ECMWF Copernicus Procurement

Invitation to Tender

Copernicus Atmosphere Monitoring Service

Provision of global inversion-optimised greenhouse gas fluxes and concentrations

Volume II: Specification of Requirements

ITT Ref: CAMS2_55_ter
ISSUED BY: ECMWF Administration Department Procurement Section
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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 g) above.

2 Contract Summary

This ITT, entitled "Provision of global inversion-optimised greenhouse gas fluxes and concentrations", is for providing quantitative estimates of net surface fluxes of greenhouse gases, which are key drivers of the Earth's climate evolution. Ground-based and satellite remote-sensing observations allow these fluxes to be monitored. The data provided so far by CAMS have delivered time-series of CH_4, CO_2 and N_2O surface flux fields of high quality. The successful Tenderer shall extend the time-series, both forwards and backwards (as far as possible) in time, while maintaining their quality at the highest international standard. The documentation of associated errors and comparison with independent observations as well as with similar products that are produced outside of CAMS will also form part of the activities. Finally, specific developments shall be included to further improve the data products.

3 Technical Specification

3.1 General Requirements

The successful Tenderer shall provide flux estimates of CH_4, CO_2 and N_2O using state-of-the-art atmospheric inversion systems to continue the current service provision[1].
The Tenderer shall define the proposed spatial and temporal resolution for the atmospheric inversions defined in the work packages below with the constraint that the detail and accuracy of the flux estimates shall be at least reflecting the performance of the current CAMS products on greenhouse gas fluxes as described in the Evaluation and Quality Control documents for the Supplementary Services on Greenhouse Gas Fluxes on the CAMS website[2].
The successful Tenderer shall validate the flux estimates with independent observations and also participate in international coordination and intercomparison projects, such as the Global Carbon Project[3], Transcom[4], the Regional Carbon Cycle Assessment and Processes (RECCAP2) from the Global Carbon Project[5], and the North American Carbon Program[6], to ensure the produced estimates are of high quality.

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

[1] https://ads.atmosphere.copernicus.eu/cdsapp#!/dataset/cams-global-greenhouse-gas-inversion?tab=overview
[2] https://atmosphere.copernicus.eu/supplementary-services
[3] https://www.globalcarbonproject.org/index.htm
[4] https://www.ggmt2022.online/transcom-2022/
[5] http://www.globalcarbonproject.org/reccap/
[6] http://www.nacarbon.org/nacp/index.html

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 Work Package 1 (WP1) – Flux estimates of CO_2

The successful Tenderer shall provide at least annually updated global flux estimates of CO_2 at a horizontal resolution of at least 1° by 1° (or a similar configuration). The successful Tenderer shall use an atmospheric inversion system with a proven track record to provide the flux estimates. The flux estimates shall be based on observations from international ground-based networks (e.g., the NOAA Earth System Research Laboratory archive and the World Data Centre for Greenhouse Gases archive) and satellite observations (e.g., GOSAT, OCO-2, MicroCarb) on the condition that the accuracy of the observations is sufficient for providing competitive flux estimates. In the case of using satellite data products, the Tenderer shall exploit the improved latency of the observations relative to the in situ observations, as indicated in the list of deliverables below. The successful Tenderer shall provide atmospheric inversions covering the time periods indicated in the table below, showing equal or better performance than the current CAMS CO_2 flux estimates. The successful Tenderer shall also provide uncertainty estimates of all flux estimates and provide an Evaluation & Quality Control (EQC) report (using independent observations of atmospheric CO_2 and/or CO_2 fluxes) with each new release of the flux estimates.

Minimum list of required deliverables:

WP1 Deliverables			
#	*Nature*	*Title*	*Due*
D1.X.Z-yyyy	Data set	Observation-based flux estimates for CO_2 based on in situ observations for the period 1979-2026	October 2027
D1.X.Z-yyyy	Report	Evaluation and Quality Control document for observation-based CO_2 flux estimates based on in situ observations for the period 1979 - 2026	October 2027
D1.X.Z-yyyy	Dataset	Observation-based flux estimates for CO_2 based on in situ observations for the period 1979-2027	October 2028
D1.X.Z-yyyy	Report	Evaluation and Quality Control document for observation-based CO_2 flux estimates based on in situ observations for the period 1979 - 2027	October 2028
D1.X.Z-yyyy	Dataset	Observation-based flux estimates for CO_2 based on satellite observations for the period 2009 - 2027	October 2027[7]
D1.X.Z-yyyy	Report	Evaluation and Quality Control document for the observation-based flux estimates for CO_2 based on satellite observations for the period 2009 - 2027	October 2027[7]
D1.X.Z-yyyy	Dataset	Observation-based flux estimates for CO_2 based on satellite observations for the period 2009 - 2028	October 2028[7]

[7] Note: This deliverable shall consist of three iterations, if possible, i.e. the deliverables D1.X.Z-YYYYR1, D1.X.Z-YYYYR2 and D1.X.Z-YYYYR3 to be delivered approximately every four months, meaning end of 02/YYYY, 06/YYYY and 10/YYYY.

D1.X.Z-yyyy	Report	Evaluation and Quality Control document for the observation-based flux estimates for CO_2 based on satellite observations for the period 2009 - 2028	October 2028[7]

WP1 Milestones			
#	*Title*	*Means of verification*	*Due*
M1.Y.Z	…	…	…

3.3 Work package 2 (WP2) – Flux estimates of CH_4

The successful Tenderer shall provide annually updated global flux estimates of CH_4 at a resolution sufficient to characterize the main CH_4 source and sink patterns (e.g., wetlands, rice fields, cattle, atmospheric loss processes) and as close to a horizontal resolution of at least 1° by 1° (or a similar configuration). The successful Tenderer shall use an atmospheric inversion system with a proven track record to provide the flux estimates. The flux estimates shall be based on observations from international ground-based networks (e.g., the NOAA Earth System Research Laboratory archive and the World Data Centre for Greenhouse Gases archive) and satellite observations (e.g., SCIAMACHY, GOSAT(-2), GOSAT-GW, Sentinel-5p, Sentinel-5, IASI) on the condition that the accuracy of the observations is good enough for providing competitive flux estimates. In the case of using satellite data products, the Tenderer shall indicate if these will be used in a combined atmospheric inversion or in separate parallel atmospheric inversions. Also, the Tenderer shall exploit the better latency of the satellite observations relative to the in situ observations, to potentially improve on the indicated deliverable dates as indicated in the list of deliverables below. The successful Tenderer shall provide atmospheric inversions covering the time periods indicated in the table below, showing equal or better performance than the current CAMS CH_4 flux estimates. The successful Tenderer shall also provide uncertainty estimates of the fluxes and provide an Evaluation & Quality Control (EQC) report (using independent observations of atmospheric CH_4 and/or CH_4 fluxes) with each new release of the flux estimates.

Minimum list of required deliverables:

WP2 Deliverables			
#	*Nature*	*Title*	*Due*
D2.X.Z-yyyy	Data set	Observation-based flux estimates for CH_4 based on in situ observations during 1983-2026	October 2027
D2.X.Z-yyyy	Report	Evaluation and Quality Control document for observation-based CH_4 flux estimates based on in situ observations during 1983-2026	October 2027
D2.X.Z-yyyy	Dataset	Observation-based flux estimates for CH_4 based on in situ observations during 1983-2027	October 2028
D2.X.Z-yyyy	Report	Evaluation and Quality Control document for observation-based CH_4 flux estimates based on in situ observations during 1983-2027	October 2028

D2.X.Z-yyyy	Dataset	Observation-based flux estimates for CH_4 based on satellite observations during 1983-2026	October 2027
D2.X.Z-yyyy	Report	Evaluation and Quality Control document for the observation-based flux estimates for CH_4 based on satellite observations during 1983-2026	October 2027
D2.X.Z-yyyy	Dataset	Observation-based flux estimates for CH_4 based on satellite observations during 1983-2027	October 2028
D2.X.Z-yyyy	Report	Evaluation and Quality Control document for the observation-based flux estimates for CH_4 based on satellite observations during 1983-2027	October 2028

WP2 Milestones			
#	*Title*	*Means of verification*	*Due*
M2.Y.Z	…	…	…

3.4 Work package 3 – Flux estimates of N_2O

The successful Tenderer shall provide annually updated global flux estimates of N_2O at a resolution sufficient to characterize the main N_2O source and sink patterns (e.g., natural soils, agricultural soils, oceans, cattle) and as close to a horizontal resolution of 1° by 1° as possible. The successful Tenderer shall use an atmospheric inversion system with a proven track record to provide the flux estimates. The flux estimates shall be based on observations from international ground-based networks (e.g., the NOAA Earth System Research Laboratory archive) and satellite observations (e.g., IASI) on the condition that the accuracy of the observations is good enough for providing competitive flux estimates. In the case of using satellite data products, the Tenderer shall indicate if these will be used in a combined atmospheric inversion or in separate parallel atmospheric inversions. The successful Tenderer shall provide atmospheric inversions covering the time periods indicated in the table below, showing equal or better performance than the current CAMS N_2O flux estimates. The successful Tenderer shall also provide uncertainty estimates of the fluxes and provide an Evaluation & Quality Control (EQC) report (using independent observations of atmospheric N_2O and/or N_2O fluxes) with each new release of the flux estimates.

Minimum list of required deliverables:

WP3 Deliverables			
#	*Nature*	*Title*	*Due*
D3.X.Z-yyyy	Dataset	Observation-based flux estimates for N_2O – Period at least 1996 - 2025	June 2027
D.3.X.Z-yyyy	Report	Evaluation and Quality Control document for observation-based N_2O flux estimates for the period 1996 - 2025	June 2027
D.3.X.Z-yyyy	Dataset	Observation-based flux estimates for N_2O – Period at	June 2028

		least 1996 - 2026	
D.3.X.Z-yyyy	Report	Evaluation and Quality Control document for observation-based N_2O flux estimates for the period 1996 - 2026	June 2028

WP3 Milestones			
#	*Title*	*Means of verification*	*Due*
M3.Y.Z	…	…	…

3.5 Work package 4 – Service evolution

Service evolution is a key aspect of all CAMS services and is therefore an important element of this ITT. Development aspects of the current CAMS2_55_bis contract have focused on an increase in horizontal resolution to roughly 1° by 1°, including a significant improvement in computational efficiency, the use of new satellite data, such as from Sentinel-5p and IASI, improved atmospheric loss rate for CH_4, and improved prior fluxes from CO_2 based on the ORCHIDEE dynamic global vegetation model. In addition, work was carried out to better align the CAMS atmospheric inversion systems, including the new global CO2MVS emission estimation system based on ECMWF's Integrated Forecast System (IFS).

Further improvements to this part of the CAMS portfolio are expected to come from further improved prior flux estimates, the potential to extract more information about human-induced emissions, and further improved consistency between the offline inversion systems and the online IFS-based system. The IFS-based system currently optimises fluxes over a short time window of 12 to 24 hours. A recent development is to extend its capabilities and enable continuous optimisation of GHG fluxes over long time periods by coupling the IFS online adjoint-based inversion system with an offline adjoint transport model. This enables near-real time updates of GHG fluxes over long time windows while maintaining the computational efficiency required for daily operational delivery. In order to ensure development flexibility and the possibility to use different offline atmospheric transport models, a prototype of a coupled inversion system is being implemented in the Community Inversion Framework (CIF) (http://community-inversion.eu/) and will need to be further improved and tested in the coming years.

The Tenderer shall provide an outline of tasks to improve the service related to greenhouse gas flux estimates. This plan shall address at least some of the items in the paragraph above. In the context of the ramp-up of the CO2MVS, the successful Tenderer shall align their developments with other relevant CAMS activities. This shall include, in particular, the harmonisation of prior flux and emission datasets, the estimation of product uncertainties, Evaluation and Quality Control activities for CO_2 and other emissions, and the continuation of development efforts towards building a coupled IFS inversion system within the CIF. The proposal shall include a clear description of the proposed development activities including a summary of the expertise that the Tenderer will bring. The service evolution shall, where meaningful, take into account outcomes from past and current research projects in support of the development of the CAMS CO_2 and CH_4 emissions monitoring capacity (CO2MVS), such as CoCO2[8], CORSO[9], and CATRINE[10].

[8] https://coco2-project.eu
[9] https://corso-project.eu
[10] https://www.catrine-project.eu

Minimum list of required deliverables:

WP4 Deliverables			
#	*Nature*	*Title*	*Due*
D4.Y.Z.yyyy	Report	Annual development plan for the Year YYYY	Annually
D4.Y.Z.yyyy	Report	Annual report on the developments achieved during the Year YYYY	Annually

WP4 Milestones			
#	*Title*	*Means of verification*	*Due*
M4.Y.Z	…	…	…

3.6 Work Package 5 (WP5) – 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:

WP5 Deliverables			
#	*Type*	*Title*	*Due*
D5.y.z-YYYY	Other	Contribution to CAMS Knowledge Base to document products and services as provided within the scope of this contract	Annually
D5.Y.Z	Report	Summary of support to CAMS user support, communication and training activities.	Due 1 month before contract end date

3.6.1 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 November 2026 and finish on 31 October 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 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.

4.4 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.

4.5 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.

4.6 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.

4.7 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.

4.8 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 and the current state of atmospheric inversions to estimate greenhouse gas fluxes.

An exhaustive and detailed description of the proposed technical solution for all work packages described above, including any ramp-up or mobilization phase, 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 flux estimates outlining in some detail the proposed atmospheric inversion system(s). The Tenderer shall indicate the spatial and temporal resolution of the flux estimates and how their accuracy will be competitive within existing international collaboration frameworks. The Tenderer shall also describe its intended procedure for annually updating the data products. Finally, the Tenderer shall clearly describe their plans for service evolution as part of this proposal.