EUROPEAN
COMMISSION

Brussels, 18.6.2021
C(2021) 4316 final

ANNEX 2

ANNEX

to the

Commission Implementing Decision

on the financing of the Union Space Programme and the adoption of the work programmes 2021 (direct management) and 2021-2027 (indirect management)

Copernicus part of the 2021 (direct management) and 2021-2027 (indirect management) work programmes of the Union Space Programme

Contents

1 Copernicus Objectives 4
1.1 Introduction 4
1.2 Climate and biodiversity mainstreaming 5
2 Multiannual delegated budget and tasks (2021-2027) 8
2.1 Tasks Entrusted to ESA 8
2.2 Tasks Entrusted to EUMETSAT 10
2.3 Tasks Entrusted to the EEA 11
2.4 Tasks Entrusted to Mercator Ocean International 12
2.5 Tasks Entrusted to the ECMWF 14
2.6 Tasks Entrusted to Frontex 16
2.7 Tasks Entrusted to the EMSA 18
2.8 Tasks Entrusted to EU Satellite Centre 19
2.9 Tasks Entrusted to the EUSPA 20
3 Priorities for Copernicus in 2021 20
3.1 Objectives 21
3.2 Financial resources and Participating Countries 22
3.3 Budget breakdown for the year 2021 for actions in direct management 22
4 Implementation of the Work Programme in 2021 23
4.1 Actions in direct management 23
4.1.1 Objective 1: Data acquisition 23
4.1.1.1 LUCAS 2022 campaign 23
4.1.1.2 Reference data provision for Cal/Val activities 23
4.1.2 Objective 2: Services Provision 24
4.1.2.1 Land Monitoring Service 24
4.1.2.2 Emergency Management Service 26
4.1.2.3 External independent expertise 31
4.1.2.4 Performance studies and support 32
4.1.2.5 Support to the Global Climate Observing System Secretariat 32
4.1.3 Objective 3: Data access and distribution 33
4.1.4 Objective 4: User uptake, market development and capacity building 33
4.1.4.1 User uptake – Global CLMS 33
4.1.4.2 User uptake – CEMS 34

4.1.4.3 Networks of Copernicus relays, Copernicus Academy and running of the Copernicus User Uptake Support Office 35
4.1.4.4 Copernicus Framework Partnership Agreement 36
4.1.4.5 Copernicus international activities 37
4.1.4.6 Copernicus communication activities 38
4.2 Actions in indirect management 39
4.2.1 Tasks Entrusted to ESA 39
4.2.1.1 Data acquisition (Objective 1) 39
4.2.1.2 Data access and distribution (Objective 3) 40
4.2.2 Tasks Entrusted to EUMETSAT 40
4.2.2.1 Data acquisition (Objective 1) 40
4.2.2.2 Data access and distribution (Objective 3) 41
4.2.2.3 User uptake (Objective 4) 42
4.2.3 Tasks Entrusted to the EEA 42
4.2.3.1 In-situ data coordination (Objective 1) 42
4.2.3.2 Land Monitoring Service (Objective 2) 44
4.2.3.3 Data and Information Access Services (Objective 3) 46
4.2.3.4 User uptake (Objective 4) 47
4.2.4 Tasks Entrusted to Mercator Ocean International 48
4.2.4.1 Marine Environment Monitoring Service (Objective 2) 48
4.2.4.2 Data and Information Access Services (Objective 3) 50
4.2.4.3 User uptake (Objective 4) 51
4.2.5 Tasks Entrusted to the ECMWF 51
4.2.5.1 Atmosphere Monitoring Service (Objective 2) 51
4.2.5.2 Climate Change Service (Objective 2) 54
4.2.5.3 Data and Information Access Services (Objective 3) 57
4.2.5.4 User uptake (Objective 4) 58
4.2.6 Tasks Entrusted to Frontex 59
4.2.6.1 Border Surveillance Service (Objective 2) 59
4.2.6.2 User uptake (Objective 4) 60
4.2.7 Tasks Entrusted to the EMSA 61
4.2.7.1 Maritime Security Service (Objective 2) 61
4.2.7.2 User uptake (Objective 4) 62
4.2.8 Tasks Entrusted to EU Satellite Centre 63
4.2.8.1 Support to Union External Actions (Objective 2) 63

4.2.8.2 User uptake (Objective 4) 64
4.2.9 Tasks Entrusted to the EUSPA 65
4.2.9.1 User uptake (Objective 4) 65
5 Appendix: Acronyms and abbreviations 67

1 Copernicus Objectives

1.1 Introduction

Copernicus is the European Union's Earth observation and monitoring programme, looking at our planet and its environment, as well as providing geo-intelligence for the ultimate benefit of all European citizens. Copernicus has been specifically designed to meet user and policy requirements. Based on satellite and in-situ observations, the Copernicus services deliver near-real-time data on a global level, which can also be used for local and regional needs, to help better understand our planet and sustainably manage the environment, as well as support the management of emergencies and civil security.

In line with the Financing Decision, section 2 constitutes the multi-annual work programme 2021-2027 for Copernicus describing actions conducted in indirect management and, as such, supports the multi-annual part of the Financing Decision, allowing the delegation of tasks to the entrusted entities via the signature of Contribution Agreements. Section 4 constitutes the annual work programme for Copernicus describing actions conducted in 2021 and, as such, supports the annual part of the Financing Decision.

In accordance with the four elements of Copernicus specified in Article 49(3) of the EU Space Programme Regulation, the four main objectives for Copernicus in 2021 are:

1. Continued acquisition of data through:

(a) the development and operations of the Copernicus Sentinels;

(b) the access to third party space-borne Earth observation data;

(c) the access to in situ and other ancillary data.

2. Continued processing data and information through the Copernicus Services, which includes activities for the generation of value-added information to support environmental monitoring, reporting and compliance assurance, civil protection and security services;

3. Continued data access and distribution, which includes infrastructure and services (including the DIAS) to ensure the discovery, viewing, access to, distribution and exploitation and long-term preservation of Copernicus data and Copernicus information, in a user-friendly manner;

4. User uptake, market development and capacity building, which includes relevant activities, resources and services to promote Copernicus, its data and services, as well as related downstream applications and their development at all levels to maximise socio-economic benefits as well as the collection and analysis of user needs.

The table below provides an overview of the actions per Entrusted Entity conducted through direct management in 2021 and indirect management in 2021-2027 under the four objectives of Copernicus. These actions are described in more detail in the subsequent sections.

Objectives	Direct management (2021)	Indirect management (2021-2027)
1. **Continued acquisition of data through**: (a) the development and operations of the Copernicus Sentinels; (b) the access to third party space-borne	• Cal/Val reference data • LUCAS 2022	• Sentinels development, operations, launches, 3rd party data (ESA)

Earth observation data; (c) the access to in situ and other ancillary data.		• Sentinels development & operations, 3rd party data (EUMETSAT) • In-situ data coordination (EEA)
2. **Continued processing data and information through the Copernicus Services**, which includes activities for the generation of value-added information to support environmental monitoring, reporting and compliance assurance, civil protection and security services.	• CLMS-global • EMS • External independent expertise • Performance studies and support • Support to GCOS Secretariat	• CLMS-European (EEA) • CMEMS (MOI) • CAMS (ECMWF) • C3S (ECMWF) • SEA (SatCen) • CBSS (FRONTEX) • CMSS (EMSA)
3. **Continued data access and distribution**, which includes infrastructure and services (including the DIAS) to ensure the discovery, viewing, access to, distribution and exploitation and long-term preservation of Copernicus data and Copernicus information, in a user-friendly manner.	*N/A*	• Data access and distribution, including DIAS (ESA) • Data access and distribution, including WEkEO (EUMETSAT) • DIAS/WEkEO (ECMWF) • DIAS/WEkEO (MOI) • DIAS/WEkEO (EEA)
4. **User uptake, market development and capacity building**, which includes relevant activities, resources and services to promote Copernicus, its data and services, as well as related downstream applications and their development at all levels to maximise socio-economic benefits as well as the collection and analysis of user needs.	• User uptake • Copernicus Support Office • Framework Partnership Agreement • Copernicus international relations • Copernicus communication	• User uptake (ESA, EUMETSAT, EEA, MOI, ECMWF, SatCen, EMSA, FRONTEX) • User uptake (EUSPA)

1.2 Climate and biodiversity mainstreaming

The entire Copernicus programme is set up to provide the necessary data and information services based on satellite and in situ data to observe and monitor our planet and its (changing) environment. The different Copernicus services provide consistent and quality-controlled information to closely monitor the climate and biodiversity, in particular:

(a) the **Copernicus Climate Change service** (C3S) will continue to provide authoritative information about the past, present and future climate, in the form of data, products, tools and reports, both at European and global level. C3S products and services provide core data to the CLIMATE-Adapt platform. The current portfolio includes multiple Essential Climate Variables, global and regional reanalysis products, near real time climate monitoring facility, seasonal forecasts, climate projections at global and regional scales, and will be expanded to include decadal predictions and possibly extreme events attributions services. (Detailed reconstruction and reanalysis of past

climate, together with near real-time climate, help establish baselines for assessment of climate change, as well as initial condition for projections of future climate). C3S will continue to support key policy areas, providing tailored information for socio-economic sectors such as agriculture, energy, insurance, health, water resources; C3E products concretely support the implementation of the Climate Adaptation Strategy, along with other European climate adaptation and mitigation policies and actions. Building on both the EU Green Deal as well as the Digital Agenda, C3S data and information support the process of setting up a strong, green economy for a more resilient, climate-neutral and sustainable society. C3S Sectoral Information System supports Global Biodiversity by developing tailored climate information for the biodiversity sector to combat against biodiversity loss and protect biodiversity from Climate Change. C3S support also the United Nations 2030 Agenda for Sustainable Development, specifically contributing to SDG 13 (take urgent action to combat climate change and its impact) and supporting, among others, targets 2.4 (ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, help maintain ecosystems, strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and progressively improve land and soil quality), and 7.2 (increase substantially the share of renewable energy in the global energy mix).

(b) The **Copernicus Atmosphere Monitoring Service** (CAMS) provides information related to the climate and biodiversity, as follows:

(i) CAMS Contribution to Climate: Radiative forcing is a useful predictor of globally-averaged temperature change. CAMS provides estimates of climate forcings separately for carbon dioxide, methane, tropospheric ozone, stratospheric ozone, interactions between anthropogenic aerosols and radiation, and interactions between anthropogenic aerosols and clouds. Climate forcing estimates produced by CAMS follow the definition of the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) and therefore are defined with respect to the year 1750 and include adjustment of stratospheric temperatures for greenhouse gases and ozone.

(ii) CAMS Contribution to Biodiversity: The Copernicus Atmosphere Monitoring Service (CAMS) uses near-real-time observations of the location and intensity of active wildfires to estimate the emissions of pollutants. Wildfires are a significant source of atmospheric pollution, including carbon gases, volatile organic compounds and particulate matter, influencing global atmospheric composition and chemistry. And they have a deep impact on biodiversity of the interested areas.

(c) The **Copernicus Marine Environment Monitoring service** (CMEMS) will continue and build upon the key policy support areas already addressed over the previous MFF, namely maritime safety, coastal environment monitoring, trade and marine navigation, fishery, aquaculture, marine renewable energy, marine conservation and biodiversity, ocean health, climate and climate adaptation, recreation, education, science and innovation. Some specific examples of support to Biodiversity and Climate policy. In support of the European Green Deal:

(i) Increasing European Union's climate ambition by proposing a comprehensive expert monitoring of the ocean climate over the past century and maintaining for policy makers a state-of-the-art assessment of the ocean state.

(ii) Preserving and restoring ecosystems and biodiversity by developing further the digital description of the biology component of the ocean, developing further

connections between climate and biodiversity for the ocean, and carrying on partnerships with NGOs involved in ecosystems restoration.

In support of the United Nations 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals (SDGs): CMEMS provides essential services required for a sustainable management of the Ocean that directly responds to SDG 14 "Conserve and sustainably use the oceans, seas and marine resources for sustainable development" but also to other SDGs related to food, energy, security and climate, including the ocean acidification indicator produced for Eurostat since 2017.

Moreover, CMEMS publishes an annual Ocean State Report and Ocean State Report Summary (https://marine.copernicus.eu/news/ocean-state-report-4-summary-available), including Ocean Monitoring Indicators (OMIs) of direct relevance to climate (e.g., sea-level rise, ocean heat content) and biodiversity (e.g., Chlorophyll-a content, acidity, oxygen inventory).

(d) The **Copernicus Land Monitoring Service** provides geographical information on land cover, land use and its changes at European and Global scale. Land use monitoring is especially essential in the context of climate change with the Land Use, Land Use Change and Forestry (LULUCF) Regulation. Most of Land Biophysical variables are also considered as Essential Climate Variables, including the water extend which covers SDG 6.6.1. and the cryosphere information produced in the Land service. At global level, the coming Forest-REDD element of the Land service will strongly contribute to mitigation strategy. Moreover, the Copernicus Land Monitoring portfolio addresses indirectly biodiversity with products describing and monitoring the environmental conditions and landscapes related to biotopes. This is provided through land cover and land change mapping at EU level with CORINE and the High Resolution Layers but also in details with Natura 2000 sites and in riparian zones monitoring. It is also valid at global scale with the Global Land cover mapping and the monitoring of protected areas in Africa to support the development of INTPA Biodiversity Strategies.

(e) The products and services provided by the **Copernicus Emergency Monitoring Service** (CEMS) are becoming increasingly relevant in a world where climate change driven disaster patterns are intensifying. We are experiencing more and stronger hurricanes, forest fires in uncommon areas that spread vigorously throughout the year, prolonged droughts and widespread flooding. CEMS products contribute to better results at all stages of the disaster risk reduction cycle. Moreover, CEMS contributes to the efforts to reverse negative trends on climate change and loss of biodiversity through its early worming component. Copernicus EMS Early Warning and Monitoring offers critical geospatial information at European and global level through continuous observations and forecasts for floods, droughts and forest fires:

(i) The European Flood Awareness Systems (EFAS) and Global Flood Awareness Systems (GloFAS) provide complementary flood forecast information to relevant stakeholders that support flood risk management and prevention at the national, regional and global level.

(ii) The European Forest Fire Information System (EFFIS) monitors forest fire activity in near-real time. EFFIS supports wildfire management at the national and regional level for EU member states and across the Middle East and North Africa.

(iii) The Drought Observatory (DO) provides drought-relevant information and early-warnings for Europe (EDO) and globally (GDO). The service publishes short analytical reports (Drought News) in anticipation of an imminent drought.

2 Multiannual delegated budget and tasks (2021-2027)

The following table presents the overview of the budget (amounts expressed in EUR, in current prices) implemented in indirect management mode over the period of the multiannual financial framework (MFF) for 2021-2027. It includes the anticipated contribution of Copernicus Participating States.

Indirect Management	**MFF 2021-2027**
ESA	4 115 000 000
EUMETSAT	735 000 000
EEA	135 000 000
MOI	228 000 000
ECMWF	411 000 000
Frontex	67 000 000
EMSA	73 000 000
SatCen	45 000 000
EUSPA	30 000 000
Total indirect management (Copernicus-specific)	**5 839 000 000**
Indirect management (horizontal part – EIF Cassini)	**98 000 000**
Grand total indirect management	**5 937 000 000**

Each of the activities are described in the following sections (except Cassini which is covered in Annex 1 of the Decision).

2.1 Tasks Entrusted to ESA

Data acquisition, access and distribution
Year(s): 2021-2027 Implementation: Indirect management by means of a Contribution Agreement with the European Space Agency (ESA). Amount: EUR 4 115 000 000

Overall objective and purpose of the action:

Tasks include parts of the provision of enhanced continuity of existing Sentinel missions and of the development, maintenance and operation of further Sentinels expanding Copernicus' observation scope according to Article 50(a) of the Space Regulation, parts of the provision of third party data according to Article 50(b) ibid., parts of the tasks for data access and distribution according to Article 52 ibid., as well as parts of user uptake, market development and capacity building according to Article 49(4)(d) ibid.

The tasks entrusted to ESA under the Agreement in the framework of coordination and management of the Copernicus Space Component (CSC) are:

(a) Tasks related to the completion of the space segment development of the Sentinel first generation, including storage / post-storage and Phase E1 activities as needed;

(b) Tasks related to the space segment development of new (CSC evolution) Sentinel missions;

(c) Tasks to be performed by ESA related to launch services, as needed, for Sentinel first generation and new (CSC evolution) missions;

(d) Tasks to be performed by ESA for the Ground Segment (including Flight Operations Segment) development and related Phase E1 activities;

(e) Tasks to be performed by ESA for the operations of the Copernicus Space Component, following the In-Orbit Commissioning Review (IOCR) of each Sentinel unit (except for those operated by EUMETSAT);

(f) Tasks related to overall operations of the Copernicus Space Component;

(g) Tasks related to Space and Flight Operation Segment operations, including satellite maintenance;

(h) Tasks related to Ground Segment operations;

(i) Tasks related to maintaining the quality of Sentinel data under ESA's responsibility, including activities related to calibration, validation, algorithms and Fiducial Reference Measurements (FRM) and in-situ data management;

(j) Tasks related to the management of access of Sentinel data under ESA's responsibility, in accordance with the Copernicus data policy;

(k) Tasks related to the management of access to third party (Copernicus Contributing Missions) data to eligible users;

(l) Tasks to be performed by ESA in relation to integrated data management for Copernicus and DIAS-like exploitation platform;

(m) Tasks related to the Sentinel end-of life / replacement phase;

(n) Tasks related to the short-term CSC evolution concerning user level data and operational needs, including the tasks and process to respond to evolving user needs;

(o) Tasks and process related to supporting the Commission in the maintenance of user and service data requirements for the long-term evolution of the CSC;

(p) Tasks related to Communications, User Uptake, Market Development and Capacity Building activities.

Specific Provisions:

These tasks entail running operations and production chains in real time or quasi-real time. Any interruption of contractual activities is immediately detrimental to the outcome and services provided. In case expenses and/or contract renewals would be needed before the contribution agreement can be signed, the entity should be allowed to anticipate those. Therefore, and in line with recital 8 of this Decision, activities supported under the Space Regulation (EU) 2021/696 and the underlying costs may be considered eligible as of the date of application of the Regulation, even if these costs were implemented and incurred before the Contribution Agreement was signed.

2.2 Tasks Entrusted to EUMETSAT

Data acquisition, access and distribution
Year(s): 2021-2027 Implementation: Indirect management by means of a Contribution Agreement with the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT). Amount: EUR 735 000 000 Overall objective and purpose of the action: Tasks include parts of the provision of enhanced continuity of existing Sentinel missions and of the development, maintenance and operation of further Sentinels expanding Copernicus' observation scope according to Article 50(a) of the Space Regulation, parts of the provision of third party data according to Article 50(b) ibid., parts of the tasks for data access and distribution according to Article 52 ibid., as well as parts of user uptake, market development and capacity building according to Article 49(4)(d) ibid. EUMETSAT shall contribute to the infrastructure upgrades of the Copernicus Space Infrastructure that are necessary to ensure continuity, enhanced continuity and expansion of the observation scope. This includes the build-up of a European operational capacity for monitoring CO2 and other greenhouse gases from space (Copernicus Carbon Dioxide Monitoring mission called CO2M),that will provide key observational inputs to a Copernicus service for monitoring anthropogenic emissions in support of the Paris Agreement. Regarding the space segment flight operations, EUMETSAT, in cooperation with ESA, shall manage the operations and maintenance of the Sentinel-3, Sentinel-6, Copernicus CO2M satellites, and the Sentinel-4 and the Sentinel-5 instruments. Regarding the space segment data operations, EUMETSAT, in cooperation with ESA, shall manage the data processing operations of the Jason-3, Sentinel-3, Sentinel-4, Sentinel-5, Sentinel-6 and Copernicus CO2M missions. Upgrades of the Copernicus Ground and Space Segment will be required to e.g. cope with new, revised or expanded operational configurations, evolutions of technologies, integration of additional or revised Copernicus data services or evolving user needs. EUMETSAT shall ensure evolution of the data services and underlying systems, in line with the requirements of the Commission and the Copernicus user communities. EUMETSAT shall ensure access to Fiducial Reference Measurements (FRMs) for calibration and validation purposes of the Sentinel missions under its operational responsibility. EUMETSAT shall operate, upgrade and manage Data Access and Distribution Services of

Copernicus Data provided by EUMETSAT.

EUMETSAT will support the federation of the Copernicus financed infrastructures and services.

EUMETSAT will ensure access to data from its own missions, as well as from selected third party missions related to the Copernicus environmental services, specifically the marine, atmosphere, climate change services and potential future services as required by the Copernicus User needs and as documented in the Data Warehouse Requirements document.

EUMETSAT shall provide support to the Copernicus element on User Uptake, Market development and capacity building, including support to the Commission in its interactions with Copernicus stakeholders and the EU's international partners in Copernicus.

Specific Provisions:

These tasks entail running operations and production chains in real time or quasi-real time. Any interruption of contractual activities is immediately detrimental to the outcome and services provided. In case expenses and/or contract renewals would be needed before the contribution agreement can be signed, the entity should be allowed to anticipate those. Therefore, and in line with recital 8 of this Decision, activities supported under the Space Regulation (EU) 2021/696 and the underlying costs may be considered eligible as of the date of application of the Regulation, even if these costs were implemented and incurred before the Contribution Agreement was signed.

2.3 Tasks Entrusted to the EEA

In-situ data coordination and Land Monitoring Service

Year(s): 2021-2027

Implementation: Indirect management by means of a Contribution Agreement with the European Environment Agency (EEA).

Amount: EUR 135 000 000

Overall objective and purpose of the action:

Tasks include parts of the land monitoring service according to Article 51(1)(a) of the Space Regulation, parts of the tasks for data access and distribution according to Article 52 ibid., parts of user uptake, market development and capacity building according to Article 49(4)(d) ibid, as well as parts of provision and access to in-situ data according to Article 50(c) ibid.

The Copernicus Land Monitoring Service (CLMS) activities in 2021-2027 will be based on a comprehensive, coherent portfolio of core Copernicus information products and services, thus building time series that enable for long term change monitoring. The portfolio aims first and foremost to support the implementation of thematic policies under the European Green Deal (EGD). Furthermore, the portfolio will serve different user communities, including the provision of baseline products upon which industry can develop downstream commercial and non-commercial activities.

The CLMS portfolio will build upon the existing complementarity of products, and will work towards a harmonisation and integration of the products across coverages (mainly pan-European wall to wall, local priority area monitoring, and gradually including some global products transferred from JRC), scales and resolutions (medium, high and very high) and

across thematic content. CLMS will screen its contribution for each of its products and services to Environmental Compliance Assurance and to statuary Monitoring and Reporting. Moreover, the Copernicus Land Monitoring Service supports the Copernicus Integrated Data Management activities and implements DIAS functionalities. The EEA will also carry out user-uptake activities.

The strategic objectives of the CLMS within the Copernicus 2.0 programme are:

(a) To provide NRT multipurpose baseline data and services that can be picked up by any stakeholder to build downstream products and applications on top of these;

(b) To provide and maintain long term sustainable time series of thematically focused land monitoring products. These products shall also serve as building blocks for downstream application developments;

(c) To improve the timeliness of the CLMS products by further reducing the production times via further automation and the increased use of Artificial intelligence (AI) and Deep Learning techniques, by increasing update frequencies where appropriate and applicable and by better anticipation of product implementation governance;

(d) To work towards a better harmonisation and integration of CLMS products across scales, resolutions, nomenclature based on international standards and thematic content, yielding substantial efficiency gains in the production workflows;

(e) To provide a user-oriented product and service access and distribution system based on the combined resources of the CLMS portal and the Copernicus DIAS. The dissemination system shall take into account different distinct levels of expertise of end users and will include spatially and time-wise on-demand functionalities;

(f) To ensure all products are fully quality controlled at production level and independently geo-statistically validated at product distribution level.

Specific Provisions:

These tasks entail running operations and production chains in real time or quasi-real time. Any interruption of contractual activities is immediately detrimental to the outcome and services provided. In case expenses and/or contract renewals would be needed before the contribution agreement can be signed, the entity should be allowed to anticipate those. Therefore, and in line with recital 8 of this Decision, activities supported under the Space Regulation (EU) 2021/696 and the underlying costs may be considered eligible as of the date of application of the Regulation, even if these costs were implemented and incurred before the Contribution Agreement was signed.

2.4 Tasks Entrusted to Mercator Ocean International

Marine Environment Monitoring Service
Year(s): 2021-2027 Implementation: Indirect management by means of a Contribution Agreement with Mercator Ocean International. Amount: EUR 228 000 000 Overall objective and purpose of the action: Tasks include the marine environment monitoring service according to Article 51(a) of the

Space Regulation, parts of the tasks for data access and distribution according to Article 52 ibid., as well as parts of user uptake, market development and capacity building according to Article 49(4)(d) ibid.

The Copernicus Marine Service is a digital information service, valuing the European Union excellence in marine sciences, technologies and services, and aiming at fostering evidence-based decisions for sustainable ocean acting as a reference global and pan-European ocean forecasting and ocean climate centre. The marine environment monitoring service delivers observation, forecasts and reanalysis of the past for ocean physics (blue ocean), ocean biogeochemistry (green ocean) and sea-ice over the poles (white ocean). It serves many sectors of interest such as (but not only) safety, climate, ocean health, marine resources management.

The Copernicus Marine Service is based on the development of a 'digital ocean' representation to connect the diversity of user and policy demands related to the ocean with the supply formed by a wide range of marine observation and marine modelling infrastructures. This pivotal digital ocean component forms the basis of the Copernicus Marine concept.

The concept identifies three inter-related fields of intervention:

(a) Produce a consistent, qualified by state-of-the-art standards, description of the marine blue/green/white environment at global, regional and coastal scales for the last decades, the present time and predictable future, from satellite observations, in situ observations and modelling and advanced data assimilation capacities based on robust and operational cloud and High performance computing (HPC) capacity.
(b) Maintain actionable digital ocean information products for human experts and AI-systems to enable a multi-dimensional navigation through the variations in space and time of the blue, white and green variables of the ocean.
(c) Deliver an open and free ocean information service based on thematic state-of-the-art science to foster marine knowledge, sustainable blue economy and environmental protection through tailored product portfolios, tailored user access to data, tools and workspaces, outreach actions and expert support.

The first field connects Copernicus Marine to modelling science and observation infrastructures, the second to digital and cloud infrastructures, the third to marketing and marine policies. This three-fold approach gives the overall framework structuring all operational and innovation processes of the Service.

The Copernicus Marine Service is closely linked to the Copernicus space and in-situ components and the other Copernicus services. It relies on external infrastructures, data and services, ranging from space and in situ observations and other input data, research outcomes in marine sciences, but also cloud and HPC computing facilities, corporate communication and international cooperation programmes. It is designed to implement the mainstream service line for reference marine information but also secondary streams focussed on related topics such as coastal environment, polar areas, marine biology and regional ocean climate, and capitalising on information from other Copernicus services. The Copernicus Marine Service also supports the Copernicus Integrated Data Management activities and implements DIAS functionalities. Moreover, CMEMS will screen its contribution for each of its products and services to Environmental Compliance Assurance and to statuary Monitoring and Reporting. Mercator Ocean will also carry out user uptake activities.

Specific Provisions:

These tasks entail running operations and production chains in real time or quasi-real time.

Any interruption of contractual activities is immediately detrimental to the outcome and services provided. In case expenses and/or contract renewals would be needed before the contribution agreement can be signed, the entity should be allowed to anticipate those. Therefore, and in line with recital 8 of this Decision, activities supported under the Space Regulation (EU) 2021/696 and the underlying costs may be considered eligible as of the date of application of the Regulation, even if these costs were implemented and incurred before the Contribution Agreement was signed.

2.5 Tasks Entrusted to the ECMWF

Atmosphere Monitoring and Climate Change Monitoring Services

Year(s): 2021-2027

Implementation: Indirect management by means of a Contribution Agreement with the European Centre for Medium-Range Weather Forecasts (ECMWF).

Amount: EUR 411 000 000 (EUR 241 000 000 for C3S and EUR 170 000 000 for CAMS)

Overall objective and purpose of the action:

Tasks include the atmosphere monitoring service and the Climate change monitoring service according to Article 51(a) of the Space Regulation, parts of the tasks for data access and distribution according to Article 52 ibid., as well as parts of user uptake, market development and capacity building according to Article 49(4)(d) ibid.

Copernicus Atmosphere Monitoring Service (CAMS)

The first building block of CAMS is the Atmosphere Data Store (ADS), which serves as a gateway to all the data and information products of the Service. All data and products available from the ADS are provided in a consistent and traceable manner and with detailed and standardised documentation.

The second building block of the Atmosphere Monitoring Service corresponds to "production" elements. It includes the acquisition and processing of satellite and in situ observations, the delivery of the main families of products and the transverse Evaluation and Quality Control (EQC) function, which provides end-to-end documentation and quality assurance about the products, how they have been generated, how they are presented to the users and how far their technical performance and scientific quality meets the expressed user requirements. The production block, including the extensive quality documentation, directly feeds into the ADS.

The third block concerns the user facing activities, which are pivotal in Copernicus as a user-driven programme. There are four main components:

(a) The contribution of CAMS to the cross-service Copernicus Knowledge Hubs;

(b) Communication activities ensure the dissemination of information to the end users, including e.g., public authorities, businesses, scientists and the general public as appropriate;

(c) User engagement and training, which will stimulate and support uptake of CAMS products to growing audiences of users and will also provide requirements that will feed the process of continuous evolution of the products and information services;

(d) Finally, CAMS will establish a national uptake scheme with all the EU Member

States and Copernicus participating countries, with two-way objectives. Firstly, it will support uptake of CAMS products for national monitoring, information and reporting functions. Secondly, countries will provide expertise to assess the quality of CAMS products over their domain and, if they have high-resolution modelling and forecasting activities that can be fully connected to CAMS European products, a solution for downscaling the information, which is a key outstanding user requirement.

This architecture is complemented by an Expert Panel and a Fitness-for-Purpose function. These elements, which are external to the Entrusted Entity, serve to provide advice and to evaluate the overall performance of the service with particular attention to the needs of Union policies and the context of related international activities. The Expert Panel and Fitness-for-Purpose (F4P) components may initiate independent evaluation activities in coordination with the EQC function of CAMS and make use of expert consultations as needed.

The continual development of CAMS services goes beyond the need to keep the scientific and technical characteristics of operations at the best international level; it also aims at addressing the information requirements for supporting effectively European and national environmental policies. The success of the implementation of the proposed service largely relies on the quality of the information flow and the overall coordination between the various blocks. Series of precise, well-defined and operational procedures are defined and established so that the information delivered to the end-user is fully traceable, quality controlled and disseminated within the most appropriate time frame all the way from the production to the dissemination to users. The articulation between the operating entities involved in the delivery of CAMS service elements is a critical aspect of the service and this is a major function to be ensured by the Management of the Service. CAMS will also screen its contribution for each of its products and services to Environmental Compliance Assurance and to statuary Monitoring and Reporting.

Copernicus Climate Change Monitoring Service (C3S)

The first building block of the C3S is a comprehensive Climate Data Store (CDS). The CDS provides access to data and information about a consistent set of bio-geo-physical climate variables and indicators, including Essential Climate Variables (ECVs), climate data records and derived climate change indicators to enable routine monitoring of both climate drivers and climate change impacts. Data and products available from the CDS must be spatially and temporally consistent, traceable, and fully characterised so that appropriate confidence envelopes can be attached.

The second building block of the Climate Change Service is the Sectoral Information System (SIS) that contains tools to tailor the CDS data to the needs of end users and customers of the service for various EU sectoral policies or other Societal Benefit Areas (SBAs). Sectoral information primarily relies on CDS core data and, where appropriate, ancillary datasets that prove useful when addressing, for instance, climate impacts at regional, or even local, time and space resolutions in various policy sectors.

The third block concerns the Evaluation and Quality Control (EQC) function in charge providing quality assurance for the C3S. The EQC function comprises a component to assess the technical performance and scientific quality of the products in particular with regard to users' information needs and requirements. The EQC function is also the natural vector for bridging the operational segments of the service with its R&D components.

The fourth block, Communications Users Training and Engagement (CUTE) is dedicated to

increase user uptake and user satisfaction, to unlock new potential applications and to provide training with respect to climate related information, both from the Climate Data Store and the Sectoral Information System, to the users, including e.g., public authorities, businesses, the scientific community and the general public as appropriate.

This architecture is complemented by a Fitness-for-Purpose (F4P) (see section 4.4) function external to ECMWF to evaluate the overall performance of the service with particular attention given to satisfy the needs of Union policies. The F4P component initiates independent evaluation activities in coordination with the EQC function of the C3S and makes extensive use of expert consultations.

The development of C3S goes beyond the scientific and technical processing of data at global and regional scales, in particular over Europe. To address the requirements for information at high resolutions and thus support European and national policies, the service shall promote regionalisation and downscaling through appropriate national uptake activities. The success of the implementation of the proposed service largely relies on the quality of the information flow and the overall coordination between the various building blocks. Precise, well-defined operational procedures have been established so that the information delivered to the end user is always fully traceable, quality controlled and disseminated or accessible within the most appropriate time frame all the way from the production in the CDS to the CUTE platforms. The articulation between the operating entities involved in the C3S is a critical aspect of the service and the one that has required most attention in the pre-operational phase. It indeed involves different public national and international institutions as well as the private sector through the entire production chain. C3S will also screen its contribution for each of its products and services to Environmental Compliance Assurance and to statuary Monitoring and Reporting.

Moreover, CAMS and C3S also support the Copernicus Integrated Data Management activities and implements DIAS functionalities.

Specific Provisions:

These tasks entail running operations and production chains in real time or quasi-real time. Any interruption of contractual activities is immediately detrimental to the outcome and services provided. In case expenses and/or contract renewals would be needed before the contribution agreement can be signed, the entity should be allowed to anticipate those. Therefore, and in line with recital 8 of this Decision, activities supported under the Space Regulation (EU) 2021/696 and the underlying costs may be considered eligible as of the date of application of the Regulation, even if these costs were implemented and incurred before the Contribution Agreement was signed.

2.6 Tasks Entrusted to Frontex

Border Surveillance Service
Year(s): 2021-2027 Implementation: Indirect management by means of a Contribution Agreement with the European Border and Coast Guard Agency (EBCGA, also referred to as Frontex). Amount: EUR 67 000 000 Overall objective and purpose of the action:

Tasks include parts of the security service, notably to support surveillance of the Union and its external borders, according to Article 51(1)(c) of the Space Regulation, parts of the tasks for data access and distribution according to Article 52 ibid., as well as parts of user uptake, market development and capacity building according to Article 49(4)(d) ibid.

The Copernicus Border Surveillance Service is provided in the framework of EUROSUR as provided for in Articles 28 and Articles 68 of Regulation (EU) 2019/1896.

As part of the EUROSUR Fusion Services, the Copernicus Border Surveillance Service is made available:

(a) to the European Border and Coast Guard which is composed of the national authorities of Member States responsible for border management, including coast guards to the extent that they carry out border control tasks and the European Border and Coast Guard Agency
(b) to the Union institutions, bodies, offices, agencies, and international organisations and to third Countries as provided for in Chapter 2 Section 11 of Regulation (EU) 2019/1896

Specifically, the Copernicus Border Surveillance Service will provide its stakeholders and end users with:

(a) geospatial support to FRONTEX for the purpose of supporting the understanding of migratory trends, volume and routes;

(b) Site/route survey of objectives of interests and along specific migration routes;

(c) Activity reports describing ongoing activities and identifying patterns of life;

(d) Validation of information coming from other sources;

(e) Change detection identifying modifications of existing infrastructure or newly established infrastructure as well as comparison of other activities in a specific area of interest;

(f) Operations support assisting ongoing Frontex and Member States and Schengen Associated countries' operations;

(g) Decision support contributing to strategic, operational and tactical informed decision making;

(h) Permeability analysis in support of vulnerabilities and risks assessments;

(i) 2D, 3D & 4D spatial analysis to gain fundamental geospatial insight for situational picture compilation and input to further risk analysis and vulnerability assessment.

The Copernicus funding will be used in particular for value-adding earth observation services. Frontex will also carry out user uptake activities.

Specific Provisions:

These tasks entail running operations and production chains in real time or quasi-real time. Any interruption of contractual activities is immediately detrimental to the outcome and services provided. In case expenses and/or contract renewals would be needed before the contribution agreement can be signed, the entity should be allowed to anticipate those. Therefore, and in line with recital 8 of this Decision, activities supported under the Space Regulation (EU) 2021/696 and the underlying costs may be considered eligible as of the date of application of the Regulation, even if these costs were implemented and incurred before the Contribution Agreement was signed.

2.7 Tasks Entrusted to the EMSA

Maritime Surveillance Service
Year(s): 2021-2027 Implementation: Indirect management by means of a Contribution Agreement with the European Agency for Maritime Safety (EMSA). Amount: EUR 73 000 000 Overall objective and purpose of the action: Tasks include parts of the security service, notably to support maritime surveillance, according to Article 51(1)(c) of the Space Regulation, parts of the tasks for data access and distribution according to Article 52 ibid., as well as parts of user uptake, market development and capacity building according to Article 49(4)(d) ibid. The maritime surveillance service is offered to national authorities and EU bodies working in the maritime domain, as well as eligible governmental bodies outside Europe and international organisations. The service will build on services which have already been established in the areas of fisheries control, maritime safety and security, law enforcement, customs, marine environment (pollution monitoring) and support to international organisations. The focus of the service provision in the period 2021-2027 is continuity of service delivery, with limited growth perspectives in the uptake of users. At this stage, it is difficult to estimate precisely the breakdown per service of the total budget for satellite licenses and services. EMSA will also carry out user uptake activities. The scope of maritime surveillance service will include support to EU authorities with responsibilities in the following functional areas: (a) Fisheries control (b) Maritime safety (c) Maritime Security (d) Customs (e) Law enforcement (f) Marine pollution monitoring (g) International Cooperation Specific Provisions: These tasks entail running operations and production chains in real time or quasi-real time. Any interruption of contractual activities is immediately detrimental to the outcome and services provided. In case expenses and/or contract renewals would be needed before the contribution agreement can be signed, the entity should be allowed to anticipate those. Therefore, and in line with recital 8 of this Decision, activities supported under the Space Regulation (EU) No 2021/696 and the underlying costs may be considered eligible as of the date of application of the Regulation, even if these costs were implemented and incurred before the Contribution Agreement was signed.

2.8 Tasks Entrusted to EU Satellite Centre

Support to Union External Actions[1]
Year(s): 2021-2027 Implementation: Indirect management by means of a Contribution Agreement with the EU Satellite Centre. Amount: EUR 45 000 000 Overall objective and purpose of the action: Tasks include parts of the security service, notably to support Union external action responding to security challenges facing the Union, and Common Foreign and Security Policy objectives and actions, according to Article 51(1)(c) of the Space Regulation, parts of the tasks for data access and distribution according to Article 52 ibid., as well as parts of user uptake, market development and capacity building according to Article 49(4)(d) ibid. The Copernicus Service in Support to EU External Actions (SEA) is a European geo-intelligence service that assists the EU and its Member States in a wide range of Application Areas: Security of EU Citizens, Crisis and Conflict, Law enforcement, International Cooperation and Humanitarian Aid, Cultural Heritage, Environmental crime, Climate Security, Arctic and Polar, Transport Safety and Security, International Trade and Economic Diplomacy. SEA is designed to support European and Member States policies by enhancing the situational awareness needed by Institutional stakeholders working in security-related domains. The service delivers custom-designed intelligence products based on the analysis of satellite imagery and the information provided contributes to enhance European capacities in crisis prevention, preparedness and response. It also aims to assist in situations of crisis or emerging crisis and supports them in order to prevent global and trans-regional threats having a destabilising effect. The EU Satellite Centre will also carry out user uptake activities. The Copernicus SEA service organised along four functional elements: (a) Service Coordination (b) Service Access and Delivery (c) Product Provision- Operations (d) Cross-cutting elements (Service Evolution and User Up-take) Specific Provisions: These tasks entail running operations and production chains in real time or quasi-real time. Any interruption of contractual activities is immediately detrimental to the outcome and services provided. In case expenses and/or contract renewals would be needed before the contribution agreement can be signed, the entity should be allowed to anticipate those. Therefore, and in line with recital 8 of this Decision, activities supported under the Space Regulation (EU) 2021/696 and the underlying costs may be considered eligible as of the date of application of the Regulation, even if these costs were implemented and incurred before the Contribution Agreement was signed.

[1] The name of the Service will reflect the scope of the Service, which is being negotiated.

2.9 Tasks Entrusted to the EUSPA

User Uptake
Year(s): 2021-2027 Implementation: indirect management by means of a Contribution Agreement with the European Union Agency for the Space Programme (EUSPA). Amount: EUR 30 000 000 Overall objective and purpose of the action: To foster the uptake of the Copernicus products and services by Other Copernicus users (i.e. Copernicus non-core users), to be implemented in close coordination with the Commission. The activities to be carried out by EUSPA include: (a) Extension of the European GNSS User Consultation Platform to Other Copernicus Users addressing primarily end-users and other actors of the value chain (i.e. ICT stakeholders), following an harmonised market segment approach suitable for all Components of the Space Programme complementing the already established user fora; (b) Foster the user uptake of the Other Copernicus Users in close cooperation with the entrusted entities and their related activities; (c) Monitoring & analysis of current access to data, in order to contribute to design and procurement of its evolution; (d) Creation of a business-friendly ecosystem to foster user uptake, including actions for entrepreneurship for the Other Copernicus Users, including by mean of blending operations under Article 21 of the Space Programme Regulation and subject to specific authorisation of the Commission; (e) Other tasks related to Other Copernicus Users' uptake that may emerge following the dynamics of the downstream sector evolution, as jointly agreed with the Commission.

3 Priorities for Copernicus in 2021

With a view to the funding available in 2021 and in order to optimise the available resources for the smooth transition to the new Multi-annual Financial Framework (MFF) of the European Union 2021-2027, the Commission proposes to concentrate the 2021 work programme on the activities described below. The actions under this work programme are mainly dedicated to the continuity, further implementation and improvement of the various Copernicus components. It is important to note that these activities are complemented by those in Annex 1 which are also co-funded by Copernicus.

The Commission will continue ensuring closer synergies and programmatic co-ordination between the Copernicus Programme, the European Green Deal and the European Digital Strategy. This concerns, in particular, the use of European-level digital infrastructures, artificial intelligence and the implementation of Open Data policies as well as European Data Spaces.

Moreover, the Commission will continue in 2021 to ensure the complementarity, consistency and links between Copernicus and other programmes, such as Horizon 2020 and Horizon

Europe, Destination Earth, or ESA programmes, such as Copernicus Space Component (CSC) or the Earth Observation Envelope Programme (EOEP).

3.1 Objectives

Objective 1: Data acquisition

The actions under the first element, "Data acquisition", will continue the development, deployment and operations of the Sentinels. They will cover in particular the operations of Sentinels-1A and B, -2A and B, -3A and B, Sentinel 5P and Sentinel-6A. In addition, preparations will continue for the launches and operations of subsequent Sentinels and for the construction of the first Sentinel C and D units. Moreover, these actions will ensure the continued access to third party space-borne Earth observation data (Copernicus contributing missions) and of in-situ data. The focus will be on the continuation and ramp-up of these activities from the previous years. An action will also be dedicated to ensure future Sentinel launches. In addition, an action will support the next LUCAS (Land Use and Coverage Area frame Survey) campaign by EUROSTAT planned for 2022. Finally, as in previous years, an action will be aiming at providing reference in-situ data for calibration and validation of satellite data.

Objective 2: Services Provision

For the second element, "Provision of services", the actions planned for 2021 will first of all ensure the continuity with the previous Copernicus work programmes, as well as provide continuity into 2022. These actions will ensure the provision of the Copernicus Land Monitoring Service (CLMS), the Copernicus Marine Environment Monitoring Service (CMEMS), the Copernicus Atmosphere Monitoring Service (CAMS), the Copernicus Climate Change Service (C3S), the Copernicus Emergency Management Service (CEMS), and the Copernicus Security Service (CSS), with its three components for border surveillance (CBSS), maritime surveillance (CMSS) and Support to Union External Action (SEA). As in previous years, there will be an activity targeted at providing external independent expertise, in particular to ensure the pertinence of the Copernicus services. Moreover, another action will aim at ensuring the continued operations of the GCOS secretariat.

Objective 3: Data access and distribution

The actions under the third element, "Data access and distribution", aims at fostering and improving the access to, the exchange and dissemination of Copernicus data and information. This comprises activities, such as evolution of the Space Component's ground segment, the fostering of platforms for data and information access and value added for end users, including the pursuit of the DIAS operations.

Objective 4: User uptake, market development and capacity building

The fourth element, "User uptake, market development and capacity building", includes relevant activities, resources and services to promote Copernicus, its data and services, as well as related downstream applications and their development at all levels to maximise socio-economic benefits as well as the collection and analysis of user needs. At this stage of programme implementation, with most infrastructure elements in place and operational, a particular emphasis will be given to these actions for which the entrusted entities will play a significant role. EUSPA will also play a role in this area, except for those performed by other entrusted entities and the Commission. Uptake of the products at all levels, from Union to national, regional and local level will receive special attention. In particular, these actions will include the Framework Partnership Agreement between the Commission and Member

States, and the networks of Copernicus relays, Copernicus Academy and the running of the Copernicus User Uptake Support Office.

3.2 Financial resources and Participating Countries

The budget (excluding administrative budget) established for Copernicus in 2021 is EUR 705 613 057 (current prices).

The anticipated contribution of Norway, UK and Iceland in 2021 corresponds to an indicative amount of EUR 146 245 362 (current prices).

3.3 Budget breakdown for the year 2021 for actions in direct management

The table below provides the indicative breakdown of the Copernicus budget for 2021 (taking into account the anticipated EFTA states contributions[2], in particular Norway and Iceland). Amounts are expressed in EUR, in current prices.

Direct Management	**2021**
Objective 1 "Data acquisition"	**1 125 700**
Cal/Val reference data	400 000
LUCAS	725 700
Objective 2 "Provision of services"	**25 060 000**
Land Monitoring Service (Global)	9 100 000
Emergency Management Service	14 560 000
External independent expertise	650 000
Performance studies and support	500 000
Support to GCOS Secretariat	250 000
Objective 3 "Data access and distribution"	**0**
Objective 4 "User uptake, market development and capacity building"	**5 440 000**
User uptake/communication Global Land	500 000
User uptake/communication Emergency	440 000
Copernicus Support Office	1 500 000
Framework Partnership Agreement	4 000 000
Copernicus international activities	200 000

[2] Subject to agreement on the participation of the EFTA States.

Copernicus Communication	300 000
Total direct actions in 2021 (Copernicus-specific)	**33 125 700**
Total Copernicus' contribution to horizontal direct actions in 2021 (Annex 1)	**5 388 000**
Grand total direct actions in 2021	**38 513 700**

Each of the activities are described in section 4.1 (except for the horizontal part actions which are covered in the Annex 1).

4 Implementation of the Work Programme in 2021

4.1 Actions in direct management

4.1.1 Objective 1: Data acquisition

4.1.1.1 LUCAS 2022 campaign

LUCAS 2022 campaign
Year(s): 2021 Implementation method: direct management by means of a co-delegation with EUROSTAT. Amount: EUR 725 700 Overall objective and purpose of the action: to support the next LUCAS (Land Use and Coverage Area frame Survey) campaign planned for 2022 with the indicative estimated cost of EUR 19 000 000. It will be co-funded by EUROSTAT and other Commission Directorates General (DG ENV, DG CLIMA, DG AGRI, and DG DEFIS). Copernicus will participate with limited budget and Copernicus related data will be part of the LUCAS core sampling. This will represent a collection of Copernicus related data over 150 000 points in EU. Although this campaign is not synchronised with the Copernicus VHR campaign, the collected data represents a widespread and valuable data set of in-situ data that complements Copernicus space observations. Such data will be used for training and validation purposes on Sentinel data, for the production of the yearly Land cover maps as well as used by JRC and EEA for thematic applications such as agriculture and crop maps. Activities: (a) Financial support to the LUCAS 2022 campaign (b) Geo-referenced sample data integrated, adapted to Copernicus needs, validated and accessible in the LUCAS database. Expected output of the action: Geo-referenced sample data integrated, adapted to Copernicus needs, validated and accessible in the LUCAS database.

4.1.1.2 Reference data provision for Cal/Val activities

Reference data provision for Cal/Val activities
Year(s): 2021 Implementation method: Direct management by means of a co-delegation with the Joint

Research Centre.

Amount: EUR 400 000

Overall objective and purpose of the action: This activity is aiming at provision of reference in-situ data for calibration and validation of satellite data. Work will continue in 2021 on the combined operational capability of Sentinel-3A and -3B.

Activities:

(a) Delivery of high quality in-situ bio-optical reference measurement and data analysis to assess the accuracy of satellite ocean colour data products from Sentinel 3 and synergistic third party missions.
(b) Operational deployment of the autonomous radiometers included in the Ocean Colour component of the Aerosol Robotic Network (AERONET-OC) and targeted oceanographic campaigns. The support will cover the needed acquisition, operation and servicing of autonomous radiometers for multiple sites around Europe.
(c) Collaboration with European and international partners (e.g., ESA, EUMETSAT, US National Aeronautics and Space Administration, National Oceanic and Atmospheric Administration, National Institute of Standards and Technology) will ensure that in-situ sensors absolute radiometric inter-calibration, the necessary update of the relevant data processors, and the final quality control of the data products are going to be publicly accessible.

Expect output of the action:

(a) Multiple site bio-optical data

(b) Validation report

4.1.2 Objective 2: Services Provision

4.1.2.1 Land Monitoring Service

Land Monitoring Service
Year(s): 2021 Implementation method: Direct management by means of a co-delegation with the Joint Research Centre. Amount: EUR 9 100 000 Overall objective and purpose of the action: the Global Land component will assure continuation for all activities and service elements that were operational during the previous work programmes. Some sectoral activities, introduced under the Copernicus 2.0, can be started up, as well as the process for a gradual transition towards cloudification of the service component. Activities: (a) Global Sentinel Analysis Ready Data – S2GM The Sentinel-2 Global Mosaic (S2GM) component will continue its activities of the Copernicus Global Land Service providing composites from time-series of Sentinel-2 Multi-Spectral Instrument (MSI) surface reflectance observations (ESA provided level-2 data, as provided since 2018). Starting in 2021, the activity will see a gradual upgrade of functionalities, mosaicking

options, interaction options (WMS, API, etc.). Toolboxes for processing of (feasible) bio-geophysical algorithms using S2GM mosaics as inputs to generate detailed but compatible bio-geophysical variable products over ROIs will be investigated and integration started up.

(b) Global bio-geophysical variable systematic monitoring (CGLOPS)

In 2021, the Global Land component will continue its production of mid-resolution (300m) products and will provide water body and lake and river water quality products at 100m resolution. This ensures complementary to high resolution activities carried out by EEA over Europe. Global Land vegetation products will be transferred to and based on Sentinel 3 input and will see completion of the quality control and product validation exercises that are needed for the independent reviewing process including the consolidation of ground observation data and networks.

The 100m global dynamic land-cover product will be continued after a short ramping up phase to switch the algorithms from PROBA-V input to Sentinel 2 input and also Sentinel 1, keeping nevertheless the 100m resolution final product. Global Land will start with the generation of land surface characterisation (LSC). These provide binary type information on direct observable surface categories such as vegetation, bare soil, water, snow, mineral surfaces, etc. Much of the above is a good step towards creating a harmonised set of products that can serve as basis and/or common input into products further down the value chain. The common engine approach is the result of the coordination and discussions between the 2 entities, EEA and JRC. It is the plan to gradually transfer the operation of these to EEA, once they reach the desired operational maturity. The CGLOPS component will also include, as in the previous phase, the collection and distribution of ground-based observations for the validation of the bio-geophysical variables, at all resolutions.

(c) Global Hot Spot monitoring and Sectoral information

The second objective is to provide user oriented and adapted products for specific applications, linked to thematic sectors, such as forest or inland water monitoring. This focuses only on areas outside the EU. This activity is in line with the EU Biodiversity Strategy, and the support given to DG INTPA, DG ENV and DG CLIMA. The budget for this first 2021 year will be inferior as compared to future years.

Through the ongoing COPERNICUS4GEOGLAM element, high-resolution crop type maps for a number of developing countries selected by the GEOGLAM secretariat will be finalized and delivered supporting GEO and FAO food security monitoring activities.

The Hot Spot and Sectoral Information activities will be extended to support forest monitoring (World Forest COM (2019) 352 of DG ENV, UN REDD+ process). Product requirements for this will be finalised through the REDD Copernicus Horizon 2020 project and, after evaluation, will be considered to gradually start ramp up towards routine production.

Inland water and related Sustainable Development Goals (SDG), will be addressed through the finalisation (quality and validation) of the water body and water quality products at 100m supporting UNEP request.

(d) Data disseminated through an improved web site portal

As fruit of the advanced collaboration with EEA, the website and portal will see an overhaul during 2021 focusing on the visual harmonisation with a gradual structural integration of both components, which will need continuation and consolidation.

Expected output of the action:

(a) Global Sentinel Analysis Ready Data – S2GM, including tool boxes for additional variables generation;

(b) Global bio-geophysical variable systematic monitoring (CGLOPS);

(i) Production of biophysical variables; including derived global land surface characterisation
(ii) Provision of ground-based observations (both reference measurements and land products) for the validation of biophysical variables (GBOV)
(iii) Service quality control, implementation of user feedback and support mechanisms
(iv) Start-up of process for gradual service element cloudification
(v) Data Dissemination coordinated within Land service and including analysis tools

(c) Global Hot Spot monitoring and Sectoral information;

(i) Production of tailored land cover products and sectoral thematic products

(d) Data dissemination through an improved web side portal in collaboration with EEA

4.1.2.2 Emergency Management Service

Emergency Management Service
Year(s): 2021 Implementation method: Direct management by means of a co-delegation with the Joint Research Centre. Amount: EUR 14 560 000 Overall objective and purpose of the action: The Copernicus Emergency Management Service supports users in disaster management, notably the Civil Protection, Humanitarian Aid and External Action communities with timely and accurate information based on space data combined with other sources, complementing their analytical and situational awareness capacities. It addresses disasters caused by natural hazards (floods, forest fires, droughts, earthquakes, tsunamis, volcanic eruptions, landslides, storms, etc.), as well as man-made threats (industrial accidents, oil spills, etc.), inside and outside the Union. Activities are carried out in close coordination with DG ECHO. In particular the Emergency Response Coordination Centre (ERCC) of DG ECHO is the single entry point for the activation of the on-demand Mapping Service (rapid and risk and recovery mapping) by the Authorised Users, notably the Union Civil Protection Mechanism National focal points and other EC Services, and for the activation validation. The Service focuses on the priority activities defined with the guidance from the Copernicus Committee, the Civil Protection Committee and the User Forums, seeking synergies with the other Copernicus services and activities. Activities: EMS On-demand Mapping Service The service provides timely, accurate and detailed geospatial information related to natural or human-made disaster management inside and outside the Union. It comprises of the three following mapping modules: Rapid Mapping: it ensures the production and delivery of on-demand mapping products during the emergency response phase (i.e. rapid delivery), to show the impact, the damage

assessment, the reference situation and to monitor the evolution of the disaster.

Risk & Recovery Mapping: it ensures the provision of relevant geo-spatial information during the phases of the emergency management cycle which are not related to an ongoing emergency and its immediate response, i.e. prevention, preparedness and early recovery, including rehabilitation and related monitoring, risk exposure, potential hazard impact and comprehensive impact statistics.

Mapping Validation: it supports the continuous improvement of the service (focussing on Mapping) based on a wide and open scientific approach in the context of the service evolution. It continues and will further develop routine assessment workflow as well as exploration of potential improvements, synergies and innovation.

The framework contracts renewed in 2019 for Rapid Mapping and for Risk & Recovery Mapping and in 2020 for Validation remain valid.

Framework contracts for an operational aerial component will be prepared during 2021 with the aim to provide imagery to the Mapping service in situations when the level of detail and/or timeliness requirements cannot be satisfied by space-borne sensors. Two framework contracts for the manned and unmanned platforms are envisaged.

These activities will be carried out in coordination with the Member States and international partners, including UN-SPIDER, the International Charter Space & Major Disasters, the African Union, the Committee on Earth Observation Satellites (CEOS) Working Group on Disasters and the International Working Group on Satellite Emergency Mapping (IWG-SEM), in order to optimise the extent and the performance of the service.

Furthermore, the Mapping services are contributing to the GEO work programme and in particular to the GEO-DARMA Initiative (Data Access for Risk Management) and the Community Activity on Earth Observation for Disaster Risk Management (EO4DRM). Given the correlation between disaster management, humanitarian crisis, urban planning and development cooperation, outreach activities will be closely pursued with all the EU and Member States' relevant entities in order to assist users with disaster risk management, as per the UN Sendai Framework for Disaster Risk Reduction.

Expected outputs of the action:

(a) On-demand mapping - Rapid Mapping service to operate 24/7 in order to support the emergency response and deliver products within pre-defined timeline and specifications;

(b) On-demand mapping - Risk & Recovery Mapping to provide products based on geo-information and analysis covering all phases of the disaster management cycle expect an emergency phase;

(c) Catalogue, archiving and dissemination of all generated products;

(d) Validation and quality control;

(e) Continuous development and integration of newly available input data based on user requests and research findings

(f) Communication, outreach and training activities to link existing and new users with the operational service;

(g) Seeking synergies between the various Copernicus Services and EMS service components.

EMS Early Warning and Monitoring Service

The service has been developed and is continuously improved in close cooperation with DG ECHO within the Union Civil Protection Mechanism framework, which provides the Commission with a mandate to complement national capacities in the field of early warning system. The Copernicus EMS Early Warning and Monitoring Service supports the ERCC in its core tasks, such as monitoring, information exchange and coordination.

Floods:

The EMS Early Warning and Monitoring Service for floods aims at providing relevant stakeholders with complementary flood early warning information to improve preparedness and response to floods. It consists of the European & Global Flood Awareness Systems (EFAS & GloFAS) and the automated, Sentinel-1 based global flood monitoring product. The EMS Early Warning and Monitoring Service for floods includes the following distinct tasks:

(a) Collection and processing of meteorological and hydrological in-situ data to be used in EFAS and GloFAS as well as in the other early warning components. This activity is linked to the Copernicus in-situ component;
(b) Computation and visualisation of the forecast products for EFAS and GloFAS;
(c) Daily analysis of EFAS and GloFAS and communication of possible upcoming floods to the end users including the EU Emergency Response Coordination Centre (ERCC) of DG ECHO;
(d) Systematic, automated, Sentinel-1 based global monitoring of floods.

During 2021 the regular upgrades of EFAS and GloFAS including improvements in the hydrological model, increase in spatio-temporal resolution and the incorporation of more in-situ data will be continued. The set-up of the systematic, automated, Sentinel-1 based global flood monitoring product will start regular operations from August 2021. To ensure continuation of EFAS and GloFAS, an overlap of 6 months between old and new framework contracts is planned and will result in temporary increase of the budget for 2021.

Wildfires:

The European Forest Fire Information System (EFFIS) consists of a modular web geographic information system that provides fire danger forecast up to 10 days and near-real time information on active fires and burnt areas in Europe, Middle East and North Africa. The Global Wildfire Information System (GWIS), currently under development, aims at providing information on wildfires and wildfire regimes at the global level.

Overall, the activities in EMS EFFIS work programme will include:

(a) Fire Danger Prediction;
(b) Active fire mapping and near real-time monitoring of burnt areas as detected by medium (approx. 250-300m ground spatial resolution) satellite imagery with two daily updates. An enhancement of the fire delineation using S-2 will be implemented;
(c) Further development of EFFIS modules;
(d) Analysis of probabilistic forecast of fire danger and the computation of long-term fire danger forecast in collaboration with other Copernicus services such as C3S and CAMS;
(e) Maintenance and update of the EFFIS Fire Database to support the calibration and validation of other EFFIS products and services.
(f) Publication on environmental impact of forest fires in Europe as regards Natura2000 sites, forest fire emissions, etc. in collaboration with Commission services;
(g) Publication on the “Forest Fires in Europe Middle East and North Africa 2020” report

in collaboration with the European Commission Expert Group on Forest Fires (EGFF) and other Commission Directorate Generals.

(h) Development, testing and calibration of Fire Danger Forecast and fire monitoring (active fires and burnt areas) in GWIS, including data from S-2, S-3 and S-5P.

(i) Implementation and further development of dissemination activities.

The current framework contract for the operation and further development of the EFFIS early warning and monitoring includes the provision of the existing products and those that will be tested and further developed in the next 4 years.

Droughts:

The Drought Observatory consists of modular web mapping services and information systems that provide near real-time information on droughts and their likely evolution in Europe and globally. It includes a European (EDO) and a global component (GDO). The activities under the current work programme will cover the development and operational drought monitoring activities, including the following modules:

(a) Processing of meteorological, in situ and modelling data to produce a set of drought indicators from meteorological, agricultural and hydrological as well as the Combined Drought Indicator (CDI);

(b) Implementation and improvement of short-, medium- and long-term drought and heatwave forecasting across the European continent and globally;

(c) Global analysis of societal exposure and vulnerability to assess the dynamic drought risk and the potential impact on agriculture/vegetation;

(d) In case of major drought events, production of analytical reports and maps for distribution via the drought portal and directly to the ERCC;

(e) Maintenance and further development of the drought portal that provide access to the web mapping, analysis tools and analytical reports;

(f) Organisation of a yearly user meeting to collect feedback on the system functionality and user friendliness in order to further develop the Drought Observatory;

(g) Launching the transfer of the operational processing components in 2021 with the objective to finalise it during the following two to three years.

Expected outputs of the action:

Floods:

(a) A daily updated European and global flood forecasts as well as on-going floods, including daily and weekly reports to the ERCC;

(b) Communication, training and outreach for existing and new users especially regarding the newly established global service;

(c) Set up and operation of the systematic, automated, global monitoring of floods.

Wildfires:

(a) A daily updated fire danger map and a forecast for 1 to 10 days;

(b) A weekly updated European overview of fire weather forecast for the following 4 weeks and a monthly updated for the following 2 months;

(c) Daily maps of active fires (up to 6 daily updates), medium-spatial resolution maps of burnt areas (2 daily updates) and seasonal high-spatial resolution maps of burnt areas for the European, Middle East and North Africa region;

(d) Test and developments of the provision of fire danger forecast and active fires at

global scale;

(e) Provision of alerts for critical fires to support pre-tasking of the Copernicus Emergency Management Service Rapid Mapping;

(f) Annual meeting of the Global Wildfire Information System partnership in collaboration with GEO and GOFC and support to meetings of the GWIS regional networks;

Droughts:

(a) Update maps of drought occurrence in Europe and globally covering 8 and 10 days as well as a month period;

(b) drought risk indicators;

(c) Forecasts of the probable drought evolution from 7 days up to 6 months;

(d) Analytical reports of ongoing drought events in Europe and globally, supporting the ERCC and published in the relevant web portals.

EMS Exposure Mapping component

Detailed information on exposure is fundamental to adequately manage disaster risk. The core character of the EMS exposure mapping component is to provide highly accurate information derived from satellite and in-situ data on different indicators for exposure. Outputs of this component will be used in the on-demand mapping and early warning and monitoring components. Currently this component addresses built-up areas and population as follows:

Global Human Settlement Layer: The GHSL will provide high quality standardized geospatial information about the status of human settlements and their dynamics both in terms of built-up areas and population. It will include all typologies of settlements considering also temporary and informal settlements (e.g. refugee camps and slums). It will maximize the use of Copernicus missions (Sentinel-1 and Sentinel-2) in conjunction with in-situ population data (census data). GHSL cross-cutting maps on human and physical assets exposed to natural hazards are integrated in the on-demand mapping and early warning and monitoring components of CEMS as baseline data.

Expected outputs of the action:

(a) A specific land cover class abstraction named “built-up areas” reporting about presence of buildings at high spatial resolution (10 meters);

(b) “Population distribution grids” reporting about human exposure will be produced by integration of the above artificial built-up areas with census data;

(c) Annual updates of spatial information (grids) reporting about the presence of built-up areas;

(d) A periodic update of spatial information (grids) reporting about the density of population by integration of artificial built-up surface and census data (GHS Pop);

(e) Triannual and sample-based collection of information about the presence of artificial built-up surfaces for the validation of the service outputs.

4.1.2.3 External independent expertise

External independent expertise
Year(s): 2021 Implementation method: Direct management by means of a co-delegation with the Joint Research Centre. Amount: EUR 650 000 Overall objective and purpose of the action: for the Commission to get support from external independent experts for the benefit of the programme. Activities: The Commission will make use of experts to support: (a) The assessment of the technical and scientific feasibility of the objectives of the Copernicus programme and the proposed solutions in all the programme's components; (b) The technical and scientific validation and review of the deliverables, solutions and results supplied by the operators of the Copernicus programme; (c) The assessment of the implementation measures proposed or carried out by the operators of the Copernicus programme; (i) In assessing the objectives and solutions under paragraph a), the experts will consider the fitness of operational services and infrastructure to meet programme objectives, and the effectiveness of solutions put in place since the programme start in 2014. Experts will be asked to render recommendations on the work programmes, plans and scenarios or any decision concerning the objectives to be achieved by the Copernicus programme; (ii) Additionally, the Commission will continue to make use of these Experts to provide independent advice and analysis in the definition of baseline requirements for potential Copernicus evolutions, including space segment, ground segment, modelling and Service infrastructure; (iii) The validation and review of deliverables under paragraph b), solutions and results will provide the Commission with technically and scientifically sound reliable opinions on the work carried out by the operators, including by their service providers along the delivery chain. These opinions will support the Commission in its decisions to process the payment requests submitted by the operators; (iv) The assessment to be provided under paragraph c) will provide an analysis of the effectiveness and improving the use and integration of Copernicus and Earth observation data by public sector and other users. This will support the Commission in the adoption of the work or implementation programmes submitted by the Copernicus operators and will feed back into the setting and review of the programme objectives in paragraph a); (v) These experts may also be used to provide expertise and advice in other relevant areas, such as supporting the implementation of the Commission Knowledge Centre on Earth Observation and the Task Forces for priority areas such as the CO2 emissions and Polar. Additionally, experts may be used in the assessment the fitness for purpose of the programme, through the inter-comparison of Copernicus

products and services with other global efforts, such as the external fitness for purpose (F4P) Copernicus Climate Change Service support, the definition of requirements for the Data Warehouse, the definition and implementation of the Copernicus Web Portal, spatial data and information acquisition and processing, or standardisation. The experts may also be asked to develop a forward vision on the challenges of the 'Big Data era' (possibly in concert with related Horizon 2020 projects and Linked Open Data technologies). The experts may provide technical evaluation of big data solutions applicable to the different domains of Copernicus taking into account where necessary the level of confidentiality requested. The experts may also assess and test the interoperability and portability of ICT solutions and methodologies in a big data environment.

Expected output of the action:

Analysis, advice and recommendations in the form of written reports.

4.1.2.4 Performance studies and support

Performance studies and support
Year(s): 2021 Implementation method: Direct management by means of procurement(s). Amount: EUR 500 000 Overall objective and purpose of the action: for the Commission to get support from external independent experts for the benefit of the programme. Activities: The Commission may find it necessary to support its assessments of the Copernicus programme through additional performance studies, targeted at the programme as a whole or at specific aspects thereof, such as security. Expected output of the action: Analysis, assessments, advice and recommendations in the form of written reports.

4.1.2.5 Support to the Global Climate Observing System Secretariat

Support to the Global Climate Observing System (GCOS) Secretariat
Year(s): 2021 Implementation method: Operating grant to the GCOS secretariat, located at the WMO headquarters in Geneva, Switzerland. The maximum possible rate of co-financing of the eligible costs is up to 100% of the total eligible costs, without prejudice to the co-financing principle. Amount: EUR 250 000 Overall objective and purpose of the action: To ensure the continued operations of the GCOS secretariat for the calendar year 2022. Activities: The activities of GCOS are of particular importance for the sustainable international coordination on and the provision of climate information to international user communities and synthesising their observational needs and requirements. GCOS activities and its

institutional weight are key factors for C3S to get full traction at the global level and to be able to drive international standards and implementation plans. A dysfunctional GCOS secretariat would be detrimental for the successful implementation and the global impact of the Copernicus Climate Change service. A direct grant to the GCOS Secretariat is the most efficient and most effective implementation, which cannot be provided by any other entity.

Expected output of the action:

The GCOS Secretariat will be supported for the calendar year 2022.

4.1.3 Objective 3: Data access and distribution

None.

4.1.4 Objective 4: User uptake, market development and capacity building

4.1.4.1 User uptake – Global CLMS

User uptake – Global Land Monitoring Service

Year(s): 2021

Implementation method: Direct management by means of a co-delegation with the Joint Research Centre.

Amount: EUR 500 000

Overall objective and purpose of the action:

The action aims at reinforcing the CLMS user community, widening the market and the related uptake of products by:

(a) ensuring quality of products and services and providing transparent user focused information on this;
(b) ensuring user feedback mechanisms for fine-tuning technical criteria and advancing current and future products to improve user uptake; and
(c) building capacity through providing use cases and compiling adapted access, visualisation and analysis tools that facilitate use, stimulate uptake and create an improved and recurrent market;
(d) provide regular outreach communication and interaction.

Activities:

(a) Organisation and implementation of the independent review process on all aspects of products and services in order to provide the user community with regular and transparent information on the scientific quality of the products and technical guidance for their use.
(b) Organisation and implementation of the Technical User Group activity to ensure the continuation of the user driven aspect of the service. User involvement is, and has been so far, a key element for the success of the global land component. User feedback and requirements for product uptake and use is systematically collected through an interactive user feedback portal and dedicated meetings focusing on products and services. User defined product technical criteria and requirements are feedback into the product and services processes. This can lead to corrective maintenance, initiate product evolution or highlight the need for new products in the

longer term.

(c) Development (or adaptation) of targeted visualisation and analysis tools for global land users that are made available on the website or e.g. as plugins for open source GIS systems. Compilation of use cases that are illustrative for the use of products in general and mainly guiding the use of the tools, therefore facilitation product integration in user processes.

(d) Compilation of user targeted communications to be published through the CLMS website and/or social media, etc. Organisation of user interaction activities (e.g. workshops, webinars, etc.)

Expected output of the action:

(a) Products that are constantly at user defined state-of-the-art level with clear communication on external reviewed quality status leading to improved trust and user uptake.

(b) Products that fully respond to user needs therefore facilitating uptake and use.

(c) Specific access, visualisation and analysis tools, and use cases, that guide and facilitate product integration in user processes.

(d) Improved communication on the service. At least one workshop or similar user interaction activity.

4.1.4.2 User uptake – CEMS

User uptake – Emergency Management Service

Year(s): 2021

Implementation method: Direct management by means of a co-delegation with the Joint Research Centre.

Amount: EUR 440 000

Overall objective and purpose of the action:

(a) To increase awareness about the CEMS and further promote its products

(b) To ensure that user feedback is collected and incorporated in the service evolution

(c) To facilitate the usage of the CEMS products through training activities

Activities:

Increasing awareness and product promotion: Various communication channels will be regularly used and maintained to ensure recognition of the service as well as to communicate about latest developments, achievements or new products. The communication channels include the CEMS twitter account (more than 29.000 followers), article contributions to the Copernicus Observer and other relevant media, the main CEMS website and sub-websites of the CEMS components as well as the regular user meetings and promotion of CEMS at various events.

User feedback: User feedback will be collected through surveys, feedback functionalities on the CEMS websites or the annual user meetings.

Training activities: Regular user trainings, webinars or seminars will be performed to

facilitate the usage of the CEMS products.

Expected output of the action:

(a) Regular publication and continuation of the CEMS Twitter account

(b) Promotion of CEMS at events

(c) Production and update of communication material (flyers, poster, banners, video)

(d) Regular article contribution to the Copernicus Observer and other relevant media

(e) Annual user meetings

(f) Annual user surveys

(g) Trainings, webinars and workshop for capacity building

4.1.4.3 Networks of Copernicus relays, Copernicus Academy and running of the Copernicus User Uptake Support Office

Networks of Copernicus relays, Copernicus Academy and running of the Copernicus User Uptake Support Office

Year(s): 2021

Implementation method: Direct management by means of a procurement.

Amount: EUR 1 500 000

Overall objective and purpose of the action: To reach out to potential end-user communities and extending its own channels of promotion towards intermediate and end-user communities.

Activities:

An awareness structure has been set-up for the mid- and long-term perspective, ensuring a sustainable and homogeneous coverage of Copernicus Participating countries. Since 2016, the Commission has engaged with national, regional and local stakeholders for Copernicus user uptake through the creation of two Networks of Copernicus helpdesks/information points called the "Copernicus Relays" and the "Copernicus Academy".

The Relays provide stakeholders/general public/experienced users with technical assistance, and increase awareness activities. A bottom-up approach also exists since the structure is perceived as one of the user-feedback mechanisms to the Commission services.

The Copernicus Academy supports an uptake from universities and research centres, through providing course material and dedicated information for public research organisation. It also supports transition from research to commercial (spin-offs). The Copernicus user uptake support office has been created to provide any supports to the Relays and Academy (e.g. organisation of awareness activities, providing with background materials), to facilitate interactions and exchange of best practices among members, as well as to animate the Networks. The main objective of the Support Office is to ensure broad, coordinated and sustainable user uptake initiatives across Copernicus Participating States.

The user uptake support office also liaises and develops partnerships with the various user uptake key partners identified in the study on Engaging with Public Authorities, the private sector and civil society for Copernicus user uptake, most notably the Copernicus Relays for User Uptake, as well as the Copernicus Academy launched in 2016, but also other relevant

networks and industry stakeholders.

The Copernicus user uptake support office also contributes to the promotion of any relevant user uptake activities through new channels of communication.

This tool maintains a user uptake initiatives action plan, supports the rendition in national action plans and also ensures cross-fertilisation of best practices between the partners.

The specific contract for the running of the Copernicus user uptake support office is based on experience from the previous contracts launched since 2016.

The Copernicus Relays should act as multipliers developing initiatives to reach two different types of objectives:

(a) To promote Copernicus as a source of free, open, and reliable information to meet the needs of local public services;
(b) To promote Copernicus as source of full, free, open, and reliable data for the development of environmental services with high commercial potential by local entrepreneurs.

An increased uptake can be achieved with the Relays' concrete involvement to broaden the spectrum of stakeholders to communities that have no direct connection with space.

Beyond an initial function of building awareness and stimulating local actors, the Network of Copernicus Relays and Copernicus Academy promotes the opportunities offered by the programme at a national level in order to develop an extensive network.

Expected output of the action:

(a) Running of the Copernicus User Uptake support office for two years (via a Specific Contract under an existing Framework Contract);

(b) Increased awareness raising of national Network of Copernicus helpdesks/information points.

4.1.4.4 Copernicus Framework Partnership Agreement

Copernicus Framework Partnership Agreement
Year(s): 2021 Implementation method: Direct management by means of Specific Grant Agreements. Amount: EUR 4 000 000 Overall objective and purpose of the action: The Commission has set-up the Copernicus Framework Partnership Agreement (FPA) between the Commission and Member States to foster the uptake of Copernicus in the European Union and beyond. This action will allow continue co-financing actions managed and coordinated by a consortium of Member States through Specific Grant Agreements (SGAs). As a primary objective it will seek to increase the number of users and applications derived from Copernicus. Activities: The FPA will finance actions (through Specific Grant Agreements - SGAs) for the following Tiers: (a) Tier 1: national user uptake, by promoting the use by national stakeholders. Examples include national or local awareness events, training sessions, online courses, support

to the production and procurement of space applications (e.g. by public authorities), design and dissemination of promotional material, hackathons, etc.

(b) Tier 2: global actions, including European cross border user uptake and international user uptake.

(i) European cross-borders user uptake, comprises actions organised in several Member States, by increasing co-operation, joint awareness events exchange of best practices and creation of common products and applications; whereas

(ii) International user uptake actions make use of the existing national and European infrastructure (such as the national research and education networks and the direct transatlantic high-bandwidth connection between Europe and South America) to develop, by concrete actions, the international co-operation agreements under Copernicus (e.g. the United States, Australia). Activities should support the internationalisation of European companies offering applications based on Copernicus and space data (e.g. matchmaking sessions with partners from third countries, business missions…)

(c) Tier 3: business solutions and innovative products and applications, by supporting innovation businesses and start-ups, their incubation and maturity and lifting administrative and legal barriers, and sponsoring the creation of new products and applications and their intellectual property rights (e.g., patents, licensing, etc.) Activities should focus on promoting innovation in the commercial Earth observation downstream sector, by providing such companies with training, networking and financing opportunities. The link with users will be strongly encouraged, in order to ensure the sustainability of the projects.

SGAs award criteria:

The award criteria for the SGAs will be the following: a) the relevance of the application to the objectives of the action; b) the visibility of the European institutions' involvement in the action; c) the impact on the target group and the multiplier effect of the action; d) the quality of the project; e) the budget and effectiveness.

Financing rate: up to 85%

Expected output of the action:

(a) Involvement of public authorities in the implementation and the promotion of the Copernicus programme;
(b) Extended use of Copernicus in public authorities, in particular for the monitoring and implementation of Union Regulation and policies;
(c) Support to the development of innovative Copernicus-based applications;
(d) Boosting jobs and growth in the Copernicus downstream sector.

4.1.4.5 Copernicus international activities

Copernicus – international relations
Year(s): 2021 Implementation method: Direct management by means of a procurement. Amount: EUR 200 000 Overall objective and purpose of the action: to promote the implementation of Copernicus

cooperation agreements with key international partners and organisations so as to maximise the opportunities given by Copernicus. Technical international cooperation is required, enabling the global uptake of EU space services, opening or expanding international markets for the EU aero-space ecosystem and projecting EU values; to support the implementation the Greenhouse Gas Roadmap, for CO_2 (carbon dioxide) and CH_4 (methane) – in support of the EU Methane Strategy from October 2020 - monitoring from Space as endorsed at the 34th Plenary of the Committee on Earth Observation Satellites (CEOS) in 2020.

This roadmap stems from the European leadership during the first ever European Commission term as Chair of CEOS in 2018. It will provide a complementary international framework to many of the aspects we are developing in Copernicus in the next MFF.

Activities:

(a) Workshops for coordination of Space agencies operating Earth observation satellites worldwide to support the greenhouse gas monitoring roadmap on support of the Paris Agreement.

(b) Workshops for user awareness in countries or for international organisation with Copernicus cooperation arrangements.

Expected output of the action:

Enhanced global uptake of Copernicus data and services.

4.1.4.6 Copernicus communication activities

Copernicus – communication
Year(s): 2021 Implementation method: Direct management by means of a procurement. Amount: EUR 300 000 Overall objective and purpose of the action: To promote the benefits of the Copernicus component on fully dedicated channels. Activities: (a) To ensure the promotion of Copernicus on online media, notably via the evolution and maintenance of copernicus.eu website. (b) Efforts will also be deployed to reinforce the coordination of activities implemented by Copernicus entrusted entities and the different partners and multipliers. Key Performance indicators for communication activities will be collected and thoroughly analysed in order to reach targets defined in the Space Programme's statement. These activities will be complemented with actions mentioned in the communication section of Annex 1. Expected output of the action: (a) Foster the promotion of Copernicus data and information, as well as their benefits; (b) Enhanced uptake of Copernicus data and information.

4.2 Actions in indirect management

The following sections give details for the implementation in 2021 for the multiannual actions in indirect management. The commitment figures and description of the tasks mentioned in this section are for information only as they are already covered in section 2 on the multiannual delegated tasks and budget for actions in indirect management.

4.2.1 Tasks Entrusted to ESA

4.2.1.1 Data acquisition (Objective 1)

Indicative Amount in 2021: EUR 510 112 129

Activities in 2021:

(a) Development of Sentinel evolution missions: some activities with EU funding may be initiated, related to the activation of the contractual options for Sentinel Expansion missions, subject to the 2021 Joint Decision. This Decision, to be taken jointly by the Commission and ESA in the second half of 2021, will adjust the preliminary system architecture, deployment schedule and operational modalities to the available funding; as well as to the programmatic, user needs, political priorities and findings available from Phase B activities of the Sentinel Expansion missions. The output of the Joint Decision will be a detailed system architecture of the overall Copernicus Space Component, including the description of the future Sentinel missions to be implemented (Expansion missions and Next Generation missions), as well as an indicative target schedule for their deployment.

(b) Launcher procurement for S-1, -2, -3 C-Units: There are no Copernicus launches foreseen in 2021. However, contracts may need to be placed with industry to ensure the next launches (based on the assumption of Sentinel-1/2/3 C units to be launched during the period end 2022-end 2025).

(c) Sentinels operations: These activities cover the continued operations of the Sentinels and preparation of the continuation of these activities for 2022. ESA manages the operations of the Sentinel-1 and Sentinel-2 missions, the Sentinel-3 mission (for the land user community), and the Sentinel-5P mission.

(d) Third party data: regular data procurements from Copernicus contributing mission entities of Additional data (on-demand), Core data (systematic) following the estimated quota needs expressed by the Copernicus Services. In addition, there will be a service buy for the Pan-European VHR2021 activity. There are also planned activities for improving the CCME activities in line with the more stringent requirements of the Copernicus Services (e.g. timeliness and data access). The Commission will also together with ESA work jointly to explore new alternative business models, including anchor tenancy schemes to provide on-demand data for rapid response and to increase the share of data procurements from European CCMEs without compromising the requirements of the Copernicus Services and the risk for distorting the market.

Expected output of the action:

(a) Sentinel expansions: activation of certain contractual options with industry, based on 2021 Joint COM-ESA Programmatic Decision

(b) Launcher procurement for Sentinel-1C planned to start in Q4 2021

(c) Operations: new contracts, contract options or CCN-s (Contract Change Notice) as necessary to complement existing contracts funded under the MFF 2014-2020.

(d) Third party data: contract with industry

4.2.1.2 Data access and distribution (Objective 3)

Indicative Amount in 2021: EUR 7 500 000

Activities in 2021:

(a) Deliver full, open and free operational Sentinel-1/2/3/5P data services to the Copernicus Services and the Copernicus user community at large.
(b) Deliver full, open and free operational Sentinel-1/2/3/5P data services to Member States to support the integrated ground segment activities.
(c) Deliver full, open and free operational Sentinel-1/2/3/5P data services to support the international agreements.
(d) Provide access to complementary operational Copernicus data and information services in continuity of the current DIAS operations.
(e) Provide user support for the user level data and data access services delivered by ESA to the Copernicus user community.
(f) Provide data access services to EUMETSAT, including Sentinel-3 land data for Africa and Sentinel-5P Near Real Time data services in Europ
(g) Provide the necessary dissemination/network capacity to support the data services operations.
(h) Maintenance and evolution of data access interfaces to ensure data access continuity and availability of enhanced interfaces supporting efficient user access to increasing data volumes.

Notes:
Operations are delivered by industrial services procured through open competition.

Data services operations cover the full Copernicus Sentinel data from the start of respective mission operations.

Full data access operations include on-line data access as well as data retrieval from long term archives and on-demand production as relevant.

Expected output of the action:

Delivery and availability of user-level data and associated support and exploitation services

4.2.2 Tasks Entrusted to EUMETSAT

4.2.2.1 Data acquisition (Objective 1)

Indicative Amount in 2021: EUR 62 582 590

Activities in 2021:

(a) Space component development:
  (i) Carry out, together with ESA, system and ground segment development activities related to the CO2M mission.
  (ii) Contribute to the establishment of the technical requirements of Sentinel "Expansion" and "Next Generation" missions, as required.
(b) Sentinels operations:

(i) Operate the Sentinel-3 A/B satellites, in cooperation with ESA.
(ii) Operate the Sentinel-6 Michael Freilich satellite in cooperation with the Sentinel-6 mission partners.
(iii) Conduct operational maintenance activities for all satellites operated by EUMETSAT, with support from ESA, including maintenance of on-board software, anomaly investigations and analysis of spacecraft parameters.
(iv) Operate and maintain the ground facilities and services used to deliver the Sentinel-3 marine and atmosphere missions, including processing, reprocessing, calibration and validation, archiving and dissemination of the mission data.
(v) Conduct Satellite in-orbit verification and commissioning activities for the Sentinel-6 Michael Freilich mission, in cooperation with the programme partners.
(vi) Operate and maintain the ground facilities and services used to deliver the Sentinel-6 Michael Freilich mission, in synergy with the Sentinel-3 Altimetry mission and in cooperation with the programme partners. This includes reception, processing, reprocessing, calibration and validation, archiving and dissemination of relevant dedicated mission data.
(vii) Operate and maintain the ground facilities and services used to deliver the Jason-3 mission, including acquisition, processing, re-processing, calibration and validation, archiving and dissemination of Jason-3 mission data, in cooperation with the Jason-3 programme partners.
(viii) Continue the upgrade and evolution of the Sentinel-3 ground segment elements operated by EUMETSAT including obsolescence removal and the upgrades necessary to support future Sentinel-3C operations.
(ix) Support user requests for evolutions of the data services delivered by EUMETSAT and conduct studies and preparatory activities to ensure the continuous improvement of the user level data services.
(x) Complement the evolution of the EUMETSAT Multi-Mission Infrastructure to continue supporting safely data operations.

(c) Access to third party data: Ensure access to data from selected Third Party Data providers to the Copernicus Marine and Atmosphere monitoring services and other Copernicus Users.

(d) Support the Commission in its interactions with international stakeholders in Copernicus.

Expected output of the action:

(a) Availability of data services from third party missions and missions operated by EUMETSAT under Copernicus, in line with the established performance requirements.

(b) Established ground segment requirements and architecture for the CO2M mission including the initiating of Phase B2 activities.

(c) Updated technical requirements for Sentinel "Expansion" and "Next Generation" missions.

4.2.2.2 Data access and distribution (Objective 3)

Indicative Amount in 2021: EUR 4 250 000

Activities in 2021:

(a) Deliver the operational data services to the Copernicus Marine Environment

Monitoring Service (CMEMS), the Copernicus Atmosphere Monitoring Service (CAMS), the international partners in Copernicus and the Copernicus user community at large.
(b) Deliver Sentinel-3 data services to Africa, including Sentinel-3 land data in cooperation with ESA and data from the Copernicus Global Land Service.
(c) Deliver Sentinel-5P Near Real Time data services in Europe in cooperation with ESA.
(d) Ensure access to data from selected Third Party Data providers to the Copernicus Marine and Atmosphere monitoring services and other Copernicus Users.
(e) Bandwidth for dissemination and/or data access link capacity.
(f) Complement the evolution of the EUMETSAT Multi-Mission Infrastructure to continue supporting safely data access operations.
(g) Operate and upgrade, in partnership with ECMWF, Mercator Ocean International and EEA, the federative WEkEO Copernicus Data Access Services, providing integrated access to Copernicus data and information.
(h) Provide user support for the user level data and data access services delivered by EUMETSAT to the Copernicus user community.

Expected output of the action:

Delivery and availability of user-level data and associated support services

4.2.2.3 User uptake (Objective 4)

Indicative Amount in 2021: EUR 700 000

Activities in 2021:

(a) Conduct activities to increase the uptake of the Copernicus data/information produced by EUMETSAT, in close coordination with the Commission.
(b) Contribution to international symposia, conferences and seminars, awareness and promotion activities
(c) User support activities and help desk on the Copernicus Marine and Atmosphere Data stream services for the Copernicus user community
(d) Training services to generate awareness and increase the uptake of marine and atmosphere data services provided by EUM
(e) Support the Commission in its interactions with international stakeholders in Copernicus.

Expected output of the action:

(a) Promotional items, media coverage, awareness and user uptake material
(b) Trained experts, training material and webinars
(c) Increased uptake of Copernicus data in Marine and atmosphere applications
(d) User support / helpdesk

4.2.3 Tasks Entrusted to the EEA

4.2.3.1 In-situ data coordination (Objective 1)

Indicative Amount in 2021: EUR 2 000 000

Activities in 2021:

(a) Determine State of Play. Maintain an overview of Copernicus' in situ data

requirements, use, and challenges. In 2021 main activities under this work package will include:

(i) Collecting, analysing, and recording information concerning in situ data requirements and data used for production and validation of Copernicus data and information products and for the calibration and validation of Copernicus Sentinel payloads and data;

(ii) Analysing and documenting in situ data gaps, priorities, and the potential for improvement of in-situ data access and availability.

(b) Provide access to data. Establish, maintain, and improve operational provision of selected in situ data in accordance with the entrusted entities' needs. In 2021 main activities under the work package will include:

(i) Operate, maintain, and develop the Copernicus Reference Data Access Portal (CORDA), including collection, transformation, completion, and provision of access to multi-country datasets, as harmonised as feasible, through a single point of access, and using primarily INSPIRE compliant data and web services;

(ii) Organise and execute training and information events (online) targeted CORDA users – mainly service providers supporting the CLMS and CEMS;

(iii) Facilitate access to specific essential environmental data themes via the Eionet Core Data Flows that are essential to the Copernicus entrusted entities, hereunder in particular the up-to-date Air Quality Data Flow.

(c) Engage with data providers. Engage and create partnership and other agreements with in-situ data providers, networks, and organisations to improve in situ data access and use conditions in accordance with Copernicus' needs. In 2021 work will target improving the completeness of and reduce use restrictions (e.g., as regards data redistribution) currently put on data and observations made available by members of EUMETNET and EuroGeograhics to Copernicus. EEA will work with EUMETNET, EuroGOOS, and Research Infrastructures to highlight their members' contributions to Copernicus, i.e., devise ways and communication channels to properly recognise their important contributions.

(d) Provide support and advice. Provide support to and advise the European Commission and Copernicus entrusted entities regarding Copernicus in situ data activities. In 2021 specific activities will include:

(i) Recue, reprocessing, and quality control of global marine drifter data;

(ii) Support to the in situ component of the CO2 Monitoring and Verification Support capacity as required. In particular, as regards activities related to coordination and governance at European level as well as facilitating the addition of complementary observing capacity (in particularly urban areas) to existing networks;

(iii) Improving access to operational and R&D observations from the Polar region;

(iv) Analysing the availability of and improving access to land use data;

(v) Analyse the state of play regarding access to hydrology data for which cross-cutting requirements have been identified;

(vi) Create methods to combine existing settlements and hydrography data to construct

harmonised datasets for the benefit of Copernicus Services.

Expected output of the action:

(a) The dedicated data portals operated by the EEA, partnership and data access agreements with selected data providers, and gap analysis activities will improve access to critical in situ data identified by Copernicus services, ESA, and EUMETSAT;

(b) The overview of the Copernicus In Situ Component will be maintained and updated to appropriately reflecting the status of the Copernicus In Situ Component across all six Copernicus Services, ESA, and EUMETSAT. This will be achieved through the release of information products and the Copernicus In Situ Component Information System;

(c) The stakeholders', e.g., the Copernicus User Forum's, Copernicus Committee's, and data providers' knowledge and understanding of the importance and functioning of the Copernicus In Situ Component will be augmented.

4.2.3.2 Land Monitoring Service (Objective 2)

Indicative Amount in 2021: EUR 27 150 000

Activities in 2021:

In 2021, the pan-European and Local Land monitoring service will build further upon the successful implementation of the Copernicus land monitoring service in 2014-2020 period during which a broad portfolio of land monitoring products was produced, based on High Resolution satellite imagery and covering the full geographic extent of 39 European countries[3]. The portfolio consists of: a) image mosaics, b) land cover and land cover change mapping, c) high resolution layers (HRL), d) hotspot monitoring products, e) biophysical parameters, f) European Ground Motion and e) reference data.

In 2021, the EEA will continue the implementation of CLC+ BackBone and CLC+ Core database production in cooperation with EIONET Action Group on Land Monitoring in Europe (EAGLE) and continue preparing the roll out of first tailored instances, in particular the one for LULUCF reporting and the Legacy one, providing continuity for CLC based assessments. For the HRL, in terms of workflow and products only minor fine-tuning changes in the HRL production for the reference year 2021 will be prepared, based on the lessons learnt from the 2018 production series. In order to fulfil this gap in the HRL suite, and thus serve the carbon accounting request for support from Copernicus CLMS by DG CLIMA, a new HRL layer on Crop mapping will be added to the HRL product suite. More emphasis will continue to be put on the bio-geophysical parameters, which are being used as a baseline for the HRL production. For the European Ground Motion database a preparatory phase was launched in 2020 and the service implementation will start early 2021 with a ramp-up phase, and then the actual service production. In 2021, the EEA will continue maintaining the EU-Hydro and start assessing the phasing out of the EU-DEM reference dataset, to be replaced by the Copernicus 30m DEM, aiming at assuring consistency between EU-Hydro and the Copernicus DEM.

It is foreseen to use the year 2021 for preparing the handover of the operational production of global biophysical parameter monitoring from the JRC to the EEA. This handover fits the

[3] 27 Union's member states, the United Kingdom, four EFTA countries, six Balkan countries and Turkey.

objective to move towards commonly used initial steps in workflows specific to each component of the CLMS, so as to realise an economy of scale, in particular on the parts that can be fully automated based on consolidated algorithms.

User uptake activities will predominantly focus on the European Green Deal which provides a strategic direction for EU policies to boost the efficient use of resources by moving to a clean, circular economy, restore biodiversity and cut pollution, and for which the EEA is committed to ensure that the CLMS can be used as a monitoring mechanism that feeds into indicators to measure progress in the policies constituting the European Green Deal.

In terms of communication activities, EEA will continue to maintain the Copernicus land portal, which functions as a single point of access for the CLMS. A range of communication, awareness raising and user uptake activities will be undertaken concerning the pan-European and Local Land monitoring activities with a focus on a broader user uptake potential for the land monitoring services. Thematic programmes at the EEA and various thematic National Reference Centres (NRC) will continue to be involved in the uptake of Copernicus products for environmental and climate related support to Community policies. At the same time, the production and dissemination of several CLMS products on the WEkEO DIAS has started in 2020, and will continue to be further extended over 2021 and the coming years.

In 2021, the operational activities for the pan-European land monitoring will focus on:

(a) The continuation of production of the CLC+ Backbone as part of the CLC+ suite of products (1st phase, reference year 2018);

(b) The production of the CLC+ Core grid hybrid database as part of the CLC+ suite of products (2nd phase).

(c) The production of the High Resolution Layer (HRL) Small Woody Features 2018;

(d) The preparation of specifications and executing the call for tender for the the High Resolution Layers (HRL) (introducing the regrouping of HRLs into vegetated LC characteristics (forest, grasslands, crop types), non-vegetated LC characteristics (imperviousness, settlements, bare rock) and Small Landscape Features) for the reference year 2021;

(e) Start of production of the HRL Crop Types, using HR-VPP, and integrating grasslands and forests (input data 2020)

(f) The ramp-up of the production of an operational pan-European Ground Motion database (EGMS) and the initial production thereof

The operational activities for the priority area land monitoring 2021 will continue focusing on:

(a) The preparation of the production of UA2021 as a first step towards a 3-yearly update cycle of the UA time series;

(b) Natura2000 2018 product, including change mapping 2012-2018 and extension to EEA member and cooperating countries;

(c) The finalisation of the first phase CZ2018 product.

The operational activities for the biophysical parameters will continue focusing on:

(a) The continuous production of high resolution vegetation phenology and productivity datasets (HR-VPP);

(b) The operational and continuous production of HR S&I, including the Sentinel 1 SAR

based information.

The operational activities for the reference datasets will focus on:

The assessment of the differences between EU-DEM and the Copernicus DEM, with respect to ensuring consistency between EU-Hydro and the Copernicus DEM.

Expected output of the action:

(a) CLC+ BackBone 2018 product available;

(b) Contracts signed for HRL update for vegetated LC characteristics and non-vegetated LC characteristics;

(c) Min. 75% of coverage for the HRL Small Woody Features available;

(d) Min. 50% of coverage of HRL Crop Types available

(e) Min. % of EGMS production available;

(f) UA2021 update call for tender published, evaluated and granted;

(g) N2K2018 available

(h) CZ2018 available;

(i) HR Snow & Ice and HR Vegetation Phenology & Productivity service operationally providing timely information.

4.2.3.3 Data and Information Access Services (Objective 3)

Indicative Amount in 2021: EUR 400 000

Activities in 2021:

EEA, in partnership with Mercator Ocean International, ECMWF and EUMETSAT, will contribute to the continuity and evolution of the Copernicus Data and Information Access Services, WEkEO, as developed and operated under the Copernicus Agreements covering the period 2014-2020. The activities related to the implementation of these services shall be jointly managed by the partnership and include:

- Operation, upgrade and management of infrastructure and software services;
- Management and upgrade of data and information available through the infrastructure;
- Operation, management and upgrade of tools and user support services;
- Stakeholder management, awareness and promotion activities.

In particular, the activities in 2021 will be:

- To ensure that all data and information products from the CLMS portfolio can be easily searched and accessed by providing the necessary transformations of metadata, and availability of the datasets in the appropriate formats.
- Support the operation of the WEkEO central service desk in replying to technical and scientific questions with regard to the use of CLMS products and services as available in WEkEO.
- Contribute, in cooperation with the other WEkEO partners to the dedicated communication, awareness raising and training activities to guide and support users in need of CLMS data or combinations of CLMS data with other data sources in

WEkEO to their use cases

- Support expert users who need to incorporate CLMS data and processing modules dedicated to land monitoring as available in WEkEO.
- Deployment of CLMS production workflows on WEkEO, (amongst other: CLC+, HR-VPP, HR S&I and MR-VPP)

Expected output of the action:

(a) CLMS metadata converted to HDA and data made available in COG

(b) User support wrt CLMS related questions

(c) Communication and training deliveries

(d) Expert guidance on specific CLMS related processing modules

(e) CLMS intermediate and final products accessible in WEkEO

4.2.3.4 User uptake (Objective 4)

Indicative Amount in 2021: EUR 1 450 000

Activities in 2021:

(a) An update of the CLMS portal with a better integrated and unified user experience throughout the components of the portfolio;

(b) Gather information about existing use cases and development of new use cases; create an easy to follow step-by-step process for users to write and submit use cases, promote these use cases on a regular basis through multiple channels;

(c) Social media activities to reflect the potential of the CLMS in all its components;

(d) Reinforce cooperation between the CLMS and the EEA social media teams for promotion of CLMS on EEA social media channels;

(e) Organise an annual meeting for all CLMS stakeholders;

(f) Produce webinars to describe product updates, train users on new products and to gather user feedback and/or requirements.

(g) Select and produce 3 selected pilot use cases as showcase for feasibility and with relevance to underpin an EU policy

(h) Provide guidance and support to the MS via the Eionet NRC/LCs to collect the necessary national in situ LU datasets, convert them into EAGLE data model compliance and ready for ingestion in the CLC+ Core DB.

Expected output of the action:

(a) Up-to-date products in line with the user expectations

(b) Improved communication and interfaces towards the final users.

(c) Webinars and meetings

(d) 3 Documented pilot use cases

(e) A first series of +/- 10 MS having national in situ LU datasets collected and converted

to the EAGLE data model (ready for ingestion in CLC+ core)

4.2.4 Tasks Entrusted to Mercator Ocean International

4.2.4.1 Marine Environment Monitoring Service (Objective 2)

Indicative Amount in 2021: EUR 49 100 000

Activities in 2021:

The 2021 activities are concentrated on:

(a) The extension of major contracts for the production, namely the Cloud Dissemination Unit, Central Information System, Monitoring and Forecasting Centres (MFCs) and Thematic Assembly Centres (TACs) to ensure the continuity of operations from 1 July 2021 (end of Copernicus 1) up to end of December 2021;

(b) The continued scaling up of the operations related to physics and biogeochemistry observation and model products in all regions based on evolutive maintenance of the data processing, model and data assimilation techniques and the inclusion of the results from past R&D projects terminated in 2020;

(c) The release of one version of CMEMS portfolio (December 2021);

(d) The preparation of the new tenders and the corresponding evaluation and selection process to cover CMEMS main production for the time period 2022-2024 (3 years);

(e) The setting up of cooperation with ECMWF to address ocean ECVs reprocessing activities and development of CO_2 fluxes for the CO_2 monitoring centre; the setting up of cooperation with JRC to address CEMS flood forecasting system needs with respect to CMEMS sea level and wave forecasts;

(f) The continuation of the user uptake activities with a new focus based on assessments carried out by Mercator Ocean International in 2020 and taking into account Copernicus 2.0 priorities and organisation in DG DEFIS.

(g) Launch of a Service Evolution User Experience call in Q3/Q4 to improve the service impact and user experience of the Copernicus Marine Service. This call will aim at better translating the marine data into sectorial understandable information, transferring it in format or media most useful for each sector and put it into exemplary usage context. It will be prepared with the CMEMS Core User Advisory Group.

(h) Launch of a Service Evolution Science&Technology call in Q3/Q4 to support the scientific and technical evolution of the Copernicus Marine Service. The call will be based on an updated version of the Copernicus Marine Service R&D roadmap prepared by the CMEMS Scientific and Technical Advisory Committee to reflect the substantial amount of new elements and relevant strategic orientations of the Copernicus Marine Service.

(i) Digital services: preparation of the major upgrade of the service to deploy a marine user gateway, a marine data store and a marine open hub based on the Wekeo architecture and services;

(j) Marine Biology: assessment of what to be prepared to implement marine biology products after 2021 linking physics with biogeochemistry and marine ecosystems models for pelagic in support to the Common Fishery Policy (CFP);

(k) Support the Commission in its leadership on the international stage. Actions in main fields of international cooperation will be carried out: Ocean Governance (UN Ocean and OurOcean conferences, International Ocean Governance), Ocean Science (UN Decade of Ocean Science), Ocean Observations (GOOS, G7), Ocean Forecasting and Services (OceanPredict, GEO Blue Planet, GMES Africa).

Specific developments and operations planning:

(a) New version of the global 1/12° real time forecasting system with an improved data assimilation scheme (Q4);
(b) Preparation of and integration of Sentinel-6 Michael Freilich in the Sea Level and Wave TACs and in the MFCs (Q4); Ocean reanalyses close to one month from real-time (Q4);
(c) Biogeochemistry and marine biology: assimilation of ocean colour, for all regional basins and for the global (Q4);
(d) Launch of a new CMEMS product quality dashboard (Q3). The dashboard will include: input observations, various validation metrics including model forecast skills and interactive visualisation of validation results;
(e) Implementation and flagging of products (thematic portals) supporting the implementation of the MSFD and MSP by Member States and ice services based on the design work performed in 2020 (Q3);
(f) Ocean monitoring indicators: continued development of ocean monitoring indicators, in particular, with the time extension for existing indicators and SDG indicators for ESTAT, improvement of the OMI web portal to better focus on specific user communities and policies, publication of the 5th Ocean State Report (Q4).

Strategic planning:

According to approved final budget, CMEMS will include strategic analyses for:

(a) the consolidation of the CMEMS portfolio for the next MFF to ensure as much as possible (within budget constraints) the development of enhanced continuity of the service to target policy developments, the Green Deal priorities and new priorities listed in the Space Regulation such as environmental compliance assurance, new development in biodiversity (Common Fisheries Policy, habitat directive, Convention on Biological Diversity);

(b) The consolidation of interfaces with other relevant services specially the land service (coastal and Arctic), the emergency and maritime surveillance service (coastal, hydrology, and ice risks), the climate change service (projections, reanalysis, ECVs), and atmospheric monitoring service (for atmospheric forcings and CO_2);

(c) The development of the multi-year R&D strategy together with the STAC for post 2021 activities (biology, Arctic, coastal, high-resolution, ensemble, AI) and with insights from the Champion User Advisory Group. The strategy will include the links with Horizon Europe activities.

<u>Expected output of the action:</u>

(a) Continued operational baseline service, delivering up-to-date ocean information observation- and model-based products, with the support of a service desk and a refurbished and more attractive portal with a release in Q4 2021;

(b) Specific effort supporting MS actions with regard to the Marine Strategy Framework Directive (MSFD), the MSP, CFP and national ice services;

(c) CMEMS Ocean monitoring indicators and Ocean State Report;

(d) R&D strategy plan for service evolution, User uptake strategy validated with DG DEFIS and KCEO.

4.2.4.2 Data and Information Access Services (Objective 3)

Indicative Amount in 2021: EUR 1 500 000

Activities in 2021:

(a) Continue the operations of the WEkEO service through the WEkEO webportal single entry point in cooperation with ECMWF and EUMETSAT:

(b) Continue the operation of the WEkEO central service desk acting as a helpdesk call centre and escalating as needed technical and scientific questions to the relevant Copernicus services;

(c) Continue to ensure the interfaces with the Copernicus services to integrate all portfolios updates in the WEkEO front-end and ensure the relevant Data Portfolio Management activities

(d) Continue the operation and ensure the improvement of the WEkEO data viewer enabling the visualisation of all the Copernicus services information and Sentinel data.

(e) Ensure the interface with a diversity of users such as developers, data managers, policy makers and national entities such as Copernicus Collaborative Ground Segments (PEPS, CODE-DE…) that may be interested in federating their national services with the WEkEO infrastructure;

(f) Organise and implement, with the support of the Copernicus services as necessary, the dedicated communication, marketing and training activities to guide and support users to adopt new digital services (e.g. online communication on the WEkEO digital channel with Web, YouTube, social media… aiming at convincing new communities to join, training and webinars explaining for example how to use the Jupyter hub and Notebooks for users who need to incorporate environmental data to their business, research, or projects and run their algorithms using cloud processing capabilities) ;

(g) Report of the activity on the WEkEO service to the Commission.

Expected output of the action:

(a) Indicators on the WEkEO usage and reporting to the services on the use of their data through WEkEO

(b) Web portal and viewer

(c) Training and communication deliveries

(d) User support

(e) Growth of WEkEO federation with new collaboration with data managers, policy makers and national entities.

4.2.4.3 User uptake (Objective 4)

Indicative Amount in: EUR 900 000

Activities in 2021:

(a) Promotion of one version of CMEMS portfolio (December 2021), improvement of the new web portal gradually;
(b) Implementation and flagging of products (thematic portals) e.g. supporting the implementation of the MSFD and MSP by Member States and ice services based on the design work performed in 2020 (Q3);
(c) Ocean monitoring indicators: continued promotion of ocean monitoring indicators, in particular for SDG indicators, improvement of the OMI web portal to better focus on specific user communities and policies, publication of the 5th Ocean State Report (Q4);
(d) Support the Commission in its leadership on the international stage: Ocean Governance (UN Ocean and OurOcean conferences, International Ocean Governance), Ocean Science (UN Decade of Ocean Science), Ocean Forecasting and Services (OceanPredict, GMES Africa). Participation to Commission events on demand (e.g. from DG MARE, DG RTD, DG ENV…) and major events related to ocean;
(e) Continuation of the user engagement and user outreach activities with a new focus based on assessments carried out in 2020 and taking into account Copernicus 2.0 priorities and organisation in DG DEFIS.

Expected output of the action:

(a) Translation of the web portal in multi-lingual
(b) First version of the new web portal educational pages called “Explainers” (Q3)
(c) First version of the new web pages called “Ocean Climate portal” (Q3)
(d) Upgrade of the MyOcean viewer (Q3 and Q4)
(e) Publication of Ocean State Report 5 and its summary (Q4)
(f) List of international conferences : IOG 2021
(g) DG ENV internal workshop on Bathing Water Directive (Q3)
(h) Organisation of a global training workshop for Africa
(i) Contribution to DG DEFIS, EUSPA publications and events

4.2.5 Tasks Entrusted to the ECMWF

4.2.5.1 Atmosphere Monitoring Service (Objective 2)

Indicative Amount in 2021: EUR 30 960 000

Activities in 2021:

2021 will be the sixth year of operations for CAMS, which will continue to deliver its evolving range of services and products to the users, both provided by the entrusted entity (ECMWF) and by its contractors. The 2021 portfolio of products and services delivered by

CAMS is a continuation of the previous years (2014-2020) and is organised into 4 main categories and 15 product groups, as outlined in the CAMS online catalogue.

In 2021, the focus will be on ensuring a smooth transition between the two funding periods. This will be achieved through timely procurement of the main existing services elements and initiating some evolutions and new activities foreseen in the CAMS Contribution Agreement for 2021-2027:

(a) restructuring and reinforcing Evaluation and Quality Control Activities;
(b) structuring and starting the launch of the national collaboration programme with Member States on air quality and greenhouse gases;
(c) starting some set-up activities relative to the CO_2 anthropogenic Monitoring and Verification Support capacity, complementing the developments performed in the new Horizon 2020 project CoCO2 and building on the CHE and VERIFY projects.

CAMS core documentation is composed of four documents describing the evolving user requirements (User Requirement Database, URDB), their analysis in terms of short- to medium- (User Requirement Analysis Document, URAD) and medium- to long-term (Service Evolution Strategy, SES) developments, as well as the Service Product Portfolio (SPP).

The CAMS website is available at https://atmosphere.copernicus.eu. Most products can be accessed from the Atmosphere Data Store (ADS): https://ads.atmosphere.copernicus.eu/#!/home.

CAMS will be running in operational mode providing services and data products on routine basis according to its product portfolio. System upgrades will concentrate on short term improvements improving product quality and system performance in order to meet better expressed user requirements and to prepare further evolution towards Target portfolio (as reported in the Technical Annex). In 2021, the data centre of ECMWF will move from Reading (UK) to Bologna (Italy). Operational provision of CAMS global products as well as the Atmosphere Data Store will start migrating to the new data centre; the entrusted entity will ensure that this is seamless for the end users.

Crosscutting technical management will concentrate on the coordination of all the technical activities (both procured and delivered directly by the Entrusted Entity), maintenance of the CAMS documentation, the coordination of technical interfaces with EUMETSAT and ESA, liaison with Copernicus stakeholders and key user categories, especially in the policy sector. As described in the Technical Annex, CAMS and C3S will jointly operate certain user-facing functions (procurement and contract management, communications, user support, outreach and training), which will ensure synergies and economies of scale.

The 2021 activities are organised as follow:

(a) Management tasks: to deliver the annual implementation plan, as well as quarterly and annual activity reporting; to procure CAMS products and activities according to the Technical Annex and provide sound accounting, with internal control and external auditing as required by the EU Financial Regulation; to oversee the delivery of these architecture elements both provided internally and procured.
(b) Decentralised activities on atmospheric composition In-Situ observations: to consolidate access of CAMS to a number of non-satellite observations streams that would not otherwise be entirely suitable for the service, either because of inappropriate timeliness of delivery or of non-existent or insufficient quality control at the time of dissemination and to secure access to key in situ data streams for the

provision of the Service and/or the verification of the products.

(c) Global atmosphere products: the global production system and its outputs are the backbone of CAMS, delivering directly a significant fraction of the portfolio and serving a majority of the users as well as supporting the production chains for all the other service elements. Ensuring its functioning under fully operational conditions is thus of utmost importance for CAMS as a whole.

(d) Regional atmosphere products: this service element corresponds to the production chain that will deliver refined products over the defined European regional domain. This chain will rely on an ensemble of state-of-the-art European air quality modelling and data assimilation systems sharing a number of required characteristics (boundary conditions, weather, emissions…). This multi-model ensemble will be used to produce analyses, forecasts and reanalyses.

(e) CO_2 and other greenhouse gas emissions and fluxes: This service element will provide the core of the new anthropogenic CO_2 emissions monitoring and verification support (CO2MVS) capacity. Its design closely follows the recommendations from the European Commission's CO_2 Monitoring Task Force, coordination with Horizon 2020 and Horizon Europe projects (in particular CoCO2 and VERIFY, as well as the outcomes from CHE) and will ensure continuation of existing CAMS services related to greenhouse gas monitoring.

(f) Air Quality emissions: Emissions of air pollutants are both much used CAMS products and essential inputs to all the other CAMS production chains. In the next years, a major evolution will be to complement the current line of products based upon inventories by observations-based ones, which will take advantage of the Copernicus Space component (Sentinel-5p, -4 and -5) and of other important satellite missions, existing or planned. In 2021, activities will focus on the re-procurement of emissions inventories, which need to be expanded in order to support the evolution towards observation-based products (improved a priori input for inverse modelling).

(g) Supplementary services are delivered consistently and homogeneously across the defined European domain or over the entire globe. They range in four categories: products in support of policy users, co-designed / co-produced products through a new national collaboration programme (air quality and greenhouse gases), solar radiation products and finally climate forcing products.

(h) Evaluation and Quality Control: Evaluation and Quality Control for CAMS products will be implemented in a separate function. The implementation will also rely on output of routine performance monitoring and other quality assurance systems that are built into the various CAMS production chains.

(i) Service desk, User engagement & training, Communication: the entrusted entity will implement these user-facing activities jointly for CAMS and C3S in order to achieve synergies and seamlessness between the two Services (including also the emerging CO2 Monitoring and Verification Support capacity).

(j) Data Access and visualisation: the aim of these joint activities between CAMS and C3S is to provide the digital infrastructures to provide access to the products of the two Services. The Data Stores, CDS and ADS, are the main facilities for this, but the entrusted entity will also directly contribute to WEkEO and ensure a smooth connection with the other DIAS.

Expected output of the action:

(a) In 2021, the existing CAMS production streams will continue to be fully operational, while some new activities will ramp-up;

(b) The management of CAMS activities will relocate from Reading (UK) to Bonn

(Germany). Further, ECMWF's operational production and ADS operations will also progressively migrate to ECMWF's new data centre in Bologna (Italy).

(c) ECMWF CAMS teams will continue managing expenditure and technical aspects, including continual improvement of the products;

(d) The CAMS documentation established in the previous phase will be reorganised and updated in order to reflect the new structure of activities and the context for the period 2021-2027 (especially regarding the Copernicus Space Segment);

(e) All user-facing activities will continue (communications, user engagement, training) with a seamless transition between the two budgetary phases;

(f) The sixth CAMS General Assembly will take place in the week starting 7 June 2021. It will be a physical event or an online event, to be decided during Q1 2021 depending on the COVID-19 situation.

4.2.5.2 Climate Change Service (Objective 2)

Indicative Amount in 2021: EUR 53 460 000

Activities in 2021:

In 2021 activities will concentrate on ensuring service continuity during the transition to the second funding period (2021-27). As C3S is a user-driven Service, its outreach component will continue to promote the uptake of C3S products to a wide variety of users.

The four main C3S documents (User Requirement Database-URDB, User Requirement Analysis Document-URAD, Service Product Portfolio-SPP, Service Evolution Specification-SES) reached the operational status in 2019 thanks to the full deployment of the Evaluation and Quality Control (EQC) functions. During 2020, EQC functions and activities have been made much more prominent on the C3S website and the CDS portal, to raise awareness about the importance of this component of the Service. The URDB and the URAD in particular, provide an assessment of the quality of the data (with user guidance and gap analysis), the quality of the tools (including fitness for purpose, best practices) and quality of the service (such as speed, responsiveness, system availability). These documents are also instrumental for coordinating the activities between the F4P (Fitness for Purpose) function established by the Commission and the Service itself, represented by its EQC function. Finally, the SES Document provides a multi-year outlook on the plans.

Starting in 2021, the C3S portfolio of products is a continuation of the 2014-2020 phase, organised for the 2021-27 period into four main categories:

(a) Essential Climate Variables (ECVs) derived from a sustained network of in situ and satellite-based observations;
(b) Global and Regional climate reanalyses (ERA);
(c) Multi-system seasonal to interannual forecasts (SEA);
(d) Climate projections under various emission scenarios (PRO);

delivered through four service components:

(a) Climate Data Store (CDS);

(b) Sectoral Information System (SIS);

(c) Evaluation and Quality Control (EQC);

(d) Communication, climate-intelligence for Users, Training & Engagement (CUTE).

Essential Climate Variables (ECVs) from observational climate data records: during Copernicus 1.0, access to a portfolio of ECV data products covering the atmosphere, land and the ocean has been secured.

Work in 2021 will aim to ensuring enhanced quality and increased efficiency of existing services so that new policy and/or user requirements can be met, and relevant technological developments incorporated.

Climate reanalyses: climate reanalyses, which combine observations from multiple sources using numerical weather prediction systems, are at the centre of the C3S portfolio. Reanalysis datasets provide a complete and homogeneous description of the past and present weather. The flagship reanalysis product of C3S is ERA5, which provides hourly data from the 1950s until the present, covering the global atmosphere from the Earth's surface to well above the stratosphere.

The top priority for 2021 will be the development of ERA6, a coupled ocean-atmosphere and possibly land reanalysis, covering a minimum of 75 years. In parallel to this, effort will be put in setting the base for the back extension of ERA5 to 1940 and improve some of the existing products.

Seasonal forecasts and climate projections: C3S routinely produces multi-system seasonal predictions based on outputs of a growing number of operational prediction systems that are developed and maintained by a variety of institutions (WMO Global Producing Centres of Long-Range Forecasts based in Europe and the Euro-Mediterranean Centre on Climate Change). Seasonal predictions have become an important tool in supporting climate change adaptation efforts and inform user decisions and policy development in many sectors. C3S also provides access to global and regional climate projections by leveraging existing international efforts conducted under the World Climate Research Program. A selection of climate model simulations is available via the Climate Data Store. Access to regional simulations generated and distributed by CORDEX, both within and outside Europe, is similarly provided.

Requirement surveys and discussions with C3S stakeholders during the previous funding phase clearly indicated a need for information about future climate change and variability at decadal timescales. In 2021, C3S will initiate the development of an operational decadal prediction service based on a set of products derived from initialised multi-year climate predictions.

Operations: C3S will be running in operational mode providing services and data products on routine basis according to its product portfolio. System upgrades will concentrate on short term improvements (in particular those regarding the spatial and temporal resolutions of the global and regional components) improving products quality and systems performance in order to meet better expressed user requirements and to prepare further evolution towards Target portfolio (as per corresponding Technical Annex of the Copernicus 2021-27 Contribution Agreement).

Crosscutting technical management will concentrate on the coordination of all the technical activities (both procured and delivered directly by the Entrusted Entity), maintenance of the four main C3S documents (URDB, URAD, SES and SPP), the coordination of technical interfaces with EUMETSAT, liaison with Copernicus stakeholders and key user categories, especially in the policy sector. The technical management will continue to be jointly shared between C3S and CAMS (join activities on procurement, contract management, communications, outreach and training activities, as well as first level support to users).

The 2021 activities are organised as follow:

(a) Management tasks, including expenditure and technical management: to deliver the annual implementation plan as well as quarterly and annual activity reporting; to procure service architecture elements and provide sound accounting, with internal control and external auditing as required by the EU Financial Regulation; to oversee the delivery of these architecture elements both provided internally and procured.

(b) High Performance Computing (HPC): to make HPC provision in relation to global and regional reanalysis as well as seasonal forecasts.

(c) Observations: observations are fundamental to the quality of C3S products and services, and they must be preserved to enable future productions of Climate Data Records (CDRs) and Earth System reanalyses. Activities in this Service element include the collection, preservation and quality control of observations, both in-situ and from space (ECV production, EUMETSAT reprocessing), as needed to enable production of climate reanalyses and observation-based CDRs.

(d) Reanalysis, predictions and projections: To maintain ERA5 provision of hourly time series of atmospheric and surface parameters at 31 km spatial resolution covering the entire globe, from 1950 to near-real time. To make preparation for extension of ERA5 backward in time to 1940. To prepare for ERA6. To maintain Climate prediction Services (Seasonal, Annual), and prepare for decadal predictions. To improve climate projections.

(e) Sectoral and general applications: Four operational services (for the energy, water, agriculture, and insurance sectors) will be operated, maintained and developed further, in order to meet requirements from current users as those described in the available use-cases and obtained through the URDB. A few on-demand applications are also expected to be developed in response to the requests of key core-users.

(f) Evaluation and Quality Control: Evaluation and Quality Control for C3S products will be implemented in a separate function based on the concept developed together with CAMS (see Sections 3.1.5 and 3.2). The implementation will strongly rely on output of routine performance monitoring and other quality assurance systems that are (or will be) built into the various C3S production chains.

(g) C3S-CAMS joint Service element: Service desk, User engagement & training, Communication: The Entrusted Entity will draw up a Communication plan for activities to be implemented on service level. This plan will be coordinated and agreed with the Commission. The plan will identify communication activities to be implemented on programme level, including some key messages, the intended target audiences, as well as communication channels and means. A revision and update of the communication plan is foreseen on an annual basis.

(h) C3S-CAMS joint System element: Data Access and visualisation: The aim of the "Data Access and Visualisation" system element is to provide the necessary technical components to build, operate and deliver C3S and CAMS products. The Data Stores (CDS and ADS) are the main facilities for this, but the contribution of C3S and CAMS to WEkEO and the connection with the other DIAS is also foreseen.

Expected output of the action:

(a) In 2021, C3S will continue to be fully operational.

(b) ECMWF C3S teams will effectively manage expenditure and technical aspects, such as further improvement of the products offered by the service, as well as to deliver ECMWF's contribution to technical activities;

(c) The four key documents of C3S established in the previous phase will be reorganised

based on new service's needs and will continue to describe the evolving user requirements (URDB), their analysis in terms of short- to medium- (URAD) and medium- to long-term (SES) developments as well as the current portfolio of products and services;

(d) Use cases projects as well as training activities will re-start in 2021;

(e) The next C3S General Assembly is expected to take place in March 2021 and will gather 100s of people in a single 3-day event.

4.2.5.3 Data and Information Access Services (Objective 3)

Indicative Amount in 2021: EUR 1 200 000

Activities in 2021:

ECMWF will support WEkEO and other DIASes by ensuring that all data and information products from C3S and CAMS portfolio (and the CO2 service, once online) can be easily searched and accessed through the common Data Store, WEkEO or any DIAS. This entails timely acquisition of new products from various data providers, and development and maintenance of the Data Store catalogues upon which WEkEO and DIASes also rely. A substantial effort on data governance is mandatory to ensure consistency and coherences are protected and where possible, enhanced.

More specifically, the data standard will also need to be enhanced to accommodate all C3S and CAMS datasets as far as technically possible. This data standard will include naming conventions, units, formats amongst others, and where possible, incorporate/extend relevant existing standards and guidance adopted by CAMS/C3S stakeholders (WMO, IPCC, ESA CCI, EUMETSAT SAFs, etc.). Such enhancement will be a game changer for Data Store, WEkEO and DIAS users, and the related communities at large. It will also facilitate the use of multiple datasets in a common data model, either in the Data Store toolbox environment or externally in WEkEO, DIAS or any user-preferred processing environment.

ECMWF will also contribute to the operations, maintenance and upgrade of WEkEO. WEkEO already offers commercial entities services such as hosted processing, demonstrating the synergy of publicly funded activities relying on free and open access to Copernicus data and services and commercial activities, offered by industry.

During the Copernicus 2021-2027 timeframe, using the federation concept, it is planned to extend the WEkEO partnership to other Copernicus services, in particular to the European Environment Agency (EEA) and the JRC in charge of the European and Global Land services. WEkEO will be able to rapidly take on board new Copernicus products and services, such as supporting the monitoring of CO2 emissions from anthropogenic activities or any other new service element implemented by the EC to support its policies. By doing so, WEkEO is expected to become the platform of choice for accessing environmental data from Copernicus satellites and services.

WEkEO will also act as a Copernicus contribution to support the Green Deal and the EU Digital Agenda such as Destination Earth. It would also be a contribution to the "Today's strategy with Africa", enabling Copernicus data and services to be accessible by African users. Providing strategic foresight for WekEO is essential to remain attractive to today's public and commercial users and potential users in the future.

This long-term, strategic WekEO perspective is essential to secure continued support from industry, which is both delivering most of the technical implementation of WEkEO but is

also exploiting the commercial part of WEkEO through the delivery of commercial added-value services to develop downstream applications based on Copernicus data. In addition to their WEkEO contributions, CAMS and C3S will also liaise with other ESA-led DIASes to enable Service products, freely available on all Copernicus platforms. For budgetary planning reasons, all the budget allocated for ECMWF's contribution to WEkEO is included in the C3S budget and CAMS budget as a no-cost line.

Expected output of the action:

(a) New WEkEO Data Adaptors able to keep up with new datasets from the different Copernicus Services as well as to cater for the migration of Services to different platforms (e.g. CLMS moving to the public Cloud).

(b) New adaptors for a number of contributing missions (e.g. EUMETSAT MSG/MFG, MetOp. Jason-3, etc)

(c) Improvement to the scalability of Data Access software and, wherever possible, enhanced interfaces with the APIs of the different data providers to maximise quality of service.

(d) Notification service with special emphasis on NRT (Near Real Time) products.

(e) INSPIRE compliant WEkEO Data Catalogue containing information from the source of all Services.

(f) Support to the data ingestion and data integration practices able to operate across services. This includes the development and maintenance of data standards able to operate across data sources

(g) Support communication, marketing and training activities to guide and support users to adopt new digital services (e.g. training for Jupyter hub and Notebooks)

(h) Improved capacity, efficiency and reliability of the interface between the different CDS/ADS infrastructure and WEkEO which will allow to accommodate the increasing workload.

(i) Enhanced interoperability and compatibility between platforms based on a wider set of standards (OGC, ISO, INSPIRE).

(j) WEkEO-oriented monitoring and reporting capabilities on CDS/ADS.

(k) Enhanced Jupyter Notebooks functionalities including those allowing users to *share* notebooks.

(l) User-friendly Python library to provide easier access to the Harmonised Data Access API with emphasis on access from Jupyter Notebooks.

4.2.5.4 User uptake (Objective 4)

Indicative Amount in 2021: EUR 80 000

Activities in 2021:

Activities to be conducted in 2021 include:

(a) Assessment of the most optimal instruments and activities to develop and foster the downstream market based on CAMS and C3S products and services. The instruments and actions should be tailored according to the specific nature of the data value chains for these products and services.

(b) Appoint a dedicated person at EUSPA to liaise with the Copernicus User Engagement team at ECMWF.

(c) Establish close interactions with ECMWF to foster the market uptake on CAMS and C3S and specific collaborations specified. Acknowledging that ECMWF remains focused on the operational service delivery as well as user uptake activities for 'core' Copernicus user, potential collaborations can be designed along the following lines:

(i) ECMWF to support EUSPA with technical and scientific knowledge as well as updates on the state of play of service evolution;
(ii) EUSPA to invite ECMWF experts as member in selection boards and advisory board panels on actions of relevance to CAMS and/or C3S;
(iii) ECMWF and EUSPA to exchange experience and statistics on user uptake and capacity building, including events and workshops. Where relevant, an active involvement by both parties at events shall be pursued;
(iv) Jointly design feedback loops on user requirements in scope of service evolution of CAMS and C3S;
(v) EUSPA to support ECMWF in raising awareness for the future CO2MVS service element of CAMS.

Expected output of the action:

(a) Deliver a strategy and roadmap to develop and foster the downstream market based on CAMS and C3S products and services, endorsed by all the stakeholders.

(b) Establish structural links between EUSPA and ECMWF with the signature of a Memorandum of Understanding.

4.2.6 Tasks Entrusted to Frontex

4.2.6.1 Border Surveillance Service (Objective 2)

Indicative Amount in 2021: EUR 14 000 000

Activities in 2021:

In 2021, Frontex will continue the provision of border surveillance services of those areas most affected by migratory pressure and cross-border crime. Frontex will work with Member States and relevant actors, making use of Earth observation data and European industry capacities for increased situational monitoring, as well as risk analyses and vulnerability assessment of external borders and pre-frontier areas. The provision of the services will also provide added-value to the implementation of Frontex operational activities in these areas. Activities for 2021 will concentrate mainly on the provision of operational border surveillance services as foreseen in the Contribution Agreement and will be implemented through the Eurosur Fusion Services (EFS). Furthermore, additional service features will be developed through Service Evolution, in order to support the tasks envisaged by the Copernicus Programme.

With the adoption of the EU Space Regulation and the signature of the Copernicus Contribution Agreement (2021-2027), the Frontex will introduce a new product-centric Copernicus Border Surveillance Service portfolio. The product delivery following this new approach will be implemented in parallel with entry into force of the Contribution Agreement. Change management activities to prepare end users will begin at least 3 months before the anticipated entry into force for a seamless introduction and without interruption in

the provisioning of the Copernicus Border Surveillance Service.

Copernicus Border Surveillance Service portfolio under the Copernicus Contribution Agreement (2021-2027):

(a) Rapid assessment report;
(b) Activity Report;
(c) Detection Report;
(d) Location Report;
(e) Large area Pre-frontier Report;
(f) Multi-Source (MUSO) migration analytical assessment;
(g) Reference maps;
(h) Thematic maps;
(i) Tactical maps;
(j) Infographic maps;
(k) Map book;
(l) Border Permeability maps;
(m) Dynamic & interactive maps;
(n) GEOINT dashboards;
(o) Terrain models;
(p) 3D object models.

In addition to the operational tasks, Frontex will in 2021 continue to work on the development and improvement of the CBSS through the Service Evolution mechanism. Service evolution will be undertaken in order to support the tasks resulting from the European Border and Coast Guard Regulation and Eurosur Regulation supplemented by the Copernicus Programme for the purpose of ensuring implementation of the border surveillance component. This will include further investigation of additional platforms, sensors and in-situ data potentially adding value to the Copernicus Border Surveillance Service, as well as the application of emerging technologies, such as Big Data processing and Artificial Intelligence.

Frontex will also work on expanding user base to cover additional law enforcement needs, in particularly in supporting the EMPACT (European Multidisciplinary Platform Against Criminal Threats) policy cycle initiative.

Expected output of the action:

(a) Provision of data and products in an operational environment, in line with the EFS service catalogue;

(b) Management of service provision contracts and related infrastructure;

(c) End user support and adequate training;

(d) Preparatory activities for service evolution.

4.2.6.2 User uptake (Objective 4)

Indicative Amount in 2021: EUR 0

Activities in 2021: none

4.2.7 Tasks Entrusted to the EMSA

4.2.7.1 Maritime Security Service (Objective 2)

Indicative Amount in 2021: EUR 17 795 000

Activities in 2021: The focus for 2021 is continuity of services with no significant programmatic changes with regards to 2020. The work to be performed is steered to ensure service continuity and to support the sustainable growth of the user base. Nonetheless, the potential deployment of new data sources (e.g. radio frequency detection) or new capabilities (e.g. machine learning derived products) may imply new framework contracts to be deployed.

In 2021, the service will continue with the work already begun in previous years by reinforcing and enhancing services for users in the different user communities served. These include:

Fisheries control service: EMSA provides support to the European Fisheries Control Agency's (EFCA) coordinated Joint Deployment Plan operations (JDP) and fisheries control authorities in Member States, for monitoring fisheries activities in selected areas of interest. Copernicus Maritime Surveillance provides a crucial component to integrated services for fisheries control by delivering information on fisheries control activities, including non-reporting vessels, in near real time to fisheries control authorities. Fish traps and fish cages are also detectable by satellite providing additional value in the fight against IUU.

Maritime safety service: Earth observation products can be analysed on a routine basis enhancing the maritime picture for traffic safety purposes and for information to navigation.

Maritime Security Service: Earth observation products are analysed on a routine basis for surveillance purposes, enhancing the maritime picture for maritime surveillance purposes, particularly in areas where vessel reporting information is scarce. Systematic monitoring using EO is used to determine patterns of life and better enable operations in the area of interest. While radar can be used to detect a specific vessel of interest, very high resolution optical can be used to identify the ship.

Law enforcement service: CMS is offered to Law enforcement in Member States, and this user community presents significant growth in terms of services delivered and number of users. Earth observation assets provide a unique capability in terms of detection of non-reporting vessels which are usually the ones targeted by law enforcement authorities. A combination of high-resolution radar for wide area monitoring with very high resolution optical for target identification brings significant value to operations, particularly in areas where other assets cannot be used.

Customs service: CMS is offered to customs authorities in Member States which represent an important volume in terms of activations of the service. The service is focused on the routine surveillance of specific areas of interest or in the monitoring of suspect targets. By deploying a combination of high-resolution radar for wide area monitoring with very high resolution optical for target identification, CMS brings significant value to Customs operations.

Marine pollution monitoring service: Since 2007 EMSA has been operating a satellite-based oil spill and vessel detection service, CleanSeaNet. SAR satellite images can be used to detected oil spill discharges at sea and the results are made available in near real time to end users, increasing efficiency of conventional oil spill detection assets (i.e. aircraft). Copernicus has strengthened CleanSeaNet's monitoring capabilities by enhancing coverage in further areas of European interest, as defined by the users of the service. An enhanced marine pollution monitoring service is already provided by Copernicus in terms of

monitoring Greenland. During the year these operations will potentially be extended to support Member States areas of interest concerning overseas territories.

Cooperation with international organisations: International cooperation enables actors to share costs, resources, and expertise, and to deal with common problems in a collaborative and focused way. This kind of cooperation is often coordinated through specific organisations or programmes established with specialised tasks in mind. In maritime surveillance, bi-lateral or multi-lateral approaches can bring significant benefits, one of which is the possibility to share data – including Earth observation data – and intelligence to address issues of regional or global concern in the maritime domain. On request, CMS provides support to such relevant international organisations in consultation with and based on the approval of DG-DEFIS and the EEAS.

To increase user awareness, foster user uptake and refine user requirements various events and activities will be organised. These activities together form a user uptake cycle which is beneficial both for the users and for EMSA:

Training activities: General training sessions for CMS users will provide a basic introduction and overview of the capabilities and limitations of Earth observation products, and how they can be used in different operational contexts, with a hands-on component related to using the EMSA interfaces. Users of the Marine Environment (Pollution Monitoring) service will benefit from the standard trainings routinely organised by the Agency for the CleanSeaNet service. An online component to the training, comprising pre-training and e-learning materials, will be developed during 2019 and available to users in 2020.

Meetings and workshops: The annual CMS User Group will be organised for existing and prospective users of the service, with the purpose of gathering feedback from existing users for improvements to the service, as well as to further refine user requirements and priorities, and to present the service to potential new users. Dedicated workshops targeting communities with high growth potential will be organised.

Expected output of the action:

(a) Provision of services in line with the Implementation Plan 2021;

(b) Management of service provision, procurements and contracts;

(c) Training to end users;

(d) Communication and user up-take activities;

(e) Reporting.

4.2.7.2 User uptake (Objective 4)

Indicative Amount in 2021: EUR 205 000

Activities in 2021:

(a) Organize training activities: General training sessions for CMS users will provide a basic introduction and overview of the capabilities and limitations of Earth observation products, and how they can be used in different operational contexts, with a hands-on component related to using the EMSA interfaces.
(b) Development of online content: Continuous improvement of the e-learning module, established in 2020, comprising pre-training and e-learning materials.
(c) Organise the Copernicus Maritime Surveillance User Group: The annual CMS User Group will be organised for existing and prospective users of the service, with the

purpose of gathering feedback from existing users for improvements to the service, as well as to further refine user requirements and priorities, and to present the service to potential new users.

Expected output of the action:

(a) Increase user uptake and expand existing user basis;

(b) Improve and expand the current usage of the service;

(c) Gather user needs towards continuous service improvement.

4.2.8 Tasks Entrusted to EU Satellite Centre

4.2.8.1 Support to Union External Actions[4] (Objective 2)

Indicative Amount in 2021: EUR 9 815 000

Activities in 2021:

Procurement

With regard to the IT Infrastructure Development, it is foreseen to perform the deployment, maintenance and upgrade of the SMI from 2021 (including online activation, service workflows management and delivery functionalities).

A new framework contract for support to User Uptake activities will be awarded and signed.

Portfolio

In 2021 the Satellite Centre will continue to provide the portfolio of the Support to External Actions (SEA) Service composed of the following categories:

(a) Reference Map;

(b) Road Network Status Assessment;

(c) Conflict Damage Assessment;

(d) Critical Infrastructure Analysis;

(e) Support to Evacuation Plan;

(f) Non-Union Border Map;

(g) Camp Analysis;

(h) Crisis Situation Picture;

(i) Activity Report.

Furthermore, a number of different product types are available in order to satisfy a wide range of user needs and can be provided according to the operational needs of the users:

(a) Quick Report (QR);

(b) First Impression Report (FIR);

(c) Briefing Note (BN);

[4] Name of the service will reflect the scope of the service, which is being negotiated.

(d) Digital Geographic Information (DGI) - Image Map;

(e) Digital Geographic Information (DGI) – City Map;

(f) MapBook;

(g) Country Map Coverage (CMC).

In 2021 the Service Evolution will continue to enable to extend the portfolio, based on the user's feedback from previous years.

In 2021 the SatCen will provide a portfolio of products resulting of the new products emerging from the service evolution plus the Copernicus SEA Service initial portfolio.

Expected output of the action:

(a) Operational services 2021 onwards;

(b) Follow up of procurement for the Service implementation;

(c) Initial operation of SEA SMI.

4.2.8.2 User uptake (Objective 4)

Indicative Amount in 2021: EUR 185 000

Activities in 2021:

User uptake action includes all the activities planned to continue targeting the increase of the users/potential new user awareness on Copernicus SEA Service.

Each activity follows the guidelines established in the Communication Strategy developed during 2018 and focused on tailoring the messages and communication efforts to the target audiences (i.e. authorised users, new potential users, other audiences and the general public).

The list of activities to consider for 2021 includes:

(a) User workshop ─ represents a unique opportunity to directly interact with the different users of the service, get input and consensus from diverse groups of users and benefit from user interactions in a collaborative environment. In this view, in 2021 the 5th Copernicus SEA User Workshop is planned (October);
(b) Info-sessions ─ correspond to dedicated (one-to-one) meetings with the Member States to provide information, updates and general awareness on the service, as well as identify new needs or engage potential new users. Info sessions with the objective to reinforce the user engagement activities are planned during 2021;
(c) Training sessions ─ represent demonstrative events where users can explore in detail the different phases of the service (from user request up to product delivery). It is foreseen to organize training sessions in 2021;
(d) Communication material ─ refers to documentation packages (printed and online version) tailored and updated to maintain clear, concise and enriched communication with the different target audiences. In 2021, it is planned to update the existing communication material and produce new material as identified during the year;
(e) Website ─ provides, via a fresh and stable front-end, a permanent point of reference for the stakeholder with all the information and documentation related to the service. It establishes an additional mean for communication between the Service and its users. During 2021, it is planned to keep website content updated and compliant with the visual identity updates, as defined by the Commission, as well as to improve information fruition through the implementation of advanced functionalities;

(f) Social media ─ constitutes an instrument to provide immediate communication on important aspects of the service (e.g. events, news, communications). It is a relevant channel to inform wider audiences and, jointly with the previous elements, it serves to maintain the user and the general audience always updated. In 2021, it is expected to improve service presence and communication on the principal social media channels (e.g. Twitter).

During first months of 2021 current COVID-19 restrictions will be maintained in place thus all the meetings and events that require physical presence have been moved, as far as possible, to the second half of the year or will be replaced by virtual events.

Expected output of the action:

(a) To increase user interest in the service;

(b) To maintain the current users constantly informed about the service and its news;

(c) To identify new needs that can be incorporated/or developed as well as to collect feedback and useful indications to improve service offer and foster service evolution;

(d) To engage potential new users;

(e) To produce new set of communication material package (including a new version of the portfolio);

(f) To continue social media presence improvement;

(g) To implement new and dynamic ways of website content fruition for the user.

4.2.9 Tasks Entrusted to the EUSPA

4.2.9.1 User uptake (Objective 4)

Indicative Amount in 2021: EUR 4 000 000

Activities in 2021:

(a) User oriented integrated data management system

The scope of this activity is to ensure the user orientation of the Integrated Data Management system for easy access of the Copernicus data from the perspective of users and potential users. Whilst the Integrated Data Management system will be defined by the European Commission, there is the need to tailor the data access to the specific needs of users with focus on commercial other users. By market segment/ecosystems and in interactions with commercial users EUSPA will identify the needed adjustments in terms of data formats, APIs and specific toolkits to be made available to respond to user needs and support the market uptake of data. In addition specific "data starter packs" would be created to ensure easy adoption of new application areas in the Copernicus user base. The identified budget would be used for the creation of such enablers for easy data access (toolkits, data starter packs, possibly APIs), as well as facilitate introduction of those formats into applicable standards and regulated areas.

(b) Support to uptake in the ecosystems

This activity is essential for the success of the Ecosystems approach. It aims at stimulating development of customised Copernicus solutions to fulfil the needs of priority business ecosystems, also creating synergies with other Space Program components. Based on the

EGNSS experience, the Ecosystems cannot be convinced without pilots, demonstrations, products/project that identify the most suitable solutions for each community, especially for those that are not familiar with Copernicus yet. The available products and services for core users developed by entrusted entities as well as any contribution from Horizon Europe will be leveraged, however this will not be sufficient for a successful uptake in the Ecosystems.

Expected output of the action:

Within the top priority business ecosystem, EUSPA will analyse the applications with highest potential for Copernicus uptake as well as the user requirements for Earth observation data, to deliver:

(a) An assessment of the value chain for those selected applications in the priority ecosystems, value proposition for Copernicus data, identification of the gaps, as well as cost benefit analysis for the selected applications. (The first phase of the action will focus on two applications areas in each of the top priority ecosystem).
(b) Design and implementation of APIs and toolkits developed into 'data starter packs', that fill the gap identified in the selected applications in the top priority ecosystems, and complement the offer provided by entrusted entities and R&D results. Moreover, the action will contribute to relevant application standards and regulation initiative in the selected areas.
(c) Testing of the most promising products developed in the previous action in end-to-end pilot projects, involving the relevant actors in the value chain in the ecosystem to demonstrate suitability and obtain customer user feedback. (The first phase of the action will launch two tests).
(d) As a result, the action will deliver a technology and business roadmap for large scale implementation and commercialisation of the tested new products, as well as identification of additional user needs that may require further service evolution, as input to Commission.

5 Appendix: Acronyms and abbreviations

API – Application Programming Interface

C3S – Copernicus Climate Change Service

CAL/VAL – Calibration/Validation

CAMS – Copernicus Atmosphere Monitoring Service

CBSS – Copernicus Border Surveillance Service (Security Service)

CCI – Climate Change Initiative

CCME – Copernicus Contributing Missions Entities

CEMS – Copernicus Emergency Management Service

CEOS – Committee on Earth Observation Satellites

CLC – CORINE Land Cover

CLMS – Copernicus Land Monitoring Service

CMEMS – Copernicus Marine Environment Monitoring Service

CMES – Copernicus Marine Monitoring Service

CMSS – Copernicus Maritime Surveillance Service (Security Service)

CORDA – Copernicus Reference Data Access

CORINE – Coordination of Information on the Environment

CSC – Copernicus Space Component

DEM – Digital Elevation Model

DG AGRI – Directorate-General for Agriculture and Rural Development

DG CLIMA – Directorate-General for Climate action

DG INTPA – Directorate-General for International Partnerships

DG ECHO – Directorate-General for European Civil Protection and Humanitarian Aid Operations

DG ENV – Directorate-General for Environment

DG ESTAT – Directorate-General for European Statistics (Eurostat)

DG GROW – Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs

DIAS – Data Information Access Services

EAGLE – EIONET Action Group on Land monitoring in Europe

EBCGA – European Border and Coast Guard Agency (Frontex)

ECMWF – European Centre for Medium-Range Weather Forecasts

ECV – Essential Climate Variables

EDO – European Drought Observatory

EEA – European Environment Agency

EEA39 – 33 member countries and six cooperating countries of European Environment Agency

EFAS – European Flood Awareness System

EFCA – European Fisheries Control Agency

EFFIS – European Forest Fire Information System

EFS – EUROSUR Fusion Services

EFTA – European Free Trade Association

EIONET – European Environment Information and Observation Network

EMS – Emergency Management Service

EMSA – European Maritime Safety Agency

EQC – Evaluation and Quality Control

ERA5 – Fifth generation of ECMWF Atmospheric Reanalyses of the Global Climate

ERCC – Emergency Response Coordination Centre

ESA – European Space Agency

ETC/ULS – European Topic Centre on Urban, Land and Soil Ecosystems

EU-DEM – Digital Elevation Model over Europe

EU-GMS – European Ground Motion Database

EU-Hydro – Pan-European Hydrographic and Drainage Dataset

EUMETSAT – European Organisation for the Exploitation of Meteorological Satellites

Eurostat – Statistical Office of the European Union (DG ESTAT)

EUROSUR – European Border Surveillance System

EUSPA – European Union Agency for the Space Programme

F4P – Fitness-for-Purpose

FAO – Food and Agriculture Organization of the United Nations

FPA – Framework Partnership Agreement

GDO – Global Drought Observation

GEO – Group on Earth Observations

GEOGLAM – Group on Earth Observations Global Agricultural Monitoring

GIS – Geographic Information System

GloFAS – Global Flood Awareness Systems

GMES – Global Monitoring for Environment and Security

GNSS – Global Navigation Satellite System

GOOS – Global Ocean Observing System

GWIS – Global Wildfire Information System

H2020 – Horizon 2020 (Union Framework Programme for Research and Innovation)

INSPIRE – Infrastructure for Spatial Information in Europe

IWG-SEM – International Working Group on Satellite Emergency Mapping

JDP – Joint Deployment Plan

JRC – Commission's Joint Research Centre

LUCAS – Land Use and Cover Area frame Survey

LULUCF – Land use, Land Use Change and Forestry

MFF – Multiannual Financial Framework

MOI: Mercator Ocean International

MSFD – Marine Strategy Framework Directive

NPP – National Polar-orbiting Partnership

NRC – National Reference Centre

NRC-LC – National Reference Centres Land Cover

PPP – Public–Private Partnership

REDD+ – Reducing Emissions from Deforestation and Degradation in developing countries

SAR – Synthetic Aperture Radar

SatCen – EU Satellite Centre

SDG – Sustainable Development Goal

SEA – Copernicus Support to the External Actions (Security Service)

SIS – Sectoral Information System

SST – Space Surveillance and Tracking

TBC – To Be Confirmed

URAD – User Requirements Analysis Document

URDB – User Requirements Data Base

VHR – Very High Resolution

WMO – World Meteorological Organization