# COMMISSION IMPLEMENTING DECISION (EU) 2018/620

## of 20 April 2018

## on the technical specifications for the Copernicus service component pursuant to Regulation (EU) No 377/2014 of the European Parliament and of the Council

**(Text with EEA relevance)**

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Regulation (EU) No 377/2014 of the European Parliament and of the Council of 3 April 2014 establishing the Copernicus Programme and repealing Regulation (EU) No 911/2010 ([1]), and in particular Article 9(8)(a) thereof,

Whereas:

(1) The Copernicus Programme, which was established by Regulation (EU) No 377/2014, is a civil, user driven programme, building on the existing national and European capacities, with the overarching operational objective to provide accurate and reliable information in the field of the environment and security, tailored to the needs of users and supporting other Union policies, more specifically relating to the internal market, transport, environment, energy, civil protection and civil security, cooperation with third countries and humanitarian aid.

(2) Pursuant to Regulation (EU) No 377/2014, Copernicus consists of three components, including a service component the purpose of which is to ensure delivery of information in the following areas: atmosphere monitoring, marine environment monitoring, land monitoring, climate change, emergency management and security. The Commission has the overall responsibility for Copernicus and coordinates its different components.

(3) The technical specifications for the Copernicus service component are necessary to establish a baseline for the implementation of the service component as part of the governance of Copernicus.

(4) The technical specifications for the Copernicus service component should address aspects such as scope, architecture, technical service portfolios, monitoring and evaluation, space and in situ data service needs, evolution, archiving and dissemination of data and are required to guarantee the correct operation of the Copernicus service component.

(5) The technical specifications for the Copernicus service component should cover the entire service component, with a specific focus on the activities funded under Regulation (EU) No 377/2014.

(6) The measures provided for in this Decision are in accordance with the opinion of the Copernicus Committee,

HAS ADOPTED THIS DECISION:

*Article 1*

### Technical specifications for the Copernicus service component

The following technical specifications for the Copernicus service component referred to in Article 5(1) of Regulation (EU) No 377/2014, regarding its implementation, are hereby adopted:

(1) General characteristics of the Copernicus service component, as set out in Annex I to this Decision;

(2) Technical specifications for the Copernicus atmosphere monitoring service referred to in Article 5(1)(a) of Regulation (EU) No 377/2014, as set out in Annex II to this Decision;

(3) Technical specifications for the Copernicus marine environment monitoring service referred to in Article 5(1)(b) of Regulation (EU) No 377/2014, as set out in Annex III to this Decision;

([1]) OJ L 122, 24.4.2014, p. 44.

(4) Technical specifications for the Copernicus land monitoring service referred to in Article 5(1)(c) of Regulation (EU) No 377/2014, as set out in Annex IV to this Decision;

(5) Technical specifications for the Copernicus climate change service referred to in Article 5(1)(d) of Regulation (EU) No 377/2014, as set out in Annex V to this Decision;

(6) Technical specifications for the Copernicus emergency management service referred to in Article 5(1)(e) of Regulation (EU) No 377/2014, as set out in Annex VI to this Decision;

(7) Technical specifications for the Copernicus security service referred to in Article 5(1)(f) of Regulation (EU) No 377/2014, as set out in Annex VII to this Decision.

*Article 2*

**Entry into force**

This decision shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Union*.

Done at Brussels, 20 April 2018.

*For the Commission*
*The President*
Jean-Claude JUNCKER

*ANNEX I*

**GENERAL CHARACTERISTICS OF THE COPERNICUS SERVICE COMPONENT**

1. SCOPE

The exact scope and the objectives of each specific Copernicus service are provided in the following thematic Annexes II to VII.

2. GENERAL SERVICE SPECIFICATION

## 2.1. **Architecture**

The entrusted entities shall develop the architecture of the different services adapted to their specific characteristics. The following general functions shall be applicable to all services:

(a) integrated operations, to provide a timely and reliable service products and information;

(b) product and service quality management, to provide a verified and state-of-the-art information;

(c) continuous service improvement and evolution, to be responsive to user requirements;

(d) user uptake and communication, to maximise the awareness, use and exploitation of the service;

(e) products dissemination and archiving, to keep a record of the information provided and to keep older and historic data sets available for users.

For the purposes of this Annex the 'entrusted entities' shall mean entities entrusted by the Commission with service component implementation tasks, including the following entities:

(a) the European Environment Agency (EEA) for the Copernicus in-situ component and the pan-European and local components of the land monitoring service;

(b) the European Centre for Medium Range Weather Forecasts (ECMWF) for the Atmosphere Monitoring Service and Climate Change Service;

(c) Mercator Océan for the Marine Environment Monitoring Service;

(d) the European Border and Coast Guard Agency (FRONTEX) for the border surveillance within the Copernicus security service;

(e) the European Maritime Safety Agency (EMSA) for the maritime surveillance within the Copernicus security service;

(f) the European Union Satellite centre (SATCEN) for the support to the Union's External Action of the Copernicus security service.

## 2.2. **Integrated operations**

The services shall be designed to operate in a robust, efficient and sustainable manner. The services shall provide their products with the technical properties and the timeliness specified for each of their products in the Copernicus portfolio.

The service design and their operations shall take appropriate precautions to minimise the unavailability of the service and its products, and the occurrences of late delivery with respect to the timeliness specified in the portfolio. Appropriate (automated) technical monitoring processes shall be put in place to detect anomalies as soon as possible.

The services shall provide a user support function, which shall provide at least full technical information on the service products and the processing leading into the meta-data associated to and delivered with each service product. A user help desk shall be available according to a schedule which is consistent with the timeliness of the service products themselves.

The entrusted entities shall support the coordination of their activities with the Commission, as well as amongst each other.

2.3. **Product and service quality management**

The entrusted entities shall put in place appropriate internal processes to ensure the high level quality of the services. This shall address at least the verification of the technical properties of (all or a sampled subset of) the service products, including quantitative evaluation where appropriate, as well as gathering feedback on the satisfaction of users with the service products.

Beyond the internal process, the services shall provide a set of performance level indicators to support monitoring at programme level [in accordance with section 4].

2.4. **Continuous service improvements**

Based on the findings of the quality assurance function and on the user feedback, the services shall develop, validate and periodically implement process improvements to ameliorate the quality of their products and/or the satisfaction of their core users. The entrusted entities shall notify in advance the Commission before introducing changes to the operational products service production.

Changes which go beyond the routine process of product maintenance and the evolution already provided for in the respective delegation agreements between the Commission and entrusted entities will have to be agreed upon beforehand between the service operator and the Commission. This procedure shall involve the Member States.

2.5. **User uptake and communication**

The services shall perform activities to develop and to expand the communities of users for their services. These activities may cover areas, such as the organisation of thematic workshops, training activities, contributions for printed and electronic media, contributions to user domain specific conferences and events.

In a limited number of justified cases, pilot activities and/or specific use cases may be supported to stimulate and foster certain application areas and to demonstrate the potential usefulness of these downstream activities.

The activities at service level shall be coordinated with the Commission's activities and planning at programme level.

2.6. **Products dissemination and archiving**

The service product dissemination strategy shall be based on a single entry point (one stop-shop) for each service to allow user access to products and information. The entry point for each service shall be a web portal providing a harmonised interface to any service component, independent from the physical locations of the data sources.

The important requirements shall include an unrestrictive user registration, effective product search and quick view, easy access to metadata including product descriptions, ability to visualize datasets, regional sub-setting, and data downloading in various formats.

The user access to Copernicus data and information shall be done through a heterogeneous collection of interfaces that shall be put in place by the various entrusted entities.

An efficient Copernicus data and information portal shall be developed with a view to make the different existing Copernicus dissemination platforms interoperable and to strengthen the overall Copernicus dissemination system. That objective will be fulfilled with the setting by the Commission of the 'Data and Information Access Service' (DIAS), making Copernicus data and information available to users through a cloud type of computing architecture.

All the products shall be archived and a fast access shall be guaranteed for the latest products.

The strategy for archiving shall be guided by user needs and requirements. All data products generated by the services shall be available permanently to allow traceability and reproducibility of results and findings. Observational datasets in particular, as well as reanalyses, shall be archived permanently. Appropriate measures shall be implemented to mitigate the risk of data loss or destruction.

User questions, complaints and suggestions shall be handled by a traceable system. A user support function shall deal with user queries interactively. This function shall be discharged through help desks at the premises of the entrusted entities for the services, complemented by user support at the data provider.

The entrusted entities shall ensure the interoperability of the service portals with the 'copernicus.eu' and the overall harmonization of dissemination services in coordination with the Commission.

3. TECHNICAL SERVICE PORTFOLIO

3.1. **Service products general standards – INSPIRE compliance**

The spatial data products and information generated within the Copernicus service component activities shall be compatible and interoperable with the data and spatial information systems provided by Member States in accordance with Directive 2007/2/EC of the European Parliament and of the Council [1] and Commission Regulations (EC) No 1205/2008 [2], (EU) No 1089/2010 [3], and (EC) No 976/2009 [4].

4. MONITORING AND EVALUATION OF THE SERVICES

Key Performance Indicators (KPIs) shall be used to monitor the quality and the progress of the Copernicus services.

These KPIs shall significantly contribute to demonstrate that the programme is on track and is making progress as planned.

**Services providing routine products (land, climate change, maritime monitoring, atmosphere monitoring)**

| ID | KPI | Proposed evaluation method |
|---|---|---|
| 1 | Quality and products completeness | Quality and completeness of the products |
| 2 | Product Timeliness<br>(where applicable) | Percentage of products available on time on the Copernicus Service dissemination portal, in line with pre-defined benchmarks for each product |
| 3 | Service availability | Percentage of time the Copernicus Service dissemination portal is available for the users (per month) |
| 4 | User satisfaction<br>(for assistance and services) | Result of the question 'Overall, how satisfied are you with the Copernicus Service X? (1 = not satisfied, 4 = very satisfied)', to be included in the annual user satisfaction survey of each Copernicus Service. |
| 5 | User uptake | A/number of registered users |
| | | B/number of active users (downloading or invoking products in the last 3 months) |

**Services providing on-demand products (e.g. security, emergency)**

| ID | KPI | Proposed evaluation method |
|---|---|---|
| 1 | Quality and products completeness | Quality and completeness of the products |

[1] Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) (OJ L 108, 25.4.2007, p. 1).
[2] Commission Regulation (EC) No 1205/2008 of 3 December 2008 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata (OJ L 326, 4.12.2008, p. 12).
[3] Commission Regulation (EU) No 1089/2010 of 23 November 2010 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards interoperability of spatial data sets and services (OJ L 323, 8.12.2010, p. 11).
[4] Commission Regulation (EC) No 976/2009 of 19 October 2009 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards the Network Services (OJ L 274, 20.10.2009, p. 9).

| ID | KPI | Proposed evaluation method |
|---|---|---|
| 2 | Product Timeliness (where applicable) | Percentage of products available on time on the Copernicus Service dissemination portal, in line with pre-defined benchmarks for each product |
| 3 | Service availability | Percentage of time the Copernicus Service dissemination portal is available for the users (per month) |
| 4 | User satisfaction (for assistance and services) | Result of the question 'Overall, how satisfied are you with the Copernicus Service X? (1 = not satisfied, 4 = very satisfied)', to be asked after each activation or to be included in an annual user satisfaction survey. |
| 5 | User Uptake | Number of activations |

The results of the KPIs measurements shall be reported to the Commission. The entrusted entities may use any other relevant KPIs according to their specific situation.

## 5. DATA NEEDS FOR COPERNICUS

The user requirements and services specifications shall serve as a basis for the constant adjustment of the Copernicus programme data needs. The data inputs for the Copernicus services shall fall in two broad categories:

(a) satellite based observations;

(b) in situ data.

### 5.1. **Satellite based observation**

The provision of space data for the Copernicus services shall be managed by:

(a) The Commission through the Copernicus Data Access Specifications of the space-based Earth Observation needs for the period 2014-2020;

(b) ESA for the technical coordination of the Copernicus Space Component, the definition of its architecture, the development and procurement of space assets, data access and the operation of Copernicus dedicated missions;

(c) EUMETSAT for the operation of Copernicus dedicated missions.

The Copernicus Data Access Specifications of the space-based Earth Observation needs for the period 2014-2020 shall be met through the Data Warehouse mechanism, established on the basis of the Copernicus ESA delegation agreement.

### 5.2. **In situ observations**

The access to in situ data licensed or provided for use in Copernicus shall be coordinated primarily for the needs of the Copernicus services.

The provision of in-situ data shall draw on different data sources, including Member States' data sources. The Copernicus in situ component shall rely mainly on existing data sources and capacities. It shall include different categories of data (regular and frequent in-situ measurements and observation data, periodically compiled data, or one time action data). The Copernicus in situ component shall integrate at European level existing in situ and reference data. In some cases the services may have, in addition, their own specific arrangement with in-situ data providers in their specific thematic domain.

## 6. EVOLUTION OF THE COPERNICUS SERVICE COMPONENT UNTIL 2020

The Copernicus operational services, programmed in the context of the current Multiannual Financial Framework (MFF), will evolve in line with recognised and emerging user requirements and state of the art methodologies.

The entrusted entities shall be continuously evolving their portfolio based on user feedback, advances in the state-of-the-art, as well as findings from validation processes in order to maintain the various products relevant. Immediate service maintenance and enhancement in response to the Copernicus work programme shall be part of operational tasks. Where appropriate, the long-term evolutions shall take into account input resulting from performed activities in the framework of H2020 and other research programmes.

In this MFF three main evolving situations may be envisaged:

(a) evolution of existing products is aimed at product enhancement;

(b) during the programme period new products and service groups may be introduced;

(c) emerging and new needs stemming from policy implementation may lead to the possible addition of new product groups currently not foreseen in these technical specifications of the service.

In cases referred to in point (c) the entrusted entity shall analyse the expected benefits, costs and impact on operations. On this basis, a discussion in the Copernicus User Forum and the Copernicus Committee shall be held to decide on the implementation of such a new product group.

The situations referred to in points (a), (b) and (c) above shall take into account the following inputs:

(a) Union policy evolution;

(b) user evolving requirements;

(c) user feedback on the current service;

(d) availability of new observation data;

(e) recommendations from experts;

(f) new methods stemming from research projects, such as Horizon 2020.

*ANNEX II*

**THE TECHNICAL SPECIFICATIONS FOR THE COPERNICUS ATMOSPHERE MONITORING SERVICE**

1. SCOPE

The Copernicus Atmosphere Monitoring Service (CAMS) shall provide information based on satellite data to facilitate the monitoring of the composition of the Earth's atmosphere. In addition, it shall develop its own capacity to continuously monitor the chemical composition of the Earth's atmosphere at global and regional scales with satellite-enhanced means. This capacity shall encompass the description of the current situation of the atmosphere (analysis), the prediction of the situation a few days ahead (forecast), and the provision of consistent retrospective data records for recent years (re-analysis). The service shall generate geophysical products which can be input to further technical processing, as well as high level information in various forms for further expert assessment to support decision makers. The products shall be subjected to rigorous quality check to ensure the highest level of quality.

CAMS shall support many applications developed by stakeholders in a variety of domains including health, environmental monitoring, renewables energies, meteorology, and climatology. It shall provide daily information on the global atmospheric composition based on processed satellite data, and by monitoring and forecasting constituents such as greenhouse gases (carbon dioxide and methane), reactive gases and aerosols, including pollens over Europe.

CAMS shall be developed to meet the needs for data and processed information related to environmental concerns. CAMS shall offer emission inventories and estimates net fluxes of $CO_2$, $CH_4$ and $N_2O$ at the Earth's surface. CAMS aims at promoting the participation in the FAIRMODE community to contribute to the harmonization of regional modelling.

2. USER REQUIREMENTS AND MAIN DOMAINS OF APPLICATION

CAMS shall provide services, categorised into the following five topical domains, grouping data and/or information products according to their main application area:

(a) air quality and atmospheric composition: these products shall characterise the chemical composition of the atmosphere and provide information on greenhouse gases, reactive gases and aerosols; the products shall be provided at global scale for the entire atmosphere and at refined horizontal resolution over a regional domain covering the Union and neighbouring areas, including the EEA Member States; the products shall include in particular the species relevant for the Union and national legislation as well as international treaties;

(b) climate forcing: Specialized products shall be provided to quantify the forcing on the Earth System due to atmospheric composition changes induced by human activities;

(c) ozone layer and UV: information on constituents of particular importance for the stratospheric ozone layer shall be provided, as well as on ultraviolet radiation;

(d) solar radiation: the domain shall cover radiation products of relevance in the context of solar energy;

(e) emissions and surface fluxes: CAMS shall also provide information on surface sources and sinks of the main greenhouse gases.

The domains shall not be mutually exclusive and some products may appear in different domains.

3. SERVICE ARCHITECTURE

The design of the service architecture shall ensure consistency with the overall vision and development strategy of Copernicus.

There shall be four main service elements:

(a) acquisition and pre-processing of input data, primarily observations (from both satellite and in-situ instruments) and ancillary data that are needed to estimate emissions of pollutants and to assess concentrations of pollutants in the atmosphere;

(b) global processing: shall be operated in three modes to deliver the products required by the users:

(1) daily production for near-real-time analyses and forecast;

(2) daily production for delayed-mode analyses and forecast;

(3) re-analyses production stream providing multi-annual consistent datasets with a frozen model/assimilation system;

(c) regional processing: shall be covered with a higher spatial resolution and shall support in particular further downstream modelling activities for sub-regions at even finer scale as well as air quality and pollen monitoring and forecasting national activities;

(d) supplementary services: shall be relative to applications processing, services and products that are built on top of or integrated into the main global and Union regional processing outputs.

The four cross-cutting functions shall deal with the following:

(a) quality control and assurance;

(b) archiving;

(c) product dissemination;

(d) user interaction, training and outreach.

4. TECHNICAL SERVICE PORTFOLIO

CAMS products shall be provided free of charge to registered users through an Interactive Catalogue available on the CAMS web portal.

The CAMS Product Portfolio shall be organised in four main categories and thirteen products lines.

(1) *Regional products*

The regional products shall be provided by an ensemble of air quality models (up to 10 members) for the European domain and for several species, such as: episodes and background concentrations of $O_3$, $NO_2$, NO, CO, $SO_2$, $NH_3$, PANs, VOCs, PM2,5, PM10, pollens (main allergens).

The services shall consist of the following:

(a) daily near real-time analyses and forecasts;

(b) daily delayed-mode interim re-analyses based on in-situ observations in an interim stage of validation;

(c) annual re-analyses based on fully validated in-situ observations.

(2) *Global products*

The global products shall be provided using ECMWF Integrated Forecasting System (IFS), which is also used for the Centre's numerical weather prediction activities. The services shall consist of daily near real-time and delayed-mode analyses and forecasts as well as reanalyses, covering the period since 2003. Species shall include aerosol, reactive gases (only a subset is directly constrained by observations), $CO_2$ and $CH_4$. The global products shall cover both the troposphere and stratosphere.

(3) *Supplementary products*

The supplementary products shall be built on the top of or integrated into the global and regional ones.

Policy support products shall consist of assessment reports commenting upon the regional reanalysis data for technical experts advising policy makers, daily scenario forecasts of pollution episodes to assess the effectiveness of short-term emissions abatement strategies, and source-receptor calculations providing information on the origin of air pollution episodes.

(a) interim assessment reports based on the interim European reanalyses;

(b) assessment reports based on the European reanalyses performed with validated data;

(c) daily 'green scenarios' forecasts with reduced level of anthropogenic emissions;

(d) on-demand country source-receptor calculations;

(e) daily regional source-receptor calculations (apportionment of local vs transported for a large number of European conurbations).

Solar radiation products shall include global forecasts of UV radiation supporting the health sector as well as data bases of clear-sky and all-sky solar irradiances to support the solar energy and other sectors

(a) global solar UV index forecast;

(b) global clear-sky surface solar irradiance;

(c) total-sky surface solar irradiance (over areas covered by geostationary satellites).

Greenhouse gases flux inversion products shall consist of estimates of surface fluxes for some of the key greenhouse gases obtained by inverse modelling.

(a) monthly fluxes of global methane (2000 to 2015);

(b) monthly fluxes of global nitrous oxide (1996 to 2015);

(c) monthly fluxes of global carbon dioxide (1979 to 2015).

Climate forcings service element shall provide estimates of the climate forcing of aerosol based on the latest global re-analysis.

(a) forcing due to aerosol-radiation interaction;

(b) forcing due to aerosol-cloud interaction;

(c) forcing due to $CO_2$;

(d) forcing due to $CH_4$;

(e) forcing due to stratospheric ozone;

(f) forcing due to tropospheric ozone.

(4) *Emission products*

The CAMS emission products shall serve as an important input for the global and regional assessment systems. In parallel, they shall be provided as end products for users. The emission products shall be the following:

(a) anthropogenic emissions:

  (1) european anthropogenic emissions;

  (2) global anthropogenic and natural emissions;

(b) fire emissions — biomass burning emissions based on Fire Radiative Power satellite observations.

5. DATA NEEDS

The data acquisition and pre-processing shall constitute the direct interface to the in situ and space observational components.

CAMS shall have two sets of requirements regarding the timeliness of the observational data feed.

(a) CAMS components that shall operate on a routine daily basis need data available in near-real time (NRT), that is within a few hours after observation, so the corresponding requirements on data quality control must be compatible with NRT and automated processing;

(b) CAMS components that shall operate in delayed mode (availability within some weeks or a few months).

5.1. **Satellites-Based Observation**

The core of the CAMS production shall consist of data assimilation and forecasting systems. The CAMS data assimilation system shall use the satellite observations to adjust the forecast model to stay as close as possible to the real atmospheric conditions. The models shall be initialised on a daily basis. To do so, forecasts from the day before shall be merged with observations to provide a best estimate of the atmospheric conditions at the start of the new forecast.

The CAMS global forecast services shall operate in real-time, delayed-mode and reanalysis configurations and shall use satellite observations data both for meteorological observations and atmospheric composition.

The categories of observations to be used shall include:

(a) the operational observations are the observations that are currently used in the CAMS data assimilation and forecasting systems;

(b) the pre-operational observations are the observations that are currently assessed to show readiness for operational use;

(c) planned observations are observations that are being considered to be implemented in the CAMS systems.

The CAM Service shall support 'ad hoc' near real time processing for some observations that are not routinely processed by the Copernicus space infrastructure or, more generally, by international space agencies concerning satellite data. The data coming from the atmospheric missions Sentinel 5p, 4 and 5 shall be taken into account in the development of the CAM service.

5.2. **In-situ Observation**

CAMS shall not operate in situ observing systems and shall collect observations from a wide range of data providers for data assimilation and validation purposes. It shall utilize existing European and international research infrastructures. CAMS shall not support financially the acquisition of data itself and shall fund dedicated activities for improving their processing in an operational context. Specific contracts shall be established for this purpose with European and international institutions and organizations.

*ANNEX III*

**THE TECHNICAL SPECIFICATIONS FOR THE COPERNICUS MARINE ENVIRONMENT MONITORING SERVICE**

1. SCOPE

The Copernicus Marine Environment Monitoring Service (CMEMS) shall provide regular and systematic reference information on the physical and biogeochemical state, variability and dynamics of the ocean and marine ecosystems for the global ocean and the European regional sea. CMEMS shall provide products which can be used in various areas of application and encompasses the description of the current situation of the oceans (analysis), the prediction of the situation a few days ahead (forecast), and the provision of consistent retrospective data records for recent years (observations reprocessing and model re-analysis). The service shall generate products which can be input to further technical processing, as well as high level information in various forms for further expert assessment to support decision makers.

The marine service shall provide a sustainable response to European users' needs in particular in application areas of marine safety, marine resources, marine and coastal environment and weather, climate and seasonal forecasting. It shall deliver generic and reliable information, derived from space and in-situ observations and from models – including forecasts, analyses and reanalyses – on the physical state and the marine biogeochemical characteristics over the global ocean and European regional seas.

2. USER REQUIREMENTS AND MAIN DOMAINS OF APPLICATION

CMEMS shall provide services categorised into the following four topical domains.

(1) *Marine Safety*

Products shall provide information in support of safe activities at sea, such as marine operations, marine weather forecasting, sea ice forecasting, combating oil spills, ship routing, search and rescue, offshore wind platforms and all activities requiring safe offshore operations.

(2) *Marine Resources*

Products shall focus on the sustainable management of living marine resources, through fisheries and mariculture and also in support to marine protected areas. The primary goals of fishery management shall be fishery sustainable ecosystem services, ensuring maximum sustainable yield while rebuilding overexploited stocks. Mariculture management bodies shall provide advice on the assessment of the multi-trophic productivity and on the environmental impact of marine farming.

(3) *Marine and coastal environment*

This service shall address the user needs of different domains: sustainable tourism and mariculture, protection of the coasts against erosion and land-based sources of pollution, human and ecosystem health. Products and information shall be required to sustain the development of effective Integrated Coastal Zone Management concepts and decision support systems.

(4) *Weather, climate and seasonal forecasting*

This service shall guarantee a robust and reliable supply of quality-controlled marine information on a daily or six-hourly basis. This shall comprise surface fields as boundary conditions as well as ocean observations at surface and ocean modelled information well below the surface.

3. SERVICE ARCHITECTURE

CMEMS shall comprise three main service elements.

(1) *Processing*

Processing centers shall process from various sets of input data the core products describing the ocean state, in near real time and delayed mode. Processing shall be provided by Thematic Assembly Centres and Monitoring and Forecasting Centres.

(a) Thematic Assembly Centres (TACs) shall be mainly focused on the direct processing of in-situ data i.e. for temperature, salinity and biogeochemistry variables and L2 satellite data for several ocean variables such as i.e. sea-surface temperature, ocean colour, sea ice parameters and sea level, dissolved oxygen, optical properties or other biogeochemical components. The outputs from this thematic processing shall be products serving as direct input to further processing by Monitoring and Forecasting centres as well as products for external usage.

(b) Monitoring and Forecasting Centres (MFCs) shall provide the three-dimensional description of the ocean state: analyses and forecasts of marine parameters (temperature, salinity, currents, sea ice, sea level, waves and biogeochemistry). There shall be seven MFCs covering the global ocean and the European regional Seas: Global, Arctic, Baltic, North West shelf, Iberic-Biscay-Irish area, Mediterranean Sea, Black Sea.

(2) *Product Management*

Product Management shall manage all marine data and products in real-time or delayed mode and shall manage their archives and provide the capacities required for a reliable discovery, viewing, access and download of these data and information at any time by the service operators and the external users; it shall be based on the continuation and update of the current data categories and variables in the catalogue, as well as the information in the service lines.

(3) *Outreach and training*

Outreach and training shall provide the users with an easy and efficient access to these data and products, and with opportunities to discover the service (either online of through dedicated training and events), improve their skills in using it and express their requirements and feedbacks. Outreach activities shall be an integrated part of the service in order to provide a direct link to the technical and scientific expertise inherent to the service. Two aspects can be considered: interaction with users and communication.

The entrusted entity shall have the dual responsibility for implementing these primary functions and the overall cross-cutting functions needed to ensure an efficient and reliable marine service.

Cross-cutting functionalities have three main requirements:

(a) integrated operations, to provide a timely and reliable service;

(b) product and service quality management, to provide scientifically verified and state-of-the-art information, and high level of quality and continuity of service;

(c) continuous service improvement, to be responsive to user requirements.

4. TECHNICAL SERVICE PORTFOLIO

CMEMS service shall provide the products free of charge to registered users through an Interactive Catalogue available on the CMEMS web portal. CMEMS shall provide regular and systematic core reference information on the state of the physical and biogeochemical oceans and regional seas. The observations and forecasts produced by the service support all marine applications. CMEMS shall be driven by quality and simplicity: quality of the ocean information provided to users, and simplicity of the access to information.

The interactive catalogue shall allow users to select products according to the following criteria:

(a) geographical areas: global ocean or regional areas: Arctic Ocean, Baltic Sea, Atlantic-European North West Shelf-Ocean, Atlantic-European South West Shelf-Ocean, Mediterranean Sea, Black Sea;

(b) parameters: Temperature, Salinity, Currents, Sea Ice parameters (concentration, edge, drift, thickness, type), Sea Level (SSH, SLA gH, SLA noise), Euphotic zone, mixed layer depth, Wind, Waves, optical water properties, Ocean Chemistry (N, P, Fe, $O_2$, Si, $NH_4$, RadFlux, $PCO_2$, pH), Ocean Biology (Chlorophyll-A, phyto, zoo, primary production);

(c) time coverage: forecast, near real time, multi-year, time-invariant products (either from observation or modelling);

(d) models or observations (products delivered from model simulation, satellite measurements, in situ observation, or combination of model and observation products);

(e) grid type;

(f) time span;

(g) vertical coverage;

(h) processing level;

(i) temporal resolution.

5. DATA NEEDS

CMEMS shall be based on ocean observations from a variety of sources, including satellite-based instruments (from Sentinels and also essential contributing missions such as Jason Series), in-situ platforms such as surface and sub-surface buoys and floats, and volunteer observing ships.

### 5.1. **Satellites-Based Observation**

CMEMS shall provide products based on operational satellite. Even more satellite observations shall be used by CMEMS for climatology, reanalysis and validation purposes, from past missions or from satellites that do not deliver data in real-time.

The most important types of data used in CMEMS shall be from spectroradiometers (to measure chlorophyll content, organic and mineral content, sea-surface temperature and sea-ice cover), infrared radiometers (to measure sea-surface temperature), microwave radiometers (to measure atmospheric water vapour content, atmospheric water liquid content (clouds), rain rates, sea-ice concentration, type, extent, sea-surface temperature, salinity), altimeters (sea-surface height, ocean surface wind speed, wave height, sea ice), scatterometers (to measure wind speed and heading, rain, sea-ice concentration) and synthetic aperture radars (to measure wind and the surface wave field and ensure sea-ice monitoring).

Sentinel-1, Sentinel-3 and Jason-3 space observations shall be fully integrated in CMEMS products and the portfolio shall be enriched with wave data and new biogeochemical products. Sentinel-2 shall be progressively integrated to improve the biogeochemical product portfolio.

### 5.2. **In-Situ Observation**

CMEMS shall not operate in-situ observing systems and shall collect observations from data providers, mainly from EuroGOOS, JCOMM networks, SeaDataNet and EMODnet.

*ANNEX IV*

**THE TECHNICAL SPECIFICATIONS FOR THE COPERNICUS LAND MONITORING SERVICE**

1. SCOPE

The Copernicus Land Monitoring Service shall provide users in the field of environment and other terrestrial applications with high quality information based on space data combined with other sources of data.

The Service shall address a wide range of policies such as environment, agriculture, regional, development, transport, energy as well as climate change, at Union level and also at global level considering European Union commitments to international treaties and conventions.

The Land Monitoring Service shall focus on the priorities already defined by a broad consultation amongst key users: relevant Commission services, the Copernicus User Forum, the European Environment Information and Observation Network (EIONET) National Focal Points (NFPs), the Reference Centres (NRCs) and the International stakeholders including United Nations Agencies.

2. USER REQUIREMENTS AND MAIN DOMAINS OF APPLICATION

The Copernicus Land Monitoring service shall comprise a global component including a systematic and a hot spot monitoring element, a pan-European component and a local component.

The Global Land monitoring component shall support the Commission in several application domains. The products shall be used, amongst others, for crop, rangeland and drought monitoring, to support livestock management, for climate studies, for water quality assessment, for in-land water and river navigation, in hydrological monitoring, for irrigation assessment, for locust early warning detection, in health studies, for biodiversity preservation, for transportation, for land degradation and soil erosion forecast. The products shall be made available to Member States, to third countries, to UN institutions (FAO, WFP) and to public, research and private institutions.

Under its systematic monitoring element, the global land component shall produce a wide range of biophysical variables worldwide, which describe the state of vegetation, the energy budget and the water cycle. Under its Hot Spot monitoring element, the global land component shall deliver, on request, detailed land information on specific areas of Union interest outside the Union territory to support Union environment or development or other policies. This information shall complement the systematic monitoring activity. The third element of the global land component shall be the production of Analysis Ready Data based on Sentinel satellite data.

The pan-European component shall produce 5 high resolution thematic layers (HRL) describing the main land cover type characteristics: artificial surfaces, forest areas, agricultural areas (grasslands), wetness and small water bodies. The HRLs shall provide complementary information other land cover/land use nomenclatures, such as Corine Land Cover (CLC). The HRLs will be updated in a 3-year cycle. A set of new HRL products shall foresee the development of a HRL Small Woody Features and Phenology.

The pan-European component shall maintain and update the Corine Land Cover (CLC) dataset in a 6 yearly cycle to the reference year 2012 and 2018. This shall include the production of land cover and land use change information. CLC shall be a key input dataset required for the calculation of the EEA Core Set of Indicators (CSI) and a baseline information source for ample thematic environmental reports.

From 2018 onwards, a new generation CLC product shall be introduced in parallel, building upon the object based concept as elaborated by the Eionet Action Group on Land cover in Europe (EAGLE). The new Land Cover product shall address evolving user requirements as set forward by the Land Use Land Use Change and Forestry (LULUCF) monitoring.

The local component shall provide specific and more detailed land cover and land use information that is complementary to the information obtained through the Pan-European component. Its focus shall be on specific areas of interest or 'hotspots' which are prone to specific environmental challenges. Urban Atlas (UA) product shall include third dimension information over downtown areas. The UA shall fulfil requirements in support of the Union regional and urban policies, as well as for the elaboration of the series of reports on economic, social and territorial cohesion in the Union.

The local component shall focus on the mapping and monitoring on a regular basis of environmental sensitive areas updating the riparian zones in view of action 5 of the Union Biodiversity Strategy to 2020.

Support to and assessment of the Natura 2000 Community policy instrument shall be at the heart of monitoring changes in LC/LU in selected Natura 2000 sites, including potential surrounding threats from a land use perspective.

Evolution of the local component shall provide for the development of coastal zone monitoring product (in collaboration with the Copernicus Marine Environment Monitoring Service). A snow and ice service shall explore economies of scale in cooperation with existing snow and ice services at Member State level.

3. SERVICE ARCHITECTURE

The Land service shall be organized in the following two main components: The Global Land Component and the European Land Component.

(1) The Global Land component shall include three elements.

(a) Systematic Monitoring shall deliver systematically and in near real time bio-geophysical terrestrial variables which are of high priority for ensuring the support to EU policies. The activity shall produce a set of biophysical variables relevant for crop monitoring, crop production forecast, carbon budget, biodiversity, water availability and quality, snow and climate change monitoring at worldwide level, as well as additional biophysical variables relevant for environmental monitoring purposes at the global and continental scale. The Global Land component shall deliver mainly mid-resolution (300 m) products with nevertheless specific products at higher resolution, such as the 100 m resolution dynamic land-cover taking advantage of satellite capacities and Sentinel data availability. The Global Land systematic monitoring activity shall offer a complete Earth coverage compared to the targeted and precise coverage of the Pan-EU and local activities. The quality of the variables shall be constantly monitored and a specific attention shall be paid to the constitution of a consistent time series which are of crucial importance for many monitoring and early warning applications.

(b) Hot Spot Monitoring shall provide detailed high and very high resolution land cover and thematic reference information on specific areas of interest for EU outside the European Union territory, particularly in the domain of the sustainable management of natural resources. The activity shall deal with the land cover and land cover change mapping of protected areas and key landscape areas in Africa, and for rural development in Asia. The activity shall support the forest monitoring including Reducing Emission from Deforestation and forest Degradation (REDD) process. The list of areas of interest to be monitored and mapped is defined in collaboration with EU Services and EU Delegations following field activities currently carried out in this context and in partnership with relevant programs/institutions. Tailored land cover and land cover change maps will be produced on protected areas and their surroundings, to support biodiversity strategy and development activities, and on areas of interest for REDD+ process.

(c) Analysis Ready Data (ARD): ARD will facilitate the uptake of Sentinel 2, supporting user communities such as Forest REDD+ and Agriculture, or environmental assessment with specific variables. The activity shall offer the whole archive of Sentinel 2 level 3 data. The provision of mosaic of Sentinel 1 data can be released on demand.

(2) The European Land monitoring shall include two components.

(a) Pan-European Land component: shall provide a portfolio of services, ranging from image mosaics, over land cover and land cover change mapping to mapping of complementary thematic land cover characteristics. A first set of tasks of the pan-European component shall address the post-processing of space data, and the production of pan-European mosaics of ortho-rectified images, and intermediate products such as biophysical variables. A second set of tasks shall update and improve the High Resolution Layers (HRLs) on LC characteristics. HRLs shall be updated in a 3-yearly cycle. As a third set of tasks, Corine Land Cover (CLC) time series will be further maintained and updated. CLC shall be a flagship product of the land monitoring service, and shall be updated every six years.

(b) The Local Land component shall provide more detailed land cover and land use information complementary to the pan-European component on specific areas of interest, so called 'hotspots'. The component shall cover and focus on the mapping and change analysis of larger urban areas following the Urban Atlas exercises of 2006 and 2012 (with now a 5 yearly update cycle). The local land component shall map and monitor environmental sensitive areas, updating the Riparian Zones work on a regular base. The Riparian Zones service shall provide crucial information for the monitoring and assessment of ecosystem functioning and biodiversity monitoring,

as defined by the MAES framework. Land cover change products shall be also provided in this context. Furthermore similar work shall be done to monitor changes in Natura 2000 sites and potential surrounding threats from a land use perspective. The Coastal Zone monitoring shall address, in cooperation with the Copernicus Marine Environment Monitoring Service the specifics of the coastal strip as a hotspot of extreme complexity, gradients, dynamics, pressures and societal risks.

4. TECHNICAL SERVICE PORTFOLIO

The Copernicus Global Land component, with the Systematic Monitoring element, shall provide a set of global biophysical variables describing systematically the state and the evolution of the vegetation and soils, the energy budget at the surface and the water cycle. The Vegetation product family shall include the following variables:

(a) Normalized Difference Vegetation Index (NDVI);

(b) Leaf Area Index (LAI);

(c) Fraction of absorbed photosynthetically active radiation (FaPar);

(d) Fraction of Vegetation Cover (Fcover);

(e) Vegetation Condition Index (VCI);

(f) Vegetation Productivity Index (VPI);

(g) Greenness Evolution Index (GEI);

(h) Dry Matter Productivity (DMP);

(i) Phenology metrics (PHENO);

(j) Evapotranspiration (ET);

(k) Radiation fluxes;

(l) Global Land Cover (GLC);

(m) Burnt areas (BA).

The Energy budget product family shall include:

(a) Top of Canopy Reflectance(ToC-R);

(b) Surface Albedo (SA);

(c) Land Surface Temperature (LST).

The Water product family shall include:

(a) Surface Soil Moisture (SSM);

(b) Soil water Index (SWI);

(c) Water bodies (WB).

The Cryosphere product family shall include:

(a) Snow extent (SE);

(b) Snow water equivalent (SWE).

The Lake related product family shall include:

(a) Lake ice coverage;

(b) Lake surface water temperature;

(c) Lake and river water level;

(d) Lake surface reflectance;

(e) Lake turbidity;

(f) Lake trophic state.

The Hot Spot related product family shall be based on high and very high resolution images, from approximately 1 to 30 meters spatial resolution, with a change assessment frequency between 1 to 20 years, acquired for areas of interest.

The pan-European component shall produce satellite image mosaics, land cover/land use (LC/LU) information in the Corine Land Cover data, and the High Resolution Layers.

(a) The High-Resolution and Very High Resolution Image Mosaics shall be seamless pan-European ortho-rectified raster mosaics based on satellite imagery covering 39 countries.

(b) The Corine Land Cover shall be provided on a regular basis. The time-series shall also include a change layer, highlighting changes in land cover and land-use.

(c) CLC+ shall provide the next generation CLC product, reducing the Minimum Mapping Unit to +/– 0,5 ha, and applying a data model built upon the EAGLE concept.

(d) The high-resolution layers (HRL) shall be raster-based datasets which provide information about different land cover characteristics that is complementary to land-cover mapping datasets. HRLs shall provide some of the main land cover characteristics: impervious (sealed) surfaces; forest areas (tree cover, crown closure density and leaf type); grasslands; wetness and water bodies; small woody features.

The local component shall provide specific and more detailed information that is complementary to the information obtained through the Pan-European component. The local component shall focus on different types of hotspots, i.e. areas that are prone to specific environmental challenges and problems. It shall be based on very high resolution imagery (2,5 × 2,5 m pixels) in combination with other available datasets (high and medium resolution images) covering the pan-European area.

Local component products shall comprise:

(a) Urban Atlas shall provide pan-European comparable land use and land cover data (including the third dimension) covering a number of Functional Urban Areas (FUA).

(b) Riparian Zones shall address land cover and land use in areas along rivers.

(c) The Natura 2000 (N2K) sites.

## 5. DATA NEEDS

### 5.1. **Satellites-Based Observation**

The satellite data necessary for product development shall be provided by the European Space Agency (ESA) in the context of the Copernicus satellite image Data Ware House (DWH). The following list of data sensors shall be considered: High resolution and very high resolution optical sensors in the Visible near infrared (VNIR) domain, complemented with High Resolution SAR sensors and Medium Resolution optical sensors in the Short wave infrared (SWIR) domain.

The Global Land systematic monitoring of the Earth shall be based on spectro-radiometer, microwave radiometer, altimeter and synthetic aperture radar satellite data spatial and temporal composites. Polar Orbiting and Geostationary satellites shall be used in the production and shall deliver their data in near real time in order to provide the variables to the users, less than three days after each 10 days period. To ensure the continuity of the observations and the availability of long time series, several sensors shall be combined Inter-calibrated data shall be requested.

The land cover and land use mapping elements of the Local, Pan-European and Global components shall be based on High Resolution and Very High Resolution spectro-radiometer and synthetic aperture radar satellite data. Historical data shall be also required for change analysis. The Pan-European mapping shall be based on a complete multi-temporal EU39 coverage. Sentinel 1 and 2 shall be operationally integrated in the process. They shall be complemented with VHR resolution satellite data for specific applications and for validation purposes.

5.2. **In-Situ Observations**

Copernicus land services shall use in situ data for calibration and validation activities.

*ANNEX V*

**THE TECHNICAL SPECIFICATIONS FOR THE COPERNICUS CLIMATE CHANGE SERVICE**

1. SCOPE

The Copernicus Climate Change Service (C3S) shall combine observations and models of the climate system with the latest science to develop authoritative, quality-assured information about the past, current and future states of the climate in Europe and worldwide.

The C3S shall achieve the following objectives:

(a) to document the past and current state of climate (based on observations and re-analysis);

(b) to generate 6-months seasonal forecasts (using a multi-model ensemble approach);

(c) to deliver climate projections (based on various scenarios).

The service shall provide access to several climate indicators and climate indices for both the identified climate drivers and the expected climate impacts.

The service shall aim to provide information that will help societal and business sectors to improve decision-making and planning regarding climate mitigation and adaptation. The service shall take into account relevant actions in the European Union's Research and Innovation Framework Programme (Horizon 2020), of existing facilities at national level and –where possible- shall contribute to the priorities of the Global Framework for Climate Services (GFCS) of the World Meteorological Organization (WMO).

2. USER REQUIREMENTS AND MAIN DOMAINS OF APPLICATIONS

The C3 Service shall primarily serve European policy makers, national/regional climate service providers and intermediaries serving national governments. C3S shall provide climate change information at global and European scales complemented by locally tailored information provided by national and regional climate service providers. The C3 Service shall be a European hub for promoting consistency and best practices, and providing common baseline information and training capability to facilitate understanding across and within the Member States. Last but not least, C3S shall facilitate the use by national climate services of its infrastructure, including climate datasets, guidance, expertise and tools.

3. SERVICE ARCHITECTURE

The C3 service infrastructure shall be designed to serve all service elements by providing shared datasets, interoperable systems and tools, computing facilities, web and data services. The C3S infrastructure shall facilitate sharing of resources and best practices with other Copernicus services, shall be distributed over multiple data providers and shall reuse as much existing infrastructure and software as possible.

The proposed architecture for the C3S shall be articulated around four complementary pillars:

(a) Climate Data Store (CDS) shall contain essential climate information for fulfilling the downstream requirements. The CDS shall be designed and built to include series of geophysical climate variables, most being listed as Essential Climate Variables (ECVs) or Thematic Climate Data Records (TCDR), seasonal forecasts, climate projections as well climate indicators for various sectors.

(b) Sectoral Information System (SIS) shall deliver information and bespoke analysis tailored to the needs of end users and customers of the service for various EU sectoral policies. The SIS shall be supplied primarily by data and geophysical products available from the CDS and complemented, where appropriate, by ancillary datasets needed to address, for instance, sector specific climate impacts at European scales. The SIS shall be designed to support the main European sectoral policies concerned with climate change.

(c) Evaluation and Quality Control (EQC) function shall be a multi-task Evaluation and Quality Control (EQC) function that will assess the technical and scientific quality of the service including the value to users. The EQC function shall be the natural vehicle that will trigger actions to improve the Service and interface with external reviews possibly conducted by the Commission.

(d) Outreach and Dissemination (O&D) platform shall be designed to ensure a timely and efficient dissemination of information to the European Institutions, public authorities and general public (as appropriate) using all modern communication tools. This component shall also interface with other institutions worldwide in charge of monitoring and reporting on climate change and related questions.

4. TECHNICAL SERVICE PORTFOLIO

The Climate Change Service shall combine observations and various categories of models of the climate system with the latest science to develop authoritative, quality-assured information about the past, current and future states of the climate in Europe and worldwide.

The Climate Data Store shall contain the geophysical information needed to analyse the climate change indicators in a consistent and harmonised way. The CDS shall provide consistent estimates of ECVs, climate indicators and other relevant information about the past, present and future evolution of the coupled climate system, on global, continental, and regional scales.

The core of the CDS shall comprise four categories.

(1) *Climate observations*

This service element shall contribute to building and providing access to comprehensive, long-term datasets providing information on a range of ECVs (Surface Air Temperature, Surface Precipitation, Water Vapour, Surface Radiation Budget, Earth Radiation Budget, Carbon Dioxide, Methane, Ozone, Aerosol, Cloud Properties, Wind speed and direction, Ocean Colour, sea Ice, Sea level, Sea Surface Temperature, Global Ocean Heat Content, Snow Cover, Glaciers and Ice Caps, Albedo, Fraction of Absorbed Photosynthetically Active Radiation, Fire Disturbance, Ice Sheets). It shall address in particular the multiple ECV datasets that are directly derived from Earth Observation historical data records and not generated by reanalyses and model simulations.

(2) *Climate reanalyses*

This component shall provide resources for technical development, production, monitoring, evaluation and delivery of the following:

(a) the following global climate reanalysis datasets and products:

  (1) an atmospheric reanalysis covering a minimum of 30 years designed for near real time (less than 5 days) monitoring of the climate system based on the comprehensive global observing system, including in-situ and satellite observations;

  (2) extended (> 100 year) reanalyses of the coupled climate system;

  (3) derived high-resolution global reanalyses of the ocean and land surface Meteorological information from atmospheric reanalyses shall be used to derive consistent estimates of terrestrial and ocean ECVs at high spatial resolution (initially 16 km);

(b) regional climate reanalysis datasets and products.

Reanalyses shall be produced by assimilating high-quality climate observations in a coupled atmosphere/land/ocean/sea-ice model compatible with the ECMWF Seasonal Prediction System. Regional reanalysis shall use of high-resolution observations and shall provide data products at higher resolution for the European region than global reanalyses. A refresh cycle of approximately five years shall be established to benefit from all inputs contributing to the generation of regional reanalyses.

(3) *Climate projections*

This component of the service element shall provide support for integration of European contributions to state-of-the-art climate projections at global and regional level. These data, which currently reside on the ESGF (Earth System Grid Federation), shall be accessible in an operational way. This service element shall also support the development of multi-model climate products and indicators, both generic and sector-specific. A similar support shall be provided to integrate the high resolution regional projection scenarios, with associated development of climate indicators.

(4) *Seasonal forecasts*

This component shall provide resources for producing high-quality well-calibrated multi-model ensemble products, and to ensure open access to seasonal forecast data. It shall achieve this by supporting regular re-forecasting activities at several European provider sites, at a resolution and frequency that would not be attainable without such support. It shall also provide, once a month, a set of multi-model products using these re-forecasts and the Centres' production forecasts.

5. DATA NEEDS

The Service shall build upon and complement capabilities existing at national level and being developed through a number of climate-change research initiatives.

The Service shall provide comprehensive climate information covering a wide range of components of the Earth-system (atmosphere, land, ocean, sea-ice and carbon) and timescales spanning decades to centuries. It shall maximise the use of past, current and future earth observations (from in-situ and satellite observing systems) in conjunction with modelling, supercomputing and networking capabilities. This conjunction shall produce a consistent, comprehensive and credible description of the past, current and future climate.

5.1. **Satellites-Based Observations**

C3S shall use operational and past satellite-based instruments to provide products for climatology, reanalysis and validation purposes.

The C3S shall use the following types of data:

(a) radiometer and spectrometer data acquired in the domain covering the infrared to the microwave wavelengths to measure brightness temperature and then derive several geophysical parameters (wind vector, ozone, surface temperature);

(b) GPS-radio occultation data to derive information on the atmosphere's temperature, pressure and water vapour content;

(c) scatterometer data to measure near-surface wind speed and direction;

(d) altimeter data to derive ocean wave height.

The service shall be also supported by data and products from the Sentinel satellites.

5.2. **In-situ Observations**

The C3S shall not operate in situ observing systems but shall collect observations from data providers. It shall utilize existing European and international infrastructures. C3S shall not support financially the acquisition of data itself, but only activities allowing their processing (quality control, format and dissemination aspects) to meet operational requirements.

Several observation types (surface pressure, temperature, wind, humidity, wind profiles) shall be collected from land stations, drifting buoys, radiosondes, ships and aircrafts.

*ANNEX VI*

**THE TECHNICAL SPECIFICATIONS FOR THE COPERNICUS EMERGENCY MANAGEMENT SERVICE**

1. SCOPE

The Copernicus Emergency Management Service (CEMS) shall provide all authorised actors throughout the world involved in the management of natural disasters, man-made emergency situations, and humanitarian crises with timely and accurate geo-spatial information derived from satellite remote sensing and completed by available in situ or open data sources.

The service shall provide maps and analyses based on satellite imagery (before, during or after a crisis) as well as early warning services for drought, flood and fire risks. The service shall support crisis managers, civil protection authorities and humanitarian aid actors dealing with natural and man-made disasters, humanitarian crises, as well as those involved in recovery, disaster risk reduction and preparedness activities.

2. USER REQUIREMENTS AND MAIN DOMAINS OF APPLICATION

The Copernicus Emergency Management Service (CEMS) shall offer a range of benefits to users in the fields of emergency response, crisis management, humanitarian aid, and disaster risk reduction, preparedness, and prevention and provides useful and timely information mainly to civil protection authorities and humanitarian aid agencies.

3. SERVICE ARCHITECTURE

CEMS shall be based on two components: the mapping service and the early warning systems.

(1) *The Mapping Component*

The Mapping Component shall support all phases of the emergency management cycle: preparedness, prevention, disaster risk reduction, emergency response and recovery. The CEMS Mapping service shall operate in rush mode for emergency management activities which require immediate response or non-rush mode, to support emergency management activities not related to immediate response.

The service shall be provided in two modules.

(a) Rapid mapping (RM) shall provide high-speed service delivery in the midst of or immediately after catastrophic events or humanitarian crises, and is available 24/7/365. This service shall deliver maps (and analyses) within hours or days, immediately following a catastrophic event. The service shall be based on the rapid acquisition, processing and analysis of satellite imagery and other geo-spatial data, and provides users with products in the form of maps and brief analyses.

(b) Risk & recovery mapping (RRM) shall be designed for pre- or post-crisis situations in support of recovery, disaster risk reduction, prevention, and preparedness activities. RRM shall deliver maps (and analyses) within weeks or months, in support of activities dealing with the recovery, disaster risk reduction, prevention, and preparedness phases. Information for different hazards on the exposure, vulnerability and resilience of people and buildings can be requested.

A dedicated validation component shall be used for the independent verification of a sample of service outputs produced by the RM and RRM modules, with the aim of continuously improving the quality of the service.

(2) *The early warning component shall deliver alerts and risk assessments of floods, forest fires and droughts.*

The service shall be based on three main modules.

(a) The European Flood Awareness System (EFAS) providing flood probability forecasts for all European rivers. EFAS shall provide added-value early flood forecasting products and unique overview products of ongoing and forecasted floods in Europe more than 3 days in advance.

(b) The European Forest Fire Information System (EFFIS) shall be a web-based geographic information system that provides fire danger forecasts up to 10 days in advance and near real-time and historical information on forest fires and their regimes in the European, Middle East and North Africa regions. Fire monitoring in EFFIS shall encompass the full fire cycle and the service shall provide information both on pre-fire conditions and post-fire damages. EFFIS shall be extended towards a Global Wildfire Information System (GWIS).

(c) The European Drought Observatory (EDO) shall be streamlined with other Copernicus EMS early warning modules. It shall use data from the meteorological data collection for EFAS and EFFIS and the outputs of the EFAS distributed hydrological model in terms of soil moisture and river flows. These products shall be then further processed into drought-relevant indicators and combined with satellite-based indicators on vegetation condition. The Global Drought Observatory (GDO) shall provide sector specific indicators of drought impact across the globe as well as targeted analysis reports for on-going droughts.

3.1. **Product Dissemination**

The information produced by the Copernicus Emergency Management Service shall be available to the public on a full, open and free of-charge basis via its dedicated public web portal. Under exceptional circumstances, dissemination restrictions may be imposed for security reasons or the protection of third party rights.

For mapping products, the ERCC shall perform a sensitivity check and, if cleared, the products will be made available on the CEMS portal. If the activation and the products are deemed sensitive however, the service provider shall notify the authorised user by email about the availability of the products on the secure file transfer (sftp) server (password restricted).

4. TECHNICAL SERVICE PORTFOLIO

(1) *CEMS — Rapid Mapping products*

The user shall have a choice between three different map types.

(a) Reference maps shall provide a quick updated knowledge on the territory and assets using data prior to the disaster. The content shall consist of selected topographic features on the affected area, in particular exposed assets and other available information that can assist the users in their specific crisis management tasks.

(b) Delineation maps shall provide an assessment of the event extent (and of its evolution if requested). Delineation maps shall be derived from satellite post-disaster images. They vary depending on the disaster type and the delineation of the areas impacted by the disaster.

(c) Grading maps shall provide an assessment of the damage grade (and of its evolution if requested). Grading maps shall be derived from post-event satellite images. Grading maps shall include the extent, magnitude or damage grades specific to each disaster type. They may also provide relevant and up-to-date information that is specific to affected population and assets.

(2) *CEMS – Risk and Recovering Mapping Products*

This service shall consist of the on-demand provision of geospatial information. This information shall support emergency management activities not related to the immediate response phase. The shall be able to request products in two ways: choosing from a pre-defined set of detailed topographic features (in particular regarding infrastructures) and disaster risk information (hazard, exposure, risk) or describing in free text the information needs specific to the given situation and type of product wanted.

The following product categories shall be available:

(a) reference maps providing a comprehensive and updated knowledge of the territory and relevant assets in a disaster risk reduction context;

(b) pre-disaster situation maps providing relevant and up-to-date thematic information that can help planning for contingencies on areas vulnerable to hazards, aiming to minimise loss of life and damage;

(c) post-disaster situation maps providing relevant and up-to-date thematic information for the needs of reconstruction planning and progress monitoring, mapping long-term impact.

Maps referred to in points a, b and c shall be updated frequently.

The maps shall contain the following information:

(a) topographic features on areas vulnerable to hazards, in particular regarding infrastructures;

(b) disaster risk information;

(c) other available information that can assist users in their specific crisis managements planning activities, such as providing protection from potential disasters, including engineering and other protective measures, taking legislative measures, awareness raising campaign.

(3) *CEMS – EFAS*

EFAS shall provide complementary, early warning flood information to National/Regional Hydrological Services and to the European Response and Coordination Centre (ERCC). EFAS shall include the following modules providing data up to 10 days in advance:

(a) Flood Forecasting: providing early warning information on a Pan-European and Global level;

(b) Flood Warning providing information including warnings such as Flash flood warnings;

(c) Flood Monitoring: monitoring ongoing floods.

(4) *CEMS – EFFIS*

EFFIS shall support the protection of forests against fires in the Union by providing four modules from pre-fire to post-fire phases.

(a) Fire Danger Assessment: Providing Pan-European and Global data supporting fire prevention and preparedness. Daily maps of 1 to 6 days projected fire danger level in EU using weather forecast data. The module shall be active from 1st of March to 31st of October;

(b) Active Fire Mapping: Providing Pan-European and Global data supporting firefighting. Daily maps of active fires providing a synoptic view of current fires in the world;

(c) Rapid Damage Assessment: Providing Pan-European post-fire evaluation data. Daily update of the perimeters of burnt areas in Europe for fires of about 40 ha or larger;

(d) Weekly Damage Assessment: Providing Pan-European post-fire evaluation data. Weekly update of the perimeters of burnt areas in Europe.

(5) *CEMS — European Drought Observatory (EDO)*

EDO shall provide four modules for communicating water scarcity and drought.

(a) Monitoring and mapping module: allowing the visualisation of the spatial and temporal evolution of droughts using different indicators for rainfall, snow pack, temperature, soil moisture, groundwater, river flow, and vegetation health. Indicators shall be calculated from in-situ measurements (meteorological data, groundwater), model outputs (soil moisture, river flow), and satellite data (vegetation stress, soil moisture, land surface temperatures). Selected indicators shall be combined into alert levels for agriculture and ecosystem impacts;

(b) Forecasting module: providing forecasts of selected drought indicators;

(c) Data analysis module: allowing analyses and comparisons of temporal profiles of available indicators, their spatial comparison, and their aggregation to administrative units;

(d) Analytical reports for significant drought events, analysing their extent and severity, as well as the potential impacts.

5. DATA NEEDS

5.1. **Satellite –Based and In-Situ Observation**

The majority of the geospatial information provided by the mapping component of the Copernicus Emergency Management Service (CEMS) shall be derived from satellite remote sensing data and completed by available in situ or open data sources. The satellite imagery shall be provided through the Copernicus Contributing missions (CCMs) as well as Sentinel 1 and 2 observations ensuring the whole range of observational requirements needed. In-situ data for the mapping component shall be provided through open source and/or data made available by the national mapping and cadaster agencies (NMCA) in line with a bilateral agreement between NMCA's and the EEA.

The early warning component of CEMS shall use of all the available imagery from the Sentinels satellites, currently Sentinel-1 and Sentinel -2 (forest fire) and Sentinel 3. Due to the need of high frequency data acquisition for its near-real time assessment of fire damages, use is also made of other sensors such as MODIS and VIIRS for medium spatial resolution and a suit of high-spatial resolution imagery from Landsat, SPOT and IRS satellites, among other. Variables such as snow water equivalent and soil moisture which are used in the floods early warning component shall be derived from sensors on board the Metop and DMSP satellites.

In situ data shall include airborne (such as aircraft and UAV) observations. For the early warning component the in situ component shall comprehend hydro-meteorological observations from the relevant national and regional authorities.

*ANNEX VII*

**THE TECHNICAL SPECIFICATIONS FOR THE COPERNICUS SECURITY SERVICE**

OBJECTIVES AND SCOPE OF THE COPERNICUS SECURITY SERVICE

The Copernicus security service are designed to ensure the provision of relevant and adequate data and information to enable the Union to respond to civil security challenges, and improve crisis prevention, preparedness and response capacities, in particular through enhanced border and maritime surveillance, and Copernicus support for the Union's external action. The Copernicus security service shall be structured in the following components:

(a) border surveillance component, operated under delegation by Frontex as an entrusted entity;

(b) maritime surveillance component, operated under delegation by EMSA as an entrusted entity;

(c) support to Union External Action component, operated under delegation by SATCEN as an entrusted entity.

The integration of the different observational capacities of the three Entrusted entities shall result in a synchronized range of products, developed at a minimum cost, as allowed by the operational synergies.

PART I

**Border surveillance component of the Copernicus Security Service**

1. SCOPE

The border surveillance element of the Copernicus security service shall be designed to provide increased situational awareness assisting response to security challenges at the Union external border through detection and monitoring of cross-border security threats, risk assessment and early warning systems, mapping and monitoring.

2. USER REQUIREMENTS AND MAIN DOMAINS OF APPLICATION

In response to the collected user requirements, the Border surveillance component shall provide services in the following topical domains, grouping data and/or information products according to their main application area:

(a) Land services (S1, S2, S3) shall be based on satellite imagery and include analysis of ports, coasts, beaches and border crossing points, require human interpretation by specialists;

(b) Maritime services (S4, S5, S6, S7) shall be based on ship reporting systems and ship detection in satellite imagery and shall be semi-automated;

(c) Environmental service (S8) shall provide analysis of environmental variables, including terrain information and weather conditions.

3. SERVICE ARCHITECTURE

The Border Surveillance component shall be divided in the following activity areas:

(a) Overall management of the delegated activities, including procurement, contract management, and reporting;

(b) Service management, including definition of needs, acquisition, quality assurance, and delivery of border surveillance services;

(c) Service evolution based on the evolving service needs of the users (border control authorities and Frontex);

(d) User up-taking and training, including all the necessary activities to train users as well as assessment of the usage level of each of the delivered services.

The Copernicus border surveillance services shall be deployed within the framework of the Frontex fusion services already in place in the Agency.

The following activities shall be mostly handled by Frontex, with support from contractors when required and include:

(a) Day to day operations and relations with users;

(b) Planning, ordering, acquisition and billing of products (EO and non-EO products);

(c) IT operations management, including incident and problem management;

(d) Quality assurance of products delivered;

(e) Implementing corrections and upgrades to the services;

(f) Monitoring of service delivery.

In support to the activities above, Frontex shall have Service Level Agreements with EUSC and EMSA, partly funded by Copernicus, for analysis of land and maritime areas, respectively.

The implementation of proof of concept and pre-operational projects can be used to test and validate new user requirements.

4. TECHNICAL SERVICE PORTFOLIO

The specific activations of the Copernicus service for the purposes of the border surveillance shall be determined by Frontex on the basis of their own risk assessment of the current situation. Border surveillance shall consist of the following services:

(a) (S1) Coastal monitoring — The Copernicus products developed in the domain of coastal monitoring shall consist of punctual and ad-hoc imagery analysis reports, vectorised data and imagery of coastal strips (beaches and ports) identified through risk analysis to support the operational assessment of irregular migration and cross-border crime related activities;

(b) (S2) Pre-frontier monitoring — Punctual and ad-hoc imagery analysis reports, vectorised data and imagery of the pre-frontier area identified through risk analysis to support the operational assessment of irregular migration and cross-border crime related activities;

(c) (S3) Reference Imagery/Mapping — The Copernicus products developed in terms of Reference Imagery/Mapping are based on VHR satellite imagery and vectorised data covering specific third country areas identified through risk analysis;

(d) (S4) Maritime Surveillance of an Area of Interest — The Copernicus products developed in the domain of maritime surveillance of an area of interest shall comprise Identity and track of Vessels of Interest using Earth Observation data combined with In-Situ Data provided by open source, and by platforms and sensors;

(e) (S5) Vessel Detection Service — The Copernicus products developed within the framework of the Vessel Detection Service shall comprise satellite based vessel detection (SAR) and identification (optical) correlated with collaborative systems (AIS, LRIT);

(f) (S6) Vessel Tracking and Reporting Service — The Copernicus products developed within the framework of the Vessel Tracking and Reporting Service shall comprise combined terrestrial/satellite AIS, LRIT and VMS feed;

(g) (S7) Vessel Anomaly Detection Service — The Copernicus products developed within the framework of the Vessel Anomaly Detection Service shall comprise alerts generated automatically when suspicious behaviour is detected;

(h) (S8) Environmental Assessment for Risk Analysis — The Copernicus products in the domain of Environmental Assessment for Risk Analysis shall comprise environmental information (current and forecasted weather conditions and state of the sea) to support operational planning, decision making processes, and satellite acquisition planning;

(i) (S9) Large Area Environmental Assessment for Risk Analysis — The service shall be delivered ‘on demand’ and can be requested through the Eurosur Fusion Services; it shall be delivered through imagery analysis based on monitoring of specific areas using both archive and new imagery;

(j) (S10) Earth Observation (EO) Recon service — The service shall be delivered 'on demand' and can be requested by the NCCs through the Eurosur Fusion Services; the Earth Observation (EO) Recon service shall deliver an initial assessment and identification of specific areas and objectives of interest within large areas; the identified areas and objects shall be validated by the requestor and, if required, further analysed with regular monitoring services;

(k) (S11) Migratory and Cross-Border Crime networks Assessment — The service shall be delivered 'on demand' and can be requested by the NCCs through the Eurosur Fusion Services; this service shall provide a socioeconomic baseline and initial analysis on a specific area, activity and/or an organized criminal group associated with irregular migration or cross-border crime activities. It shall be based on multiple sources.

5. DATA NEEDS

To deliver border surveillance intelligence, Frontex shall collect data from a broad range of sources and shall generate added value through its data fusion service.

The service shall use the following data inputs:

(a) satellite imagery (both optical and radar imagery);

(b) data from specialized Vessel Detection Systems;

(c) meteorological information;

(d) intelligence information.

PART II

## Maritime surveillance component of the Copernicus Security Service

1. SCOPE

The Maritime Surveillance component of the Copernicus security service shall be designed to improve the crisis prevention, preparedness and response capacities of the Union through enhanced maritime surveillance relying on the use of Copernicus data and information for better detection and monitoring of trans-regional security threats, risk assessment and early warning systems, mapping and monitoring of maritime areas.

2. USER REQUIREMENTS AND MAIN DOMAINS OF APPLICATION

The Maritime Surveillance component shall respond to the monitoring requirements of the following user communities:

(a) fisheries control;

(b) maritime security and safety;

(c) customs and law enforcement;

(d) defence.

3. SERVICE ARCHITECTURE

The Copernicus Maritime Surveillance services shall rely on the architecture in place in EMSA, to combine different service elements, including Earth Observation, and shall deliver services tailored to different user communities. These services elements shall be divided in service inputs and service modules.

Service inputs shall consist of the following categories:

(a) earth observation;

(b) specific maritime domain awareness (MDA).

The service modules shall consist of the following modules:

(a) generic service modules;

(b) integration service modules.

The combination of service inputs with the appropriate capabilities (modules) shall allow the delivery of tailor-made, cost efficient, services to the full range of authorized user communities.

EMSA shall be intrusted with the following specific tasks:

(a) overall management of the delegated activities;

(b) management and administrative, which includes procurement, contract management and reporting and quality assurance;

(c) service development, which includes service design, testing and deployment;

(d) service operation, which include day to day operations, incident and problem management, and continual service improvement. Service operation includes all the activities linked with planning, ordering and validation of satellite products;

(e) user up-taking and training, which includes all the necessary activities to train users as well as assessment of the usage level of each of the delivered services.

Additionally to these activities, but linked with service delivery, shall be the implementation of proof of concept and pre-operational projects, that can be used to test and validate new user requirements in a specific field.

4. TECHNICAL SERVICE PORTFOLIO

The products delivered within the framework of the Maritime surveillance component of the Copernicus Security Service shall comprise the following services.

(1) *Fishery control services*

Illegal fishing activities can compromise the implementation of management plans and undermine the rational exploitation of the fishery resources. these services shall take into account the following types of requirements:

(a) monitoring of fishing grounds;

(b) monitoring of fishing ports to survey and control the departing or landing of fishing vessels.

(2) *Maritime safety and security services*

The maritime safety and security services shall respond to two main categories of user needs.

(a) Search and rescue. Search and Rescue (S&R) is the search for and provision of lifesaving assistance to people in distress and imminent danger of loss of life. S&R activities shall include remote area operations, rescues at sea, and the need for specialist S&R facilities not normally available to emergency services. A S&R service shall include rapid tasking of satellite resources, deployment of UAVs for wide area monitoring and visualization of the position, and respective search pattern, of S&R assets for better coordination of operations.

(b) Ship safety. The service shall consist of the search for and provision of enhanced maritime traffic picture using EO products. It shall have a global scope, with additional focus on remote areas and specifically in the Polar Regions.

(3) *Customs services*

Customs services shall ensure that cooperative data is used to track ships and correlate trajectories and port arrivals with already existing systems' information for a number of purposes.

Monitoring of criminal trafficking of goods shall focus on expanding the maritime domain awareness picture and cross checking information with base registries, vessel related information and reporting data. The service shall support specific operations/interventions where rapid tasking and monitoring are an important requirement. The implementation activities shall include monitoring of third country ports and beaches for departure of specific ships, as well as the detection of abnormal behaviour.

(4) *Law enforcement services*

Law enforcement services shall focus on expanding the maritime domain awareness picture based on the existing civilian resources and capabilities, and enacting further integration of information. It shall be based on the modalities of rapid tasking and monitoring of specific operations.

(5) *Marine environment services*

Marine environment services shall comprise the CleanSeaNet activities. They shall offer assistance to participating States for the following activities:

(a) identifying and tracing oil pollution on the sea surface;

(b) monitoring accidental pollution during emergencies;

(c) contributing to the identification of polluters.

5. DATA NEEDS

The Copernicus Maritime Surveillance services shall comprehend both Copernicus and non-Copernicus data, as input for providing the products.

(1) EO data and derived products, from:

(a) SAR imagery;

(b) optical imagery;

(c) satellite video.

(2) Non-EO data and value adding products

(a) remotely piloted aircraft systems (RPAS);

(b) satellite AIS (SAT-AIS);

(c) ship reporting systems in accordance with their respective legal bases;

(d) vessel related information (from vessel databases).

(3) In-situ data from other sources — Sensors mounted on any vehicle, vessel or other craft.

PART III

## Support for the Union's External Action component of the Copernicus Security Service

1. SCOPE

The SEA service establishment shall be premised on the hypothesis for close cooperation with the Copernicus Emergency Management Service. The coordination between SEA and EMS shall be based to the following principles:

(a) the integration of the SEA and EMS portfolios needs to take into account the needs of both user communities;

(b) the services' coordination must not compromise the speediness, specificities or quality of the respective service portfolios and the sensitivity of the request;

(c) the coordination must aim at potential cost savings by sharing resources.

2. USER REQUIREMENTS AND MAIN DOMAINS OF APPLICATION

The service shall cover the following main domains:

(a) Crisis Information;

(b) Crisis Prevention and Preparedness;

(c) briefing notes and activity analysis.

The SEA service products shall be available only to the following authorized users:

(a) the European External Action Service (EEAS crisis management structures; EU Delegations, EEAS Regional desks)

(b) the CSDP Missions and Operations

(c) the following Commission services

(1) DG-ECHO;

(2) DG-DEVCO;

(d) the Ministries of Defence, Ministries of Foreign Affairs and Intelligence Centres in Member States.

(e) United Nations

3. SERVICE ARCHITECTURE

The service shall consist of the on-demand provision of geospatial information in support of decision making and operations during a crisis. The service shall be based on the acquisition, processing and analysis of satellite imagery and collateral information.

The products shall be a combination of standardized layers of information that respond to user needs. These layers can be grouped in different output formats, such as Maps, Geospatial Datasets (Vector and Raster data), and/or services accessible via web (web maps). The Users can select products from the SEA portfolio, as well as expressing their specific needs.

The service shall target 24h/7days availability and shall include 'rapid response' service.

The operations of the service shall include:

(a) running the Service Focal Point (SFP) for all SEA activations;

(b) Copernicus help-desk;

(c) product design;

(d) CSCDA data request/handling;

(e) guide contractor in products generation;

(f) in-house analysis and added-value, whenever appropriate, for all activations compliant with SATCEN governance;

(g) products validation and distribution;

(h) coordination with the Copernicus EMS Service;

(i) coordination with other Copernicus services relevant to External Action and CFSP/CSDP users;

(j) dissemination and policy implementation – taking into account user profiles and data sensitivity.

The service operations activities shall implement and operate all the processes for the SEA Service in accordance with the framework defined at Management and Coordination level.

The SEA Service Coordinator (SSC) shall be in charge of the following actions for each activation:

(a) estimate cost for a cost-benefit trade-off or impact assessment;

(b) handling sensitivity issues;

(c) incident and problem management;

(d) monitoring of service delivery.

4. TECHNICAL SERVICE PORTFOLIO

The detailed portfolio of the Copernicus SEA Service shall be composed of the following products.

(1) *Reference Maps:*

Reference Maps shall be high quality cartographic products including a wide range of observable features. The different layers of information shall include basic types such as road network, boundaries, hydrography, terrain, etc. The information contained in the Reference Maps shall support orientation, local navigation, strategic decision making and logistic deployment. Depending on the circumstances, the information layers in the Reference Map may be enriched with specific layer required by the situation.

(2) *Road Network Status Assessment:*

Road Network Status Assessment shall provide users with a map containing different type of information on the status of the road network.

(3) *Conflict Damage Assessment:*

Conflict Damage Assessment shall use change detection in order to provide visual interpretation containing information on distribution of damage in a crisis area. In urban areas, the urban blocks shall be colour-coded to show the intensity of the damage. In dispersed areas, a heat map shall be used to represent the damage, with grading colours to highlight how different sections of each area have been affected.

(4) *Critical Infrastructure Analysis:*

Critical Infrastructure Analysis shall identify the most relevant components of an man made or natural infrastructure considered to be critical, and shall assess their operational status.

(5) *Support to Evacuation Plan:*

Support to Evacuation Plan shall provide geospatial information to support the evacuation of people from crisis areas. The products developed, based on a preliminary analysis performed in accordance with the types of risks associated with a particular location, shall include information such as potential rally points, helicopter landing areas, and evacuation points and routes.

(6) *Non-EU Border Map:*

Non-EU Border Map shall provide users with the possibility of acquiring information specific to support decisions about non-EU border issues.

(7) *Camp Analysis:*

Camp Analysis shall be a product oriented to support decision making regarding displaced population (either internally displaced or refugees). The products shall focus on characterizing the facilities of a camp, identifying dwellings and buildings with other functionalities and eventually providing estimated spans of population.

(8) *Crisis Situation Picture:*

Crisis Situation Picture shall be a product designed for the overall assessment of the severity of a conflict/crisis and its consequences. In order to fulfil this purpose, the product shall be composed of a collection of ancillary information regarding the crisis. The ancillary information found shall be collected, homogenized and prepared in a seamless picture (composed of situation maps and optionally a report).

(9) *Activity Report:*

Activity Report shall be a product focused in providing the user with an analysis of a given human activity. The product shall be very flexible.

5. DATA NEEDS

The service shall require the use of Very High Resolution data.