

# ECMWF Copernicus Procurement

## Invitation to Tender



# Copernicus Atmosphere Monitoring Service

## Volume II

### Solar radiation services

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## 1 Introduction

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

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

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

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

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

- a) Daily production of real-time analyses and forecasts of global atmospheric composition;
- b) Reanalyses providing consistent multi-annual global datasets of atmospheric composition with a stable model/assimilation system;
- c) Daily production of real-time European air quality analyses and forecasts with a multi-model ensemble system;
- d) Reanalyses providing consistent annual datasets of European air quality with a frozen model/assimilation system, supporting in particular policy applications;
- e) Products to support policy users, adding value to "raw" data products in order to deliver information products in a form 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<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O net surface fluxes, allowing the monitoring of the evolution in time of these fluxes;

- h) Climate forcing from aerosols and long-lived (CO<sub>2</sub>, CH<sub>4</sub>) 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<sub>2</sub> and CH<sub>4</sub> for the global domain and emission hotspots.

This Invitation to Tender (ITT) is targeting the CAMS service elements described under item (f) above.

## 1.1 Definitions

Definitions specific for this ITT are defined below.

**Global Service Provider:** ECMWF is the provider of global products

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

**Real-Time Global Products:** the operational (near-)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 twice- daily and include 3-dimensional fields of aerosol and chemical species 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 provided by the Global Service Provider. The reanalysis covers a period of approximately fifteen years and provides 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.

## 2 Contract Summary

This ITT, entitled “Solar Radiation Services”, is for providing and continuously evaluating the CAMS products related to solar radiation. The solar radiation service consists of global (clear sky) and multi-continental (defined by the field of view of geostationary satellite sensors to take into account the effect of clouds) solar irradiance databases. Daily updated time series for user-selected geographic locations covering a historical period defined by the data availability of the relevant geostationary satellite sensors shall be made available to users with a time lag of a few days maximum, targeting particularly solar energy applications. The successful bidder will have to demonstrate expertise in the field as well as a proven track record of delivering operational quality-controlled solar energy services.

## 3 Technical Specification

### 3.1 General Requirements

The successful Tenderer shall provide solar radiation services in the form of values of Global, Direct, and Diffuse Solar Irradiance as well as of Direct Normal Irradiance, which fulfil the needs of European and national policy developments and the requirements of (partly) commercial downstream services, e.g., for planning, monitoring, efficiency improvements, and the integration of solar energy systems into energy supply grids. The Irradiances defined above depend on various atmospheric quantities,

such as aerosol optical properties, water vapour and ozone concentrations, and these shall all be taken into account for providing the solar radiation products. Other properties, such as ground albedo and ground elevation, shall also be taken into account. In the case of irradiance products for cloudy skies, the impact of clouds on the irradiance shall be taken into account at the highest spatial resolution possible. Information about these atmospheric and surface properties shall be taken from either satellite observations directly or the CAMS Real-Time Global Products or Global Reanalysis Products.

### 3.2 Work package 7310 – Provision of CAMS services for solar radiation

The successful Tenderer shall provide time series of Global, Direct, and Diffuse Solar Irradiance as well as Direct Normal Irradiance that would be observed at a specific geographical location anywhere on the globe under clear-sky conditions. A historical record shall be provided starting from at least 1 January 2004 up to 2 days behind real-time and this time record shall be extended by one day each day. Data shall be available with a time step of one minute as well as in the form of time-aggregated products at 15-minutes, 1-hour, 1-day and 1-month resolution.

The successful Tenderer shall also provide time series of Global, Direct, and Diffuse Solar Irradiance as well as Direct Normal Irradiance that would be observed at a specific geographical location under cloudy conditions. The geographical domain must initially at least include the field-of-view of the Meteosat satellite located at 0° longitude. However, it is expected that over the course of the contract the successful tenderer will increase this geographical domain to also include the footprint of the Himawari satellites. For the Meteosat satellites, a historical record shall be provided starting from at least 1 February 2004 (commencement of routine operations of first Meteosat Second Generation satellite) up to 2 days behind real-time and this time record shall be extended by one day each day. For the Himawari satellites, a historical record shall be provided starting from at least 1 February 2015 (commencement of routine operations of the Himawari-8 satellite) up to 2 days behind real-time and this time record shall be extended by one day each day. Data shall be available with a time step of one minute as well as in the form of time-aggregated products at 15-minutes, 1-hour, 1-day, and 1-month resolution. The Tenderer shall describe the time schedule for the ramp-up phase for the implementation of the Himawari-based solar radiation products, which shall start within the first six months of the contract.

The successful Tenderer shall provide uncertainty estimates of the provided irradiance products and routinely monitor the quality of the products over all geographic areas for which the products are provided. An Evaluation and Quality Control (EQC) report describing the performance of the service in terms of scientific and operational performance shall be provided every 3 months. Each report shall document the 3-month period in terms of mean and variability of the product quality based on the individual irradiance estimates. For the scientific EQC, the Tenderer shall acquire the necessary independent observational data sets. The Tenderer shall define in the proposal the timeliness of the reports taking into account the availability of the independent observations to be used for the EQC.

In addition, while the daily updated time series can be provided as an interactive service, the successful Tenderer shall also provide historical gridded data sets for the main areas of the service (Meteosat and Himawari field-of-view) for the time period covered by the service at a minimum spatial resolution of 0.2° longitude/latitude and temporal resolution of 15 minutes.

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

<b>WP7310 Deliverables</b>			
<i>#</i>	<i>Type</i>	<i>Title</i>	<i>Due</i>
D1.y.z <sup>1</sup> -YYYYtoYYYY	Service	Provision of on-demand CAMS solar radiation service for clear-sky irradiances over the previous quarter	Quarterly
D1.y.z-YYYYtoYYYY	Service	Provision of on-demand CAMS solar radiation service for all-sky irradiances over the previous quarter	Quarterly
D1.y.z-YYYYQx	Report	EQC report	Quarterly
D1.y.z-YYYY	Report	Description of data sets used for EQC	Annually
D1.y.z-YYYY	Data set	Historical gridded data set of solar radiation products (clear-sky and all-sky) for the Meteosat field-of-view from 2005 – 2022.	June 2023
D1.y.z-YYYY	Data set	Historical gridded data set of solar radiation products (clear-sky and all-sky) for the Meteosat field-of-view for the year 2023.	June 2024
D1.y.z-YYYY	Data set	Historical gridded data set of solar radiation products (clear-sky and all-sky) for the Himawari field-of-view from 2016 – 2023.	December 2024
...			

<b>WP7310 Milestones</b>			
<i>#</i>	<i>Title</i>	<i>Means of verification</i>	<i>Due</i>
M1.y.z			
...			

### 3.3 Work package 7320 - Service evolution

As CAMS is a user-driven programme, the successful Tenderer shall, in collaboration with ECMWF, closely interact with users of the solar radiation services to assess the need for service evolution. As defined in the contract summary, the operational CAMS solar radiation services currently provide irradiance products for clear- and all-sky conditions as historical time-series. As part of this Work Package, the Tenderer shall include in the Tender their proposal for future service evolution. It is envisaged that this will be in the form of investigations and subsequent developments either to improve the current service or to enable potential new and beneficial directions into which to take

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

the service. However, it is left to the discretion of the Tenderer to outline the proposed evolution taking into account the budget and length of the contract.

In addition, the Successful Tenderer shall allocate resources to support the Global Service Provider with the assessment of the potential provision of an irradiance forecasting capability (Global, Direct, and Diffuse Solar Irradiance as well as Direct Normal Irradiance) as part of the Real-time Global Products. Such a forecast provision is currently under investigation and the Global Service Provider might decide to implement such a capability in the (near-)future. The irradiance products would be based on consistently modelled cloud, aerosol and ozone information.

Finally, the successful Tenderer shall explore and assess the optimal use of the Real-Time Global Products and Global Reanalysis Products as input to the solar radiation products, taking into account the service evolution of these products. The impact of upgrades of the Real-Time Global Products on the solar radiation service products shall be assessed and feedback shall be provided to the Global Service Provider.

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

<b>WP7320 Deliverables</b>			
<i>#</i>	<i>Type</i>	<i>Title</i>	<i>Due</i>
D2.y.z	Report Dataset	...	
...			

<b>WP7320 Milestones</b>			
<i>#</i>	<i>Title</i>	<i>Means of verification</i>	<i>Due</i>
M2.y.z			

### 3.4 Work package 7330 – User support and documentation of service

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

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

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

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

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

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

<b>WP7330 Deliverables</b>			
#	Type	Title	Due
D4.y.z-YYYY	Other	Overview of contribution to CAMS Knowledge Base to document products and services requiring expertise specific to CAMS solar radiation service	Annually
D4.y.z-YYYY	Report	Documentation of solar radiation service	Annually
...			

<b>WP7330 Milestones</b>			
#	Title	Means of verification	Due
M4.y.z	...	...	...
...			

### 3.5 Work package 7300 – Management and coordination

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

- Contractual obligations as described in the Framework Agreement Clause 2.3 on reporting and planning.
- Meetings (classified as tasks and listed in a separate table as part of the proposal):

- ECMWF will organise annual CAMS General Assemblies. The successful Tenderer is expected to attend these meetings with team members covering the various topics that are part of this ITT.
- ECMWF will host monthly teleconference meetings to discuss CAMS service provision, service evolution and other topics. The Prime Investigator appointed by the successful Tenderer will represent the successful Tenderer in such meetings.
- ECMWF will organise six-monthly project review meetings (linked to Payment milestones).
- Tenderers can propose additional project internal meetings (kick-off meeting, annual face-to-face meeting and monthly teleconferences) as part of their response.
- Quality assurance and control: the quality of reports and Deliverables shall be equivalent to the standard of peer-reviewed publications. The final quality check of the deliverables should be made by the prime contractor (contents, use of ECMWF reporting templates for deliverables and reports (Microsoft Word), format, deliverable numbering and naming, typos...); all reports in this project shall be in English. Unless otherwise specified the specific contract Deliverables shall be made available to ECMWF in electronic format.
- Communication management (ECMWF, stakeholders, internal communication).
- Resources planning and tracking using the appropriate tools.
- Implementation of checks, controls and risk management tools for both the prime contractor and subcontractors.
- Subcontractor management, including conflict resolution, e.g. the prime contractor is responsible for settling disagreements, although advice/approval from ECMWF may be sought on the subject.
- A list of subcontractors describing their contribution and key personnel shall be provided, as well as back-up names for all key positions in the contract. The Tenderer shall describe how the Framework Agreement, in particular Clause 2.9 has been flowed down to all their subcontractors.
- Management of personal data and how this meets the requirements of Section 2.8 and Annex 6 of the Volume V Framework Agreement

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

<b>WP7300 Deliverables</b>				
<i>#</i>	<i>Responsible</i>	<i>Nature</i>	<i>Title</i>	<i>Due</i>
D0.y.z-YYYYQQ	Tenderer	Report	Quarterly Implementation Report QQ YYYY <i>QQ YYYY being the previous quarter</i>	Quarterly on 15/01, 15/04, 15/07 and 15/10
D0.y.z-YYYY	Tenderer	Report	Annual Implementation Report YYYY <i>YYYY being the Year n-1</i>	Annually on 28/02
D0.y.z-YYYY	Tenderer	Other	Preliminary financial form YYYY <i>YYYY being the Year n-1</i>	Annually on 15/01
D0.y.z	Tenderer	Report	Final report, including letter from auditor specific to CAMS contract YYYY <i>YYYY being the last year of the contract</i>	60 days after end of contract
D0.y.z-YYYY	Tenderer	Report	Draft Implementation plan YYYY <i>YYYY being the Year n+1</i>	Annually on 28/02

D0.y.z-YYYY	Tenderer	Report	Finalised Implementation plan YYYY <i>YYYY being the Year n+1</i>	Annually on 31/10
D0.y.z-YYYY	Tenderer	Other	Copy of prime contractor's general financial statements and audit report YYYY <i>YYYY being the Year n-1</i>	Annually
D0.y.z	Tenderer	Other	Updated KPIs (list, targets...) after review with ECMWF	One year after start of contract

WP7300 Milestones				
#	Responsible	Title	Means of verification	Due
M0.y.z-Px	Tenderer	Progress review meetings with ECMWF / Payment milestones	Minutes of meeting	~ Every 6 months

## 4 General Requirements

### 4.1 Implementation schedule

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

### 4.2 Deliverables and milestones

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

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

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

### 4.3 Acquisition of necessary data and observations

The Global Service Provider will provide the Real-Time Global Products and Global Reanalysis Products needed for this tender. The Tenderer itself shall acquire the relevant observational data sets and make them available for use in all CAMS activities related to CAMS solar radiation services. The successful Tenderer is expected to closely collaborate with the Global Service Provider on the use of the Real-Time Global Products and Global Reanalysis Products for the solar radiation products. The successful

Tenderer shall also interact with the provider of the CAMS EQC activities, which is the subject of another call for tender, CAMS\_84 (Global and regional a posteriori EQC), in order to harmonize the CAMS EQC methodologies.

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

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

The following deliverables are thus to be added to the WP7340 deliverable lists:

WP7340 Deliverables			
#	Type	Title	Due
D4.y.z-YYYY	Other	Input to CAMS URDB - YYYY	Checked by ECMWF annually in November
...			

#### 4.6 Data sets

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

##### *Provision of data and products:*

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

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

In the case of (a), suppliers will have to agree with ECMWF on the data formats to be used. ECMWF will only accept data in formats that follow internationally recognised standards. Such standards must be open (i.e. non-proprietary), managed by a recognised international standardisation body (e.g. ISO, WMO, OGC, etc.), or any de-facto standard. Open source software should also exist that can read and

write files of these standards. Serialisation formats (e.g. NetCDF, XML, JSON) should be supported by standard schemas and conventions. All text-based formats should be encoded in UTF-8. ECMWF will implement tools to check the compliance of the provided data and products to the agreed standards before they are added to the ADS.

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

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

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

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

#### *Provision of processing capabilities:*

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

As for data retrievals, invocation of these web services will originate from the ADS itself as part of a workflow run on behalf of an end user, and ECMWF will need to have the necessary end-user credentials to invoke these services. ECMWF will not provide information on the end user's identity when invoking the web services. ECMWF will nevertheless collect usage statistics.

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

#### *Data and IPR:*

It is a condition of EU funding for CAMS that ownership of any datasets developed with CAMS funding passes from the suppliers to the 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 Tenderers' production system. The identity and ownership of such

exceptional components will be passed from the suppliers to the European Union via ECMWF. The successful Tenderer will be granted a non-exclusive licence to use them for any purpose.

#### 4.7 Key performance indicators

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

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

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

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

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

<b>Service availability KPI #</b>	<b>KPI Title</b>	<b>Performance Target and Unit of Measure</b>	<b>Frequency of Delivery</b>	<b>Explanations / Comments</b>
<i>KPI_73.1.2</i>	<i>Server or webAPI uptime</i>	<i>95%</i>	<i>Quarterly</i>	<i>Percentage of uptime vs total time for the data servers (running average over the past calendar year).</i>
<i>KPI_73.1.3</i>	<i>Completeness of production for each product</i>	<i>95%</i>	<i>Quarterly</i>	<i>Percentage of outputs delivered vs expected for each product defined in the SPP</i>

				<i>(running average over the past calendar year). This percentage is computed in terms of data volume</i>
<b>KPI_73.1.4</b>	<b>Timeliness of production for each product</b>	<b>90%</b>	<b>Quarterly</b>	<b>Percentage of products delivered completely and on time if delivery time is specified in the SPP (running average over the past calendar year).</b>
<b>KPI_73.10.1</b>	<b>% of deliverables delivered on time or with short delay</b>	<b>90%</b>	<b>Quarterly</b>	

## 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.

<i>Section</i>	<i>Page Limit</i>
<i>Executive Summary</i>	2
<i>Track Record</i>	2 (for general) and 2 (per entity)
<i>Quality of resources to be Deployed</i>	2 (excluding Table 1 in Volume IIIB and CVs with a maximum length of 2 pages each)
<i>Technical Solution Proposed</i>	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)
<i>Management and Implementation</i>	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)
<i>Pricing Table</i>	No limitation

*Table 1: Page limits*

### 5.2 Specific additional instructions for the tenderer's response

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

### 5.2.1 Executive Summary

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

### 5.2.2 Track Record

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

### 5.2.3 Quality of Resources to be Deployed

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

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

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

### 5.2.4 Technical Solution Proposed

The Tenderer is expected to provide a short background to the proposed technical solution to demonstrate understanding of the solution proposed. This should include background of the Tenderer's understanding of the Copernicus Atmosphere Monitoring Service and the current state of solar radiation service provision.

An exhaustive and detailed description of the proposed technical solution for all work packages described above shall be given. The Tenderer shall indicate which observational data sets it intends to use and how it will acquire the relevant data. The Tenderer shall describe the proposed method for producing the time series of Global, Direct, and Diffuse Solar Irradiance as well as Direct Normal Irradiance for clear and cloudy skies. The Tenderer shall also describe the validation methodology for above-mentioned irradiance products, which will be used including the acquisition of relevant independent observations. Finally, the Tenderer shall describe how they will deliver the required service evolution aspects.