ECMWF Copernicus Procurement

Invitation to Tender

Copernicus Atmosphere Monitoring Service

Volume II

Global and regional emissions

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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-live green-house 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.

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.

The Service consolidates many years of preparatory research and development and delivers the following operational services:

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 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 surface flux inversions for CO_2, CH_4 and N_2O, 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 for the global and European domains and global emissions from wildfires and biomass burning

This Invitation to Tender (ITT) is mainly targeting the CAMS service elements described under items (i) in support for (a), (c) and (d).

1.1 Definitions

Definitions specific for this ITT are defined below.

Global Service Provider: ECMWF is the provider of global products

Regional Service Provider: Météo-France and INERIS are the regional service providers, selected through another ITT, CAMS_50, Regional Production.

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

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

2 Contract Summary

This ITT, entitled "Global and regional emissions", is to provide gridded distributions of anthropogenic (global and European domains) and natural and biogenic emissions (global only) in direct support of CAMS production chains, with target resolutions of 10 to 50 km (global) and 5 to 10 km (Europe). The emissions will include the species that are defined in the respective work package descriptions. They must also be stratified into headline activity sectors. The period covered will be from 2000 to 2021 for the global emissions, and from 2000 to 2018 for the European regional emissions. Besides the yearly totals, the Successful Tenderer will deliver monthly, weekly and diurnal temporal profiles, so that variations can be accounted for in the CAMS systems. Improving the representation of the temporal variations of emissions and investigating modelling methodologies to calculate certain emissions as a function of meteorological parameters (including forecasted ones) or of other proxies will be in scope of the developmental aspects of the work.

3 Technical Specification

3.1 General Requirements

This ITT asks for the provision of natural and anthropogenic emissions as input for the CAMS Regional and Global Production Systems. Emissions form a key component of the CAMS production systems and underpin the time evolution of pollutants in the atmosphere. The Successful Tenderer shall therefore closely interact with the Global Service Provider and Regional Service Provider and provide them with accurate and timely emissions on the relevant horizontal scales as defined below. The emission data sets will also be part of the CAMS services and therefore it is required that all the datasets can be made freely available to CAMS users as products in their own right.

3.2 Work package 8110 – Anthropogenic emissions for the CAMS regional domain

As part of this work package the Successful Tenderer shall provide a data set of anthropogenic emissions to be used by the Regional Service Provider and delivered also as a CAMS product. The anthropogenic emissions shall primarily consider the officially reported emissions data to EMEP , with a possibility to combine them with other estimates where needed to fill gaps, inconsistencies or suspected errors. The Tenderer shall describe in the technical solution proposed the methodology which will be used and, in particular, how emissions from point sources will be accounted for and treated.

In the case that the spatial emission reported by the countries to EMEP are re-mapped by the Tenderer with their own proxies, the motivation, methodology and added-value of this re-mapping shall be documented.

The minimum set of species shall consist of aerosol (at the minimum, segregated by country, activity sector and reporting year into EC[1], OC[2], SO_4[3], Na, Other Minerals for both the fine coarse fractions and total and also providing the share of biofuel in PM2.5 and PM10 by country, activity sector and reporting year), NO_x[4] (with NO[5]/NO_2[6] ratio by country, activity sector and reporting year), NH_3[7] (from both crops and livestock), SO_2[8], DMS[9], NMVOCs[10] (total and split into main individual species), CO[11], CH_4[12] and CO_2[13]. The emissions shall be stratified into main source categories, as defined by the GNFR classification (https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/part-a-general-guidance-chapters/7-spatial-mapping-of-emissions).

For the purpose of running emissions reduction scenarios, the regional emissions from road transport shall be further segmented into: exhaust (gasoline vehicles), exhaust (diesel vehicles), exhaust (LPG/ natural gas vehicles), gasoline evaporation and tire/brakes/road wear.

The non-road transport emissions shall at least distinguish between emissions from shipping and from aircraft.

The fugitive emissions should include in particular emissions of reactive gases and methane from shale gas extraction as well as leaks.

Emissions from soil (both agricultural lands and natural ecosystems) should be carefully documented for each country and activity sector to allow modelers avoid duplication in their estimation of biogenic emissions.

The emissions shall have a gridded horizontal resolution of between 5 and 10 km, as well as point source information (including release height) whenever possible. The geographical domain shall at least include the CAMS European domain (25°W-45°E, 30°N-72°N) and emissions shall be estimated for the entire corresponding land and maritime domains (e.g. including over the parts of North Africa and Middle East covered).

Gridded emissions shall be provided at the surface for all sources except for emissions by aircraft, for which information on the vertical distribution is needed.

The temporal range of the emissions shall at least consist of the period 2000 to the most recent possible year (2018 or posterior) and produced as soon as new officially reported emissions data become available. Temporal changes variations shall be accounted for, so that variations at hourly, daily and monthly timescales can be modelled, preferably providing country (or gridded), activity sector (differentiating crop and livestock for the agriculture sector), and year-dependent temporalization factors.

[1] Elemental carbon
[2] Organic carbon
[3] Sulfate
[4] Nitrogen oxides
[5] Nitrogen monoxide
[6] Nitrogen dioxide
[7] Ammonia
[8] Sulfur dioxide
[9] Dimethyl sulfide
[10] Non-methane volatile organic compounds
[11] Carbon monoxide
[12] Methane
[13] Carbon dioxide

The Successful Tenderer shall provide guidance on how to best apply the latest emissions available for use in the Regional Production for the current year, by recommending scaling factors and/or proxy-based approaches.

The Successful Tenderer shall provide alternative emission datasets based on expert knowledge for the activity sectors and harmonized methodologies between countries where well documented shortcomings exist in the official emission reported to EMEP/EEA. This is specifically relevant for the emission related to wood burning in the residential sector.

All data sets shall undergo sufficient Evaluation and Quality Control, which shall be described in short reports. This shall include the provision of total emission budgets for all species, which can be used to verify the proper uptake of the emissions in the regional forecasting systems.

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

WP8110 Deliverables			
#	*Type*	*Title*	*Due*
D1.y.z[14]	Report Dataset	European emissions dataset (2000 - 2018)	
…			

WP8110 Milestones			
#	*Title*	*Means of verification*	*Due*
M1.y.z			
M1.y.z			

3.3 Work package 8120 – Anthropogenic emissions for the global domain

As part of this work package the Successful Tenderer shall provide a data set of anthropogenic emissions to be used by the Global Service Provider and delivered also as a CAMS product. The anthropogenic emissions shall be derived from official reported emission data by source category to

[14] 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.

the extent possible, and combined with other estimates where needed. Synergies with international initiatives on global emissions would be an advantage. The Tenderer shall describe in the technical solution proposed the methodologies which will be used for deriving these emissions.

The minimum set of species shall consist of aerosol (segregated at least into Organic Carbon and Black Carbon), NO_x[15], NH_3[16], SO_2[17], NMVOCs[18], CO[19], CH_4[20], N_2O[21], CO_2[22] with , H_2[23], HCN[24] and CH_3CN[25] as optional species.

The emissions shall be stratified into main source categories, following as much as possible the definitions from the Intergovernmental Panel on Climate Change and the Convention on Long-Range Transboundary Air Pollution as well as the GNFR classification used for the regional emissions. The sectors used for the current CAMS global emissions can be used as guideline and are documented in Table 3.2 of the CAMS documentation (https://atmosphere.copernicus.eu/sites/default/files/2019-06/cams_emissions_general_document_apr2019_v7.pdf). One specific requirement is the separation of Agricultural waste burning emissions to avoid double-counting, since these emissions are also included in the CAMS Global Fire Assimilation (GFAS) emission products.

The emissions shall have a horizontal resolution of between 10 and 50 km. The geographical domain shall cover the entire globe.

The non-road transport emissions shall at least distinguish between emissions from shipping and from aircraft.

The fugitive emissions should include in particular emissions of reactive gases and methane from shale gas extraction as well as leaks.

Gridded emissions shall be provided at the surface for all sources except for emissions by aircraft, for which information on the vertical distribution is needed.

Point sources shall be spatially distributed using the specific location of the point source. An option is to provide point source emissions (with release heights) as separate files, as far as possible. Information or advice on how to specify effective emission heights for the gridded data sets suitable for the use in the CAMS global forecast model shall be provided.

The methodology for deriving the inventory of emissions shall be described in the technical solution. It is acceptable to use existing datasets as an input, and adapt them for the specific purpose of CAMS. If different sources are used for the same emissions process but different emitted species, some justification of the consistency between the different species' emissions must be provided. The reported data shall be analysed by sector in detail, and completed with alternative emission estimates, as needed, ensuring a complete emission inventory for all countries worldwide. The emission dataset shall be spatially distributed consistently across all countries.

[15] Nitrogen oxides, NO and NO2
[16] Ammonia
[17] Sulphur dioxide
[18] Non-Methane Volatile Organic Compounds
[19] Carbon Monoxide
[20] Methane
[21] Nitrous oxide
[22] Carbon dioxide
[23] Molecular hydrogen
[24] Hydrogen cyanide
[25] Acetonitrile

The temporal range of the emissions shall at least consist of the year 2021 and previous years up to 2000 in case significant changes to the methods to compile the data set have been made relative to the current CAMS global emissions (https://atmosphere.copernicus.eu/sites/default/files/2019-06/cams_emissions_general_document_apr2019_v7.pdf). As some of these years are in the future and no official data yet exists, the Successful Tenderer shall describe their proposed methodology for providing the most accurate emission estimates for those years. This can be based on credible, scientifically accepted emission projections but does not have to. The temporal resolution shall be at least monthly means and further information about mean diurnal (hourly) and weekly cycles shall be provided, in such a way that it can be easily implemented in a global model.

All data sets shall undergo sufficient Evaluation and Quality Control, which shall be described in short reports. This shall include the provision of global emission budgets for all species, which can be used to verify the proper uptake in the global forecasting system.

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

WP8120 Deliverables			
#	*Type*	*Title*	*Due*
D2.y.z	Report Dataset	Global emissions dataset (2000 - 2021)	
…			

WP8120 Milestones			
#	*Title*	*Means of verification*	*Due*
M2.y.z			

3.4 Work package 8130 – Natural and biogenic emissions for the global domain

As part of this work package the Successful Tenderer shall allocate resources to further develop the modelling of biogenic and natural emissions in the CAMS global forecasting system. The Tenderer shall describe initial ideas on the topics listed below with a detailed development plan to be agreed between ECMWF and the Successful Tenderer at the start of the Framework Agreement taking into account the final development reports delivered by the current CAMS contractor in charge of providing emissions. The following development topics shall be addressed:

- Provide support to model the biogenic emissions using an on-line approach in the CAMS global forecasting system for the total or only the diurnal and day-to-day variability imposed by meteorological variables on top of monthly prescribed emissions. Evaluation with the on-line approaches and state-of-the art off-line models shall be carried out.
- Related to the topic above, special focus shall be put on creating consistent global emission potential maps for isoprene and monoterpenes taking into account the detailed knowledge available within the EMEP programme.

- Provide formulations driven by variables available in the CAMS global forecasting system (see online IFS documentation (https://www.ecmwf.int/en/publications/ifs-documentation)) to model the natural emissions of NO_x and NH_3 from soil and non-frozen land surfaces; evaluation with the on-line approaches and state-of-the art off-line models shall be carried out.
- Provide formulations driven by variables available in the CAMS global forecasting system (see online IFS documentation (https://www.ecmwf.int/en/publications/ifs-documentation)) to model the natural emissions of DMS [26]and OCS[27] from oceans.

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

WP8130 Deliverables			
#	*Type*	*Title*	*Due*
D3.y.z	Code Report Dataset	XXX	

WP8130 Milestones			
#	*Title*	*Means of verification*	*Due*
M3.y.z			
M3.y.z			

3.5 Work package 8140 – Support to CAMS forecasting systems

Emissions are an integral part of the upgrade process of the CAMS global and regional production systems. The global and regional systems will normally use the latest emissions datasets delivered as part of the work in this ITT in their annual upgrades. However, the use of new emission data sets has to be extensively tested to avoid unexpected negative impacts on the forecast results.

The Successful Tenderer shall allocate resources for taking part in the discussions with the Global and Regional Service Providers about the results from trial runs, for identifying issues with the provided emissions as they are used in specific model configurations and for adjusting datasets as needed in case issues with emissions are identified.

[26] Dimethyl sulfide
[27] Carbonyl sulfide

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

WP8140 Deliverables			
#	*Type*	*Title*	*Due*
D4.y.z	Code Report Dataset	XXX	

WP8140 Milestones			
#	*Title*	*Means of verification*	*Due*
M4.y.z			
M4.y.z			

3.6 Work package 8150 – User support and documentation of service

The objective of this work package is to provide specialised 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 is used for ticketing user requests and distributing these requests to specialists as needed. Dedicated staff at ECMWF provide basic support in the form of self-help facilities (FAQs, knowledge bases, 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, user guides and knowledge bases.

As part of the bid, Tenderers shall describe the level of user support service on Service Desk tickets, they can provide.

Tenderers shall also address development of user guides. Documentation of the CAMS services is an integral part of the service provision. The technical and scientific specification of each service shall be documented in reports that will be available to users through the CAMS web site. The successful Tenderer shall therefore produce documentation reports describing in detail the methodologies and products they deliver for this ITT. The documentation reports shall be targeted at an informed external user community.

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

WP8150 Deliverables			
#	*Type*	*Title*	*Due*
D5.y.z	Other	Specialised user support via the CAMS Service Desk (Respond to user support queries requiring expertise specific to the global reactive gases aspects developed)	within one week of raising the issue
D5.y.z-P1	Other	Specialised User Support - Period 1	At Payment milestone 1
D5.y.z-YYYY	Report	Documentation of emission products and developments	
…			

WP8150 Milestones			
#	*Title*	*Means of verification*	*Due*
M5.y.z	Link with CAMS User Support team established; service desk set-up completed	Specialised Service Desk up and running	Month 2
…			

3.7 Work package 8100 – 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:
  - ECMWF will organise annual CAMS General Assemblies within EU member states. 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 should 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.
- Personal data management (name, ID and contact details of prime contractor's data controller in line with Clause 2.8).

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

WP8100 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-YYYY	Tenderer	Other	Letter auditor's opinion specific to CAMS most recent Annual Implementation 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

WP8100 Milestones

#	Responsible	Title	Means of verification	Due
M0.y.z-YYYY	Tenderer	CAMS General Assembly	Participation to the meeting	Annually
M0.y.z	Tenderer	Monthly teleconference meetings with ECMWF	Participation to meeting	Monthly
M0.y.z-Px	Tenderer	Progress review meetings with ECMWF / Payment milestones	Minutes of meeting	~ Every 6 months
M0.y.z	Tenderer	Kick-Off meeting	Minutes of meeting	Month 1
M0.y.z-YYYY	Tenderer	Internal face to face project meetings	Minutes of meeting	Annually
M0.y.z	Tenderer	Internal project monthly teleconferences	Meetings happened	Monthly

4 General Requirements

4.1 Implementation schedule

The Framework Agreement will run from 1 September 2020 to 31 December 2021. The Tenderer shall provide a detailed implementation plan of proposed activities for the period until 30 June 2021 based on an average budget of €36,000/per month. However, note that by Q1 2021 the level and duration of activities for the remainder of 2021 will be communicated by ECMWF to the successful Tenderer depending on the Copernicus programme implementation for the next phase (2021-2027) by the European Commission.

4.2 Deliverables and milestones

Deliverables should be consistent with the technical requirements specified in section 3.

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). The total of these allocated resources shall amount to the entire requested budget.

Milestones should be designed as markers of demonstrable progress in service development and/or quality of service delivery. They should not duplicate deliverables.

4.3 Acquisition of necessary data and observations

The Successful Tenderer shall acquire the relevant emission inventory and observational or ancillary data sets and make them available for use in all CAMS activities related to the provision of emission estimates for the regional and global production systems and for distribution to users.

4.4 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.

4.5 User requirements

As part of CAMS, the database and three documents described below will be maintained. 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 CAMS_94 (User Interaction) with the analysis of relevant user requirements in the URDB. Finally, in case the successful Tenderer provides service elements that are listed in the Service Product Portfolio (SPP), the successful Tenderer shall provide input on product lines and their metadata to ECMWF to ensure the SPP is up-to-date.

User Requirements Database (URDB) and Requirement Analysis Document (RAD)

User requirements are collected in this database in a structured and traceable way, and links to entries in the Service Product Portfolio (see below) are provided, when appropriate. The URDB, which tracks all requirements emanating from a wide variety of user fora, surveys, and support panels, is complemented by a Requirements Analysis Document (RAD) which captures the stratification of user requirements per domain, importance and feasibility. The RAD constitutes the basis for distilling, filtering and translating user requirements into technical specifications for the Service. The URDB and RAD are maintained and continually updated by ECMWF and its contractor for CAMS_94 (User Interaction).

Service Product Portfolio (SPP)

Both data and value-added products are presented in this document in a structured way, providing key technical aspects, when appropriate, such as geophysical parameter, temporal resolution and coverage, spatial resolution and coverage, data formats, time availability, expected quality, data format together with a direct link to detailed information on methodology and quality monitoring for each specific product or services.

Service Evolution Strategy (SES)

The appropriateness of the list of emerging and existing user requirements, the routinely updated Requirement Analysis Document and the existing Service Product Portfolio, are continually monitored by ECMWF and feed into a Service Evolution Strategy (SES) document. The SES document is produced on an annual basis and provides, in addition to the annual implementation plan focussing on year n+1 service Deliverables, a proposed longer term (typically 4 years) perspective for forthcoming service upgrades and extensions, the expected benefits and costs, together with recommendations for potential research needs outside Copernicus operations. This document allows informed discussions to be opened on specific proposed service upgrades and extensions with the stakeholders.

The following deliverables are thus to be added to the WP8150 deliverable lists:

WP8150 Deliverables			
#	*Type*	*Title*	*Due*
D5.y.z-YYYY	Other	Input to CAMS URDB - YYYY	Checked by ECMWF annually in December
…			

4.6 Data sets

It is expected that data sets (including databases) generated or acquired by the successful Tenderer will be delivered via the Atmosphere Data Store (ADS). The section below indicates generic requirements for these datasets in terms of standards and conformity.

Provision of data and products:

Suppliers will make the output of their work available to CAMS users via the ADS, by one of two methods:

a) uploading their data and products to a designated server,
b) providing them via web services.

In the case of (a), suppliers will have to agree with ECMWF on the data formats to be used. ECMWF will only accept data in formats that follow internationally recognised standards. Such standards must be open (i.e. non-proprietary), managed by a recognised international standardisation body (e.g. ISO, WMO, OGC, etc.), or any de-facto standard. Open source software should also exist that can read and write files of these standards. Serialisation formats (e.g. NetCDF, XML, JSON) should be supported by standard schemas and conventions. All text-based formats should be encoded in UTF-8. ECMWF will implement tools to check the compliance of the provided data and products to the agreed standards before they are added to the ADS.

Examples of case (a) are data uploaded to the ADS in WMO GRIB edition 1 and 2, NetCDF files conforming to CF-1.6, or greater.

In the case of (b), suppliers will have to agree with ECMWF on the protocols to be used to invoke the web services. ECMWF will only accept protocols that follow internationally recognised standards. Such standards must be open (i.e. non-proprietary), managed by a recognised international standardisation process (e.g. ISO, WMO, OGC, etc), or be a de-facto standard such as OpenDAP. ECMWF will consider using bespoke web-based APIs to access the data and products if they implement very simple protocols (e.g. REST), as long as the results returned by these APIs are compatible with (a). It should be noted that requests for these web services will mostly originate from the Climate Data Store itself, as part of a workflow run on behalf of an end-user; ECMWF will therefore need to have the necessary credentials to invoke these services. ECMWF will not provide information on the end user's identity when invoking the web services. ECMWF will nevertheless collect usage statistics for all aspects of CAMS.

Examples of case (b) are OGC standards (WMS, WCF, WFS, etc), OpenDAP, etc. Other protocols could be considered as the system evolves.

Every dataset and/or service provided shall be documented using the appropriate metadata standards (e.g. ISO 19115).

Provision of processing capabilities:

Successful tenderer will (when appropriate) implement specific web-service-based data manipulation facilities. These will make it possible to run some agreed reduction and/or analysis algorithms directly on the data and products located on the suppliers' systems, and to return the results of said algorithms.

As for data retrievals, invocation of these web services will originate from the Atmosphere Data Store itself as part of a workflow run on behalf of an end user, and ECMWF will need to have the necessary

end-user credentials to invoke these services. ECMWF will not provide information on the end user's identity when invoking the web services. ECMWF will nevertheless collect usage statistics.

ECMWF will ensure that these services are invoked in a controlled fashion, to prevent any misuse of the system. This web services will be implemented with OGC's WPS standards or will be based on simple web-based REST API or equivalent. The results returned by these services will have to be in formats compatible with options (a) or (b) described above.

Data and IPR:

It is a condition of EU funding for CAMS that ownership of any datasets developed with CAMS funding passes from the suppliers to the EC, via ECMWF. Ownership will pass on delivery of the datasets. In return, the suppliers will be granted a non-exclusive licence to use the datasets which they have provided to CAMS for any purpose except one which conflicts with the aims of CAMS.

All software and products used by the successful Tenderer to produce the CAMS datasets will remain the property of the successful Tenderer, except for those components which are acquired or created specifically for CAMS purposes, with CAMS funding, and which are separable and useable in isolation from the rest of the successful Tenderers' production system. The identity and ownership of such exceptional components will be passed to the EC via ECMWF annually, but in return the successful Tenderer will be granted a non-exclusive licence to use them for any purpose except one which conflicts with the aims of CAMS.

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 observational data sets it intends to use and how it will acquire the relevant data. The Tenderer shall describe the proposed method for producing the various emissions data sets requested as part of this ITT. Finally, the Tenderer shall describe how they anticipate to address the needs for service evolution.