ECMWF Copernicus Procurement

Invitation to Tender

Copernicus Atmosphere Monitoring Service

Volume II

Products in support of users in the domain of air quality policies

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1 Introduction

Some of today's most important environmental concerns relate to the composition of the atmosphere. The increasing concentration of the greenhouse gases and the various aerosol-weather feedbacks are prominent but often uncertain drivers of climate change. Ozone distributions in the stratosphere influence the amount of ultraviolet radiation reaching the surface.

In the troposphere, aerosols, ozone and other reactive gases such as nitrogen dioxide determine the quality of the air around us, affecting human health and life expectancy, the health of ecosystems and the fabric of the built environment. The variable abundance of the reactive gases change the oxidation capacity of the atmosphere and control therewith also the abundance of long-lived greenhouse gases. The composition of the troposphere and the associated deposition fluxes are major components of the biogeochemical cycles of carbon, nitrogen and sulphur and iron, which effect the land- and marine eco systems. Dust, smoke and volcanic aerosols affect the safe operation of transport systems and the availability of power from solar generation, the formation of clouds and rainfall, and the remote sensing by satellite of land, ocean and atmosphere.

In the wake of the agreement signed in Paris at the UNFCCC's 21st Conference of the Parties (COP-21) in December 2015, the need to monitor and to inform about the effectiveness of mitigation efforts for anthropogenic emissions of key greenhouse gases has become more acute and prominent. With its global coverage (or regional in the case of geostationary platforms), Earth Observation has a decisive role to play within such a monitoring system, complementing ground-based observations, "bottom-up" estimates of the emissions (included in official reporting) and atmospheric transport modelling.

To address these environmental concerns there is a need for data and processed information. The Copernicus Atmosphere Monitoring Service (CAMS) has been developed to meet these needs, aiming at supporting policymakers, business and citizens with enhanced atmospheric environmental information.

Within its first phase (2015 – 2020), the Service consolidated many years of preparatory research and development to deliver a range of operational services. In its second phase (2021 – 2027) these services are further consolidated, improved and expanded to address all the existing and emerging societal needs related to the atmospheric environment. The CAMS service portfolio consists of the following service elements:

a) Daily production of real-time analyses and forecasts of global atmospheric composition;
b) Reanalyses providing consistent multi-annual global datasets of atmospheric composition with a stable model/assimilation system;
c) Daily production of real-time European air quality analyses and forecasts with a multi-model ensemble system;
d) Reanalyses providing consistent annual datasets of European air quality with a frozen model/assimilation system, supporting in particular policy applications;
e) Products to support policy users, adding value to "raw" data products in order to deliver information products in a form more directly adapted to policy applications and policy-relevant work;
f) Solar and UV radiation products supporting the planning, monitoring, and efficiency improvements of solar energy production and providing quantitative information on UV irradiance for downstream applications related to health and ecosystems;

g) Greenhouse gas atmospheric inversions for CO_2, CH_4 and N_2O net surface fluxes, allowing the monitoring of the evolution in time of these fluxes;
h) Climate forcing from aerosols and long-lived (CO_2, CH_4) and shorter-lived (stratospheric and tropospheric ozone) agents;
i) Anthropogenic and natural emissions, based on inventory data and modelling, for the global and European domains;
j) Observation-based emission estimates of atmospheric pollutants for the global and European domains;
k) Observation-based anthropogenic emission estimates of CO_2 and CH_4 for the global domain and emission hotspots.

This Invitation to Tender (ITT) is mainly targeting the CAMS service element described under item (e), focusing on air quality aspects.

1.1 Definitions

Definitions specific for this ITT are defined below.

Global Service Provider: ECMWF is the provider of global products

Regional Service Provider: The contractor selected through another ITT (CAMS2_40) for delivering Regional Production comprising air quality analyses, forecasts and reanalyses over Europe.

Regional Production System: the modelling and data assimilation infrastructure used to provide the CAMS regional analyses and forecasts of atmospheric composition.

Atmosphere Data Store (ADS): the ADS is the primary access to the numerical datasets included in the CAMS portfolio.

Interim Annual Assessment Reports (IAAR): these assessment reports are based on the reanalyses of European air quality produced annually by the Regional Service Provider using the Regional Production System and European air quality observations gathered with little delay after real-time from the European Environment Agency (EEA). These observations have not been subjected to detailed quality control by the participating countries.

Annual Assessment Reports (AAR): these assessment reports are based on the reanalyses of European air quality produced annually by the Regional Service Provider using the Regional Production System and European air quality observations officially reported by the countries to the EEA. These observations have been subjected to full quality control by the countries.

2 Contract Summary

The ITT is about activities to deliver a range of products of the CAMS portfolio especially relevant for Policy Users. These products are:

- IAAR based on the Interim annual European air quality reanalyses and material in support of national reporting duties on air quality and threshold exceedances;
- AAR based on the annual European air quality reanalyses which make use of validated data, to serve as a reference document on the status of air quality in Europe;
- an “air control toolbox” that offers alternative forecasts of European air quality with reduced level of emissions, which allow assessing the effectiveness of possible temporary mitigation measures or of candidate measures as part of future policy developments;

- daily source-receptor calculations, which allow tracking the pollutants according to the geographical origin and chemical composition of their (or their precursors) sources;
- reports about major air pollution episodes in Europe produced within one month after the event in support of the concerned Member States' a posteriori analysis.

It also includes work in the area of design and implementation of European air quality policies, by supporting directly the European Commission's Directorate General for the Environment (DG-ENV) and Joint Research Centre (JRC), as well as the European Environment Agency (EEA) and ensuring a close liaison with them. This work will build on all the relevant products and services in the CAMS portfolio in order to bring most relevant information to these stakeholders. It will also interface with the CAMS national collaboration programme, involving all the EU Member States and Copernicus cooperating states, which aims to facilitate further the elaboration and implementation of air quality and emissions policies.

Finally, the work comprises the organisation of annual workshops to gather the community of air quality Policy Users of CAMS in order to discuss and gather feedback on the products delivered under this ITT as well as more generally on other CAMS Regional and Global Products that are relevant for EU, national and local policies.

3 Technical Specification

3.1 General Requirements

Several of the requested services in the sections below shall make use of one or more air quality forecasting systems. These air quality forecasting systems must have the following characteristics:

- the domain covered must be at least (25°W-45°E, 30°N-72°N);
- the system's horizontal resolution must be finer than or equal to 0.3° by 0.3°, or equivalent resolution in kilometres;
- transport and physical processes must be driven by ECMWF's high-resolution operational meteorological forecasts (using the most recent available forecast, which will be provided by ECMWF), either directly in the case of chemistry-transport models or by means of nudging or similar techniques;
- the system will use for the baseline the regional emissions datasets (other than fire) of the CAMS portfolio;
- the system will use fire emissions as well as chemical boundary conditions provided by the CAMS Global Service Provider (aerosol, reactive gases and greenhouse gases -if accounted for) using the most recent available products;
- the system must have the capability to forecast atmospheric pollutants regulated at the European and national levels in Europe (gases and particulate matter);
- the system must have an existing track record of providing daily forecasts with evidence of performance (quality, timeliness/completeness of the output…) as documented in peer-reviewed publications, reports or technical notes.

3.2 Work package 7110 – European Air Quality Annual Assessment Reports

This work package shall deliver assessment reports based on the (Interim) annual European air quality reanalyses, which will be themselves produced as part of the activities covered by the CAMS Regional

Service Provider. One interim reanalysis (available by the end of February each year for the previous year) and one reanalysis based upon validated surface observations (its timing depends upon availability of validated surface observations from the EEA) will be produced annually. The two reanalyses will cover key air pollutants (O_3, NO_2, SO_2, CO, PM_{10} and $PM_{2.5}$) over the domain (25°W-45°E, 30°N-72°N) and with a horizontal resolution of 0.1° by 0.1°. Companion verification reports against surface observations will be produced together with each reanalysis dataset by the Regional Service Provider; these verification reports will complement the assessment reports produced as part of this workpackage. The production of the reports shall be discussed and co-ordinated with the EEA, which is producing annually its own report (based on observations only).

3.2.1 Task 7111: Interim Annual Assessment Reports

The Successful Tenderer shall produce an Interim Annual Assessment Report (IAAR) every calendar year, which will describe the past year in terms of background concentrations of air pollutants in Europe based upon the Interim annual European air quality reanalysis dataset for the past year.

The IAAR shall be a reference document of high standard, including text, graphics and statistical tables. For this, it will strictly follow a template that will be discussed and agreed with ECMWF. The final document shall be reviewed and proof-read, in order to meet similar standards as scientific peer-reviewed publications or official publications of the EEA. In addition, the IAAR shall have an executive summary of a few pages highlighting the main findings.

The IAAR shall document the situation for the main regulatory pollutants (ozone, NO_2, PM_{10} and $PM_{2.5}$) in terms of concentrations and/or indicators for the whole of Europe and the entire year. Other pollutants and pollens shall be covered, but with less emphasis. The IAAR shall investigate and comment on the situation for the different seasons and at least a few sub-regions of Europe. Graphics and statistical tables (within the main text or in annex) shall support the text. The main significant adverse air quality episodes, particularly episodes extending over more than one country, shall be commented upon, highlighting in particular the contribution from (or absence of) natural contributions to PM and chemical pollutants (dust, fires, sea salts…) or from long-range transported pollution from outside Europe.

The IAAR shall be delivered not later than three months after the release of the Interim annual European air quality reanalysis dataset. Unless there are delays with the production of the numerical dataset and evaluation report (by the Regional Service Provider), the latest publication date for the IAAR is thus the end of May each year. Meeting this target date for delivery is of high importance because one of the main uses for the IAAR is to support EU Member States in completing their reporting duties to the European Commission, a process that has to be completed by the end of September annually. Tenderers shall explain in their proposal how the process of delivering the IAAR will be handled for delivering on time while adequately addressing the requirements mentioned above.

3.2.2 Task 7112: Annual Assessment Reports

The requirements are the same as for Task 7111 but will be based upon the annual European air quality reanalysis datasets, which are based upon validated surface observations. The Successful Tenderer shall deliver one Annual Assessment Report (AAR) during each year of the contract.

The AAR shall be a reference document of high standard, including text, graphics and statistical tables. For this, it will strictly follow a template that will be discussed and agreed with ECMWF. The final document shall be reviewed and proof-read, in order to meet similar standards as scientific peer-

reviewed publication or official publications of the EEA. In addition, the AAR shall have an executive summary of a few pages highlighting the main findings.

The AAR shall document the situation for the main regulatory pollutants (ozone, NO_2, PM_{10} and $PM_{2.5}$) in terms of concentrations and/or indicators for the whole of Europe and the entire year. Other pollutants and pollens shall also be covered, but with less emphasis.

The AAR shall be delivered not later than three months after the release of the Annual Regional Reanalysis dataset by the Regional Service Provider. The AAR is complemented by a verification report, which is delivered by the Regional Service Provider. The AAR shall include an annex to indicate how much the assessment changed from the one provided in the IAAR for the same year, which was released between one and two years before; the origin changes should be investigated (changes in values due to the observations validation process; addition or removal of sites; changes in regional data assimilation systems).

Tenderers shall complete the relevant table in Volume IIIA as part of their bid, which shall include the deliverables and milestones for this work package already indicated in the tables below. Volume IIIA will be used by the Tenderer to describe the complete list of deliverables, milestones and schedules for each work package. All milestones and deliverables shall be numbered as indicated. All document deliverables shall be periodically updated and versioned as described in the tables.

WP7110 Deliverables			
#	*Type*	*Title*	*Due*
D1.y.z-yyyy[1]	Report	Interim Annual Assessment Report for the year YYYY	Annually
D1.y.z-yyyy	Report	Annual Assessment Report for the year YYYY	Annually
D1.y.z	Report Dataset Service Other		
…			

WP7110 Milestones			
#	*Title*	*Means of verification*	*Due*
M1.y.z-yyyy	Notification of the start of production of the AAR	Email to ECMWF Technical Officer	Annually
…			

3.3 Work package 7120 – Air control toolbox

CAMS operates an online air quality scenario web interface, called “Air Control Toolbox”, which allows assessing the potential impact of different anthropogenic emissions abatement measures on a daily

[1] Deliverables (and Milestones) shall be numbered as per the following format DX.Y.Z (MX.Y.Z), where X is the WP number, Y is the task number and Z is the Deliverable (Milestone) number in this task. Deliverables delivered annually should be numbered DX.Y.Z-yyyy, where yyyy is the year the Deliverable refers to (e.g. DX.Y.Z-2016, DX.Y.Z-2017). Deliverables delivered quarterly should be numbered DX.Y.Z-yyyyQx, where yyyyQx is the quarter of the year the Deliverable refers to (e.g. DX.Y.Z-2016Q1, DX.Y.Z-2016Q2). The same numbering format shall be applied for Milestones. Continuous deliverables at higher frequency can be labelled in the same way as quarterly deliverables.

basis (http://policy.atmosphere.copernicus.eu/CAMS_ACT.html). The Successful Tenderer shall provide and operate such a toolbox with at least the same functionalities as the existing one. The toolbox will offer users a flexible framework to explore quantitatively the benefit of different levels of emissions reduction on a daily basis. For the air quality situation forecasted in the upcoming days, the user can assess the magnitude of improvement that shall be expected from any reduction of the emissions of the four main activity sectors: traffic, industry, residential heating, and agriculture. In the course of the contract, the shipping sector shall also be included. The custom emission scenarios are targeting primary pollutants and precursors through uniform Europe-wide reductions that are translated on the fly in terms of ozone and particulate matter pollution, therefore including the secondary pollutants. The tool shall rely on an air quality forecasting system as described in Section **Error! Reference source not found.**.

The forecast results shall be presented in terms of daily mean surface concentrations of at least O_3 and PM_{10} in the form of graphics, showing absolute values as well as difference plots compared to the reference (unperturbed emissions). The toolbox shall also provide graphics showing the emissions of the various sectors for the European domain. While the main functionality of the toolbox relies on the user specifying the emission reductions, the toolbox should also include the functionality for specific pre-sets that mimic emission reductions as part of specific international agreements. At a minimum, this pre-set functionality shall include the emission reductions agreed as part of the Gothenburg protocol (see also, http://policy.atmosphere.copernicus.eu/GothenburgScenario.html) and, when it becomes relevant, its revision.

The toolbox shall either be hosted on the CAMS website or in a single comprehensive web-based system, which will be embedded in the CAMS website. The Tenderer shall describe the chosen option. Technical support for the service shall be available on a next-working-day basis.

The Successful Tenderer shall describe the methodology employed and the system set up in a report, to be delivered less than three months after the start of the contract resulting from this ITT. By that time, the air control toolbox shall have started to be delivered on a daily basis. The report shall be written in a way that gives enough insight to the users of the service on the approach and its reliability.

As part of this workpackage, the bidder shall also conduct developments for the continuous evolution of this service. The proposal shall describe the work that will be carried out to this effect.

Tenderers shall complete the relevant table in Volume IIIA as part of their bid, which shall include the deliverables and milestones for this work package already indicated in the tables below. Volume IIIA will be used by the Tenderer to describe the complete list of deliverables, milestones and schedules for each work package. All milestones and deliverables shall be numbered as indicated. All document deliverables shall be periodically updated and versioned as described in the tables.

WP7120 Deliverables			
#	*Type*	*Title*	*Due*
D2.y.z	Report	Methodology and system set-up of the CAMS Air Control Toolbox	M3
D2.y.z-yyyyQq	Service	Provision of the daily updated Air Control Toolbox Service over the past quarter	Quarterly
D2.y.z	Report Dataset		

	Service Other		
…			

WP7120 Milestones			
#	*Title*	*Means of verification*	*Due*
M2.y.z	Implementation of Air Control Toolbox	Service publicly available through the CAMS website	As early as possible and latest 3 months after the start of the contract
…			

3.4 Work package 7130 - Source allocation service

CAMS provides a source allocation service, providing daily forecasts of source contributions and, on an experimental basis, chemical composition of particulate matter for a set of capitals and cities in the European Union (http://policy.atmosphere.copernicus.eu/DailySourceAllocation.html). It aims at addressing specifically the characterisation of the sources that are contributing to air pollution. The relative influence of local and remote sources as well as the chemical composition of fine particulate matter is critical information to assess effectiveness of potential measures to be taken: e.g., in the case of an episode where long-range transport from distant sources is prominent, local emission reduction measures may have only limited effect. Such calculations, also called source-receptor calculations, rely on regional air quality systems and the specific requirements for this ITT are described in Section **Error! Reference source not found.**.

3.4.1 Task 7131: Daily forecasts of source contributions to EU cities

The Successful Tenderer shall operate a regional source-receptor system, which shall be run daily to forecast for the next four days the relative influence of reducing local air pollution sources versus reducing sources from outside the agglomeration for three regulatory pollutants (ozone, PM_{10} and $PM_{2.5}$) and for at least all the cities covered in the current service (see https://policy.atmosphere.copernicus.eu/DailySourceAllocation.php). In addition, this service shall provide information on the breakdown of pollutants according to the geographical origin of pollution (precursors in the case of ozone) and according to chemical composition in the case of PM10.

Source-receptor forecasts will be made available daily to the users in the form of graphics not later than 08 UTC (0-48h) and 10 UTC (49-96h). At the minimum, the current functionality shall be reproduced. However, the Tenderer is free to suggest change in the graphical presentation, as long as at least the same information is available (the current version is the result of interactions with users and meets several expressed user requirements). The Tenderer is invited to describe in the technical solution the user interface and the different graphical products, which will be made available daily to the users. This material shall either be hosted on the CAMS web site or in a single comprehensive web-based system, which will be embedded in the CAMS web site. The Tenderer shall describe the chosen option. Technical support for the daily produced material shall be available on a next-working-day basis.

The Successful Tenderer will describe the methodology employed and the system set up in a report, to be delivered less than three months after the start of the contract resulting from this ITT. By that time, the daily forecasts of source contributions to EU cities themselves shall have started to be delivered on a daily basis.

Discussions with the European Commission, particularly the Joint Research Centre, have indicated that the scientific aspects underpinning source-receptor calculations still require attention. As a result, work is on-going as part of the FAIRMODE initiative in order to compare methodologies, improve them where possible, and identify limitations. The Successful Tenderer shall reserve some resources to engage with the JRC and the corresponding activities in FAIRMODE in order to ensure that CAMS supports these investigations and remains at the best state-of-the-art and that it provides most relevant information to the users about applicability and limitations.

In addition, the successful bidder shall provide an annual report building upon the routine operations of the source-receptor calculations. For each of the cities covered by the service, the results from daily operations will be averaged over seasonal (DJF, MAM, JJA, SON) and annual timescales. This will allow providing source-receptor information for each season of the past year, as well as for the past year as a whole, in terms of local/non-local/other, of geographical origin of species/precursors and of chemical composition.

3.4.2 Task 7132: Episode analysis reports

The Successful Tenderer shall use primarily the results from the source-receptor calculation service to provide specific information in case of large-scale/trans-boundary air pollution episodes in Europe. For each chosen episode, results will be presented in the form of a detailed report, which is intended to support the concerned Member States' a posteriori case analysis and complement in particular the IAAR, which will be produced after the end of the year.

The Tenderer shall describe a proposed activation process, which shall be discussed with ECMWF during negotiations, if successful. This process shall include the possibility of responding to queries from users received by CAMS user support. The process should also be capable of identifying autonomously situations where such information can be of general interest. It shall not be activated more than 5 times per year.

Other modelling results could be included to complement the results from the source/receptor calculations (task 7131), as long as the model(s) employed meet the requirements described in Section 3.1. The outputs from the CAMS global system should also be considered regarding long-range transported plumes of dust, fire, volcanic ash or pollution.

Once activation has been received from ECMWF, the Successful Tenderer shall complete the report within one month. Episode analysis reports will be made available on the CAMS website directly.

Tenderers shall complete the relevant table in Volume IIIA as part of their bid, which shall include the deliverables and milestones for this work package already indicated in the tables below. Volume IIIA will be used by the Tenderer to describe the complete list of deliverables, milestones and schedules for each work package. All milestones and deliverables shall be numbered as indicated. All document deliverables shall be periodically updated and versioned as described in the tables.

WP7130 Deliverables			
#	*Type*	*Title*	*Due*

D3.y.z	Report	Methodology and system set-up for production of daily forecasts of source contributions to EU cities	M3
D3.y.z-yyyyQq	Service	Provision of the daily updated Source-Receptor Service over the past quarter	Quarterly
D3.y.z-yyyy	Report	Annual report about the source-receptor calculations	Annually
D3.y.z	Report	Episode Report	5 times in each year
D3.y.z	Report Dataset Service Other		
…			

WP7130 Milestones			
#	*Title*	*Means of verification*	*Due*
M3.y.z	Implementation of Source Receptor service	Service publicly available through the CAMS website	As early as possible and latest 3 months after the start of the contract
M3.y.z	Triger of episode report	Email to ECMWF Technical Officer	5 times in each year
…			

3.5 Work package 7140 – Support to DG-ENV, JRC and the EEA

In recent years, CAMS has become a trusted source of information for the main stakeholders for air quality policies at European level, namely DG-ENV, the JRC and the EAA. In September 2020, a meeting between CAMS and these stakeholders identified great potential for reinforcing the contribution of CAMS to work relevant for policy monitoring and policy design. The pillars of air quality policies in Europe are the National Emissions Ceilings Directive, which transposes the emissions reduction commitments under the (revised) Gothenburg Protocol of the UNECE Convention on Long-Range Transboundary Air Pollution, and the Air Quality Directive, which defines the regulatory framework for ambient air monitoring. These Directives are also transposed in the national law of the Countries of the European Union. The context is the upcoming new revision of the Gothenburg protocol, for which CAMS current and upcoming activities on emissions can be very useful. Besides, the European Commission has related high-level initiatives including the overarching European Green Deal (especially the policy area “Eliminating pollution”) and the recently published second Clean Air Outlook, which presents the prospects for reducing air pollution in Europe up to 2030 and beyond. It updates the analysis that was presented in the First Clean Outlook (2018), in particular by including the measures put forward by Member States in their National Air Pollution Control Programmes and an increased level of ambition for fighting climate change. Finally, the Forum for Air quality Modeling (FAIRMODE) is as a joint response initiative of the EEA and the JRC (chair) involving the Member States

of the EU and the EEA; the scope of activities discussed in FAIRMODE relate very much to CAMS and several contractors and subcontractors of CAMS are naturally involved given their expertise.

It has been agreed going forward that there will be 6-monthly meetings between ECMWF, DG-ENV, JRC and the EEA to discuss items of common interest and agree some specific contributions that CAMS could bring. The contractor shall reserve resources of between 20 to 25% to serve as support to ECMWF in these meetings and carry forward the bulk of the tasks agreed during the meetings, building on the work of the different CAMS contracts and service lines, as appropriate, and liaising with the relevant Horizon Europe projects (especially related to CAMS Service evolution). This work will require expertise on air quality modelling including source apportionment, on emissions both from inventories and from inverse modelling, and on satellite observations relevant for air quality. The work will be defined on a 6-monthly basis and agreed between the Successful Tenderer and ECMWF shortly after each meeting with the above-mentioned European stakeholders. The meetings shall be listed in a meeting overview table as outlined in section 4.2. Finally, for this purpose, the Successful Tenderer will support ECMWF for the liaison with Countries as part of the CAMS National Collaboration programme that will be set-up in late 2021 or early 2022 as part of this programme, Countries will have some resources to carry out work, which will be of course relevant in the context mentioned in the previous paragraph.

Tenderers shall complete the relevant table in Volume IIIA as part of their bid, which shall include the deliverables and milestones for this work package already indicated in the tables below. Volume IIIA will be used by the Tenderer to describe the complete list of deliverables, milestones and schedules for each work package. All milestones and deliverables shall be numbered as indicated. All document deliverables shall be periodically updated and versioned as described in the tables.

WP7140 Deliverables			
#	*Type*	*Title*	*Due*
D4.y.z-yyyyQq	Report	Plan of activities in support of DG-ENV, JRC and EEA	6-monthly
D4.y.z-yyyyQq	Report	Report about activities in support of DG-ENV, JRC and EEA	6-monthly
D4.y.z	Report Dataset Service Other		
…			

WP7140 Milestones			
#	*Title*	*Means of verification*	*Due*
M4.y.z			
…			

3.6 Work package 7150 - Interaction with users in the policy domain

Experience has shown that the community of Policy Users has specific needs and that dedicated workshops are needed to discuss these and follow up on corresponding development activities. The Successful Tenderer shall organize annual events dedicated to users in the policy domain. It shall also contribute to general user interaction activities by participating in and supporting user workshops (organised as part of the ITT on CAMS user interaction) and by providing the requirements gathered from users in the policy domain to the contractor for User Interaction activities for logging into the CAMS User Requirements DataBase (URDB, see Section **Error! Reference source not found.**). The CAMS products presented and discussed should not be limited to the ones produced as part of this ITT, but also cover all the other CAMS products that are relevant for European or national environmental policies and regulations.

3.6.1 Task 7151: Policy User workshop

The Successful Tenderer shall organize one Policy User workshop (1 to 2 days) each year to interact with CAMS Policy Users. The location and timing of these user workshops shall be agreed between the Successful Tenderer and ECMWF each year taking into account relevant key meetings and events of the European policy community and involving EU member states.

Once agreed, the Successful Tenderer will propose one or more potential venues easily reachable by public transport where the event might take place. The Successful Tenderer will draft a programme including presentations as well as discussions with the Policy Users. The Successful Tenderer can use their own creative input to define the exact format of the workshop. The budget proposed for the organization of the CAMS Policy User workshops must include all aspects: venue hire, tea/coffee and lunch breaks for all attendees, engagement, and the organization of the event itself. In the case of a 2-day workshop, covering dinner and accommodation costs of participants is not mandatory. It is not expected that travel costs of participants shall be covered other than possibly for some invited speakers. The Tenderer can use an indicative number of 40 attendees for each event to estimate the budget, which has to be covered under the present contract. Given the current pandemic and its impact on travel, the Tenderer shall also indicate how it would address the option of virtual workshops in case significant travel restrictions are in place at the time of the foreseen workshops.

The Successful Tenderer must take minutes from the meeting and deliver a report not later than one month after each workshop. Workshop reports shall be approved by ECMWF before finalisation and publication.

3.6.2 Task 7152: Contribution to wider CAMS user interaction activities

The Successful Tenderer shall also take part in the general CAMS user workshops, when requested by ECMWF, sending at least one participant to present updates of Policy Products and gather related user requirements and feedback. Two meetings will be organised annually as part of ITT on User Interaction activities. It is expected that presentations and discussions in these user workshops can cover in principle all different aspects of European, national and regional/local policies, and it is thus essential that the Successful Tenderer of this ITT is actively involved.

Tenderers shall complete the relevant table in Volume IIIA as part of their bid, which shall include the deliverables and milestones for this work package already indicated in the tables below. Volume IIIA will be used by the Tenderer to describe the complete list of deliverables, milestones and schedules for each work package. All milestones and deliverables shall be numbered as indicated. All document deliverables shall be periodically updated and versioned as described in the tables.

WP7150 Deliverables			
#	*Type*	*Title*	*Due*
D5.y.z	Report Dataset	…	
…			

WP7150 Milestones			
#	*Title*	*Means of verification*	*Due*

3.7 Work package 7160 – User support and documentation of service

The objective of this work package is to provide support to users of the delivered products and services.

ECMWF has established a centralised Copernicus Service Desk to provide multi-tiered technical support to all users of CAMS data, products, tools and services. The Service Desk handles user queries through a ticketing system and distributes these queries to specialists when needed. Dedicated staff at ECMWF provide basic support in the form of self-help facilities (FAQs, Knowledge Base, online Forum, tutorials etc.) as well as individualised support on technical queries related to the Atmosphere Data Store (ADS), data formats, data access etc. In addition, ECMWF staff provide specialised scientific support to address questions related to its industrial contributions to CAMS, e.g. in the areas of global forecasting of atmospheric composition.

All CAMS contractors are expected to contribute to the delivery of multi-tiered technical support for the data and/or services they provide. Such specialised user support shall take the form of direct response to individual user queries via the Service Desk facility, as well as contributions to FAQs, Knowledge Base, and user guides. Contractors may also be requested by the CAMS Service Desk to contribute to support questions in the online Forum.

Tenderers shall describe the level of user support service on Service Desk tickets as a specific Key Performance Indicator (KPI) with a target value of 80% of the assigned specialised user queries being resolved within 15 days after being informed by the CAMS Service Desk.

Tenderers shall also address development of user guides. Documentation of the CAMS services is an integral part of the service provision and is directly linked to the Atmosphere Data Store. The technical and scientific specification of each service shall be documented in the CAMS Knowledge Base as linked from the Atmosphere Data Store (see example for the CAMS global reanalysis at https://ads.atmosphere.copernicus.eu/cdsapp#!/dataset/cams-global-reanalysis-eac4?tab=doc), and, if more detail is required, in reports that will be available to users through the CAMS web site. The successful Tenderer shall therefore produce documentation describing in detail the methodologies and products they deliver for this ITT. The documentation in the Knowledge Base shall be targeted at the general external user community, while the additional detailed reports shall address the needs of expert users.

Tenderers shall complete the relevant table in Volume IIIA as part of their bid, which shall include the deliverables and milestones for this work package already indicated in the tables below. Volume IIIA will be used by the Tenderer to describe the complete list of deliverables, milestones and schedules

for each work package. All milestones and deliverables shall be numbered as indicated. All document deliverables shall be periodically updated and versioned as described in the tables.

WP7160 Deliverables			
#	*Type*	*Title*	*Due*
D6.y.z-YYYY	Report	Overview of contribution to CAMS Knowledge Base to document products and services requiring expertise specific to CAMS air quality policy support service	Annually
D6.y.z-YYYY	Report	Documentation of CAMS air quality policy support service elements	Annually
D6.y.z	Report Dataset Service Other		
…			

WP7160 Milestones			
#	*Title*	*Means of verification*	*Due*
M6.y.z	…	…	…
…			

3.8 Work package 7100 – Management and coordination

The following management aspects shall be briefly described in the bid:

- Contractual obligations as described in the Framework Agreement Clause 2.3 on reporting and planning.
- Meetings (classified as tasks and listed in a separate table as part of the proposal):
  - ECMWF will organise annual CAMS General Assemblies. The successful Tenderer is expected to attend these meetings with team members covering the various topics that are part of this ITT.
  - ECMWF will host monthly teleconference meetings to discuss CAMS service provision, service evolution and other topics. The Prime Investigator appointed by the successful Tenderer will represent the successful Tenderer in such meetings.
  - ECMWF will organise six-monthly project review meetings (linked to Payment milestones).
  - Tenderers can propose additional project internal meetings (kick-off meeting, annual face-to-face meeting and monthly teleconferences) as part of their response.
- Quality assurance and control: the quality of reports and Deliverables shall be equivalent to the standard of peer-reviewed publications. The final quality check of the deliverables should be made by the prime contractor (contents, use of ECMWF reporting templates for deliverables and reports (Microsoft Word), format, deliverable numbering and naming, typos…); all reports in this project shall be in English. Unless otherwise specified the specific contract Deliverables shall be made available to ECMWF in electronic format.
- Communication management (ECMWF, stakeholders, internal communication).
- Resources planning and tracking using the appropriate tools.
- Implementation of checks, controls and risk management tools for both the prime contractor and subcontractors.

- Subcontractor management, including conflict resolution, e.g. the prime contractor is responsible for settling disagreements, although advice/approval from ECMWF may be sought on the subject.
- A list of subcontractors describing their contribution and key personnel shall be provided, as well as back-up names for all key positions in the contract. The Tenderer shall describe how the Framework Agreement, in particular Clause 2.9 has been flowed down to all their subcontractors.
- Management of personal data and how this meets the requirements of Clause 2.8 and Annex 6 of the Volume V Framework Agreement.

Tenderers shall complete the relevant table in Volume IIIA as part of their bid, which shall include the deliverables and milestones for this work package already indicated in the tables below. Volume IIIA will be used by the Tenderer to describe the complete list of deliverables, milestones and schedules for each work package. All milestones and deliverables shall be numbered as indicated. All document deliverables shall be periodically updated and versioned as described in the tables.

WP7100 Deliverables				
#	*Responsible*	*Nature*	*Title*	*Due*
D0.y.z-YYYYQQ	Tenderer	Report	Quarterly Implementation Report QQ YYYY *QQ YYYY being the previous quarter*	Quarterly on 15/01, 15/04, 15/07 and 15/10
D0.y.z-YYYY	Tenderer	Report	Annual Implementation Report YYYY *YYYY being the Year n-1*	Annually on 28/02
D0.y.z-YYYY	Tenderer	Other	Preliminary financial form YYYY *YYYY being the Year n-1*	Annually on 15/01
D0.y.z	Tenderer	Report	Final report, including letter from auditor specific to CAMS contract YYYY *YYYY being the last year of the contract*	60 days after end of contract
D0.y.z-YYYY	Tenderer	Report	Draft Implementation plan YYYY *YYYY being the Year n+1*	Annually on 28/02
D0.y.z-YYYY	Tenderer	Report	Finalised Implementation plan YYYY *YYYY being the Year n+1*	Annually on 31/10
D0.y.z-YYYY	Tenderer	Other	Copy of prime contractor's general financial statements and audit report YYYY *YYYY being the Year n-1*	Annually
D0.y.z	Tenderer	Other	Updated KPIs (list, targets…) after review with ECMWF	One year after start of contract

WP7100 Milestones				
#	*Responsible*	*Title*	*Means of verification*	*Due*
M0.y.z-Px	Tenderer	Progress review meetings with ECMWF / Payment milestones	Minutes of meeting	~ Every 6 months

4 General Requirements

4.1 Implementation schedule

The Framework Agreement will run from 1 July 2021 to 31 December 2024. The Tenderer shall provide a detailed implementation plan of proposed activities for the full period.

4.2 Deliverables and milestones

Deliverables should be consistent with the technical requirements specified in section 3. A deliverable is a substantial, tangible or intangible good or service produced as a result of a project. In other words, a deliverable is an outcome produced in response to the specific objectives of the contract and is subject to acceptance by the technical contract officers at ECMWF. When defining deliverables please **consolidate their numbers** against a specific single deadline where possible. All contract reports shall be produced in English. The quality of reports and deliverables shall be equivalent to the standard of peer-reviewed publications and practice. Unless otherwise specified in the specific contract, deliverables shall be made available to ECMWF in electronic format (PDF/Microsoft Word/Microsoft Excel or compatible) via the Copernicus Deliverables Repository portal.

Each Deliverable shall have an associated resource allocation (person-months and financial budget, resource type: payroll only). The total of these allocated resources shall amount to the requested budget associated with payroll.

Milestones should be designed as markers of demonstrable progress in service development and/or quality of service delivery. They should not duplicate deliverables. Apart from the payment milestone review meetings, all foreseen meetings shall not be classified as milestones but listed in a separate overview table for each work package.

4.3 Acquisition of necessary data and observations

The Regional Service Provider will provide the data from the (Interim) annual European air quality reanalyses needed for this tender. The Global Service Provider will provide the boundary conditions and the fire emissions from the Global Products needed for this tender.

4.4 Operational aspects and quality control

For the elements covered by this ITT, which have a time-critical dimension (air quality scenario toolbox described under workpackage 7120 and source allocation services described under workpackage 7130), timeliness and completeness of production, technical/scientific quality of the products and availability of them are the key operational dimensions. The Tenderer shall describe how these critical aspects are addressed in the Technical Solution proposed and how the performance will be monitored (see also section 4.8 on Key Performance Indicators)

4.5 Communication

The successful Tenderer shall support ECMWF in its communication activities for the CAMS services, where they are related to the activities described in this ITT. Examples are contributions to the Copernicus State of the Climate report, CAMS web site news items, and CAMS brochures and flyers.

4.6 User requirements

As part of the CAMS user interaction, user requirements are continually collected in a User Requirements Database (URDB) in a structured and traceable way. This URDB tracks all requirements emanating from a wide variety of user fora, surveys, user support and direct interactions between service providers and their users. The entries of the URDB are analysed on a regular basis in terms of user requirements per domain, importance and feasibility. This analysis constitutes the basis for distilling, filtering and translating user requirements into technical specifications for the Service and its evolution.

The successful Tenderer shall provide input to the User Requirements Database (URDB) regarding user requirements that are directly related to activities covered by this ITT. The successful Tenderer shall also support ECMWF and the contractor for User Interaction activities with the analysis of relevant user requirements in the URDB.

The following deliverables are thus to be added to the WP7160 deliverable lists:

WP7160 Deliverables			
#	*Type*	*Title*	*Due*
D6.y.z-YYYY	Other	Input to CAMS URDB - YYYY	Checked by ECMWF annually in November
…			

4.7 Data sets

It is not expected that this contract will deliver datasets to be served though the Atmosphere Data Store (ADS).

4.8 Key performance indicators

Contractors shall report to ECMWF on a set of Key Performance Indicators (KPIs) suitable for monitoring various aspects of service performance. These will be used in the overall monitoring of the CAMS programme for which the following KPI categories have been identified:

- KPI1 Service availability
- KPI2 Products usage
- KPI3 Products quality
- KPI4 User support
- KPI5 User statistics
- KPI6 Service audience
- KPI7 User engagement
- KPI8 User satisfaction
- KPI9 Contracts
- KPI10 Deliverables
- KPI11 Data usage

The table below provides the template to be used by the Tenderer to describe the KPIs, relevant for this ITT, together with performance targets, delivery schedules and explanations, if needed. Please note that the listed KPIs form part of the overall set of KPIs comprising the full CAMS service portfolio; the successful Tenderer therefore might have to provide KPI values for a KPI in support of services outside this ITT.

All KPIs shall be labelled and numbered as indicated. All KPIs shall be periodically updated as described in the tables. Tenderers shall provide preliminary versions of the completed tables as part of their bid.

The list of KPIs shall be reviewed with ECMWF in the second year of the contract and updated if necessary.

Service availability KPI #	KPI Title	Performance Target and Unit of Measure	Frequency of Delivery	Explanations / Comments
KPI_71.1.2	Server or webAPI uptime	95%	Quarterly	Percentage of uptime vs total time for the data servers (running average over the past calendar year).
KPI_71.1.3	Completeness of production for each product	95%	Quarterly	Percentage of outputs delivered vs expected for each product defined in the SPP (running average over the past calendar year). This percentage is computed in terms of data volume
KPI_71.1.4	Timeliness of production for each product	90%	Quarterly	Percentage of products delivered completely and on time if delivery time is specified in the SPP (running average over the past calendar year).
KPI_71.5.1	Number of users segmented by main service product lines		Quarterly	
KPI_71.5.2	Number of active users by main service product lines		Quarterly	
KPI_71.5.3	Number of new users		Quarterly	
KPI_71.5.4	Number of users per country		Quarterly	
KPI_71.5.5	Number of active users per country		Quarterly	
KPI_71.5.6	Number of new users per country		Quarterly	
KPI_71.6.6	Policy audience		Annual	Total number of citations or uses in reports or documents done by institutional or policy entities to respond to EC

				regulations/laws (EU and national level). Note: this is difficult to track because of lack of bibliometric tools such as the ones which exists for scientific literature; many policy uses may actually be omitted. Also, policy uses of the Service's products may not systematically end up in a publicly available document (but rather in internal notes supporting public decision).
KPI_71.10.1	% of deliverables delivered on time or with short delay	90%	Quarterly	

5 Tender Format and Content

General guidelines for the tender are described in Volume IIIB. Specific requirements to prepare the proposal for this particular tender are described in the next sub-sections.

5.1 Page Limits

As a guideline, it is expected that individual sections of the Tenderer's response do not exceed the page limits listed below. These are advisory limits and should be followed wherever possible, to avoid excessive or wordy responses.

Section	*Page Limit*
Executive Summary	2
Track Record	2 (for general) and 2 (per entity)
Quality of resources to be Deployed	2 (excluding Table 1 in Volume IIIB and CVs with a maximum length of 2 pages each)
Technical Solution Proposed	2 + 3 per Work package (Table 2 in Volume IIIB, the section on references, publications, patents and any pre-existing IPR is excluded from the page limit and has no page limit)
Management and Implementation	6 (excluding Table 3, Table 5, Table 6 and Table 7 in Volume IIIB) + 2 per each Work package description (Table 4 in Volume IIIB)
Pricing Table	No limitation

Table 1: *Page limits*

5.2 Specific additional instructions for the tenderer's response

The following is a guide to the minimum content expected to be included in each section, additional to the content described in the general guidelines of Volume IIIB. This is not an exhaustive description and additional information may be necessary depending on the Tenderer's response.

5.2.1 Executive Summary

The Tenderer shall provide an executive summary of the proposal, describing the objectives, team and service level.

5.2.2 Track Record

The Tenderer shall demonstrate for itself and for any proposed subcontractors that they have experience with relevant projects in the public or private sector at national or international level. ECMWF may ask for evidence of performance in the form of certificates issued or countersigned by the competent authority.

5.2.3 Quality of Resources to be Deployed

The Tenderer shall propose a team that meets at least the following requirements:

- A senior team member (Prime Investigator) with more than 5 years of experience in managing activities related to this ITT;
- At least two additional senior team members with more than 5 years of experience on performing activities related to the various aspects of this ITT.

These team members shall be involved in the activities of this ITT at a minimum level of 10% of their total working time. The successful Tenderer shall also appoint a Service Manager, which will be its primary contact for contractual delivery and performance aspects.

5.2.4 Technical Solution Proposed

The Tenderer is expected to provide a short background to the proposed technical solution to demonstrate understanding of the solution proposed. This should include background of the Tenderer's understanding of the Copernicus Atmosphere Monitoring Service, the current state of forecasting of global atmospheric composition and regional air quality, and the current state of building comprehensive and consistent data sets of emissions.

An exhaustive and detailed description of the proposed technical solution for all work packages described above shall be given. The Tenderer shall indicate which air quality forecasting systems it intends to use and how it will acquire the relevant input data. The Tenderer shall describe the proposed method for producing air quality scenario toolbox and the source allocation services. The Tenderer shall describe the validation methodology. Finally, the Tenderer shall describe how they will deliver the potential service evolution aspects.