ECMWF Copernicus Procurement

Invitation to Tender

Copernicus Atmosphere Monitoring Service

Development of a regional benchmark system for Greenhouse Gas observation-based emissions

Volume II: Specification of Requirements

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1 Introduction

Some of today's most important environmental concerns relate to the composition of the atmosphere. 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 changes the oxidation capacity of the atmosphere and controls 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 affect the land- and marine ecosystems. 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.

The increasing concentration of the greenhouse gases and the various aerosol-weather feedbacks are prominent but often uncertain drivers of climate change. 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) based on inventory data and biogeochemistry models, 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, Cop1), the Service consolidated many years of preparatory research and development to deliver a range of operational services. In its second phase (2021 – 2028, Cop2), 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 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 space and 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 k) above.

2 Contract Summary

This ITT, entitled "Development of a regional benchmark system for Greenhouse Gas observation-based emissions", is for the development and operation of a regional-scale benchmark system that can be used to evaluate the data products from the global CO2MVS monitoring system. Such a benchmark system shall consist of more than one state-of-the-art regional inverse modelling system and use high-quality in situ observations as input. The in situ observations provided by the Integrated Carbon Observation System (ICOS) shall be at the core of such a benchmark system, but other non-satellite observations can be considered as well. The outputs of the benchmark system shall consist of estimates, including their uncertainties, of biogenic sinks and sources and fossil fuel emissions for a domain and at a spatial resolution that make optimally use of the available in situ observations. Comprehensive evaluation of the results of the benchmark system itself shall also be included.

3 Technical Specification

3.1 General Requirements

The concept for an anthropogenic CO_2 and CH_4 emissions Monitoring and Verification Support (CO2MVS) capacity as part of the CAMS portfolio is based on the recommendations from the European Commission's CO_2 Monitoring Task Force[1]. As shown in Figure 1, it comprises an integrated system approach capable of inferring emissions from observations (space and in-situ), prior information (such as bottom-up emission estimates from inventories and reporting) and modelling as well as data assimilation capabilities.

[1] The reports from the CO_2 Monitoring Task Force can be found on https://www.copernicus.eu/en/news/news/new-co2-green-report-2019-published

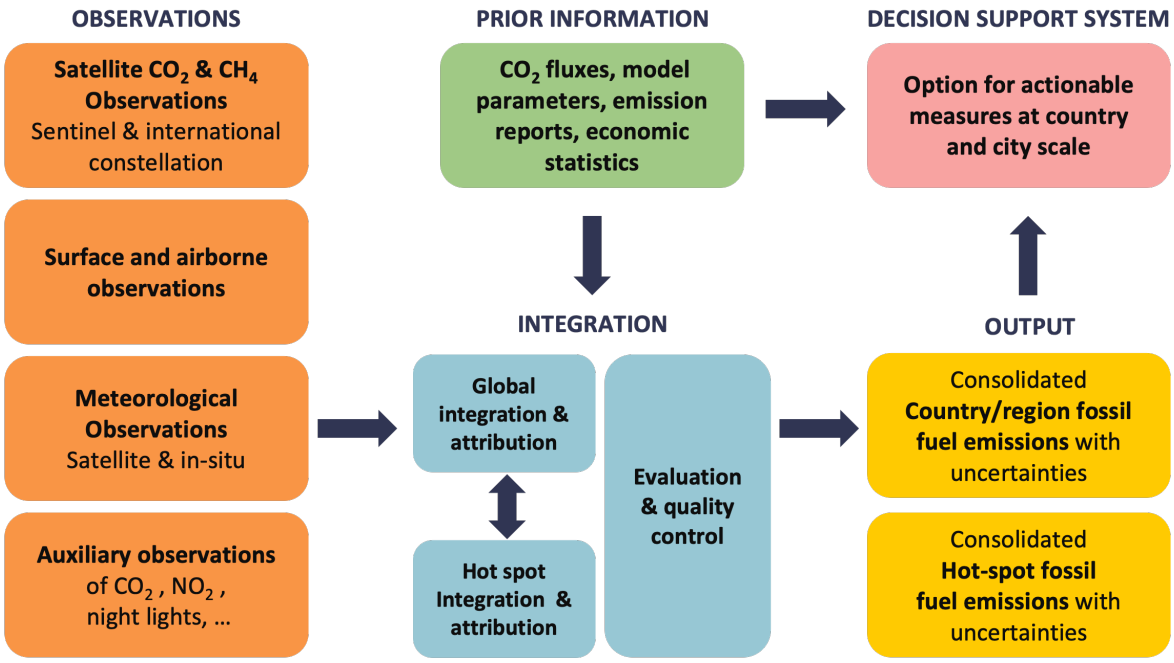

Figure 1 *Main building blocks of the functional architecture of a future CO_2 and CH_4 human emissions monitoring system*

The top four priorities for the new CO_2 and CH_4 service element during phase 2 of CAMS (2021 – 2028) are:

- Transform the various related research activities into a mature pre-operational (and then operational) system that can deliver the required monitoring and verification support capacity.
- Support the European Commission and EU member states with the global stocktake in 2028 using Earth Observation data and state-of-the-art modelling capabilities in order to provide accurate and globally consistent estimates of emissions, their uncertainties and their reductions.
- Support the European Commission and EU member states with the implementation of the EU Methane Strategy as well as the Global Methane Pledge through a capability for detecting and monitoring global super-emitters.
- Contribute to international coordination frameworks related to the monitoring of greenhouse gas concentrations and fluxes, such as the Global Greenhouse Gas Watch (G3W) of the World Meteorological Organisation (WMO) and the International Methane Emissions Observatory (IMEO) of the United Nations Environment Programme (UNEP).

As recommended in the second CO_2 report from the CO_2 Monitoring Task Force, the future CO2MVS capacity will deliver the following high-level products as defined by user requirements:

1. Detection of emitting hot spots such as megacities or power plants,
2. Monitoring of the hot spot emissions to assess emission reductions of the activities,
3. Assessing emission changes against local reduction targets to monitor impacts of the Nationally Determined Contributions (NDCs),
4. Assessing the national emissions and changes in 5-year time steps to estimate the global stocktake.

The CO2MVS services shall, in the long term and in some well-identified instances and situations, provide additional evidence on the amount of anthropogenic CO_2 and CH_4 emissions reported by national statistical offices and, in particular, help to identify and assess the uncertainties and gaps associated with their emission inventories. More generally, the CO2MVS will provide the European

Union with a comprehensive and consistent picture on the actual level of emissions and their reductions by all countries worldwide. The new service element is targeted for operational status in 2027 based on observations from the CO_2 Monitoring (CO2M) satellite constellation and other satellite sensors.

An important part of the CO2MVS is the Evaluation and Quality Control of the provided emission and flux estimates. The European Commission's CO2 Task Force recommended in its Green Report the establishment of dense in-situ atmospheric CO_2 networks that can be used with inverse modeling to establish a budget including the anthropogenic emissions as a benchmark for the satellite-based CO2 emissions and biogenic flux estimates from the CO2MVS. Such a benchmark system would be part of the overall Evaluation and Quality Control (EQC) of the CO2MVS and should be as accurate as possible by using high-quality in-situ observations of atmospheric CO_2, its radiocarbon content, atmospheric potential oxygen (APO), and potential other observations constraining the full carbon cycle.

Based on these recommendations, **this ITT focuses** on the development and operation of a regional-scale benchmark system that can be used to evaluate the data products from the global monitoring system. Such a benchmark system shall consist of more than one state-of-the-art regional inverse modelling system and high-quality observations. In situ observations provided by the Integrated Carbon Observation System (ICOS)[2] shall be at the core of such a benchmark system, but other observations can be considered as well. At this stage of the ramp-up of CO2MVS services, satellite observations shall not be considered as routine input to the benchmark system. The outputs of the benchmark system shall consist of estimates, including their uncertainties, of biogenic sinks and sources and fossil fuel emissions for a domain and at a spatial resolution that make optimally use of the available in situ observations (see also section 3.1.1 below). Evaluation of the results of the benchmark system itself shall also be included.

The Tenderer shall base its proposed solution as much as possible on the outcomes of relevant Horizon2020 and Horizon Europe projects, such as VERIFY[3], CoCO2[4], CORSO[5], CATRINE[6], EYE-CLIMA[7], AVENGERS[8], and PARIS[9]. This includes the potential use of the Community Inversion Framework[10] (or an equivalent tool) to ensure the harmonization of the required inverse modelling systems. Recent examples of exploratory studies as part of the CORSO project can be found in Gómez-Ortiz et al., 2025[11], and Gachkivskyi, 2025[12].

3.1.1 Input observations and prior fluxes

The Tenderer shall in

Observations:
CAMS has established a contract with the ICOS European Research Infrastructure Consortium to provide access to observations of atmospheric concentrations of CO_2 and CH_4, atmospheric concentrations of $^{14}CO_2$ (radiocarbon), and flux measurements. While ICOS observations of

[2] https://www.icos-cp.eu/
[3] https://verify.lsce.ipsl.fr/
[4] https://coco2-project.eu/
[5] https://www.corso-project.eu/
[6] https://www.catrine-project.eu/
[7] https://eyeclima.eu/
[8] https://avengers-project.eu/
[9] https://horizoneurope-paris.eu/
[10] http://community-inversion.eu/
[11] https://acp.copernicus.org/articles/25/397/2025/
[12] https://doi.org/10.11588/heidok.00037507

atmospheric CO_2 and CH_4 concentrations are already available through the Carbon Portal[13], ICOS will also develop a new ICOS Fast Track product providing high-frequency (monthly), low-latency (1 month) data from ICOS atmospheric stations, including tall towers. The data will include CO_2, CH_4, and CO and the service becomes available in July 2026.
The concentrations of $^{14}CO_2$ are being analysed approximately every 3 days (the native flask sampling frequency) at 10 ICOS Class 1 stations and one ICOS-candidate site (Białystok, Poland) and provide thus 1050 $^{14}CO_2$ analyses per year (see also Figure 2).

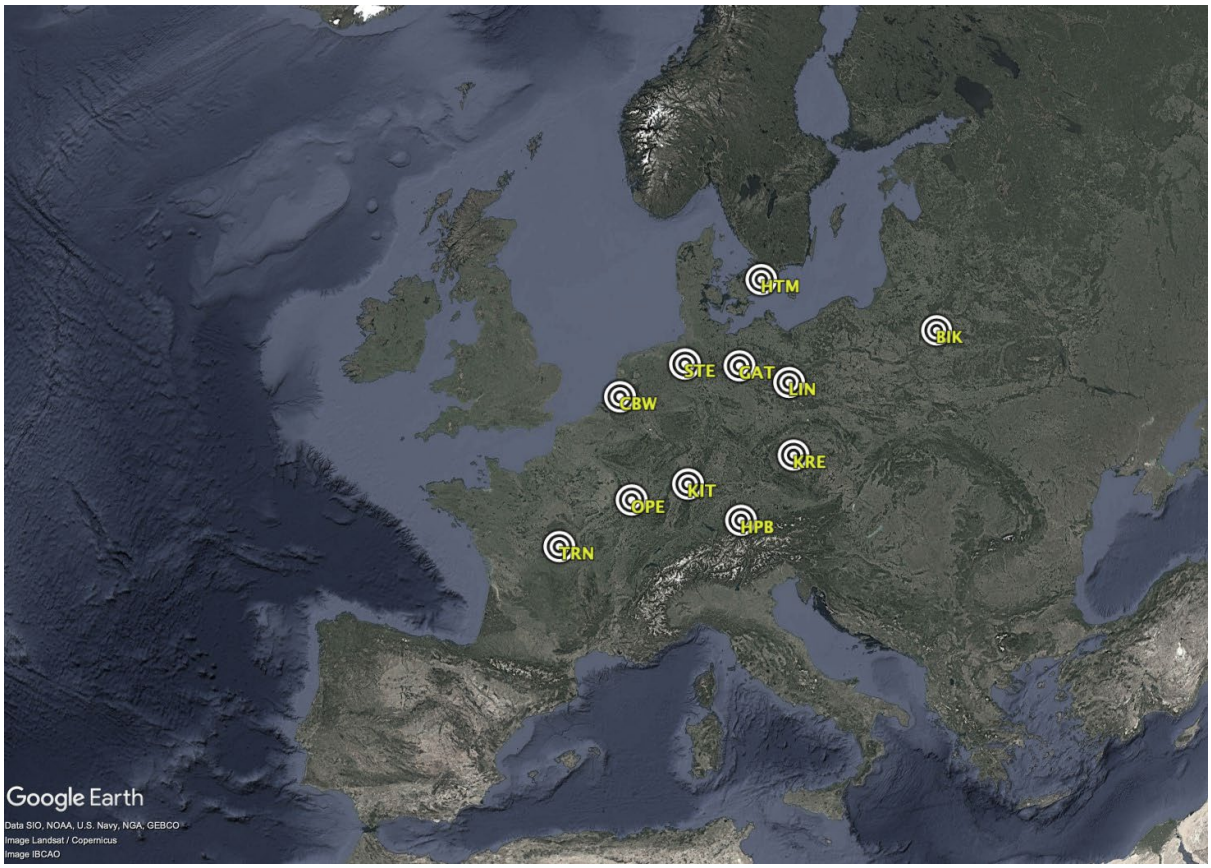

Figure 2 Locations of ICOS stations for which 14CO2 analyses are taking place for CAMS.

The $^{14}CO_2$ observations are released quarterly approximately 6 months after each quarter and will cover 2025, 2026, and 2027 During the CORSO project, a similar data set was already generated for the year 2024. The CORSO flask-based measurements are available from the ICOS Carbon Portal[14] and are described in the related CORSO Deliverable[15].
ICOS will also integrate ecosystem GHG fluxes from ICOS stations, measured via eddy covariance methods, into the global FLUXNET Data System by implementing the so-called “shuttle” pipeline, enabling continuous and harmonised updates. ICOS will also assist in onboarding and processing data from non-ICOS sites across Europe and globally, with attention to standardisation and quality. This will provide CAMS with regularly updated harmonised access to global terrestrial fluxes.

The Tenderer can also propose the use of other in situ observational data sets as long as these are expected to be available for the full duration of the contract.

Prior fluxes and emissions

[13] https://www.icos-cp.eu/observations/carbon-portal
[14] https://doi.org/10.18160/PP29-9CNZ
[15] https://www.corso-project.eu/sites/default/files/2025-07/CORSO-D3-3-V1-3.pdf

As part of the CORSO project, terrestrial and oceanic isotopic disequilibrium fluxes and nuclear emission datasets (for $^{14}CO_2$) were prepared as well as global and regional ocean flux databases (for APO). This was complemented by an improved regional anthropogenic APO inventory. The datasets are described in a CORSO deliverable document[16] including links to the datasets.

As part of the CAMS contract on global and regional emission datasets, a global gridded radiocarbon ($^{14}CO_2$) emissions dataset will be delivered in April 2028 based on the work performed in the CORSO project and updated to the most recent years (until at least 2026). The dataset will consist of estimated radiocarbon emissions from land and ocean and covers in particular the so-called isotopic disequilibrium fluxes. For the ocean, the gridded time series provided in CORSO will be used and extrapolated by using the atmospheric record following the method outlined in Lindsay (2016). Nuclear power plants also release radiocarbon emissions, and as part of the above-mentioned contract with ICOS temporally resolved estimates of $^{14}CO_2$ emissions from all major European nuclear power plants will be provided, based on redistribution of officially reported annual or quarterly ^{14}C emission data using energy production data and reactor operation conditions.

3.2 Work Packages

The ITT contains the following work packages (WP):

- WP0: Management and coordination
- WP1: Development of prototype regional benchmark system
- WP2: Production of benchmark results
- WP3: Evaluation of benchmark system
- WP4: User support and documentation of service

For WP1 – WP3, the Tenderer shall include in their proposal a clear development plan, including deliverables and milestones, that will result in the described outcomes. The plan shall also include regular technical progress meetings with ECMWF. For WP0 and WP4, the Tenderer shall take the required Deliverables from the tables in the respective sections below.

Tenderers shall complete the relevant table in Volume IIIA as part of their bid. 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.

3.2.1 Work Package 1 (WP1) – Development of prototype CO2MVS regional benchmark system

In this work package, the Successful Tenderer shall develop a prototype regional benchmark system based on available in situ observations that can be used to evaluate satellite-based emission estimates from the global CO2MVS systems. The system shall provide estimates of fossil fuel and biogenic fluxes, including their uncertainties, for a geographic domain that covers the largest European area possible given the availability and spatial density of the available in-situ observations. The spatial resolution of the flux estimates shall also be based on the information content of the available observations. The system shall consist of more than one inverse modelling system but set up such that results can be easily compared. A framework, such as the Community Inversion Framework (CIF), shall be used to

[16] https://www.corso-project.eu/sites/default/files/2025-02/CORSO-D3-4-V1.1.pdf

establish this. The Tenderer shall provide in its proposal the following characteristics of the benchmark system:

- The inverse modelling systems to be used, including their technical specifications
- The inversion framework to be used or developed that allows accurate comparisons of the inverse modelling systems that are part of the benchmark system
- The observations to be used
- The geographical domain to be targeted including the spatial resolution
- The boundary conditions to be used and how these will be acquired or generated
- The targeted temporal resolution of the resulting emissions and fluxes (monthly means at a minimum)
- The specifics of the derived fluxes and emissions, including their uncertainty estimates

The Tenderer shall provide in its proposal a clear timeline for the development of the benchmark system within the duration allocated for this contract, including the indicative deliverables listed below.

Indicative list of required deliverables:

- Consolidated workplan for developing the required benchmark system described above;
- The benchmark system as described above;
- Detailed description of all components of the benchmark system, including the used inverse modelling systems, the used observations, and the inversion framework. This technical specification will be complemented by user-oriented documentation in WP4.

3.2.2 Work Package 2 (WP2) – Production of CO2MVS benchmark results

In this work package, the Successful Tenderer shall provide estimates of fossil fuel and biogenic fluxes, including their uncertainties, for the years 2024 to 2027 using the developed systems in WP1.

The Tenderer shall provide in its proposal a clear timeline for the production of the datasets within the duration allocated for this contract, including the indicative deliverables listed below. This shall include the latency of the produced emission and flux estimates, once the benchmark system can be operated routinely.

Indicative list of required deliverables:

- Consolidated workplan for the production of the required datasets;
- Estimates of fossil fuel and natural fluxes, including their uncertainties, for the years 2024, 2025, 2026, and 2027.

3.2.3 Work Package 3 (WP3) – Evaluation of CO2MVS benchmark system

In this work package, the Successful Tenderer shall evaluate the data sets produced in WP2. The evaluation shall include the assessment of national budgets for selected countries within the domain with well-established inventories (e.g., from national inventories or from the Global Carbon Budget[17]), and the reliability on sub-national scales. Sensitivity tests shall be performed assessing the impact of emissions from nuclear power generation, uncertainties in terrestrial respiration fluxes, and uncertainties in the observations.

[17] https://www.globalcarbonproject.org/carbonbudget/

The Tenderer shall provide in its proposal a clear timeline for the evaluation of the datasets within the duration allocated for this contract, including the indicative deliverables listed below.

Indicative list of required deliverables:

- Consolidated workplan for the evaluation of the datasets produced in WP2, including the data that will be used for the evaluation;
- Evaluation of the datasets produced in WP2 for the years 2024, 2025, 2026, and 2027;
- Recommendations for future implementation of a fully operational CO2MVS benchmark system.

3.2.4 Work Package 4 (WP4) – User engagement 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 include in their proposal 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.

The Successful Tenderer shall contribute to the relevant documentation. Documentation of CAMS 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. The Successful Tenderer shall therefore support the updates of the Knowledge Base based on the latest developments.

The Successful Tenderer shall accommodate for eventual needs in providing technical and scientific expertise in support of CAMS communication and training activities. The Tenderer shall specify in the bid the experts intended to be allocated to provide this support.

Requests to support activities may be raised on for example:

- Contribute with content specific input to training, education and capacity building material: development and/or review of learning resources in the domain of the contract, participation in train-the-trainer events and Massive Open Online Courses (MOOCs);
- Contribute with content specific input to user-oriented communication material such as slides, story maps and user testimonials;
- Contribute and attend User Uptake workshops and stakeholder meetings. Presentations in your mother tongue may be asked to be provided;

- Input to the User Requirements Database (URDB) with user requirements (cf. template as provided during the negotiation process) as well sharing needs and aspirations as raised by potential new user communities;

If applicable, a small budget may be proposed to cover such resources. Details on the expected activities and the budget shall be refined during the negotiation/contract preparation phase.

Indicative list of required deliverables:

WP4 Deliverables			
#	*Type*	*Title*	*Due*
D4.y.z-YYYY	Other	Contribution to CAMS Knowledge Base to document products and services as provided within the scope of this contract	Annually
D4.Y.Z	Report	Summary of support to CAMS user support, communication and training activities.	Due 1 month before contract end date

3.2.5 Work Package 0 (WP0) – Management and coordination

The following management and coordination activities are part of WP0 and shall be briefly described, and included accordingly in the bid:

- Management, planning and coordination of the different Work Packages activities and corresponding resources, including the appropriate tools used to monitor them.
- Contractual obligations as described in the Volume V Framework Agreement Clause 2.3 “Reporting and Planning” and its Annex 5 “Report content”.
- Meetings organisation and/or attendance (classified as tasks and listed in a separate table as part of the proposal):
    - ECMWF and the Successful Tenderer will organise a Kick-Off Meeting during the first month of implementation of the contract. The Kick-Off meeting will be hosted at the ECMWF premises in Bonn in a hybrid format. The prime contractor is expected to attend in person with a maximum number of 5 people. Additional interim/ad-hoc progress meetings might be required. All meetings shall be classified as “Milestones” under Volume IIIA “Pricing and deliverables” Excel sheet, tab “Deliverables List”.
    - ECMWF will host monthly teleconference meetings to discuss CAMS service provision, service evolution and other topics (Service Level Board). The Prime Investigator and/or Service Manager appointed by the Successful Tenderer will represent the Successful Tenderer in such meetings.
    - ECMWF and the Successful Tenderer will organise Progress Review Meetings, linked to Payment Milestones, every six months unless otherwise agreed.
    - ECMWF will organise annual CAMS General Assemblies. The Successful Tenderer is required to attend these meetings with team members covering the various topics that are part of this ITT. Contractors are required to attend annually and should plan for participation in 2026, 2027, and 2028, with in principle a maximum of two representatives

per year. Additional attendees can be proposed with a short justification. The costs for these missions must be included in the bid.

  - Successful Tenderer's internal meetings.
  - Tenderers can propose additional project internal meetings (annual face-to-face meeting and monthly teleconferences) as part of their response.
  - See Section 4.8 for further guidance regarding Travel Costs.

- Quality assurance and control: the final quality check of the deliverables prior the submission to ECMWF should be made by the prime contractor (contents, use of ECMWF's templates for deliverables and reports, format, deliverables/milestones numbering and naming, typing errors, etc.).
- Implementation of checks, controls and risk management tools for both the prime contractor.
- Communication management (ECMWF, stakeholders, internal communication).
- Management of personal data and how this meets the requirements of Clause 2.8 and Annex 6 "Personal Data Protection" of the Volume V Framework Agreement.
- Sub-contractor management, including dispute 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 sub-contractors, if any, describing their contribution and key personnel shall be provided, as well as back-up names for all key positions in the contract. The Tenderers shall describe how the Volume V Framework Agreement, in particular its Clause 2.9 "Sub-contracting", has been flowed down to all their sub-contractors.

Minimum list of required deliverables:

WP0 Deliverables			
#	*Nature*	*Title*	*Due*
D0.Y.Z-yyyyQx	Report	Quarterly Implementation Report YYYYQQ *YYYYQQ being here the previous quarter (e.g. 2025Q3)*	Quarterly on 15/04, 15/07 and 15/10 *(only at the above dates since QIR for Q4 will be part of the AIR Part 1)*
D0.Y.Z-yyyy	Report / Other	Annual Implementation Report Part 1 for year YYYY *including both:* • *the Quarterly Implementation Report YYYYQ4 and* • *the requested financial information for year YYYY* *YYYY being here the year n-1*	Annually on 15/01
D0.Y.Z-yyyy	Report	Annual Implementation Report Part 2 for year YYYY *YYYY being here the year n-1*	Annually on 28/02
D0.Y.Z	Report	Final Implementation Report	By end date of the contract

D0.Y.Z-yyyy	Report	Annual Implementation Plan for year YYYY *YYYY being here the year n+1*	Annually on 30/09
D0.Y.Z-yyyy	Other	Copy of Prime Contractor's general financial statements and audit report for year YYYY *YYYY being here the year n-1*	Annually, not later than on 15/12[(1)] (no associated cost)
D0.Y.Z	Presentation/MoM	Kick-Off Meeting	Not later than 30 days after the start of contract
D0.Y.Z	Presentation/MoM	Progress Review Meeting No. xx / Payment Milestone SC1-PMx *xx being here the iteration number of the PRM*	~ Every 6 months[(2)]
D0.Y.Z	Report	Mission reports (brief) from the travel listed in the Cost and Prices tab in the "Pricing tables"	By end of April 2028 or once per calendar year, depending on the mission schedule

WP0 Milestones			
#	*Title*	*Means of verification*	*Due*
M0.Y.Z	Updated KPIs (list, targets, etc.) after review with ECMWF	Report	One year after start of contract
M0.Y.Z	CAMS Service Level Board meetings	Attendance	Monthly
M0.Y.Z	CAMS General Assembly YYYY *YYYY being here the concerned year*	Attendance	Annually, not later than on 15/12[(3)]

These due dates are indicated to frame the corresponding deliverables and milestones schedule only, consequently the following shall be considered by the Tenderer:

[(1)] the general financial statements shall be sent by the Successful Tenderer as soon as available,

[(2)] the schedule of the PRMs shall be aligned with the different Payment Milestones,

[(3)] depending on the year, the CAMS GA may take place at a different period of the year.

ECMWF will provide the templates for reports and plans at the beginning of the contract. Reporting documents should be short and factual, following the guidance which will be provided by ECMWF during negotiations with the Successful Tenderer.

⇨ Contract management and coordination is expected to amount to approx. 7% - 10% of the planned use of the resources (effort and personnel costs).

4 General Requirements

4.1 Implementation schedule and allocation of resources

ECMWF intends to award a single Framework Agreement, which shall be implemented via a single Service Contract expected to commence on 1 June 2026 and finish on 31 May 2028 (24 months).

4.2 Deliverables and milestones

The Tenderer shall provide the list of deliverables and milestones (cf. ITT Volume IIIA "Pricing and deliverables", Excel spreadsheet "Deliverables List") for each WP. All deliverables and milestones must be consistent with the activities and objectives described in section 3 of this ITT Volume II:

- A deliverable is a substantial, tangible or intangible good or service produced as a result of a project (see also the deliverable definition in this ITT Volume V Clause 1.2 and Clause 3.2). In other words, a deliverable is a verifiable outcome produced in response to the specific objectives of the contract and is subject to approval by both ECMWF's TO and CMO before being considered as contractually approved. All document deliverables shall be periodically updated and versioned as described in section 2.
- Milestones should be designed as markers of demonstrable progress in service development and/or quality of service delivery during the contract implementation (see also the milestone definition in this ITT Volume V Clause 1.2). They should not duplicate deliverables.

The following shall apply to the deliverables and milestones:

- The deliverables and milestones should be consistent with and meet the technical requirements specified in section 2 of this ITT Volume II;
- All contract deliverables shall be produced in English;
- The quality of reports shall be equivalent to the standard of peer-reviewed publications and practice;
- Unless otherwise specified in the contract, or requested by ECMWF during the contract implementation the final version of each deliverable shall be made available to ECMWF without any comments and tracked changes in electronic format (Microsoft Word/Microsoft Excel/HTML or compatible, PDF in case of signed version, while all other formats – if any – must be agreed during the contract negotiation) via the Copernicus Deliverables Repository portal – OpenText Core (OTC).

The Successful Tenderer shall make the output of their work available on a server accessible by ECMWF using standard protocols such as FTP or HTTPS. **The Successful Tenderer 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) should be supported by standard schemas and conventions.

The following shall apply in ITT Volume IIIA "Pricing and deliverables" (cf. Excel spreadsheet "Deliverables List"):

- Deliverables and milestones shall respectively follow the referencing system used in section 2 of this ITT Volume II. Additional deliverables and milestones, if any, shall follow the same referencing system.

- Each deliverable shall have an associated resource allocation and price (cf. column I "Nb of PM allocated" and column J "Estimated price"), while the only resource type to be considered is "payroll" (the total of these allocated resources and prices shall therefore amount to the total price associated with payroll in Volume IIIA spreadsheet "Costs and Prices").
- Milestones shall not attract the budget under Volume IIIA in the Excel spreadsheet "Deliverables list".

The Tenderer shall provide a due date for each proposed deliverable and milestone (in accordance with those indicated in section 3 for each WP). The Tenderer shall ensure that the proposed due dates of deliverables and milestones are realistic and achievable.

⇨ Please note that any dependency on input data, whose origin must be specified, shall be detailed by the Tenderer, and also accounted for in the risk register (cf. ITT Volume IIIB Section 5.6).

4.3 CAMS website

The CAMS website was initially developed in August 2015, with an additional major re-development and re-launch completed in September 2018 following an extensive usability research and testing phase in 2017. New templates were applied to the website in line with the European Commission's requirements for a common Copernicus look and feel in 2020. Further user experience (UX) testing has taken place to refine the navigation and user experience in Q3 and Q4 2021. The current website can be found via the following link: http://atmosphere.copernicus.eu.

The website is built using Drupal 8 with the colours, typeface, logos and domain, all specified by the European Commission DG DEFIS which must be adhered to.

The website contains static content covering news, events and tendering opportunities, resources for press such as brochures and staff photos, as well as multi-media files such as video. It also provides sign-up functionality for the CAMS newsletter, which is issued quarterly.

In addition, CAMS website provides access to its Atmosphere Data Store at https://ads.atmosphere.copernicus.eu.

4.4 Acquisition of necessary data and observations

The Successful Tenderer is responsible for acquiring all the needed observational data sets but shall closely interact with ECMWF for the exchange of relevant data sets related to this ITT.

4.5 Communication

The Successful Tenderer shall support ECMWF in its communication activities with regards to CAMS 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.

All communication activity must be agreed with the ECMWF Copernicus Communication team in advance. This includes, but not exhaustively, communication planning, branding and visual style, media outreach, website and social media activity, externally facing written and graphic content and events. Agreed activity would also need to be evaluated and reported on, once complete, so that success measures and KPIs can be provided to the European Commission.

4.6 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 European Union via ECMWF. Ownership will pass from the date of

creation of the datasets. Suppliers will be granted a non-exclusive licence to use the datasets which they have provided to CAMS for any purpose.

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 Tenderer's production system. The identity and ownership of such exceptional components will be passed to the European Union via ECMWF annually. The Successful Tenderer will be granted a non-exclusive licence to use them for any purpose.

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 uploading their data and products to a designated server. 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 are data uploaded to the ADS in WMO GRIB edition 1 and 2, NetCDF files conforming to CF-1.6, or greater.

Every dataset and/or service provided shall be documented using the appropriate metadata standards (e.g. ISO 19115, INSPIRE Directive 2007/2/EC).

Particular attention shall be paid to the file naming convention to ensure consistency between the various ADS datasets. The specific details shall be agreed with the ADS team at ECMWF during the kick-off meeting of the contract.

4.7 Key performance indicators

The Successful Tenderer shall report to ECMWF on a set of Key Performance Indicators (KPIs) suitable for monitoring various aspect of service performance.

The table below provide the minimum set of KPIs to be used by the Tenderer in its Tender. Therefore, the Tenderer may propose additional KPIs suitable for the activities subject of this ITT but shall limit them to the sole KPIs whose reporting and analysis may help to optimize the performance of the contract in case of deviation per comparison with the performance targets.

KPI #	KPI Title	Performance Target and Unit of Measure	Frequency of Delivery	Explanations / Comments
KPI_1	Delivery of data within agreed timeliness	90%	quarterly	
KPI_2	Level of user support service on Service Desk tickets	80% of the assigned specialised user queries being resolved within 15 days after being informed by the CAMS Service Desk.	annually	

KPI_3	Deliverables submitted on time for review during last quarter	100% of deliverables submitted on time	quarterly	Due dates are the deadlines (inclusive) for the deliverables to be submitted on time for review by ECMWF
…	…	…	…	…

All KPIs shall be labelled and numbered as indicated in the table above. 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.

4.8 Travel Costs

The travel costs shall be presented in accordance with the following provisions:

Travel costs should, in principle, be based on the European Commission's calculator [Table 3: Unit cost per distance band for air or combined air/rail travel, Commission Decision C(2024)5405], and consider a daily subsistence allowance not to exceed €300.

Travel costs must reflect **estimated actual costs and must not include any profit margin**.

If the proposed travel costs deviate from these reference values, the deviation shall be clearly indicated and duly justified.

The Tenderers are requested to provide a summary table as shown below as part of their bid.

Type of cost	**Route/Destination**	**Estimated number of missions**	**Estimated unit price [€]**
Travel/Subsistence			
Travel/Subsistence			

Travel Costs summary

ECMWF will reserve the right to re-claim any declared unspent or unaccounted budget for “Travel”, as it will be described in the Annex 2 Pricing Tables of the Framework Agreement.

4.9 Payment Plan

The Tenderer can propose a draft Payment Plan in ITT Volume IIIA “Pricing and deliverables” (cf. Excel spreadsheet “Payment Plan preparation”):

- The Payment Milestones should relate to the deliverables and milestones delivered during the corresponding Payment Milestone period (e.g. the payment covering the period January-June would only relate to the deliverables and milestones whose due dates are part of the same period).

- Given the total duration of the contract, it is recommended to abide by a circa 6-month frequency between each Payment Milestone and associated payment. Any other plan can be submitted by the Tenderer but shall be duly substantiated.
- In case of request for a payment at contract signature, please note that this should be duly substantiated by the Tenderer (e.g. in terms of necessary investment that would be necessary prior to or during first weeks/months of implementation for ensuring the initial set up of the project). It is necessary to relate this payment to activities subject to other Payment Milestones.
- The frequency of Progress Review Meetings might be adapted to synchronise with the anticipated date of completion of each Payment Milestone (i.e. with one PRM ca. 15 days before each PM anticipated date of completion).

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 of Volume IIIB (technical proposal), additional to the content described in the general guidelines of the said 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 sub-contractor 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 one additional senior team members with more than 5 years of experience on performing activities related to the various aspects of this ITT.

- The Successful Tenderer shall appoint a Service Manager, which will be its primary contact for contractual delivery and performance aspects.

These team members shall be involved in the activities of this ITT at a minimum level of 10% of their total working time.

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 global earth observing system, and the current state of monitoring greenhouse gas emissions.

An exhaustive and detailed description of the proposed technical solution for all work packages described above, including any short ramp-up or mobilization phase, shall be given. The Tenderer shall describe the proposed method for producing the flux and emission estimates outlining in some detail the proposed methodology. The Tenderer shall indicate the timeliness and how their accuracy will be competitive within existing international collaboration frameworks.