ECMWF Copernicus Procurement

Invitation to Tender

Copernicus Atmosphere Monitoring Service
Volume II

Development of the global fire assimilation system

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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 cooling effect of aerosol are prominent drivers of a changing climate, but the extent of their impact is often still uncertain.

At the Earth's surface, 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. Ozone distributions in the stratosphere influence the amount of ultraviolet radiation reaching the surface. Dust, sand, 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 supporting the CAMS service elements described under item i above.

1.1 Definitions

Definitions specific for this ITT are defined below.

Global Service Provider: ECMWF is the provider of global products

Regional Service Provider: The regional service provider is selected through another ITT, CAMS_50, Regional Production.

Real-Time Global Products: The operational real-time analyses and forecasts from the global CAMS data assimilation and forecasting system, which is run by the Global Service Provider. These analyses

and forecasts are produced at least daily and include 3-dimensional fields of aerosols, chemical species, and greenhouse gases with a temporal resolution of at least 6 hours.

Forecast-only Global Products: the outputs of a global CAMS forecasting system that is based on the system used to produce the Real-Time Global Products but without the assimilation of observations of atmospheric composition. The forecasts are produced at least daily and include 3-dimensional fields of aerosols, chemical species, and greenhouse gases with a temporal resolution of at least 6 hours.

Global Reanalysis Products: the outputs of a reanalysis from the global CAMS data assimilation and forecasting system, which is being run by the Global Service Provider. The reanalysis will cover the period between 2003 onwards and provide analyses and forecasts every 12 hours of 3-dimensional fields of aerosols, chemical species, and greenhouse gases with a temporal resolution of at least 6 hours.

Regional Products: the outputs of analyses and forecasts from the regional CAMS data assimilation and forecasting systems, which are run by the Regional Service Provider. The Regional Products consist in the first place of real-time analyses and forecasts. The regional CAMS data assimilation and forecasting systems will comprise at least seven individual systems as well as their model ensemble products. These analyses and forecasts will be produced every 24 hours and include 3-dimensional fields of aerosols and chemical species with a temporal resolution of 1 hour. The Regional Products also include the outputs from interim re-analyses based on fast-track in-situ observations and re-analyses based on fully validated in-situ observations. Outputs from these reanalyses consist of analyses of chemical species and aerosols with a temporal resolution of 1 hour and will be provided on an annual basis by the Regional Service Provider.

2 Contract Summary

This ITT, entitled “Development of the global fire assimilation system”, is for providing support for and further development of the global fire assimilation system (GFAS) of CAMS operated at ECMWF. GFAS delivers near-real-time emissions of gases and aerosols through data assimilation and numerical modelling supporting atmospheric composition forecasts. The Successful Tenderer will be expected to provide improvements for the current GFAS system in terms of updated injection height estimation using the Plume Rise and IS4FIRES models[1], provide near-real-time Fire Radiative Power (FRP) observations from the GOES and Himawari geostationary satellites, monitor global FRP, improve GFAS usage, and regularly update information on land cover maps and spurious FRP signals, as well as deliver memoranda and reports. The Successful Tenderer will also advise the team working on the global production system at ECMWF. The Successful Tenderer will have to demonstrate considerable experience in the field of estimation of fire emissions from satellite data.

3 Technical Specification

3.1 General Requirements

The Global Service Provider provides estimates of emissions from wildfires and biomass burning based on the Global Fire Assimilation System (GFAS), which was originally developed during the CAMS pre-

[1] For current GFAS implementation see Remy et al. (2017). Two global data sets of daily fire emission injection heights since 2003. Atmospheric Chemistry and Physics, 17, 2921-2942.

operational phase[2]. GFAS uses satellite observations of Fire Radiative Power (FRP) to detect fires and estimate emissions of CO_2, CO, CH_4, black carbon aerosol, organic carbon aerosol, total carbon aerosol, $PM_{2.5}$, total particulate matter, H_2, NO_x, N_2O, SO_2, and non-methane volatile organic compounds (NMVOCs). These emissions are key inputs to the CAMS modelling systems that are used for providing the Real-time Global Products, the Forecast-only Global Products, the Global Reanalysis Products and the Regional Products. The fire emissions are also part of the CAMS product portfolio. The emissions can be derived from the FRP observations through empirical relationships between the strength of a fire (derived from FRP), the type and state of vegetation, and the so-called emission factors of a particular species, which relate the dry matter combustion rate estimated from FRP to the actual emission rates of these species. GFAS also provides an estimate of the injection height of the fire emissions using a Plume Rise Model (PRM). The PRM uses FRP (strength of the fire) as well as meteorological variables to derive the instantaneous vertical transport of the emitted aerosols and gases providing an altitude of maximum injection of these species into the atmosphere. GFAS currently provides daily mean, soon to be hourly mean, output based on the observations of the day before. The Successful Tenderer shall support the further development of GFAS, in coordination with the Global Service Provider, by improving the GFAS modelling and assimilation system, by providing FRP retrievals from the constellation of geostationary satellites that are currently not available in near-real-time, and by monitoring the consistency between the FRP products from the various satellite sensors that are currently available, as outlined in the workpackages in the following sections. The Successful Tenderer will provide code developments and new parameter definitions for GFAS in the format as used at ECMWF, including current Python coding practices and ECMWF use of GRIB encoding.

3.2 Work package 4410 – GFAS algorithm development

One of the primary applications of GFAS is the use of fire emission estimates in the global and regional production systems of CAMS. These production systems produce the Real-Time Global Products, Forecast-only Global Products, Global Reanalysis Products, and Regional Products. An important asset of all these CAMS products is their high temporal resolution and their forecast capabilities. The current operational GFAS system provides daily mean emissions from the previous day and has undergone significant developments under a previous contract to provide a diurnal cycle of the emissions. Information on the vertical distribution of fire emissions (i.e., the injection height) is provided with the GFAS output, including the altitude of the plume top/bottom and mean altitude of maximal injection.

The successful tenderer will provide continued assistance and support to ECMWF in the maintenance and operational implementation of GFAS. The successful tenderer shall update the current GFAS development to include injection height calculations and to further develop the implementation of these calculations in GFAS, evaluating the currently calculated parameters and investigating/implementing physically meaningful and statistically robust parameters related to the injection heights.

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

[2]Kaiser et al. (2012). Biomass burning emissions estimated with a global fire assimilation system based on observed fire radiative power. Biogeosciences, 9:527-554.

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

WP4410 Deliverables			
#	*Type*	*Title*	*Due*
D1.y.z[3]-YYYYtoYYYY	Report	Review and recommendations of parameters related to injection height estimation	M6
	Code	Update plume rise and IS4FIRES model codes to match coding standards and formatting of existing operational GFAS code	M12

WP4410 Milestones			
#	*Title*	*Means of verification*	*Due*
M1.y.z	Revised parameters describing injection heights	Report	M18

3.3 Work package 4420 - Provision of FRP retrievals from geostationary satellites

The CAMS GFAS system currently uses FRP observations from the MODIS instruments on board of the polar orbiting Aqua and Terra satellites. ECMWF is also working with ESA and EUMETSAT to acquire FRP data from the VIIRS and Sentinel-3 instruments. In parallel, the potential for using geostationary satellites has been investigated during the initial CAMS phase. While FRP observations from EUMETSAT's Meteosat satellites will be provided through EUMETSAT's Land Surface Analysis Satellite Applications Facility (LSA SAF), no such mechanism currently exists for non-European geostationary instruments. In order to ensure the continuity of the service development and provision, the Successful Tenderer shall provide FRP retrievals from the American GOES-East and GOES-West satellites and the Japanese Himawari-8 satellite delivered within 3 hours after observation with at least 3-hourly resolution for the full disk GOES/Himawari imagery. The FRP retrievals shall be provided for the duration of the contract resulting from this ITT after a possible ramp-up period that needs to be identified in the Tender. The geostationary FRP retrievals will ensure high-temporal resolution coverage of a large part of the globe. The Successful Tenderer shall provide Fire Radiative Power (FRP) values from GOES-East, GOES-West and Himawari-8 with associated uncertainties, as well as geo-location information for each individual satellite footprint (at least the longitude, latitude, viewing angle and pixel size of the observation). The quality of the retrieval values shall be competitive with international products, such as are for instance available from MODIS and Meteosat. This quality shall be assessed, against independent observations if possible, and documented in annual reports. The Tenderer shall indicate the expected timeliness and reliability of its GOES/Himawari FRP data provision. The latter shall take into account operational aspects of the data provision with a focus on

[3] 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.

risk management (e.g., dependencies on raw satellite data timeliness, potential failure of required hardware, monitoring of processing chain, timely communication of system down-time).

The tables below provide the deliverables and milestones for the work package. Tenderers shall complete Volume III C as part of their bid, which should include the deliverables and milestones already indicated in the tables below and will form a preliminary version. Volume III C will be used by the contractor 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.

WP4420 Deliverables			
#	*Type*	*Title*	*Due*
D2.y.z-YYYYtoYYYY	Data	GOES-E/-W & Himawari FRP data stream in near-real-time	Daily
D2.y.z-YYYYtoYYYY	Report	Report on statistics of operational GOES-E/-W & Himawari data stream (based on NRT quality monitoring system)	Every six months
D2.y.z-YYYYtoYYYY	Report	GOES-E/-W & Himawari FRP Retrieval Quality Assessment	Every six months

WP4420 Milestones			
#	*Title*	*Means of verification*	*Due*
M2.y.z			

3.4 Work package 4430 - Monitoring of consistency between FRP products

GFAS produces estimates of fire emissions through the assimilation of FRP observations from various satellite sensors. While currently only MODIS observations are used in the routine production, recent developments to GFAS will make optimal use of several satellite sensors that provide an FRP product. A critical element of this data assimilation process is the assumption that the FRP products from the various sensors are consistent with each other. Differences in FRP algorithms as well as issues with saturation of spectral channels of the instrument or problems with the detection of small fires can lead to significant differences that need to be accounted for before FRP observations from different satellites can be combined. The Successful Tenderer shall provide routing monitoring, using the python-based monitoring system developed under the previous CAMS44 contract, of FRP products from the currently used (MODIS, SEVIRI and GOES) and future (e.g., VIIRS, Sentinel-3, Himawari-8) instruments to assess the consistency between the products. Differences in sensitivity, sampling time, and pixel size of the various instruments shall be taken into account. The monitoring shall also be used to detect the impact of any potential satellite sensor degradation on the FRP product. The provided comparison statistics for monitoring will consist of at a minimum a) FRP values on a per fire basis, b) number of active fire pixels per region, and c) number of low-FRP fire pixels per region. The achievable temporal resolution for these statistics shall also be monitored. Based on the results of the monitoring system, the Successful Tenderer shall provide algorithms to bias correct the FRP products, where necessary. The Successful Tenderer shall document its findings based on the monitoring in quarterly reports, which shall be delivered within 2 months after each quarterly period, and shall also provide

the Global Service Provider with all necessary inputs to include elements of the developed monitoring system in the operational GFAS production chain.

The tables below provide the deliverables and milestones for the work package. Tenderers shall complete Volume III C as part of their bid, which should include the deliverables and milestones already indicated in the tables below and will form a preliminary version. Volume III C will be used by the contractor 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.

WP4430 Deliverables			
#	*Type*	*Title*	*Due*
D3.y.z-YYYYtoYYYY	Report	FRP product consistency monitoring for the past 3 months	Quarterly

WP4430 Milestones			
#	*Title*	*Means of verification*	*Due*
M3.y.z	Acquire the FRP monitoring code from ECMWF	Code available to tenderer	M1

3.5 Work package 4440 – Updates to GFAS static inputs

GFAS processing utilises static input fields to provide information on land cover types and spurious signals from non-fire thermal sources such as volcanoes and gas flaring. The information in these static fields needs to be updated and should be more aligned with the other CAMS services. The tenderer shall revise the static inputs currently used in GFAS and update them to provide the most up-to-date information.

Land cover maps are required by GFAS to provide the correct information on vegetation types in the conversion of observed FRP to the emitted species. The tenderer shall compile global land cover maps, including information on vegetation type, for use in GFAS. Land cover maps should be provided for each year from 2003 to the latest full year, at a spatial resolution of 0.1 degrees longitude by 0.1 degrees latitude, to provide information on land cover change relevant to estimating biomass burning emissions. The tenderer shall also provide updated emission factors used in GFAS, to convert FRP to the emission flux, based on the updated land cover masks. In particular, the tenderer will provide updates of the GFAS VOC species to the VOC split used in the operational CAMS forecasting system or a more general approach to derive fire emissions for VOCs.

Satellite observations of FRP are not only sensitive to wildland fires but also thermal signals from other sources such as volcanoes and gas flaring. These ‘spurious’ signals are somewhat accounted for in GFAS and the tenderer shall provide annual updates to a global spurious signal mask which can omit the non-fire signals. The spurious signal masks should make use of available information on active volcanoes, on-shore gas flaring, and urban developments, along with and evaluation of persistent annual emissions in the GFAS output. The spurious signal mask will have a spatial resolution of 0.1 degrees longitude by 0.1 degrees latitude.

The tables below provide the deliverables and milestones for the work package. Tenderers shall complete Volume III C as part of their bid, which should include the deliverables and milestones already indicated in the tables below and will form a preliminary version. Volume III C will be used by the contractor 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.

WP4440 Deliverables			
#	*Type*	*Title*	*Due*
D4.y.z-YYYYtoYYYY	Report & Data	Land cover map (including vegetation types) and emission factors	M12 and annually
D4.y.z-YYYYtoYYYY	Report & Data	Spurious signal mask	M12 and annually

WP4440 Milestones			
#	*Title*	*Means of verification*	*Due*
M4.y.z	Methodology for providing land cover maps	Report	M6
M4.y.z	Methodology for deriving fire emissions of VOCs	Report	M6
M4.y.z	Methodology for providing spurious signal masks	Report	M6

3.6 Work package 4450 – Service evolution

Service evolution is a critical part of all CAMS services. The Tenderer shall therefore provide a research and development plan covering the full duration of the contractual agreement that results from this ITT. The proposed development topics shall be based on the Tenderer's own expertise, but could include the following topics:

- Evaluate the feasibility for calibrating GFAS emissions estimates with CAMS analyses of species associated with biomass burning emissions such as carbon monoxide and aerosol optical depth.
- Investigate the application of daytime and nighttime FRP observations to provide information on fire temperature and to distinguish between flaming and smouldering fires in GFAS.

The tables below provide the deliverables and milestones for the work package. Tenderers shall complete Volume III C as part of their bid, which should include the deliverables and milestones already indicated in the tables below and will form a preliminary version. Volume III C will be used by the contractor 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.

WP4450 Deliverables			
#	*Type*	*Title*	*Due*

D5.y.z-YYYYtoYYYY			

WP4450 Milestones			
#	*Title*	*Means of verification*	*Due*
M5.y.z			

3.7 Work package 7200 - 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).

The tables below provide the deliverables and milestones for the work package. Tenderers shall complete Volume III C as part of their bid, which should include the deliverables and milestones already indicated in the tables below and will form a preliminary version. Volume III C will be used by the contractor 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.

WP4400 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	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

WP4400 Milestones				
#	*Responsible*	*Title*	*Means of verification*	*Due*
M0.y.z	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	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	Tenderer	Internal face to face project meetings	Minutes of meeting	Annually
M0.y.z	Tenderer	Internal project monthly teleconferences	Meetings happened	Monthly

4 Specific Requirements

4.1 Acquisition of necessary data and observations

The Successful Tenderer shall acquire the relevant observational data sets for the production of GOES and Himawari FRP data and make them available for use in all CAMS activities related to CAMS global fire estimation services. ECMWF shall provide an off-line version of the GFAS code for the development of the diurnal cycle and forecasts capability of the fire emissions. ECMWF shall also provide the required input data for GFAS that is needed for the work described in this ITT.

4.2 Implementation schedule

The Framework Agreement will run from 1 April 2019 to 31 December 2021. The Tenderer shall provide a detailed implementation plan of proposed activities for the period until 30 June 2021. However, note that by Q4 2019 the level and duration of activities for the full year of 2021 will be communicated by ECMWF to the successful Tenderer based on the Copernicus programme review by the European Commission.

Adjustments to the proposed implementation plan can be made on an annual basis depending on needs for service evolution, changed user requirements, or other requirements as agreed between the European Commission and ECMWF.

4.3 Deliverables and milestones

Based on the work package descriptions of this ITT the Tenderer shall define a set of Deliverables and Milestones for each work package. The Deliverables shall cover all the proposed products and services to be delivered by the Successful Tenderer. Each Deliverable shall have an associated resource allocation. The total of these allocated resources shall not amount to more than the entire requested budget and shall take due account of the level and quality of the resources applied.

The Successful Tenderer is also required to provide input to the quarterly and annual reporting to the European Commission. These reports shall be defined as Deliverables as part of an overall management work package. Each quarterly report shall provide information on the performed activities for the previous period, list the achieved Deliverables and Milestones, and provide reasons for deviation from the implementation plan, where relevant.

All reports in this project shall be 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.

ECMWF will organise annual CAMS meetings. 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 (see 4.2.2) will represent the Successful Tenderer in such meetings.

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.

4.6 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.

4.7 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*

4.8 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.

4.8.1 Executive Summary

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

4.8.2 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.

4.8.3 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.

4.8.4 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 estimating fire emissions using satellite FRP observations.

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 and delivering the FRP retrievals for the GOES and Himawari satellites. The Tenderer shall describe the various required and proposed improvements of the GFAS system. Finally, the Tenderer shall describe how they will deliver the required service evolution aspects.