days, the most recent updates only, etc.

- **Regular off-line deliveries**

  Floppy disks or CD-ROMs, once a month.

- **Special deliveries**

  Argos stores all Users' data for six months, making them available off-line on request.

- **GTS Subsystem**

  These data are usually **relayed** onto the Global Telecommunications System (**GTS**), a world-wide operational system for the sharing of meteorological and climate data. Argos established a powerful **Argos/GTS** processing subsystem to simplify the transmission of data directly onto the GTS. The system provides maximum flexibility in processing sensor data. This has resulted in increased quantity and quality of Argos data on the GTS.

CLS, Service Argos throughput times for delivery of results are calculated in terms of the time for the raw Argos data to reach end users. For each message received by the satellite, Service Argos computes the data turnaround time/data availability which is the time elapsed between the recording of the message on board the satellite and processing of the same message by the global processing center.

The following table shows the throughput time for real-time result delivery from NOAA-18, NOAA-17, NOAA- 16, NOAA-15, NOAA-14 and NOAA-12 and acquired by the 44 HRPT receiving stations.

| Satellite Delivery | NOAA-12, NOAA-14 NOAA-15, NOAA-16 NOAA-17 & NOAA-18 |
|---|---|
| < 10' | 41 % |
| < 15' | 55 % |
| < 30' | 85 % |
| < 45' | 93 % |

**Table 5-3: Real-time data availability**

As far as GTS distribution is concerned, the following delays must be added:

- GTS data processing at Service Argos;
- GTS bulletins routing delays.

#### 5.4.1.6 Overview of the FTP/ Internet (Opendap DODS) network

Standard **ftp** connection could be used for all kind of data exchange not covered by dedicated networks.

Data transfer via **Internet using the Opendap protocol** (Distributed Oceanographic Data System **DODS**) allows a flexible way to exchange data from various data centres.

The DODS is a system that allows you to access data over the internet, from programs that weren't originally designed for that purpose, as well as some that were. With DODS, you access data using a URL, just like a URL you would use to access a web page.

#### 5.4.1.7 Communication network synthesis

As presented in section 5.4.1, several distinct networks could be used for data transfer in HALO:

- Meteorological networks GTS/RMDCN (WMO) & Future WMO Information System (FWIS)
- Dedicated Networks such as EumetCast, ARGOS or GEANT
- Mobile networks such as Inmarsat, Iridium
- Standard internet/ FTP

The following table present a synthesis overview of the various candidate networks.

| Network | Data rate | Domain | Restrictions | Candidate solution to deliver |
|---|---|---|---|---|
| GTS/RMDCN | 8 to 1024 Kbps | WMO world | The access to GTS is restricted and governed by WMO rules. One needs authorization from one of the National Weather Services to access the data, or to inject it onto the system. Data format is somewhat rigid and not practical for specific data extraction. Data accuracy is limited to two decimal point. There is no quality control on the data, although data providers are supposed to inject only QC 'ed data. | See FWIS |

| Network | Data rate | Domain | Restrictions | Candidate solution to deliver |
|---|---|---|---|---|
| FWIS | TBD | WMO but less restricted than GTS (TBC) | TBD | GTS later replaced by FWIS when available for<br>• In-Situ, EO & Meteo data<br>• Geoland products to GEMS (ECMWF)<br>• GEMS products to MERSEA, Geoland<br>• MERSEA products to GEMS (TBC) |
| Eumetcast | 2.5Mbps | Eumetsat satellite | Eumetcast is primarily used for the distribution of image data and derived products from **EUMETSAT's own satellites**. In addition, EUMETCast provides access to data and services provided by several external data providers. | Necessitate usage extension (TBC)<br>• In-Situ data<br>• EO data<br>• Meteo data |
| Geant | 34 Mbps to 16 Gbps | Research & education | Reserved specifically for research and education use enabling them to share and distribute research data faster than ever before. | For specific needs to rapidly transfer large quantities of data. (Layer 2 Virtual Private Networks (VPNs) are used on GÉANT to support projects that have a need for them.)<br>• (TBC) Geoland **RT** products to GEMS (ECMWF) |

| Network | Data rate | Domain | Restrictions | Candidate solution to deliver |
|---|---|---|---|---|
| ARGOS | | Ocean applications, essentially for tracking | Very low data rate, low power requirements : data must be severely decimated and compressed. | • Meteo data (**NOAA**)<br>ARGOS data are usually **relayed** onto the **GTS**. Argos established a powerful **Argos/GTS** processing subsystem to simplify the transmission of data directly onto the GTS. |
| Inmarsat | 64 to 144 Kbps | Private telecom operator oriented towards platforms at sea (and airplanes) | It operates as a telephone service. Can transmit voice, or e-mails with text. It requires large antenna and power so that it is not convenient for autonomous instruments | Broadcast In-situ or radar data<br>• In-Situ data<br>• Meteo data |
| Iridium | 2.4 Kbps | Iridium delivers essential communications services to and from remote areas where no other form of communication is available. | | Broadcast In-situ or radar data<br>• In-Situ data<br>• Meteo data |
| FTP/ Opendap | | | | • In-Situ data |
| Geonetcast | TBD | TBD | TBD | • In-Situ data<br>• EO data |

**Table 5-4 : Overview of the various candidate networks**

**GTS (RMDCN)/ FWIS** network

The **GTS (RMDCN)/ FWIS** network should be used to deliver some of the HALO interacting and external data. MERSEA access to meteorological field data and in situ observations already relies on GTS (RMDCN), the links are provided by meteorological centres such as Meteo-France, UKMetoffice or Met.no which often

host the ocean modelling activities. GEMS and ONC, both hosted at ECMWF, will have access to GTS (RMDCN) too.

Geoland CSP & OLF should also access to meteorological field data and-in situ observations relying on GTS (RMDCN).

Moreover, interacting data flows could also be delivered using GTS (RMDCN)/FWIS, in particular:

- Geoland-OLF vegetation CO2 for land use change & forest fires (G3/A1) in research mode towards GEMS (ECMWF)
- Geoland-CSP global products for generic land cover (G2/A7) in regular or on-demand mode toward GEMS (ECMWF)
- Geoland-CSP Satellite forcing fields for land surface models (G14) for improved precipitation fields and incoming radiation toward Geoland ONC
- GEMS global aerosol products (G5/G5b/A4) atmospheric aerosol data for atmospheric correction in retrieval toward Geoland
- MERSEA ocean parameters (e.g. SST) toward ECMWF (TBC )

**Eumetcast network**

**Eumetcast** already provides access to data and services provided by several external data providers (see Table 5-2) nevertheless, additional external in-situ, EO and meteo data could be provided using this network, in particular (TBC):

- Meteo satellite data (Eumesat, NOAA) for atmospheric species concentration & fire burnt area (A8) toward GEMS
- Meteo satellite data for information about land surface (vegetation, radiation, water) (G6) toward Geoland-CSP
- In situ data for rainfall (G7) toward Geoland-CSP.
- Meteo & EO satellite data for land surface & vegetation status (G10) toward Geoland-ONC.
- EO satellite data for validation data for vegetation & land cover (G9) toward Geoland-CSP.
- EO and meteo satellite data for along track, validated (M3) toward GEMS.

**Géant Network**

**GÉANT** network aims at supporting researchers by allowing them to rapidly transfer large quantities of data (up to 10Gbps). Therefore, Géant layer 2 Virtual Private Networks (VPNs) could be used by HALO /GMES service providers that needs to rapidly transfer data between each other.

The Layer 2 VPNs are point-to-point connections linking two sites. Typically, these will be two sites which are each connected to a different network. Using a Layer 2 VPN, the two sites can communicate as though they were directly connected to each other. For instance Géant VPN could be used to transfer (TBC):

- MERSEA ocean parameters (e.g. SST) toward ECMWF (TBC )
- Geoland-CSP global products for generic land cover (G2/A7) toward GEMS (ECMWF)
- Geoland-CSP Satellite forcing fields for land surface models (G14) for improved precipitation fields and incoming radiation toward Geoland ONC
- Geoland-OLF vegetation CO2 for land use change & forest fires (G3/A1) towards GEMS (ECMWF)

**FTP/ Internet**

Standard ftp connection will be used for all kind of data exchange not covered by GTS or dedicated networks (presented above). For instance, ECMWF receives about 50% of its satellite data via this network from data sources such as the research platforms run by ESA and NASA.

Data transfer via Internet using the Opendap protocol (Distributed Oceanographic Data System **DODS**) allows a flexible way to exchange data from various data centres. Live Access Severs using OPeNDAP are widely used in the Ocean community. Their application should be expanded in order to access field data for all IPs such as (TBC):

- CMDL, GAW CO2 concentration (A10) as validation data for CO2 assimilation toward GEMS.
- Fluxnet In-situ data for validation (A12) for CO2 fluxes toward GEMS
- Fluxnet In-situ data for validation (G11) for CO2 and water fluxes toward Geoland-ONC
- GAW In-situ data for validation (G12) for radiative surface fluxes toward Geoland
- Research Lab In-situ correlative data (A13) toward GEMS
- Research Lab In-situ data (G8) for Validation data for vegetation, radiation, soil moisture products toward Geoland-CSP

**Geonetcast**

"GEONetcast" is a major GEOSS initiative to develop a worldwide, operational, end-to-end Earth observation data collection and dissemination system, using existing commercial telecommunications infrastructure. GEONetcast will collect and disseminate **space-based and in-situ derived data**, metadata, and products for all GEO societal benefit areas. "GEONetcast" is a 2006 GEOSS special initiative (study) with whom HALO should coordinate.

The following figure present a synthetic overview of the proposed network solutions :

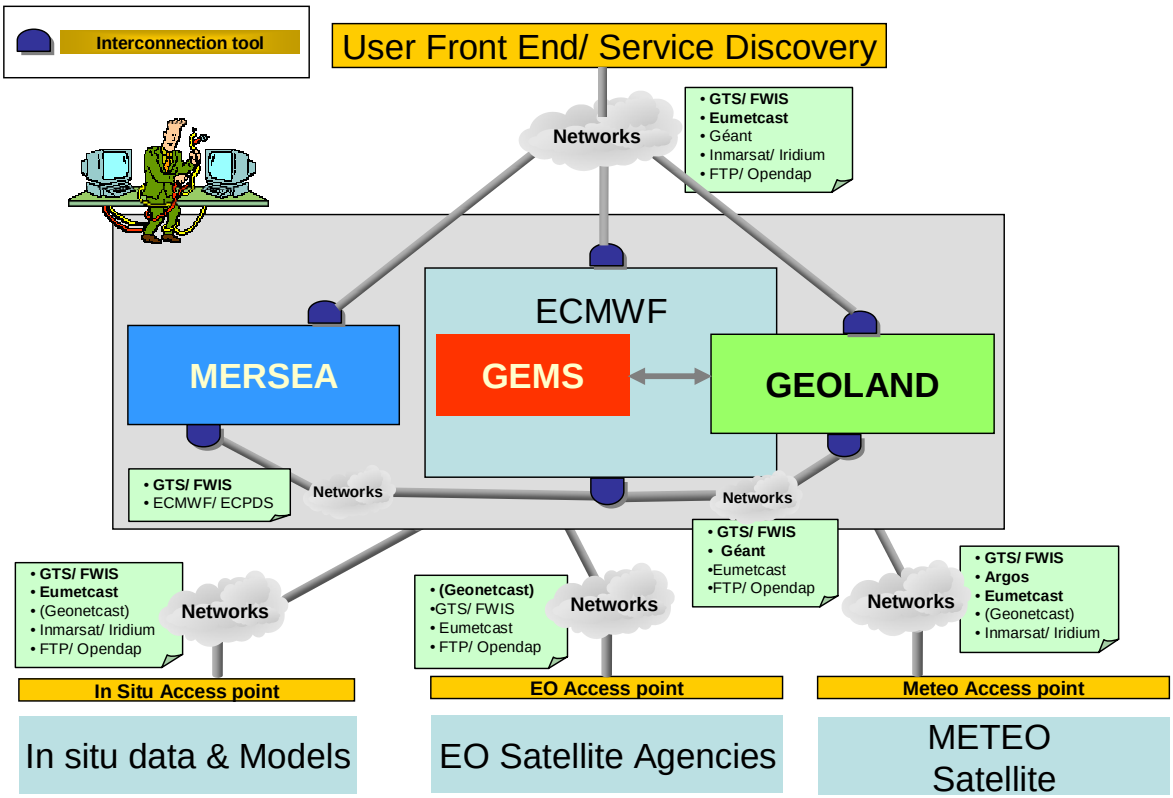


**Figure 5-19: Network candidate solutions overview**

### 5.4.2 Which Access to EO Data

As mentioned in section 5.3 ESA has initiate a specific "Heterogeneous Mission Accessibility (**HMA**)"study that aims at specifying, designing and prototyping the EO Data Access Integration Layer (**EO DAIL**) of the future European Earth Observation Ground Segment (G/S). This layer will provide a harmonised interface between the GMES Service Users and the EO data providers. The EO DAIL will allow a user to communicate with the G/Ss of several missions through a single set of interfaces (see schematic representation of the GMES architecture in Figure 5-20 ).

One of the main objectives of the HMA Programme is the definition of new set of interfaces for functionality allowing users to exploit EO main services (catalogue, ordering, mission planning, on-line data access, user management). For instance the HMA will necessarily have to define common mission interfaces protocols (such as those promoted by the OGC SWE working group) eligible as the core interfaces of the **EO DAIL**.

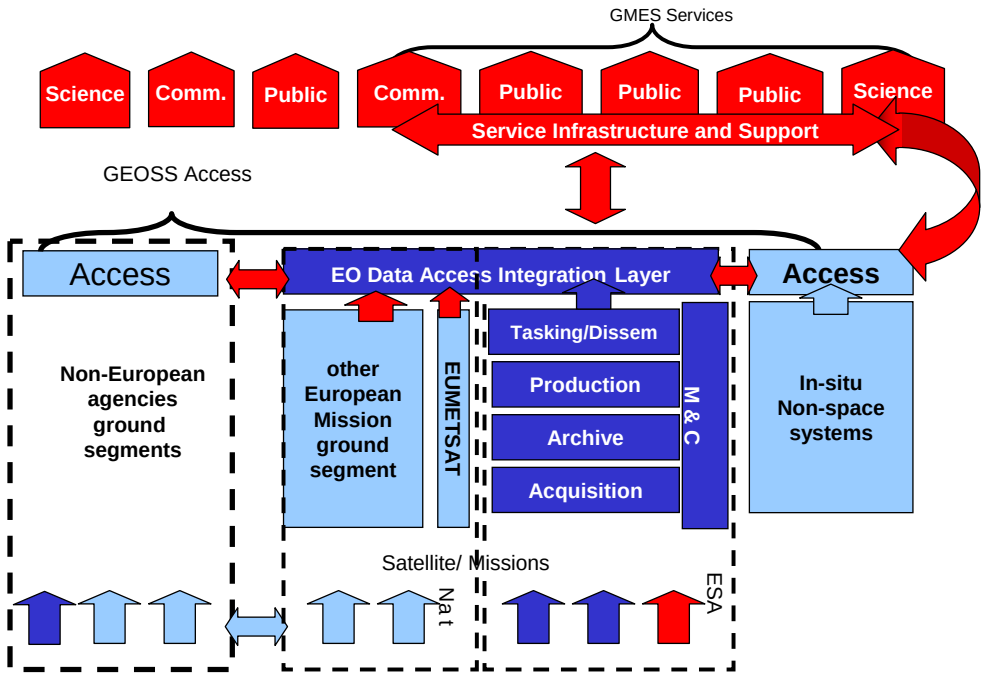


**Figure 5-20 : The GMES architecture including the EO DAIL layer**

For a better understanding a high-level scenario is presented below in this section that respond to the expected user need where the EO DAIL interface will allow them to place composite orders, i.e. orders made of products from different missions (in this case from GMES Sentinels satellites and another mission).

In this scenario, the order is managed as a single order, i.e. the user receives status, reports, confirmation, etc for the whole of the order at once. The ordering is coordinated by the EO DAIL, and the planning, acquisition and processing is performed by the respective G/S's. The dissemination part of the scenario is left optional, as the means of dissemination may not be via online access.

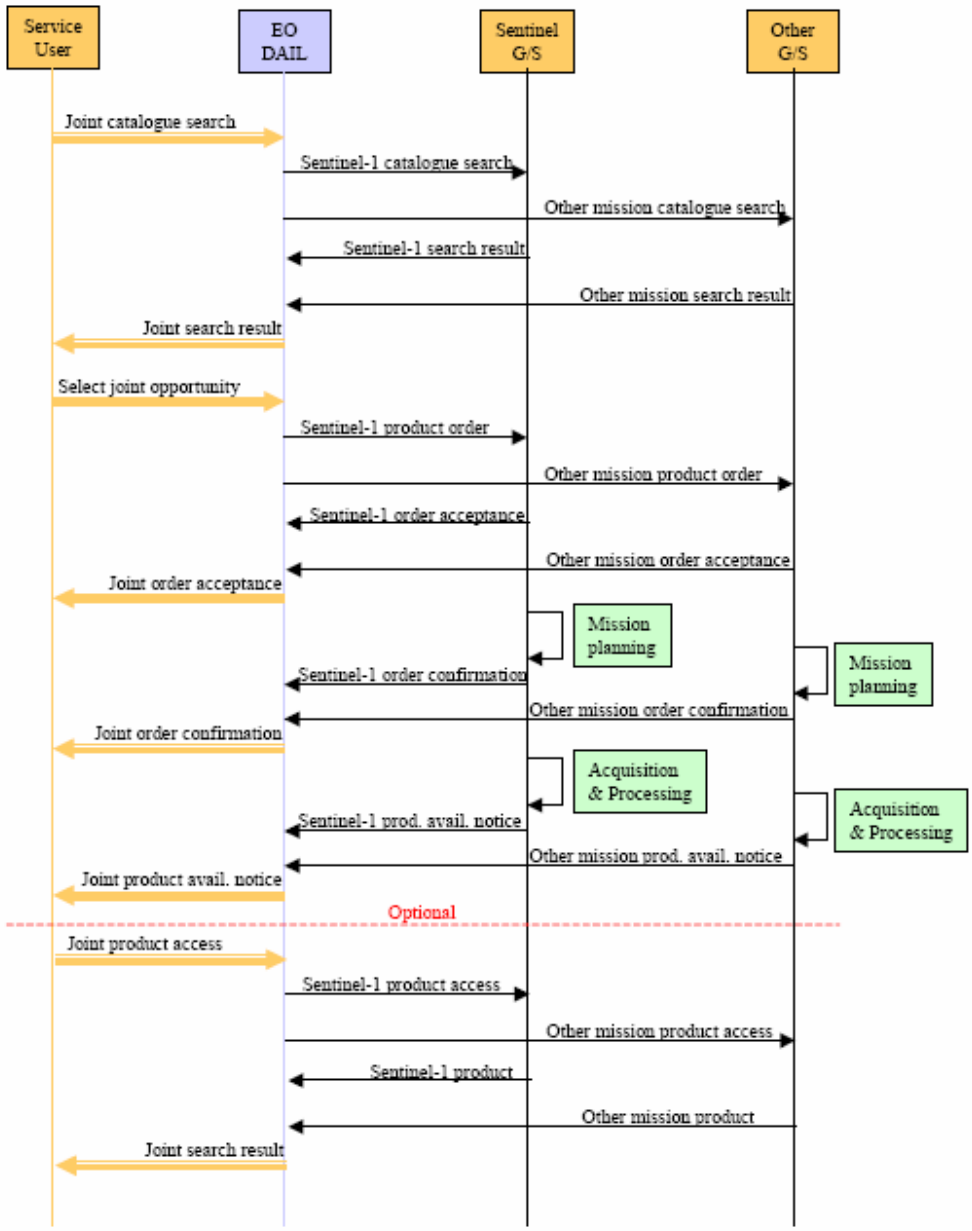


**Figure 4.2-1 Joint Ordering Scenario for GMES Sentinels satellites**

The scenario contains **5 main steps**:

- **Search for opportunity:** A Service User would place a joint catalogue search request for a Sentinel product and a product from another mission (operated from a separate G/S), over a given geographical area during a given time span. The EO DAIL splits this request into 2 individual requests, one for each catalogue, the search results are collected by the EO DAIL and returned to the user as a single set of results.
- **Ordering:** The user selects a pair of products that satisfies the application needs and places an order for the joint product. The EO DAIL splits the order into 2 individual orders that are sent to the respective G/Ss. The G/Ss return an order acceptance that is transformed by the EO DAIL into a joint order acceptance passed on to the user.
- **Order confirmation:** Once each G/S has successfully integrated the requests into their respective acquisition plans, they confirm the orders to the EO DAIL that in turn returns an overall confirmation for the joint order.
- **Product availability notice:** The scene is acquired and downlinked, and the data processed. On completion of these tasks, the products are ready and each G/S informs the EO DAIL of the availability of their products. When both products are ready, the EO DAIL informs the user that he can collect the composite product from the respective archives.

**First Iteration Solution**

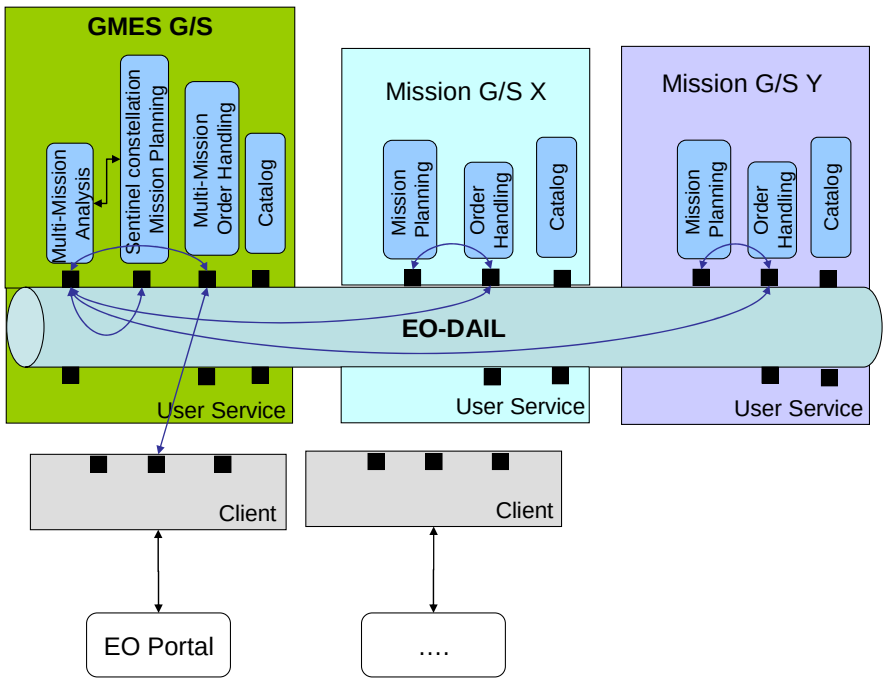


**Figure 5-21 : EO DAIL Scope**

The Service Oriented Architecture (**SOA**) is well suited to this system as it can support services and data integration in an easy and cost effective way, providing a flexible solution.

Users will access the system by a single interface that allows them to deal with all the missions' features seamlessly. The range of available services will be given by the cooperation and composition of services offered by each Ground Segment (the service provider in this context).

Offered services will be provided using the Service Discovery process specific for an open SOA architecture. In this way, the services can be discovered and used by multiple applications such as the EO-Portal (http://www.eoportal.org/ ).

### 5.4.3 Which Access to Meteo Data

In order to understand the problem of federation in meteorology, we need to clarify the role of the various entity, and their link with existing networks.

The MTN (Main Telecommunication Network) is the heart of the GTS Network. Only, official governmental Centres are allowed to access GTS Network, like UK Met Office (Exeter), Offenbach. GTS provides necessary rules and standards for data transfer using mainly X25 protocol, also guarantying the date of arrival of the product, at the opposite of Internet that can't guarantee the arrival. In addition, all GTS traffic travels through RMDCN (Regional Meteorological Data Communication Network) which is a Virtual Private Network limited to Europe.

RMDCN is hold by a private company and gives access to GTS to some entities like EUMETSAT or ECMWF.
The following figure shows the configuration of RMDCN in Europe.

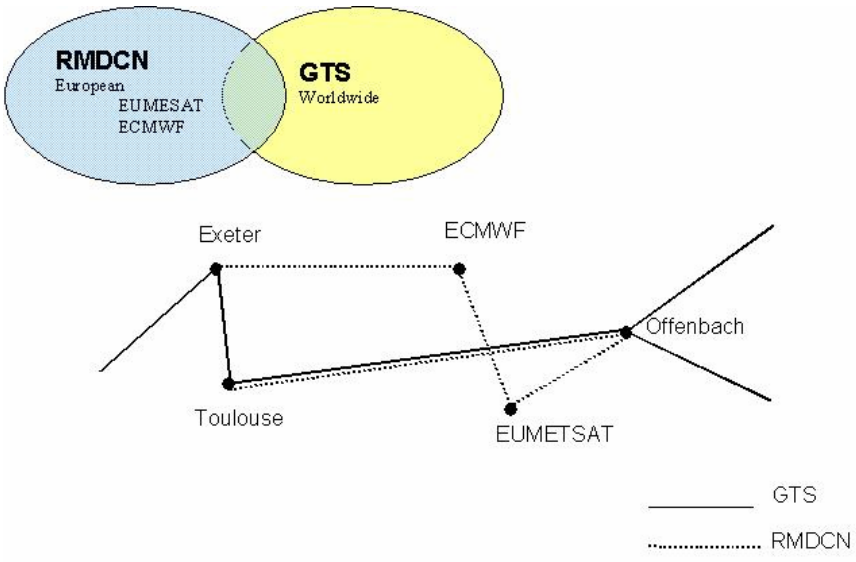


**Figure 5-22 : RMDCN Network**

The World Meteorological Organization, maintains a world-wide Meteo Catalog, also informing on the existing and new data, their type and characteristics. Whenever a new data is produced, like IASI for instance, it has to be referred in the WMO inventory.

The WMO also contains links to the servers for data retrieval, as NOAAH server, to the NWS (National Weather Service),to EUMETNET.

Let's do a synthesis and point out some limitation on the existing Networks :

- GTS has a too small bandwidth (from 16 Kbits to 100 Kbits). It is too slow for providing certain kind of data, but it has the great advantage of the historicity. It is operational, deterministic and conform to standard for Meteo Data Provisional.
- EUMETCAST is much more powerful but limited to Europe; It is more open, flexible, concerning the bandwidth, using DVB Multicast. Other countries, like China, use this kind of Regional Network.

Concerning a federated access to all the Meteo Data and Service, some entities could play the role of federator, like WMO at international level, or RMDCN at Regional Level. RMDCN has the advantage of being linked with GTS and private. However, some other regional private or public entities could also play this role, even if they are regional. But in that case, WMO should provide links and accesses to all these Regional entities.

TBD

### 5.4.4 Which Access to In-situ Data

In-situ data are provided through a wide variety of networks, depending on the application fields. No federating In-situ Network do exist nowadays.
Therefore, it would be beneficial to define methodology and concepts for a federated access to all in-situ data through access to existing and on-going in-situ networks.

Several In-situ Networks exist, that are dedicated to various themes, generic such as GTS for Meteorology, ARGOS Network for Marine, as well as specific such as NDSC Network for the Detection of Stratospheric Change GAW for Global Atmosphere Watch of the WMO And so on…

Given the huge number and the variety of in-situ data, as well as the number of already existing operational networks, the problem is mainly an interoperability problem.

WIN offers suitable components and a methodology for data retrieval through the definition of an in-situ community sub-network. This community will cope with existing sub-networks under the condition their representatives accept to register to WIN community.

This is only through this registration that each sub-network will be recognised, will access to WIN community services, through Service Oriented Architecture.

The WIN Solution is be based on the following concepts:

- Topologies that are deployed at different levels, by area, by thematic, by institution, using various physical networks (optical fiber, DVB-RCS,…) and technologies.
- Nodes or Common Integration Point, hosting dedicated services such as archiving services for data, processing storage, etc.

- **Communities** that provide links between various nodes, also hosting common « plug-and-play » services, dedicated to security, self-healing, sharing, data access, data dissemination. Communities can be characterised by the thematic, offering suitable characteristics such as rapid response to a request for crisis management.

A **Win In-situ Community** could be developed, using baseline SW, also hosting WIN core services such as data access, data sharing, data dissemination, security, traceability, user authentication, workflow editor, processing editor, … It would be designed in accordance with in-situ sensors existing networks.

Dedicated services could be added in order to fulfil dedicated requirements for interoperability, security, rules for protocols and communication paths. Some services has to be considered as critical in regards with the related applications and in-situ sensors technologies to be considered :

- Quality assessment services

  For assessing the quality of the raw in-situ sensor data, value-added data, final product as well as intermediate product.

- Workflow editor

  For producing chain of processing (acquiring the data, processing level 1, 2, 3,…) in accordance with one specific user need.

- Processing editor

  For editing one processing, by computing one specific algorithm for instance

- Security services

  For guarantying the security for the data transfer on the network.

- Interoperability services

  For providing interoperability between heterogeneous data.

- Self-healing services

  For providing maintenance and robustness.

These services will be based on the existing one in WIN, but will be refined when needed in order to fulfil specific In-situ requirements, and existing networks. The standards will be used to classify every input data respective to the environmental domains for. Meteorology, Oceanography and Land Monitoring. All these taxonomies will be extracted from the expressed user needs from users and operational taking into account existing directives and the different reporting needs. At the same time also the standards to follow for metadata definition will be defined and adapted to the specific case of In-situ data. The related taxonomies will be linked themselves in order the space and time variables be reflected as new classification subjects. The determination of data sets and related system models to be considered has to done from use cases by considering various fields.

### 5.4.5 Relevance of using Data Grid technology for data sharing

TBD

### 5.4.6 How to manage interconnection and interoperability

The HALO infrastructure will be built upon network of services facilities & infrastructure and has to be seen as a set of **components** to create "virtual network". This implies to set-up full interoperability between services facilities in order to establish communication and share data. Interoperability is a key issue to access heterogeneous datasets, integrate and combine different data and services. Interoperability will be achieved by linking the services facilities by common **standards** and **protocols**. HALO IPs must agree on interoperability technical specifications to which individual system components will adhere. Process for reaching agreements must be established and must include results issued by major international programs such as INSPIRE, OGC, W3C, ISO/CEN…

As mentioned previously, the idea is to complement and organize the existing service infrastructure (From data access up to end users product delivery) with new Service Support Infrastructure (**SSI**) elements which will allow the building-up of an integrated end-to-end operational system for the delivery of services.

In particular, the SSI will include elements that will ensure optimal "communication" between "actors" using interoperability standards issued by INSPIRE, OGC and other relevant initiatives. These elements will rely on new information technology (IT) enabling design of complex systems as assemblies of components. Indeed, software components of modern systems are now being designed to **interoperate** primarily by passing structured messages such as typical "Web service" interactions. This new type of "service oriented" interaction is gathered into a more general concept called Service Oriented Architecture (SOA). Web Services and SOA are all about designing and building systems using heterogeneous network addressable software components.

**Service-oriented architecture** (SOA) is a methodology and a specification that can be used in software development. As the concept of an "object" is central to Object Oriented Architecture, SOA is based on the concept of a "**service**". In SOA, a service is an application that can be invoked by other applications.

A Service Oriented Architecture is essentially a collection of services. These services communicate with each other. The communication can involve either simple data passing or it could involve two or more services coordinating some activity. Some means=**tools** of connecting services to each other is needed.

Moreover, distributed service-oriented architectures help create a distributed environment in which any number of services, regardless of physical location, can interoperate seamlessly in a platform. The goal of the Web Services architecture is to simplify the development and integration of distributed services over the network, and one of the key aspects of this goal is to enable inter and intra service processes and workflows to seamlessly integrate new and existing services.

The proposed approach is to define and develop a dedicated SSI element called: "**Interconnection Tool**" implementing interconnection standards and components to manage of service **chaining** (Workflow, registry, publication, DRM, Security, …).

Introducing workflow support into IPs services would enable coordination and integration of services. Workflow deals with the management, specification and execution of operations in organizations. It addresses the concerns of coordination of geographical and organizational distribution within distributed organizations.

We suggest that a service oriented architecture (SOA), such as that offered by the "**Interconnection Tool**", readily enables IPs services to be published, deployed, and invoked by other services on a global scale on the internet (and/or Geant VPN).

This "Interconnection tool" will be usable by any service provider to organise and manage locally its interfaces with its customers and suppliers. The "Interconnection tool" will allow, in particular, service provider to manage the exchanges workflows with its customers and suppliers. At the global level, from a service chain point of view, the global process execution will rely on the coordination of individual nodes.

The main functional issues of the "Interconnection tool" will be to:

- **Orchestrate** external business processes and information exchanges between service providers
- Allow simple service **discovery** and **access**
- Capture **metrics** and **statistics** that provide improved management and control, not only of business processes, but also in supporting organizational structures, forecasting and scheduling workloads, and streamlining overall operations
- Implement common **standards** (W3C, OGC,…) and interchange language for interoperability

The following diagrams illustrate the role of the "Interconnection tool" inside service providers infrastructure:

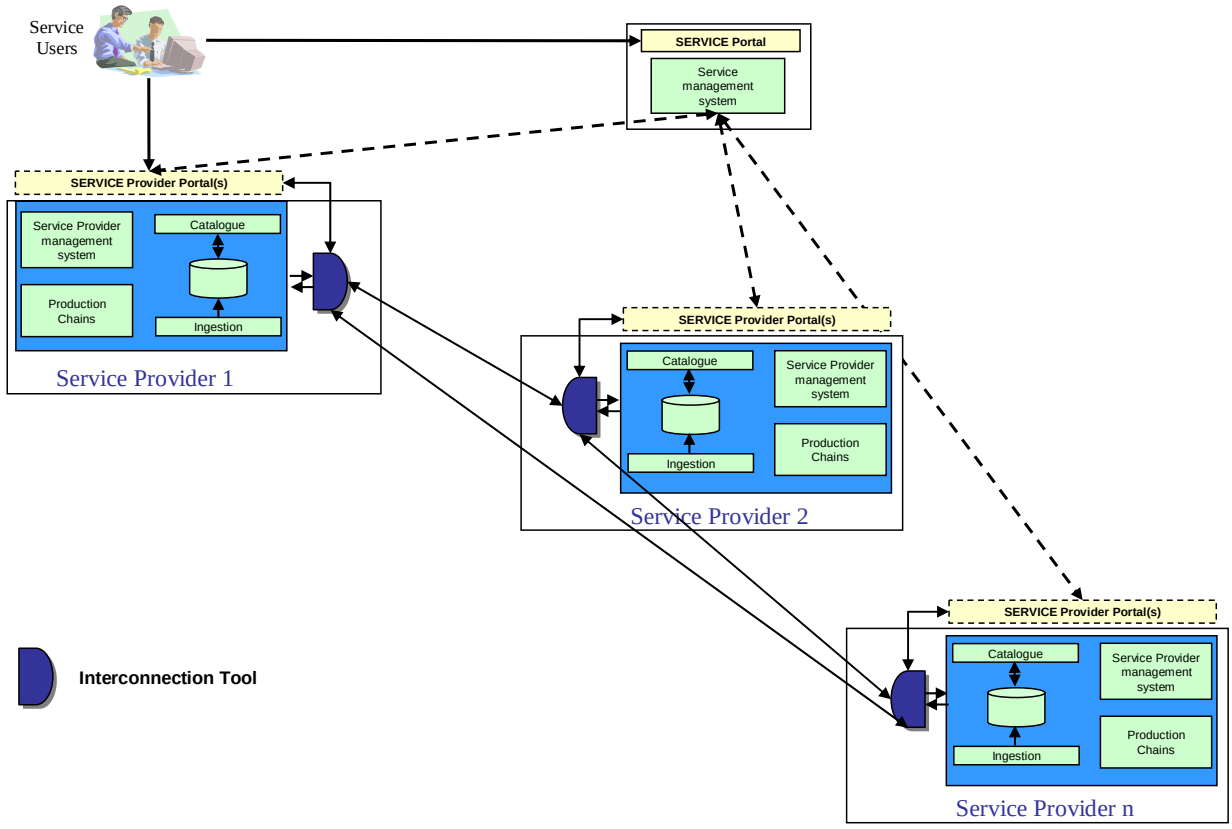


**Figure 5-23 : « Interconnection tool » inside service providers infrastructure**

The ESA Service Support Environment (**SSE**) developed for the Ground Segment Department at ESA-ESRIN implement an open service-oriented and distributed environment among business users. The SSE service-enabling environment facilitates service provision and orchestration, allowing each organisation to get an easy access to the service know-how and provision ability of the others.

The main objectives of the SSE are to:

- Provide an infrastructure enabling the business to business interactions among service providers (B2B) and with users (B2C),
- Allow basic and end-to-end services to remain on the service provider infrastructure,
- Allow for easy plug-in and plug-out of services to/from the SSE environment,
- Allow chaining of services into more complex ones,
- allow easy identification of, and access to requested services, with progress follow-up until completion,

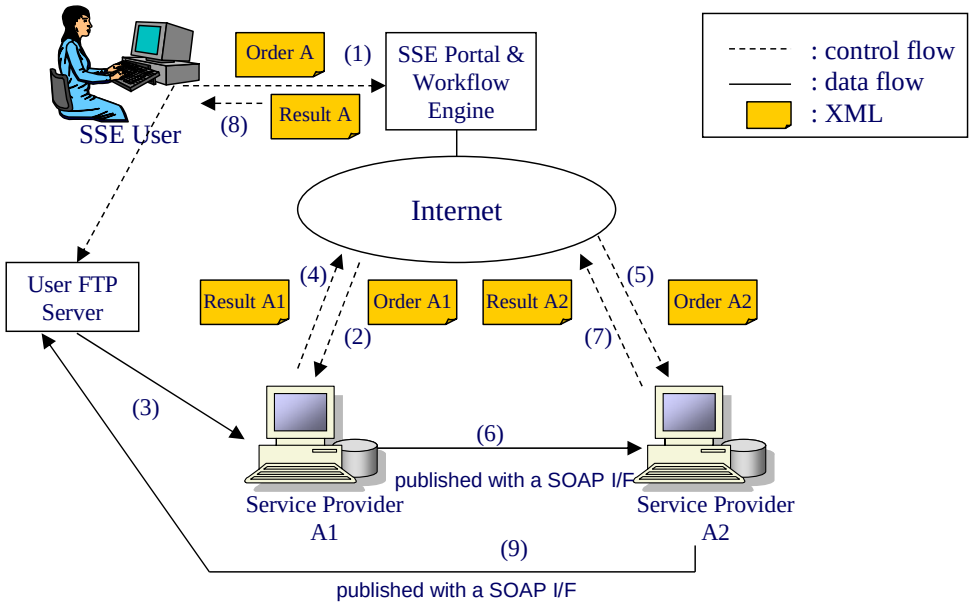


**Figure 5-24 : SSE chaining example**

The ESA SSE environment is considered as good starting point to implement the proposed "Interconnection tool". However, it has to be adapted to provide the expected functions: include capabilities to manage workflows at service provider level, manage orders and deliveries, manage digital right on the delivered products,…

For instance, the current version of the SSE isn't adapted to **distributed** environment due to the monolithic nature of the workflow server.

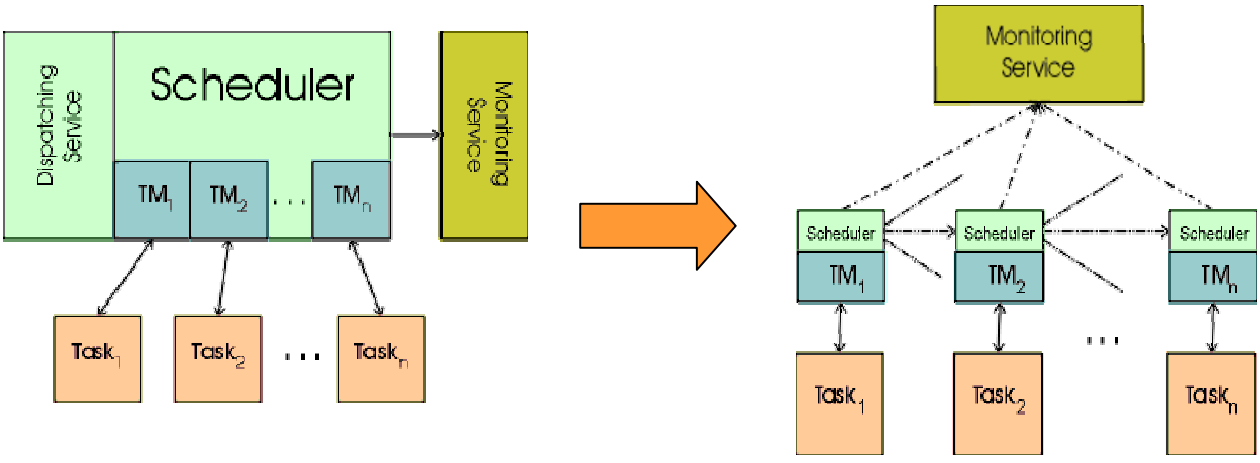


**Figure 5-25 : from centralised to distributed workflow management system**

In conclusion, we suggest designing something similar to the ESA SSE solution, but decentralised, for the HALO purpose that would interconnect service providers and manage **distributed** workflow and data.

### 5.4.7 Which reusable relevant components or concepts issued by close related initiatives (ORCHESTRA, OASIS, WIN, INSPIRE,….) ?

Potential reusable components are listed below, with respect to the projects :

- From WIN
  - Service-Oriented Architecture – SOA
  - Common component CIP/Order deposit
  - Archiving : Catalogue Component
  - Services and Product Registry
  - Data Storage
  - FTP and Mail Services
- From ORCHESTRA
  - Semantic Catalog component
- From OASIS
  - TBD
- From INSPIRE
  - INSPIRE provide a set of standards (from OGC) for interoperability management and a set of high-level requirements to be considered for GMES infrastructure.

#### 5.4.7.1 Potential reusable components issued from WIN Project

##### 5.4.7.1.1 Service-Oriented Architecture – SOA

SOA is a SW architecture concept providing services to answer users' needs.

Using SOA, the nodes of a network allow resources to be available for other network elements as independent services for standardized access to users.

Contrary to object oriented architectures, SOA is built around a set of applicative services, interoperable and with a low coupling level.

The definition of the interface access to a service is described in WSDL, which allows to hide the specificities of the development language of one service for customers.

SOA defines a methodology and a framework as well as high level languages such as BPEL or WS Coordination in order to define and support workflows and "business processes".

SOA isn't a product, but several companies are offering products today providing the baseline for an SOA :

- BEA Systems: WebLogic Platform & AquaLogic
- Eclipse : Eclipse.org
- Forum Systems
- IBM: WebSphere Platform
- Microsoft: BizTalk and WCF
- Oracle Corporation: Oracle Application Server
- Pegasystems: SmartBPM Suite
- Ruby on Rails: Get Real

- SAP: SAP NetWeaver
- JBoss: JBoss JEMS
- Sun Microsystems: Java Enterprise System
- Sun Microsystems: Jini

#### 5.4.7.1.2 Common component CIP/Order deposit

J2EE technology is the best adapted pour such a common component, since the technology is mature enough for high level development.

However, following technologies will be used (for WIN project) : JSP and/or Servlet, GeoBeans, API Java towards server OpenGIS, API Java vers WMS, WFS, WCS, Catalogue, JAXR, …. Interfaces with common components, complete architecture (machines, interface potocols) are to be defined in the architecture.

#### 5.4.7.1.3 Archiving : Catalogue Component

Two main drives : conformity to the standards (WCS, WMS, CS-W) and "classical" service of catalog (request, answer) but also coverage service (which catalog components allow to cover interest area with a selected optimisation criterion).

The coverage service requires to index dynamically the data ingested in the catalog, the content of the catalog being published through OGC CSW interfaces.

WCS, WMS, WFS are OPENGIS standards.

#### 5.4.7.2 Potential reusable components issued from ORCHESTRA Project

##### 5.4.7.2.1 Semantic Catalog component

Allows publishing and search resource by means of semantic resource descriptions. A resource can be a data element (feature) or a service. A resource is described by meta-information which is structured in accordance with an ontology. The query on a Semantic Catalog is also illustrated in the following figure :

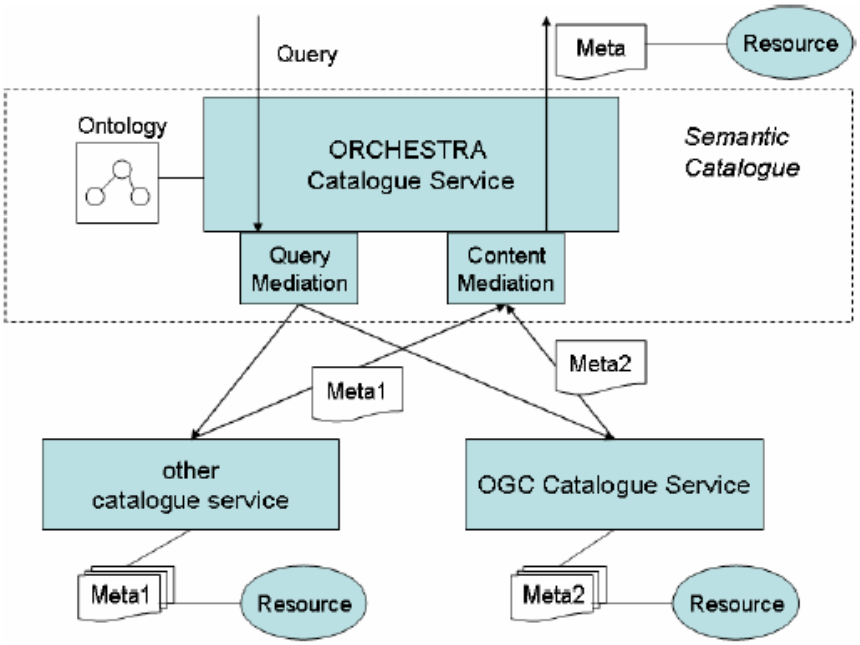


**Figure 5-26: Example of Semantic Catalog from ORCHESTRA**

#### 5.4.7.3 Potential reusable components issued from OASIS Project

TBD

## 5.5 CANDIDATE ARCHITECTURES OVERVIEW

TBD

## ANNEXE 1: DATA FLOWS ANALYSIS SYNTHESIS

The following tables synthesises the requirements defined in document [DA5] from MERSEA, GEMS, GEOLAND resulting from:

- Data Flow Analysis
- Data and Product Analysis

The following nomenclature is used :

For Meteo Data and products

[ ] For remote sensing Data

For in-situ Data

The last column (resp. first column) of the first table (resp. second table) gives the related index of the requirement as follow :

- Mxx for MERSEA requirement
- Gxx for GEOLAND requirement
- Axx for GEMS (Atmosphere) Requirement

| Data flow | Source | Destination | Author | Criteria | Theme/Product | REQ |
|---|---|---|---|---|---|---|
| **Interacting** | | | | | | |
| Meteorological forcing fields | ECMWF | Ocean Model Centre | Desaubies | Regular distribution, real-time analysis and forecasts, Regional High resolution models | Meteorological forecast/NWP Bulletin | M1 |
| GEMS global aerosol products | ECMWF | Mersea retrieval centres | Flemming | to be checked, initially research mode only | Atmospheric Aerosol data for atmospheric corrections in retrieval | M2 |
| Meteorological forcing fields for land surface models | ECMWF | Geoland/ONC | Calvet | Regular | Air temperature/humidity, wind speed, precipitation, incoming radiation (short and longwave) | G1 |

| Data flow | Source | Destination | Author | Criteria | Theme/Product | REQ |
|---|---|---|---|---|---|---|
| Geoland Global products | Geoland-CSP | GEMS | Leroy | Regular + On-demand | Generic Land Cover (300 m – 1 km resolution | G2 |
| Geoland CSP-OLF vegetation CO2 | GEOLAND-OLF | GEMS @ ECMWF | Calvet | to be checked, initially research mode only | Land use change and forest fires | G3 |
| geoland ONC vegetation CO2 | GEOLAND-ONC @ ECMWF | GEMS @ ECMWF | Flemming | to be checked, initially research mode only | Vegetation data as input for emission models (biogenic and fires): CO2 fluxes, above-ground biomass, stomatal conductance | G4 |
| GEMS global aerosol products | ECMWF | geoland retrieval centres | Flemming | to be checked, initially research mode only | Atmospheric Aerosol data for atmospheric corrections in retrieval | G5 |
| Geoland CSP-OLF vegetation CO2 | GEOLAND-OLF | GEMS @ ECMWF | Calvet | to be checked, initially research mode only | Land use change and forest fires | A1 |
| Geoland ONC vegetation CO2 | GEOLAND-ONC @ ECMWF | GEMS @ ECMWF | Flemming | to be checked, initially research mode only | Vegetation data as input for emission models (biogenic and fires): CO2 fluxes, above-ground biomass, stomatal conductance | A2 |
| GEMS global aerosol products | ECMWF | Mersea retrieval centres | Flemming | to be checked, initially research mode only | Atmospheric Aerosol data for atmospheric corrections in retrieval | A3 |

| Data flow | Source | Destination | Author | Criteria | Theme/Product | REQ |
|---|---|---|---|---|---|---|
| GEMS global aerosol products | ECMWF | geoland retrieval centres | Flemming | to be checked, initially research mode only | Atmospheric Aerosol data for atmospheric corrections in retrieval | A4 |
| Meteorological forcing fields | ECMWF | Ocean Model Centre | Desaubies | Regular distribution, real-time analysis and forecasts, Regional High resolution models | Meteorological forecast/NWP Bulletin | A5 |
| Meteorological forcing fields for land surface models | ECMWF | Geoland/ONC | Calvet | Regular | Air temperature/humidity, wind speed, precipitation, incoming radiation (short and longwave) | A6 |
| Geoland Global products | Geoland-CSP | GEMS | Leroy | Regular + On-demand | Generic Land Cover (300 m – 1 km resolution | A7 |
| **External** | | | | | | |
| Satellite data | ESA, EUMETSAT, NASA, NOAA | MERSEA Satellite TEP | Desaubies | Regular | Along track, validated | M3 |
| Satellite products | SAT -TEP, GHRSST, SSALTO, OSI/SAF | Ocean Model Centre | Desaubies | Regular | Merged, gridded, validated products | M4 |
| In-situ observations | GDAC,RDAC, ARGO, GTSPP, DBCP, | In-situ Data Centre | Desaubies | Regular + On-demand | High quality controlled, merged gridded products, climatology | M5 |

| Data flow | Source | Destination | Author | Criteria | Theme/Product | REQ |
|---|---|---|---|---|---|---|
| In-situ observations in real time | ARGO | In Situ - TEP | Kaiser | Real Time flow | ARGO data in real -or near real -time, with QC flags | M6 |
| Satellite data | ESA<br>EUMETSAT<br>NOAA/NASA | Geoland-CSP | Leroy | Regular + On-demand | Satellite observation to infer information about the land surface, in three areas : vegetation, radiation, water | G6 |
| in-situ data | Meteo | Geoland-CSP | Leroy | Regular + On demand | Rainfall | G7 |
| In-situ data | Research labs | Geoland-CSP | Leroy | On demand | Validation data for Vegetation, radiation, soil moisture products | G8 |
| Satellite data | SPOT Image, NASA | Geoland-CSP | Leroy | On demand | Validation data for Vegetation & Land cover products | G9 |
| Satellite data to be assimilated | ESA<br>EUMETSAT<br>NOAA/NASA<br>CNES | Geoland/ONC | Calvet | Regular + On-demand | Satellite observation to infer information about the land surface and the vegetation status. | G10 |
| In-situ data for validation | Fluxnet | Geoland/ONC | Calvet | On-demand | CO2 and water fluxes | G11 |
| In-situ data for validation | GAW | Geoland | Kaiser | On-demand | radiative surface fluxes | G12 |
| Satellite data | ESA<br>EUMETSAT<br>NOAA/NASA<br>(UNI-BREMEN, UMW) | ECMWF | Flemming | operational | Raw radiances and satellites products on atmospheric species concentration and fire count/ burnt area | A8 |

| Data flow | Source | Destination | Author | Criteria | Theme/Product | REQ |
|---|---|---|---|---|---|---|
| in-situ data | Scattered provider (NILU, EEA, national and regional authorities) | ECMWF MPI KNMI RAQ Centres | Flemming | regular | In situ observation for validation | A9 |
| CO2 concentration | www.cmdl.noaa.gov gaw.kishou.go.jp | GEMS @ ECMWF | Kaiser | on demand | validation data for CO2 assimilation. open access on the internet. | A10 |
| In-situ data for validation | Fluxnet | GEMS @ ECMWF | Kaiser | On-demand for validation | CO2 fluxes | A12 |
| In-situ correlative data to be used in GEMS | Research Lab (Ciais, Heimann, NUIG( CEA-IPSL-LSCE, MPI-M), NKUA, FMI, DWD, SA, LA, BIRAMeteo-FR, KNMI/ U.Bremen, CNRS-LOA, RMIB_SA_UPMC, met.no) | GEMS @ ECMWF | Kaiser | On-demand for validation | GHG, GRG, AER, RAQ | A13 |
| **Internal** | | | | | | |
| In-situ observations in real time | In Situ - TEP (from ARGO) | Ocean Model Centre | Desaubies | Real Time flow | ARGO data in real -or near real -time, with QC flags | M7 |
| In-situ observations in real time | In Situ - TEP | ? | Kaiser | Real Time flow | GSUD / VOS, Ocen time series / BBCP | M8 |

| Data flow | Source | Destination | Author | Criteria | Theme/Product | REQ |
|---|---|---|---|---|---|---|
| Geoland Global products | Geoland-ONC @ECMWF | GEMS @ ECMWF | Leroy | Regular + On-demandTo be checked, initially research mode only (TBC) | Biogeophysical Parameters (Rainfall for water cycle, burned area, active fire and LAI for trace gas emission)Vegetation data as input for emission models (biogenic and fires) (TBC) | G13 |
| Satellite forcing fields for land surface models & leaf area index (LAI) | Geoland/CSP | Geoland/ONC | Calvet | Regular | Improved precipitation fields and incoming radiation (short and longwave) | G14 |
| GEMS global products | ECMWF | GEMS RAQ Centres (6) | Flemming | operational | Boundary conditions for regional air pollution models | A11 |

**Table 0-1 :Data Flow Analysis Synthesis**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Data / Product ID** | **Origin** | **Operational Constraints** | **Interaction and communality** | **Security[1]** | **Local, Regional or Global** | **Service[2]** | **Provider** | **Format[3]** | **Temporal Coverage** | **Spatial Coverage** | **Access Delay** | **Revisit Delay** | **Access Time** |
| M9 | O2: SST | NOAA, ESA, EUMETSAT, NASA | NRT, re-analysis, research | High, direct exchange | NR | Global, with regional products | | SAT - TEP | | 2000 to present | Global to regional | daily | daily | |
| M10 | O3: Altimetry | NOAA, ESA, EUMETSAT, NASA | NRT, re-analysis, research | Low | NR | Global, with regional products | | SAT - TEP | | 1992 to present | Global to regional | daily | Daily to 10 days (for merged products | |
| M11 | O4: Ocean Color | NOAA, ESA, EUMETSAT, NASA | NRT, re-analysis, research | Medium | NR | Global, with regional products | | SAT - TEP | | 2004 to present | Global to regional | daily | Daily to 10 days, but cloud dependent | |

[1] Security levels (i.e. data policy) are to be defined for the system to be delivered. It is expected to make all data available freely for **research purposes**, and in compliance with Resolution 40 of WMO, notwithstanding specific restrictions from some providers.

[2] The MERSEA system plans on *classes of users* for whom different *services and products* will be available.

[3] Preferred data format is netcdf, because of its ability to carry meta-data; this issue is part of the ongoing design work plan (MERSEA Information Management).

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Data / Product ID** | **Origin** | **Operational Constraints** | **Interaction and communality** | **Security[1]** | **Local, Regional or Global** | **Service[2]** | **Provider** | **Format[3]** | **Temporal Coverage** | **Spatial Coverage** | **Access Delay** | **Revisit Delay** | **Access Time** |
| M12 | O5: Sea Ice | NOAA, ESA, EUMETSAT, NASA | NRT, re-analysis, research | High | NR | Polar regions | | SAT - TEP | | ? | Polar regions | daily | 3 to 10 days | |
| M13 | O6: Wave / winds | ESA, EUMETSAT + NWP | RT, re-analysis | High | NR | Global, with regional products | | NWP service | | Real time | Global to coastal | 6 hrs | 6 hrs | |
| M14 | O7: NWP | Assimilation Models | RT, re-analysis, forecasts | NA | ? | Global, with regional high resolution | | NWP service | | ERA- 40 (40 years) | Global, with regional high resolution | 6 hrs | 6 hrs | |
| M15 | O8: Meteorological field Data | ECMWF, NWP | RT, re-analysis, forecasts | Ocean corrected fluxes | ? | Global, and regional | | NWP service, Forcing TEP | | ERA-40 (40 years) | Global, and regional | 6 hrs | 6 hrs | |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Data / Product ID** | **Origin** | **Operational Constraints** | **Interaction and communality** | **Security[1]** | **Local, Regional or Global** | **Service[2]** | **Provider** | **Format[3]** | **Temporal Coverage** | **Spatial Coverage** | **Access Delay** | **Revisit Delay** | **Access Time** |
| M16 | O9: Argo / GTSPP | In-situ TEP | RT, and delayed mode | Low | NR | Global | | In situ TEP, ARGO GDAC | | Since 1992 | Global | 24 hrs | 10 days | |
| M17 | O10: GOSUD / VOS | In-situ TEP | RT, and delayed mode | Medium | NR | Global + regional | | In situ TEP, GOSUD, GDAC | | Since 1985 | Global + regional | 24 hrs to weekly | monthly | |
| M18 | O11: Ocean time series/BBCP | In-situ TEP | RT, and delayed mode | high | NR | Global, regional | | In situ-TEP; OTS , GDAC | | Since 2001 | Point observatories | 24 hrs to weekly | daily | |
| M19 | O12: GHG forecast | ECMWF | operational | | | | | | | | | | | |
| M20 | O13: GHG analysis | ECMWF | off line | | | | | | | | | | | |
| M21 | O14: GRG forecast | ECMWF | operational | | | | | | | | | | | |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Data / Product ID** | **Origin** | **Operational Constraints** | **Interaction and communality** | **Security[1]** | **Local, Regional or Global** | **Service[2]** | **Provider** | **Format[3]** | **Temporal Coverage** | **Spatial Coverage** | **Access Delay** | **Revisit Delay** | **Access Time** |
| M22 | O15: GRG analysis | ECMWF | off line | | | | | | | | | | | |
| M23 | O16: AER forecast | ECMWF | operational | | | | | | | | | | | |
| M24 | O17: AER analysis | ECMWF | off line | | | | | | | | | | | |
| M25 | O18: GRG forecast | ECMWF | operational | | | | | | | | | | | |
| M26 | O19: GRG analysis | ECMWF | off line | | | | | | | | | | | |
| M27 | 020: RAQ forecast | 9 RAQ Centres | operational | | | | | | | | | | | |
| G15 | L1: Leaf Area Index (LAI) | Satellite observations Model & assimilation | NRT Re-analysis Research | Direct exchange | Non restricted (NR) | Global | Geoland | CSP | | –1980 up to present | 8km/ 1 Km | 1 day | 10 days | 1 hour |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Data / Product ID** | **Origin** | **Operational Constraints** | **Interaction and communality** | **Security[1]** | **Local, Regional or Global** | **Service[2]** | **Provider** | **Format[3]** | **Temporal Coverage** | **Spatial Coverage** | **Access Delay** | **Revisit Delay** | **Access Time** |
| G16 | L2: Burned areas | Satellite observation | NRT Re-analysis Research | Direct exchange | NR | Global | Geoland | CSP | | 1998 up to present | 1 Km | 1 day | 10 days | 1 hour |
| G17 | L3: Active fires | Satellite observation | NRT Re-analysis Research | Direct exchange | NR | Global | Geoland | CSP | | 1998 up to present | 1 km | 1 day | 10 days | 1 hour |
| G18 | L4: Rainfall | Satellite observation | NRT Re-analysis Research | Direct exchange | NR | Global | Geoland | CSP | | 1998 up to present | 50 Km | 1 hour | 1 day | 1 hour |
| G19 | L5: Land Cover | Satellite observation | Differed time delivery | Direct exchange | NR | Global | Geoland | CSP | | 2000 up to present | 300 m – 1 km | | 5 years | |
| G20 | L6: Land & Vgt Monitoring | Satellite images high resolution | Research | data need partly common | NR | Local | Geoland | , Spot Image, NASA | | | 10 – 30 m | | | |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Data / Product ID** | **Origin** | **Operational Constraints** | **Interaction and communality** | **Security[1]** | **Local, Regional or Global** | **Service[2]** | **Provider** | **Format[3]** | **Temporal Coverage** | **Spatial Coverage** | **Access Delay** | **Revisit Delay** | **Access Time** |
| G21 | L7: TBD | In-situ Products | Research | TBD | | | | | | | | | | |
| G22 | L9: Burned areas | observation | | TBD | | Regional | Geoland | OLF | | 2000-2003 | 1 Km | | | |
| G23 | L10: Rainfall | observation | | TBD | | Global/ Regional | Geoland | CSP | | | 5 Km | | | |
| G24 | L11: Land & Vgt Monitoring | observation | | data need partly common | | | Geoland | ESA, Eumetsat, Spot Image, NASA | | | 60km- earth disk | | | |
| G25 | L12: CO2 and Water fluxes | model & assimilation | off line | perhaps exchange | no | global | geoland | ONC ECMWF | GRIB | 2000-05 | | | | |
| G26 | L13 : Carbon storage | model & assimilation | reanalysis | perhaps exchange | no | global | geoland | ONC ECMWF | GRIB | 2000-05 | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Data / Product ID** | **Origin** | **Operational Constraints** | **Interaction and communality** | **Security[1]** | **Local, Regional or Global** | **Service[2]** | **Provider** | **Format[3]** | **Temporal Coverage** | **Spatial Coverage** | **Access Delay** | **Revisit Delay** | **Access Time** |
| A14 | A1: GHG analysis + forecast | model & assimilation | operational | perhaps exchange | access if needed (a) | global | GEMS | GEMS ECMWF | GRIB | starting 2008 | global | RT | | ? |
| A15 | A2: GHG re-analysis | model & assimilation | off line | perhaps exchange | open access for scientificommunity (oa) | global | GEMS | GEMS ECMWF | GRIB | 2000-05 | global | avail. 2007 | | ? |
| A16 | A3: GHG surface fluxes | variational inversion | off line | perhaps exchange | a | global | GEMS | GEMS ECMWF | GRIB | 2000-05 | global | avail. 2007 | | ? |
| A17 | A4: GRG analysis + forecast | model & assimilation | operational | perhaps exchange | a | global | GEMS | GEMS ECMWF | GRIB | starting 2008 | global | RT | | ? |
| A18 | A5: GRG re-analysis | model & assimilation | off line | perhaps exchange | oa | global | GEMS | GEMS ECMWF | GRIB | 2000-05 | global | avail. 2007 | | ? |
| A19 | A6: AER analysis + forecast | model & assimilation | operational | perhaps exchange | a | global | GEMS | GEMS ECMWF | GRIB | starting 2008 | global | RT | | ? |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Data / Product ID** | **Origin** | **Operational Constraints** | **Interaction and communality** | **Security[1]** | **Local, Regional or Global** | **Service[2]** | **Provider** | **Format[3]** | **Temporal Coverage** | **Spatial Coverage** | **Access Delay** | **Revisit Delay** | **Access Time** |
| A20 | A7: AER re-analysis | model & assimilation | off line | perhaps exchange | oa | global | GEMS | GEMS ECMWF | GRIB | 2000-05 | global | avail. 2007 | | ? |
| A21 | A8: RAQ analysis + forecast | model & assimilation | operational | | ? | regional | GEMS | GEMS regional partners) | TBD | | regional | | | ? |
| A22 | A9: Satellite data and products | Satellite | off line and operational | data need partly common | ? | global | | ESA, Eumetsat | GRIB, NetCDF tc | from project start | global | operational and off line | | |

**Table 0-2 : Data and Product Analysis Synthesis**

## ANNEXE 2: OPERATIONAL INFRASTRUCTURE STATUS

Therefore, three complementary tables (XXX) have been submitted to and populated by systems representatives in order to collect information related to the existing and required infrastructure elements and their status quo (bottlenecks & gaps) with respect to operational service use.

The three following tables focus on Technical requirements for candidate solution and system designing.

They present IPs status regarding expressed requirements and specificities.

Previous **Error! Reference source not found.** gives an overview of the architecture, showing the coupling between various themes (atmosphere, ocean, land) for data/products access. It can be used to understand the distinction between direct product exchange, internal and external.

The first following table corresponds to the **direct product exchange**, which means the products that correspond to a direct data flow from Atmosphere to Land, or Land to Ocean, or Ocean to Atmosphere.

The second table corresponds to the data access related to each theme Atmosphere, Land, Ocean, using data that are produced externally by (EO, Meteo, In-situ data providers).

The third table corresponds to the General Technical Requirement Table issued from WIN project and targets to refine the system requirements of the overall infrastructure.

The fourth Table 0-4: Technical Requirement Description is a functional description of the previous tables.

With respect to operational use, please depict in brief text form the requirements on and the status quo of each functional element in your service chain. If you consider that a function is not relevant for satisfaction of operational requirements for your service, just indicate it and pass on to the next function.

**Table 0-1 : Direct product exchange Technical Requirement Table**

| **Direct product exchange Technical Requirement Table** | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID**: *ECMWF provides:* Meteorological Fields, *(GEMS global aerosol product)* | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Direct product exchange:***<br>*Do you have operational capacities to offer or manage the following elements?* | | *Indicate if functional element is relevant for your service operations (yes/no)?* | *What is the current status of function in your service (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| **Provisioning & Dissemination** | Real time access & delivery | yes | access through member states met services | yes (*no: aerosols are currently not included*) | Aerosols and trace gases will be included by end of GEMS. This may increase product size drastically.<br>Future use of FWIS[4] | high, GRIB format and ECPDS[5] are used |
| | On demand access & delivery | yes | manual action by operator or ftp | yes (*no: aerosols are currently not included*) | see above | high, GRIB format used |

[4] Future WMO Information System, search for "FWIS" at <http://www.wmo.int>

[5] European Centre Product Dissemination System <http://www.ecmwf.int/sevices/dissemination>

| Direct product exchange Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID**: *ECMWF provides:* Meteorological Fields, *(GEMS global aerosol product)* | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Direct product exchange:***<br>*Do you have operational capacities to offer or manage the following elements?* | | *Indicate if functional element is relevant for your service operations (yes/no)?* | *What is the current status of function in your service (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| | Multi-User access & delivery | yes | see above | see above | see above | see above |
| | Standardized data exchange | yes | ECPDS for real time dissemination. All products in GRIB1/2 format. | yes | no plans | high |
| | Service publication (catalogue, metadata) | yes | web page | yes | no plans | not known |
| | Interoperable catalogue of products | no | catalogue can be searched | yes | no plans | not known |
| | Secure Service Access (Authentication) and product security (encryption) | yes (authent.)<br>yes (encryption) | yes<br>yes | yes<br>yes | no plans<br>no plans | not known |

| Direct product exchange Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID**: *ECMWF provides:* Meteorological Fields, *(GEMS global aerosol product)* | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Direct product exchange:***<br>*Do you have operational capacities to offer or manage the following elements?* | | *Indicate if functional element is relevant for your service operations (yes/no)?* | *What is the current status of function in your service (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| | Interoperable workflow systems to directly exploit (or provide) Data provider reporting through your own Workflow system | no | no function | yes | no plans | not known |
| | Billing & invoicing | yes | variable: free, handling charge, charge | yes | no plans | no |
| | Data right management | yes | Users are not allowed to distribute product. | yes | no | no |
| | User system integration (e.g Order desk) | yes | yes | yes | no | no |
| | User support (e.g. helpdesk) | yes | yes | yes | no | no |

| Direct product exchange Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID:** *ECMWF receives: geoland CSP/OLF generic land covers, vegetation CO2, land use change, and forest fires* | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Direct product exchange:***<br>*Do you have operational capacities to offer or manage the following elements?* | | *Indicate if functional element is relevant for your service operations (yes/no)?* | *What is the current status of function in your service (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| **Provisioning & Dissemination** | Real time access & delivery | yes | no function | no: These links are new and depend on future product developments of geoland. | | |
| | On demand access & delivery | yes | no function | no | | |
| | Multi-User access & delivery | no | no function | yes | | |
| | Standardized data exchange | yes | no function | no | | |
| | Service publication (catalogue, metadata) | yes | no function | no | | |

| Direct product exchange Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID:** *ECMWF receives: geoland CSP/OLF generic land covers, vegetation CO2, land use change, and forest fires* | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Direct product exchange:***<br>*Do you have operational capacities to offer or manage the following elements?* | | *Indicate if functional element is relevant for your service operations (yes/no)?* | *What is the current status of function in your service (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| | Interoperable catalogue of products | yes | no function | no | | |
| | Secure Service Access (Authentication) and product security (encryption) | no (authent.)<br>no (encryption) | no function | yes<br>yes | | |
| | Interoperable workflow systems to directly exploit (or provide) Data provider reporting through your own Workflow system | no | no function | yes | | |
| | Billing & invoicing | no | no function | yes | | |

| Direct product exchange Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID:** *ECMWF receives: geoland CSP/OLF generic land covers, vegetation CO2, land use change, and forest fires* | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Direct product exchange:***<br>*Do you have operational capacities to offer or manage the following elements?* | | *Indicate if functional element is relevant for your service operations (yes/no)?* | *What is the current status of function in your service (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| | Data right management | no | no function | yes | | |
| | User system integration (e.g Order desk) | yes | no function | no | | |
| | User support (e.g. helpdesk) | yes | no function | no | | |

| Direct product exchange Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID : GEOLAND CSP - The assumptions below is that the main service providers for CSP are IM Portugal (present SAF), VITO and Medias-France** | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Direct product exchange:*** *Do you have operational capacities to offer or manage the following elements?* | | *Indicate if functional element is relevant for your service operations (yes/no)?* | *What is the current status of function in your service (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| **Provisioning & Dissemination** | Real time access & delivery | yes | Real time facilities available at IM and VITO | Current performance satisfactory ; extension of capacity to be envisaged | No extension of capacity programmed yet | Major impact of onset of new standards. Useful satndards TBD |
| | On demand access & delivery | yes | Facilities available at IM, VITO and Medias | Current performance satisfactory | | |
| | Multi-User access & delivery | yes | Facilities available at IM, VITO and Medias | Current performance satisfactory | | |
| | Standardized data exchange | yes | No | | No upgrade foreseen yet. MoU between IM, VITO and Medias in construction | Major impact |

| Direct product exchange Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID : GEOLAND CSP - The assumptions below is that the main service providers for CSP are IM Portugal (present SAF), VITO and Medias-France** | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Direct product exchange:*** *Do you have operational capacities to offer or manage the following elements?* | | *Indicate if functional element is relevant for your service operations (yes/no)?* | *What is the current status of function in your service (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| | Service publication (catalogue, metadata) | yes | Catalogue facilities at IM, VITO, Medias | Current performance satisfactory | TBD | |
| | Interoperable catalogue of products | yes | No interoperable catalogue available | | MoU between IM, VITO and Medias in construction | Major impact |
| | Secure Service Access (Authentication) and product security (encryption) | no | | | | |
| | Interoperable workflow systems to directly exploit (or provide) Data provider reporting through your own Workflow system | No | | | | |

| Direct product exchange Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID : GEOLAND CSP - The assumptions below is that the main service providers for CSP are IM Portugal (present SAF), VITO and Medias-France** | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Direct product exchange:*** *Do you have operational capacities to offer or manage the following elements?* | | *Indicate if functional element is relevant for your service operations (yes/no)?* | *What is the current status of function in your service (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| | Billing & invoicing | No | | | | |
| | Data right management | ? | Data right management service at VITO | | | |
| | User system integration (e.g Order desk) | Yes | | | | |
| | User support (e.g. helpdesk) | Yes | | | | |

| Direct product exchange Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID : GEOLAND ONC - The assumptions below is that the main service provider for ONC is ECMWF** | | | | | | |
| *Please insert your Service ID & Name to be considered in this table; add further tables for all the other sub- services if necessary* | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Direct product exchange:*** *Do you have operational capacities to offer or manage the following elements?* | | *Indicate if functional element is relevant for your service operations (yes/no)?* | *What is the current status of function in your service (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| **Provisioning & Dissemination** | Real time access & delivery | yes | Real time facilities available at ECMWF | yes | Land surface model of ECMWF still in the upgrading phase | Low impact |
| | On demand access & delivery | yes | Facilities available at ECMWF | yes | | |
| | Multi-User access & delivery | yes | Facilities available at ECMWF | yes | | |
| | Standardized data exchange | yes | ECMWF standards | yes | Mainly internal data exchange | |
| | Service publication (catalogue, metadata) | yes | ECMWF service | yes | | |

| Direct product exchange Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID : GEOLAND ONC - The assumptions below is that the main service provider for ONC is ECMWF** | | | | | | |
| *Please insert your Service ID & Name to be considered in this table; add further tables for all the other sub- services if necessary* | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Direct product exchange:*** *Do you have operational capacities to offer or manage the following elements?* | | *Indicate if functional element is relevant for your service operations (yes/no)?* | *What is the current status of function in your service (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| | Interoperable catalogue of products | yes | ECMWF catalogue | yes | | |
| | Secure Service Access (Authentication) and product security (encryption) | ? | ? | ? | | |
| | Interoperable workflow systems to directly exploit (or provide) Data provider reporting through your own Workflow system | No | | | | |
| | Billing & invoicing | No | | | | |

| Direct product exchange Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID : GEOLAND ONC - The assumptions below is that the main service provider for ONC is ECMWF** | | | | | | |
| *Please insert your Service ID & Name to be considered in this table; add further tables for all the other sub- services if necessary* | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Direct product exchange:*** *Do you have operational capacities to offer or manage the following elements?* | | *Indicate if functional element is relevant for your service operations (yes/no)?* | *What is the current status of function in your service (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| | Data right management | ? | | | | |
| | User system integration (e.g Order desk) | Yes | | | | |
| | User support (e.g. helpdesk) | Yes | | | | |

**Table 0-2 : In-situ, EO, Meteo Data Access Technical Requirement Table**

| In-situ, EO, Meteo Data Access Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID:** *ECMWF for GEMS* | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Data access:***<br>*Do you wish to have access to data providers offering the following operational capacities?* | | *Indicate if functional element is relevant for your service operations*<br>*(yes/no)?* | *What is the current status of function in your service chain (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| **EO data access & procurement** | Real time access & delivery | yes | GTS via UK Metoffice or DWD, ftp from EUMETSAT, NASA, NOAA, ESA, JMA, … | yes | inclusion of additional products, e.g. from MODIS | yes, GTS format is standardised. Products are often in a WMO format, e.g. BUFR. |
| | On demand access & delivery | no | no function | yes | no plans | n/a |
| | Standardized data exchange | yes | Products are often in a WMO format, e.g. BUFR. | yes | Conversion of all products to BUFR might help. No plans. | helpful but not necessary |
| | Catalogue services | no | no function | yes | no plans | no |

| In-situ, EO, Meteo Data Access Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID:** *ECMWF for GEMS* | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Data access:***<br>*Do you wish to have access to data providers offering the following operational capacities?* | | *Indicate if functional element is relevant for your service operations*<br>*(yes/no)?* | *What is the current status of function in your service chain (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| | Interoperable workflow systems to directly exploit Data provider reporting through your own Workflow system | no | no function | yes | no plans | no |
| | Data right management | yes | manual | yes | no plans | SW tool might help. |
| | Secure data & service access | yes | access restricted by GTS access or ftp login | yes | no plans | no |
| **In-situ & ancillary** | Real time access & delivery | see EO data | see EO data | see EO data | see EO data | see EO data |
| | On demand access & delivery | see EO data | see EO data | see EO data | see EO data | see EO data |

| In-situ, EO, Meteo Data Access Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID:** *ECMWF for GEMS* | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Data access:***<br>*Do you wish to have access to data providers offering the following operational capacities?* | | *Indicate if functional element is relevant for your service operations*<br>*(yes/no)?* | *What is the current status of function in your service chain (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| | Standardized data exchange | see EO data | see EO data | see EO data | see EO data | see EO data |
| | Catalogue services | see EO data | see EO data | see EO data | see EO data | see EO data |
| | Interoperable workflow systems to directly exploit Data provider reporting through your own Workflow system | see EO data | see EO data | see EO data | see EO data | see EO data |
| | Data right management | see EO data | see EO data | see EO data | see EO data | see EO data |
| | Secure data & service access | see EO data | see EO data | see EO data | see EO data | see EO data |

| In-situ, EO, Meteo Data Access Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID:** *ECMWF for GEMS* | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Data access:***<br>*Do you wish to have access to data providers offering the following operational capacities?* | | *Indicate if functional element is relevant for your service operations*<br>*(yes/no)?* | *What is the current status of function in your service chain (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| **Meteo data access & procurement** | Real time access & delivery | n/a (ECMWF is producing the meteo data, thus no access required) | n/a | n/a | n/a | n/a |
| | On demand access & delivery | n/a | n/a | n/a | n/a | n/a |
| | Standardized data exchange | n/a | n/a | n/a | n/a | n/a |
| | Catalogue access | n/a | n/a | n/a | n/a | n/a |

| In-situ, EO, Meteo Data Access Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID:** *ECMWF for GEMS* | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Data access:***<br>*Do you wish to have access to data providers offering the following operational capacities?* | | *Indicate if functional element is relevant for your service operations*<br>*(yes/no)?* | *What is the current status of function in your service chain (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| | Interoperable workflow systems to directly exploit Data provider reporting through your own Workflow system | n/a | n/a | n/a | n/a | n/a |
| | Data right management | n/a | n/a | n/a | n/a | n/a |
| | Secure data & service access | n/a | n/a | n/a | n/a | n/a |

| In-situ, EO, Meteo Data Access Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID: GEOLAND CSP - The assumptions below is that the main service providers for CSP are IM Portugal (present SAF), VITO and Medias-France** | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Data access:***<br>*Do you wish to have access to data providers offering the following operational capacities?* | | *Indicate if functional element is relevant for your service operations (yes/no)?* | *What is the current status of function in your service chain (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| **EO data access & procurement** | Real time access & delivery | yes | Real time facilities available at VITO, IM | Current performance satisfactory ; extension of capacity to be envisaged | No extension of capacity programmed yet | Major impact of onset of new standards. Useful satndards TBD |
| | On demand access & delivery | yes | Facilities available at IM, VITO and Medias | Current performance satisfactory | | |
| | Standardized data exchange | No | | | | |
| | Catalogue services | yes | Catalogue facilities at IM, VITO, Medias | Current performance satisfactory | TBD | |

| In-situ, EO, Meteo Data Access Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID: GEOLAND CSP - The assumptions below is that the main service providers for CSP are IM Portugal (present SAF), VITO and Medias-France** | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Data access:***<br>*Do you wish to have access to data providers offering the following operational capacities?* | | *Indicate if functional element is relevant for your service operations (yes/no)?* | *What is the current status of function in your service chain (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| In-situ & ancillary | Interoperable workflow systems to directly exploit Data provider reporting through your own Workflow system | No | | | | |
| | Data right management | No | | | | |
| | Secure data & service access | no | | | | |
| | Real time access & delivery | no | | | | |
| | On demand access & delivery | no | | | | |

| In-situ, EO, Meteo Data Access Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID: GEOLAND CSP - The assumptions below is that the main service providers for CSP are IM Portugal (present SAF), VITO and Medias-France** | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Data access:***<br>*Do you wish to have access to data providers offering the following operational capacities?* | | *Indicate if functional element is relevant for your service operations (yes/no)?* | *What is the current status of function in your service chain (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| | Standardized data exchange | no | | | | |
| | Catalogue services | yes | Catalogue facilities at IM, VITO, Medias | Current performance satisfactory | TBD | |
| | Interoperable workflow systems to directly exploit Data provider reporting through your own Workflow system | no | | | | |
| | Data right management | no | | | | |

| In-situ, EO, Meteo Data Access Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID: GEOLAND CSP - The assumptions below is that the main service providers for CSP are IM Portugal (present SAF), VITO and Medias-France** | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Data access:***<br>*Do you wish to have access to data providers offering the following operational capacities?* | | *Indicate if functional element is relevant for your service operations (yes/no)?* | *What is the current status of function in your service chain (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| | Secure data & service access | no | | | | |
| Meteo data access & procurement | Real time access & delivery | yes | Real time facilities available at VITO, IM | Current performance satisfactory ; extension of capacity to be envisaged | No extension of capacity programmed yet | Major impact of onset of new standards. Useful satndards TBD |
| | On demand access & delivery | yes | Facilities available at IM, VITO and Medias | Current performance satisfactory | | |
| | Standardized data exchange | no | | | | |
| | Catalogue access | no | | | | |

| In-situ, EO, Meteo Data Access Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID: GEOLAND CSP - The assumptions below is that the main service providers for CSP are IM Portugal (present SAF), VITO and Medias-France** | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Data access:***<br>*Do you wish to have access to data providers offering the following operational capacities?* | | *Indicate if functional element is relevant for your service operations (yes/no)?* | *What is the current status of function in your service chain (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| | Interoperable workflow systems to directly exploit Data provider reporting through your own Workflow system | no | | | | |
| | Data right management | no | | | | |
| | Secure data & service access | no | | | | |

| In-situ, EO, Meteo Data Access Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID: GEOLAND ONC - The assumptions below is that the main service provider for ONC is ECMWF** | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Data access:***<br>*Do you wish to have access to data providers offering the following operational capacities?* | | *Indicate if functional element is relevant for your service operations (yes/no)?* | *What is the current status of function in your service chain (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| **EO data access & procurement** | Real time access & delivery | yes | Real time facilities available at ECMWF | Current performance satisfactory | | |
| | On demand access & delivery | yes | Facilities available at ECMWF | Current performance satisfactory | | |
| | Standardized data exchange | No | | | | |
| | Catalogue services | yes | Catalogue facilities at ECMWF | Current performance satisfactory | | |

| In-situ, EO, Meteo Data Access Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID: GEOLAND ONC - The assumptions below is that the main service provider for ONC is ECMWF** | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Data access:***<br>*Do you wish to have access to data providers offering the following operational capacities?* | | *Indicate if functional element is relevant for your service operations (yes/no)?* | *What is the current status of function in your service chain (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| | Interoperable workflow systems to directly exploit Data provider reporting through your own Workflow system | No | | | | |
| | Data right management | No | | | | |
| | Secure data & service access | no | | | | |
| **In-situ & ancillary** | Real time access & delivery | no | | | | |
| | On demand access & delivery | no | | | | |

| In-situ, EO, Meteo Data Access Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID: GEOLAND ONC - The assumptions below is that the main service provider for ONC is ECMWF** | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Data access:***<br>*Do you wish to have access to data providers offering the following operational capacities?* | | *Indicate if functional element is relevant for your service operations (yes/no)?* | *What is the current status of function in your service chain (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| | Standardized data exchange | no | | | | |
| | Catalogue services | no | | | | |
| | Interoperable workflow systems to directly exploit Data provider reporting through your own Workflow system | no | | | | |
| | Data right management | no | | | | |
| | Secure data & service access | no | | | | |

| In-situ, EO, Meteo Data Access Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID: GEOLAND ONC - The assumptions below is that the main service provider for ONC is ECMWF** | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Data access:***<br>*Do you wish to have access to data providers offering the following operational capacities?* | | *Indicate if functional element is relevant for your service operations (yes/no)?* | *What is the current status of function in your service chain (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| **Meteo data access & procurement** | Real time access & delivery | yes | Real time facilities available at ECMWF | Current performance satisfactory | | |
| | On demand access & delivery | yes | Facilities available at ECMWF | Current performance satisfactory | | |
| | Standardized data exchange | yes | | | | |
| | Catalogue access | yes | | | | |

| In-situ, EO, Meteo Data Access Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID: GEOLAND ONC - The assumptions below is that the main service provider for ONC is ECMWF** | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Data access:***<br>*Do you wish to have access to data providers offering the following operational capacities?* | | *Indicate if functional element is relevant for your service operations (yes/no)?* | *What is the current status of function in your service chain (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| | Interoperable workflow systems to directly exploit Data provider reporting through your own Workflow system | yes | | | | |
| | Data right management | yes | | | | |
| | Secure data & service access | yes | | | | |

**General Technical Requirement Description**

The following tables (issued from WIN TRD) are related to general system requirements, and can be fulfilled independently of the previous ones.

**Table 0-3: General Technical Requirement Table**

*The functional element description is provided in the next section "General Technical Requirements Description"*

| General Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID:** *Please insert your Service ID & Name to be considered in this table; add further tables for all the other sub- services if necessary* | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Data access:***<br>*Do you wish to have access to data providers offering the following operational capacities?* | | *Indicate if functional element is relevant for your service operations (yes/no)?* | *What is the current status of function in your service chain (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| User Management | User Management :<br>User Administration | | | | | |
| | User Management :<br>Billing and Invoicing | | | | | |

| General Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID:** *Please insert your Service ID & Name to be considered in this table; add further tables for all the other sub- services if necessary* | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Data access:***<br>*Do you wish to have access to data providers offering the following operational capacities?* | | *Indicate if functional element is relevant for your service operations (yes/no)?* | *What is the current status of function in your service chain (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| **Services & Products Registration** | | | | | | |
| **Interface with legacy providers** | | | | | | |
| **Services & Product** | Services & Products Access<br>Supervision and Selection | | | | | |

| General Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID:** *Please insert your Service ID & Name to be considered in this table; add further tables for all the other sub- services if necessary* | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Data access:***<br>*Do you wish to have access to data providers offering the following operational capacities?* | | *Indicate if functional element is relevant for your service operations (yes/no)?* | *What is the current status of function in your service chain (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| | Services & Products Access<br>Catalogue services | | | | | |
| | Services & Products Access<br>Services & Products Ordering | | | | | |
| | Services & Products Access<br>Workflow Management | | | | | |
| | Services & Products Access<br>Object viewer | | | | | |

| General Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID:** *Please insert your Service ID & Name to be considered in this table; add further tables for all the other sub- services if necessary* | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Data access:***<br>*Do you wish to have access to data providers offering the following operational capacities?* | | *Indicate if functional element is relevant for your service operations (yes/no)?* | *What is the current status of function in your service chain (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| | Services & Products Access<br>Co-Operative Working | | | | | |
| | Services & Products Access<br>Help Desk | | | | | |
| | Services & Products Access<br>SPR & SMR Management | | | | | |
| | Services & Products Access<br>Documentation Management | | | | | |

| General Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID:** *Please insert your Service ID & Name to be considered in this table; add further tables for all the other sub- services if necessary* | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Data access:***<br>*Do you wish to have access to data providers offering the following operational capacities?* | | *Indicate if functional element is relevant for your service operations (yes/no)?* | *What is the current status of function in your service chain (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| | Services & Products Access<br>Human Language Interface | | | | | |
| | Services & Products Access<br>Data fusion service | | | | | |
| | Services & Products Access<br>Data mining service | | | | | |

| General Technical Requirement Table | | | | | | |
|---|---|---|---|---|---|---|
| **Service ID:** *Please insert your Service ID & Name to be considered in this table; add further tables for all the other sub- services if necessary* | | | | | | |
| **Functional element** | | **Relevance of element** | **Status Quo** | **Compliance** | **Upgrades** | **Relevance of standardisation** |
| ***Data access:***<br>*Do you wish to have access to data providers offering the following operational capacities?* | | *Indicate if functional element is relevant for your service operations (yes/no)?* | *What is the current status of function in your service chain (e.g. which infrastructure, SW used today)?* | *Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks* | *What are potential or already planned upgrades* | *Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?* |
| **Data Storage & Dissemination** | | | | | | |
| **System Administration and Telecommunication** | | | | | | |

The following table describes the functions identified for the general technical requirements classification. Most complex functions (display in bold) are divided into sub-functions. This breakdown results from the functional analysis performed in the frame of the Prototyping Activities.

**Table 0-4: Technical Requirement Description**

| Name | Description |
|---|---|
| **Provisioning & Dissemination** | See detailed sub-functions in Table 0-1 : Direct product exchange Technical Requirement Table |
| **data access & procurement** | The "Access Point" function checks the user name and password from an external authentication server and also get from this server the user profile.<br><br>Then, according to the user profile, it customises the home pages so to propose/give access to the relevant services, data, tools ....<br><br>See detailed sub-functions in Table 0-2 : In-situ, EO, Meteo Data Access Technical Requirement Table |
| **User Management** | The "User Management" function administrates information on users, the history and statistics on their session, the orders they have issued as well as the associated billing.<br><br>Users are classified as follow :<br>➢ Policy and Decision Makers<br>international / UE level<br>national level<br>local level<br>➢ Scientific & Technical Supports<br>➢ On Scene Operators<br>➢ Services/Data Providers |

| Name | Description |
|---|---|
| | ➢ Administrators who are of 2 types :<br>CIP system's user administrators.<br>He will create and administrate all user account.<br>User organism's user administrator.<br>He will be allowed to perform some limited operations on the accounts for the users belonging to its organism : changing user name, user quota, some privileges. |
| User Management :<br>User Administration | "User Administration" is a sub-function" of "User Management"<br><br>It registers all user's features that will allow to adapt the services according to the user profile.<br><br>The user profile is at least composed of<br>➢ administrative information such as name, company, coordinates ...<br>➢ language<br>➢ role within the risk phases<br>➢ privileges and access rights to services<br>➢ authorization validity period<br><br>It may also record the user activities, such as dates of connection, list of products ordered, list services invoked, profile modifications ... into an history.<br><br>The main functions of this unit are :<br>➢ Register a new user. Modify or Delete an existing user.<br>➢ Build profiles and provide couple login/password<br>➢ Maintain user DB<br>➢ Maintain order DB<br>➢ Maintain users' histories |

| Name | Description |
|---|---|
| User Management :<br>Billing and Invoicing | “Billing and Invoicing” is a sub-function” of "User Management"<br>It provides services for performing billing and invoicing. |

| Name | Description |
|---|---|
| **Services & Products Registration** | The "Service/Product Registration" function offers functions to manage the services and products which are for example :<br>➢ Satellite Operation<br>➢ Monitoring Services<br>➢ Meteorological Services<br>➢ GIS data suppliers<br>➢ Data & Value added product Providers<br>➢ ...<br><br>It registers all Services/Products' features that will allow to select and propose to the user the most appropriate sub-set of services and products according to the user profile.<br><br>These features are at least :<br>➢ administrative information such as name, company, coordinates ...<br>➢ language<br>➢ availability period<br>➢ charter related information :<br>technical description<br>business models<br>quality commitments<br>interoperability properties<br>➢ plus all information necessary so the provider is also recognized as an user<br><br>This unit may also record the service/product activities, such as activation dates, list of delivered products, delivery statistics into an history<br><br>The main functions of this unit are :<br>➢ Register a new service/product; Modify or Delete an existing service/product<br>➢ Manage queries to the registry<br>➢ Maintain services/products' histories |

| Name | Description |
|---|---|
| **Interface with legacy providers** | The " Interface with legacy providers" function manages the interfaces with Products/Services providers : generic interfaces will be implemented as far as possible with Products/services providers however some adaptations to the generic interface will be required on a case by case if the Products/services providers cannot comply with the generic interface or with the different charters. |

| Name | Description |
|---|---|
| **Services & Products Access** | The "Services & Products Access" function filters the access to data, products and services of each user according to their profile and to allow connection to the different CIP services. |
| Services & Products Access<br>Supervision and Selection | The "Supervision and Selection" sub-function supervises the interactions with generic services such as Catalogues services, HLI, Workflows, … |
| Services & Products Access<br>Catalogue services | The "Catalogue services" sub-function provides :<br>➢ facilities for internal catalogue consultation and administration thanks to tanks to<br>Adapted and Relevant "meta" catalogue making<br>Meta data filtering<br>Search facilities<br>➢ facilities to consult and search in external catalogue:<br>It translates generic catalogue requests into external catalogue request.<br>It collects and formats search results so the user can easily perform a selection or refine his query. |
| Services & Products Access<br>Services & Products Ordering | The "Services & Products ordering" sub-function is devoted to the ordering activities :<br>➢ Gathering of request information according to user preferences (Area Of Interest, time window and frequency, delivery formats ...) and format the request according to the Service interface description<br>➢ Request for quotation<br>➢ Order follow up<br>➢ … |
| Services & Products Access<br>Workflow Management | The "Workflow Management" sub-function allows to chain processes where documents, information or tasks are passed between participants according to a defined set of rules to achieve, or contribute to, an overall business goal. |

| Name | Description |
|---|---|
| | There are mainly four processes to define correctly and completely work flows :<br>➢ Creating Work Flows<br>➢ Storing Work Flows<br>➢ Executing Work Flows<br>➢ Monitoring Work Flows<br><br>This functionality could be used by the users to create their own workflows for example to support the decision processes.<br><br>It could also be used by the service providers to offer complex services made of a succession of basic services |
| Services & Products Access<br><br>Object viewer | The "Object viewer" sub-function proposes a set of tools to<br>➢ access to distributed and shared geographical information<br>➢ select date, time span, geographical region of interest (for a request of product generation for example) thanks to a user friendly MMI<br>➢ display the result of the queries performed by the user in the form of quick-looks (sampled images) and/or associated auxiliary data in order to speed up the selection process.<br>➢ display graphical objects such as tabular, vector and raster data with common visualization functions such as filtering, zooming, panning and scaling to facilitate the inspection process.<br>➢ generate reports |
| Services & Products Access<br><br>Co-Operative Working | The "Co-operative Working" sub-function is an enhanced videoconference system allowing rich content sharing between participants.<br><br>All participants connect themselves into a virtual room where the video, audio and data of each participant can be visualised by each one and shared.<br><br>The main functions are :<br>➢ Video conference with voice and video of all actors<br>➢ Message: exchange of instant textual messages between actors |

| Name | Description |
|---|---|
| | ➢ Whiteboard which allows the participants to work together on the same document. The picture of the document is displayed on screen of each team member. Then notes and modifications can be applied directly to the document on screen for all to see.<br>Application sharing : this powerful tool makes it possible to share any GIS application or more between several end-users. Unlike the Whiteboard, the sharing is not limited to a picture or photo: the whole application with all its functions is available, and each user may take control of it. |
| Services & Products Access<br>Help Desk | The "Help Desk" sub-function provides a support to the Users (end users and providers) providing mechanisms :<br>➢ to manage users' question (register question, send and store responses)<br>➢ to publish FAQ and News<br>➢ to access to documentation such as user guides |
| Services & Products Access<br>SPR & SMR Management | The "SPR & SMR Management" sub-function is devoted to the management :<br>➢ manage the SPR (Software Problem Report) raised by the users (register the SPRs, deploy the resources necessary to analyze and fix (if required) the problem)<br>➢ manage the software's configuration<br>➢ keep the user informed on the SPR status<br>➢ maintain a knowledge database to improve the service efficiency |
| Services & Products Access<br>Documentation Management | The " Documentation Management " sub-function is devoted to the management of the documentation :<br>➢ stores useful documentation<br>➢ makes the documentation available to the members at any moment<br>➢ offers search facilities that to indexes, table of contents ..<br>➢ manage the RIDs Review Item Discrepancy) raised by the reviewers,<br>➢ manage the documents configuration |

| Name | Description |
|---|---|
| | |
| Services & Products Access<br><br>Human Language Interface | The "Human Language Interface" sub-function proposes tools to improve multi linguality such as :<br>➢ Multilingual dictionary<br>➢ Multilingual glossary<br>➢ In passing translation of User Interfaces thanks to mechanisms for translation of HTML data flow<br><br>These tools could be activated by authorised users through the Portal for isolated uses and also by the other components to adapt the information presented to the users (search & request formularies, work flow information, meta-data ..) |
| Services & Products Access<br><br>Data fusion service | The "Data Fusion" sub-function covers the needs of exploiting heterogeneous information coming from different sources in order to take benefit of their complementarities. The main objective is to provide enhanced products putting together for instance :<br>➢ Teledetection images coming from various sensors (merge optical and radar; merge various spectral bands; merge various resolutions)<br>➢ Raster image and vector image<br>➢ Multi-temporal images of a same scene<br>➢ … |
| Services & Products Access<br><br>Data mining service | The "Data Mining" sub-function includes the services that allow to extract useful information or knowledge ("actionable assets") from raw data and/or large volume . |
| **Data Storage & Dissemination** | The "Data Storage & Dissemination" manages the most CIP storage node as well as FTP and e-mail exchanges with users and Products/services providers. The storage node is an essential component of the CIP, all most products or data forwarded by providers will transit via the CIP in order to be made available to the users |

| Name | Description |
|---|---|
| **System Administration and Telecommunication** | The "System administration and telecommunication" function is dedicated to the coordination of the interactions between the different components (or nodes) of the architecture and also provides external interfaces to other crisis related "networks". |