

# ECMWF Copernicus Procurement

## Invitation to Tender



## Copernicus Climate Change Service Volume II

Support for climate reanalysis including  
satellite data rescue

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# 1 Introduction

ECMWF, as the Entrusted Entity for the Copernicus Climate Change Service (C3S), invites tenders for activities to support climate reanalysis by extending the coverage and quality of input data from the data-sparse past. This document describes the scope and technical requirements for C3S2\_314, addressing satellite data rescue.

The objective of this contract is to prepare a selection of early satellite data records for use in future climate reanalyses. Activities in C3S2\_314 shall build on the outcomes of a previous Satellite Data Rescue Service Contract in Copernicus Phase 1 (Cop1, C3S\_311C Lot 1, 2018-2021), as well as on the earlier FP7 ERA-CLIM and ERA-CLIM2 projects ([www.ecmwf.int/en/research/projects](http://www.ecmwf.int/en/research/projects)). In Cop1, datasets for a list of instruments prioritised by the ERA-CLIM projects were recovered, assessed and delivered to ECMWF. Several additional issues, detailed in supporting documents (Draft Algorithm Theoretical Basis [ATBD] documents), were identified which require additional analysis and development work, beyond the scope of Cop1. The consolidation of the products delivered in Cop1, to facilitate their assimilation in global reanalyses, is the first objective of C3S2\_314. The second objective involves the recovery and assessment of new datasets from additional sensors identified in earlier projects and confirmed in the data inventory activity of Cop1.

All relevant results to date from Cop1 are available to bidders, including documentation, on request via the messaging board on the e-Procurement Portal, as can additional technical clarifications.

The products prepared and delivered in C3S2\_314 shall be used as input for future climate reanalyses, including the next-generation C3S global reanalysis, ERA6, which is scheduled to go into production by 2024.

ECMWF intends to award a framework agreement with a single multi-annual service contract (maximum duration of 36 months and an end date not later than 30 December 2024) for these activities in support of satellite data rescue.

## 2 Technical requirements

The objective is to extend the coverage and quality of input satellite data records available for climate reanalysis, and to improve the impact of such data by targeted development of forward modelling capability, quality control and bias correction schemes.

### 2.1 Scope of Service

The selected Contractor for this contract shall:

- Consolidate and maintain a complete inventory of known candidate satellite data records requiring data rescue;
- Improve, consolidate and deliver updated data records and documentation for sensors investigated in the Cop1 Data Rescue Contract (C3S\_311C Lot 1);
- Obtain, assess, and deliver datasets for additional historical sensors;
- Assess, develop and improve forward modelling capacity for early-era and reprocessed satellite observations using RTTOV;
- Develop, improve and validate cloud filtering methodologies for IRIS, SIRS and MSU;
- Perform detailed evaluation of the geo-location of the data, and improve where appropriate and possible;
- Consolidate guidance on quality control and bias modelling for the datasets addressed, using approaches including: (1) comparison with state-of-the art reanalyses, and; (2) inter-sensor co-registration, to gain additional insight into data quality and bias characteristics;
- Consolidate guidance on uncertainties associated with the data, including estimates of radiometric noise characteristics;

- Provide any other guidance needed to prepare the data for use in reanalysis and/or for validation purposes;
- Provide the datasets in NetCDF4 format, together with comprehensive technical documentation in the form of Algorithm Theoretical Basis Documents (ATBDs) to include, as annexes, product user guides;
- Build upon outcomes of the Cop1 Satellite Data Rescue contract, ERA-CLIM, ERA-CLIM2 and FIDUCEO (www.fiduceo.eu) projects, as well as any other relevant prior research;
- Liaise and collaborate with EUMETSAT and relevant EUMETSAT Satellite Application Facilities (SAFs), as well as other data providers as needed.

## 2.2 Specification of Work

The list of satellite data records in Table 1 serves as the basis for the specification of work in Tasks 2-7. Task 1 involves the development of an inventory of early satellite data sets. The work required to consolidate or prepare each of these data records for use in reanalysis is presented in Table 2 and in the associated notes.

The details of the task specifications listed in Table 2 (below) are derived from the outputs of the Cop1 Satellite Data Rescue activity, including the definition of the work to be done for the consolidation of already available datasets (items colour coded blue). These datasets and their description, in the form of draft Algorithm Theoretical Basis Documents (ATBDs) are available to bidders, on request.

For new datasets (items colour coded green for all, or most, tasks) listed in Table 2, contractors are expected to verify the current status of each data record and ascertain plans and timelines of any parties currently working on improving the data record.

Tasks 1-7 are specified below:

**Task 1: Satellite data rescue inventory.** Maintain and extend an up-to-date global inventory of known satellite data records that require some form of data rescue, as a resource for coordination of current and future data rescue activities. The scope of this document covers sensors from satellites where the launch of the first sensor (where sensors formed part of a series of similar instruments) was prior to 1979. The contractor shall update and extend, where appropriate, the existing inventory developed in Phase 1. The inventory shall contain descriptive information about each data record, its physical state and location, stewardship, available documentation, any existing assessments and applications, potential value for climate reanalysis, and any other useful information to help clarify information content and potential value of the data records. The current documents shall be supplemented with an appendix that records issues and requirements for development work for each instrument based on the experience gained in the contract and previous activities.

Sensor	Satellite	Period	Primary sensitivities	Availability
Early infrared sensors				
PMR	Nimbus-6	1975-1976	Stratospheric temperature	Univ. Oxford, Met Office and ECMWF
IRIS	Nimbus-4	1970-1971	Temperature, humidity and trace gases	Nimbus-4 at NASA (copy at ECMWF)
VTPR	NOAA-2 → -5	1972-1979	Temperature and humidity	ECMWF (used in ERA-40 and JRA-55)
SSH*	DMSP F-1 → F-4	1977-1980	Temperature and humidity	NASA
SI-1*	Meteor-28 and -29	1977, 1979	Temperature, humidity and trace gases	EUMETSAT
HRIR	Nimbus-1,-2,-3	1964-1970	Cloud cover and surface emission	NASA
MRIR	Nimbus-3	1969-1970	Water vapour, clouds, surface and atmospheric temperature	NASA
SIRS	Nimbus-3,-4	1969-1971	Temperature profiles	NASA
THIR	Nimbus-4 → -7	1970-1985	Water vapour and surface	NASA
SCR	Nimbus-4,-5	1970-1974	Stratospheric temperature	Univ. Oxford, ECMWF, NASA

Early microwave sensors				
SMMR *	Nimbus-7	1978-1987	Sea-ice, TCWV, ocean surface wind, cloud LWP	CM SAF
SSM/T-2*	DMSP F-11,-12,-14 and -15	1994-2005	Upper tropospheric humidity	EUMETSAT, NOAA
SSM/T*	DMSP F-4, F-8→F-15	1979-2004	Upper air temperatures	NOAA
NEMS	Nimbus-5	Dec. 1972 to Oct 1973	Lower stratospheric and tropospheric temperature profiles	NASA
SCAMS	Nimbus-6	June 1975 to May 1976	Lower stratospheric and tropospheric temperature and H2O profiles	NASA
ESMR	Nimbus-5	Dec 1972 – May 1977	sea ice	NASA
Reprocessed radiance data				
HIRS-1, -2, -3, -4*	Nimbus-6, TIROS-N/NOAA, METOP	1975/1976, 1978-present	Temperature, humidity and ozone	NOAA, NASA, EUMETSAT
SSU	TIROS-N/NOAA	1979-2006	Stratospheric temperature	FCDR at NOAA CLASS
MSU *	TIROS-N/NOAA	1978-2007	Temperature	CDR at NOAA
SSMIS *	DMSP F-16→F-19	2003-present	Sea-ice, TCWV, ocean surface wind, cloud LWP	CM SAF

Table 1: List of sensors addressed in the Contract. Note: for sensors marked with (\*) the scope of the work is limited, as set out in Table 2 below.

**Deliverables required:** Database, supported with a user-friendly interface from the C3S website, containing the satellite data rescue inventory; annual updates; documentation. A first version of the database and documentation shall be delivered within 6 months of the start of contract.

**Task 2: Provision of consolidated satellite datasets for use in reanalyses.** For datasets delivered in Cop1, a consolidated version resulting from the activities carried out in Tasks 3-7 of C3S2\_314 shall be delivered. These products shall take into account any feedback received from ECMWF, including from pre-production assimilation tests, and shall reach a level of readiness allowing their direct use in reanalysis systems. For the additional historical sensors considered in this Contract and listed in Table 2, the contractor shall obtain and provide access to the original datasets, convert the data to a common netCDF format with documentation of the data content and format and perform a basic quality assessment. The final versions of the products shall contain quality flags, and if appropriate updated values (e.g. radiances, geo-location) derived from the work performed in Tasks 3, 5, 6 and 7.

**Deliverables required:** Consolidated datasets, technical documentation in the form of ATBDs, preliminary assessment of potential use in reanalysis.

**Task 3: Assessment of data quality.** This task focuses on new datasets not covered previously in Cop1. The contractor shall select data quality metrics appropriate to reanalysis applications of the data, consistent with what has been done in Cop1, as reflected in the relevant draft ATBDs. Scientific assessment of original data quality shall be performed by comparing with independent observational datasets and with modern reanalyses (ERA5, [Hersbach et al., 2020]) using community tools (e.g., the NWP SAF Radiance Simulator) for forward modelling. This assessment shall include the assessment of instrument behaviour.

**Deliverables required:** Draft version of ATBD for each instrument with relevant sections populated. Following completion of tasks 4, 5 and 7, a final version of the relevant ATBD sections.

**Task 4: improvement and development of forward modelling to support reanalysis.** For already available datasets, improve RTTOV coefficients following Cop1 recommendations and identify further actions. For new datasets, review and assess currently available radiative transfer coefficients, or generate new coefficients. Take steps to improve RT modelling where, for instance, new measured spectral characteristics become available or where there is significant uncertainty in the specification of the spectral characteristics of satellite radiometers. Provide estimates of uncertainties in RT modelling, due to fast model parameterisations, uncertainties in spectral characteristics of the radiometers, and uncertainties in the underlying spectroscopy.

*Deliverables required:* Optimised RTTOV radiative transfer coefficients for early-era and reprocessed datasets. Report on assessment of uncertainties in radiative transfer modelling

**Task 5: Quality control.** Consolidate and develop quality control and bias reduction schemes based on Cop1 results, the initial data quality assessment of Task 3, and knowledge of the application of the data for assimilation in reanalyses. Such schemes should take account of likely causes of degradation in data quality, for example: geo-location errors in the original data, instrumental errors and cloud contamination. This task shall cover both quality control for new instruments (data filtering, quality flag assessment, geolocation errors, ...) and consolidation of the quality control for already available datasets (cloud filtering, update of geolocation for instruments identified in Cop1). This task shall include inter-instrument co-registration where appropriate and feasible.

*Deliverables required:* Reports, in the form of draft and final Algorithm Theoretical Basis Documents (ATBDs), on quality control schemes, for each of the datasets addressed.

**Task 6: Uncertainty assessment.** Assess the uncertainties associated with the data, including an assessment of the radiometric noise characteristics of the data and a comparison of these with closest equivalent satellite instruments, where available, for all of the datasets addressed.

*Deliverables required:* Populate sections of draft and final versions of the ATBD for each sensor.

**Task 7: Bias modelling.** Assess biases relative to reanalyses. Assess performance of bias models currently used in climate reanalysis. Develop improved bias models as needed and assess the performance of these models for a representative subset of each dataset. For already available datasets, the work shall cover the consolidation of the assessment of existing variational bias correction error models based on Cop1 datasets. For new datasets, the work shall address large scale RTM simulations and assessment of the global scale comparisons with reanalysis, and the assessment of the variational bias correction error model. For both, alternative approaches shall be explored for bias correction models, including instrument oriented bias models.

*Deliverables required:* Report on assessment of current bias correction schemes for the datasets addressed, and report on improved bias models for future reanalysis applications.

Sensor	Task					
	2 Data provision	3 Quality assessment	4 RT modelling	5 Quality control	6 Uncertainty assessment	7 Bias modelling
Early infrared sensors						
PMR [1]						
IRIS [2]						
VTPR [3]						
HRIR* [4]						
THIR* [5]						
MRIR [6]						
SIRS [7]						
SSH	EUMETSAT	EUMETSAT	✓	EUMETSAT	EUMETSAT	EUMETSAT
SI-1	EUMETSAT	EUMETSAT	✓	EUMETSAT	EUMETSAT	EUMETSAT
SCR	✓	✓	✓	✓	✓	✓
Early microwave sensors						
SMMR	CM SAF	CM SAF	✓	EUMETSAT	EUMETSAT	EUMETSAT
SMM/T	EUMETSAT	EUMETSAT	✓	EUMETSAT	EUMETSAT	EUMETSAT
SSM/T-2	EUMETSAT	EUMETSAT	✓	EUMETSAT	EUMETSAT	EUMETSAT
NEMS	✓	✓	✓	✓	✓	✓
SCAMS	✓	✓	✓	✓	✓	✓
ESMR N5	✓	✓	✓	✓	✓	✓
Reprocessed radiance data						
HIRS-1, 2, 3, 4	EUMETSAT	EUMETSAT	✓	EUMETSAT	EUMETSAT	EUMETSAT
SSU [8]						
SSMIS [9]		EUMETSAT	✓	EUMETSAT		EUMETSAT
MSU*	EUMETSAT	EUMETSAT	✓	EUMETSAT	EUMETSAT	✓
CONSOLIDATION						
NEW SENSORS						
MSU* The RT activity here involves RT optimisation and non-linearity characterisation for the MSU series.						
THIR*, HRIR* - the feasibility of AMV generation from THIR and HRIR will be led by EUMETSAT						
THIR* this activity also covers new work on Nimbus-7 THIR						

Table 2: Tasks to be addressed in this contract. The Tasks shaded in blue denote consolidation of tasks carried out in Phase 1. Tasks in green denote new activities, largely for new sensors.

**Supplementary Notes on Table 2:**

MSU\*. The RT activity involves RT optimisation (including the diagnosis of shifts in the spectral response functions for all sensors on all satellites, over the lifetime of those sensors) and non-linearity correction.

THIR\*, HRIR\*. The feasibility of AMV generation from these sensors will be led by EUMETSAT, using the consolidated L1 data from this contract. Contractors should ensure alignment of plans and schedules with EUMETSAT to ensure feedback from the EUMETSAT AMV activities can be addressed within the contract.

THIR\*. This activity also covers new work on Nimbus-7 THIR.

Consolidation activities (in blue) shall address the following priorities, in addition to supporting ECMWF in preparing the datasets for assimilation tests prior to production of the next reanalysis:

- [1] PMR. (Tasks 2 and 3) Addressing remaining uncertainties in pre-processing (e.g., scaling factors applied); (Task 7) Assessing characteristics of significant remaining biases in data provided in Cop1; (Task 4) Provision of updated radiative transfer coefficients, in accordance with normal RTTOV conventions.

[2] IRIS. (Task 7) Assessment of most significant biases remaining in data provided in Cop1, including optimal corrections and guidance on bias models to be applied in reanalysis production runs; (Task 5) cloud detection assessment and optimisation.

[3] VTPR. (Task 5) Assessment of improved geolocation, and (Task 2 & 3) provision of updated data; (Task 4) provision of updated guidance on radiative transfer model coefficients, based on further optimisation of instrument spectral response functions.

[4] HRIR (Tasks 1-3) Provision of updated data, as required by assessment studies by EUMETSAT on feasibility of retrieving atmospheric motion vector winds from early sensor data.

[5] THIR (Task 1-3) Provision of updated data, as required by assessment studies by EUMETSAT on feasibility of retrieving atmospheric motion vector winds from early sensor data.

[6] MRIR. (Task 5) Development and assessment of cloud filtering algorithms; (Tasks 1-3) provision of data with improved cloud flagging if appropriate.

[7] SIRS. (Task 7) Assessment of most significant biases remaining in data provided in Cop1, including optimal corrections and guidance on bias models to be applied in reanalysis production runs; (Task 5) cloud detection assessment and optimisation.

[8] SSU. (Task 3) Assessment of data quality for data assimilated in ERA5 and any other viable reprocessed SSU data; (Task 4) Provision of updated radiative transfer coefficients, if appropriate.

[9] SSMIS (Task 4). Provision of metadata (or scripts and code required) for RT calculations (dot product of geomagnetic field and satellite view angle [b.k]). RT calculations will be performed at EUMETSAT. Likewise, provision of orbit angle code and scripts, for calculation of orbital bias corrections.

### 2.3 Summary of Deliverables and Acceptance Criteria

Deliverable #	Deliverable Name	Criteria	Metric and Tolerances/ [due date]	Approving authority
C3S2_314_D1.1.1 / C3S2_314_D1.1.2 / C3S2_314_D1.1.3	Data Inventory (initial [1.1.1] and 2 annual updates [1.1.2 & 1.1.3])	Provision of updated database & supporting updated documentation	Delivery to target schedule of both database and documents / [Start + 6 months, +2 years, +3 years, resp.]	C3S Technical Officer
C3S2_314_D2.1.1 / C3S2_314_D2.1.2/ C3S2_314_D2.2.1	Provision of database with new rescued sensor data [initial D2.1.1 & final D2.1.2] and; consolidated data from Phase 1 [D2.2.1]	Database available & relevant section of ATBD complete. Successful Scientific review by C3S TO.	Delivery of initial data for new sensors [D2.1.1] & final [D2.1.2] and;/ [Start+1 year Start+2.5 years resp.] final consolidated from phase 1 [D2.2.1]/ [start + 1 year]	C3S Technical Officer
C3S2_314_D3.1.1 - D3.1.n / C3S2_314_D3.2.1- D3.2.n / C3S2_314_D3.3.1- D3.3.n /	Updated ATBDs for consolidated datasets from Phase 1 [D3.1.1- 3.1.n] Updated ATBDs for new sensors [draft: D3.2.1-3.2.n & final: D3.3.1-3.3.n]	Relevant sections of consolidated ATBD complete [D3.1.1-3.1.n] Draft of relevant sections of ATBD [D3.2.1-3.2.n] Final version [D3.3.1-3.3.n] Successful Scientific review by C3S TO.	Conformance to ATBD template to be agreed at contract negotiation/  [start+1 year; start+2 years; start+2 years 6 months resp.]	C3S Technical Officer



C3S_314_D4.1 / C3S_314_D4.2 / C3S_314_D4.3 / C3S_314_D4.4 /	Provision of initial RT coefficients (MW)  Assessment of RT biases in MSU  Provision of initial RT coefficients (IR)  Provision of final RT coefficients (MW & IR) & Documentation (report/paper on RT modelling for newly rescued sensors)	Availability of coefficients  Report & review by C3S TO  Availability of coefficients  Availability of coefficients  Report & review by C3S TO	Compatibility with up-to-date version of RTTOV (V11, 13 or 14)  Compatibility with up-to-date version of RTTOV (V11, 13 or 14) Compatibility with up-to-date version of RTTOV (V11, 13 or 14) / [start+6 months; start+18 months; start+6 months; start+2 years]	C3S Technical Officer
C3S2_314_D5.1.1 - D5.1.n C3S2_314_D5.2.1 - D5.2.n C3S2_314_D5.3.1 - D5.3.n	Updated ATBDs for consolidated datasets from Phase 1 [D5.1.1-5.1.n] Updated ATBDs for new sensors [draft: D5.2.1-5.2.n & final: D5.3.1-5.3.n]  <i>(Updated ATBDs to include Quality Control Information)</i>	Relevant sections of consolidated ATBD complete [D5.1.1-5.1.n] Draft of relevant sections of ATBD [D5.2.1-5.2.n] Final version [D5.3.1-5.3.n] Successful Scientific review by C3S TO.	Conformance to ATBD template to be agreed at contract negotiation / [start + 1 year; start + 2 years; start+ 2 year 6 months]	C3S Technical Officer
C3S2_314_D6.1.1 - D6.1.n C3S2_314_D6.2.1 - D6.2.n C3S2_314_D6.3.1 - D6.3.n	Updated ATBDs for consolidated datasets from Phase 1 [D6.1.1-6.1.n] Updated ATBDs for new sensors [draft: D6.2.1-6.2.n & final: D6.3.1-6.3.n]  <i>(Updated ATBDs to include Uncertainty Assessment)</i>	Relevant sections of consolidated ATBD complete [D6.1.1-6.1.n] Draft of relevant sections of ATBD [D6.2.1-6.2.n] Final version [D6.3.1-6.3.n] Successful Scientific review by C3S TO.	Conformance to ATBD template to be agreed at contract negotiation / [start + 1 year; Start + 2 years; start+ 2 years 6 months]	C3S Technical Officer
C3S2_314_D7.1.1 - D7.1.n C3S2_314_D7.2.1 - D7.2.n C3S2_314_D7.3.1 - D7.3.n	Updated ATBDs for consolidated datasets from Phase 1 [D7.1.1-7.1.n] Updated ATBDs for new sensors [draft: D7.2.1-7.2.n & final: D7.3.1-7.3.n]  <i>(Updated ATBDs to include Assessment of biases and bias models)</i>	Relevant sections of consolidated ATBD complete [D7.1.1-7.1.n] Draft of relevant sections of ATBD [D7.2.1-7.2.n] Final version [D7.3.1-7.3.n] Successful Scientific review by C3S TO.	Conformance to ATBD template to be agreed at contract negotiation  [start + 1 year; Start + 2 years; start+ 2 years 6 months]	C3S Technical Officer

Table 3: Summary Table of Technical Deliverables

Bidders should provide a complete set of deliverables to suit their proposed work plans and should use the numbering format for deliverables as described in Volume IIIA – Pricing and Deliverables (Deliverables list sheet).

## 3 Other Requirements

### 3.1 Schedule

A detailed time plan and schedule shall be included in the tender response. The proposed time plan and schedule shall address the main tasks, inputs, outputs, intermediate review steps, milestones, deliverables and dates. Regular/monthly progress meetings will be held with ECMWF during the contract to assess contract status, risks and actions.

ECMWF is required to prepare Annual Implementation Plans, which must be approved by the European Commission before they can enter into force. The implementation plans will take full stock of service reviews, performed thoroughly on an annual basis, as well as of the continuously evolving user requirements and corresponding service specifications. The successful tenderer shall therefore provide each year for ECMWF's approval an updated detailed plan of proposed activities including Deliverables and Milestones, using the Work Package table template in Volume IIIB, which will form part of this Implementation Plan. The successful tenderer has to report on a quarterly and annual basis (for more details please see Volume V Framework Agreement for this ITT).

### 3.2 Meetings

ECMWF will organise meetings at 12- to 18-month intervals to bring together all C3S service providers. The successful tenderer is expected to attend these meetings. The successful tenderer is required to attend monthly teleconference meetings to discuss C3S service provision, service evolution and other topics that cut across different aspects of C3S.

The cost of attending these meetings shall be covered by the successful tenderer and shall be included in the tendered price. The cost of organising and attending any additional meetings required to carry out the contracted activities shall also be covered by the successful tenderer and shall be included in the tendered price.

### 3.3 Key Performance Indicators (KPIs)

The successful contractor shall propose a small set of meaningful Key Performance Indicators (KPIs) which enable ECMWF to monitor and assess the progress of the contract in meeting the overall objectives set. For C3S2\_314 these should reflect the primary relevance of the datasets provided - in supporting the use of the rescued satellite data in future global reanalyses. The final set of KPIs may be refined in the contract negotiation phase.

### 3.4 Stakeholder Involvement

The successful contractor should take account of the dependencies and relationships (of the programme of work) to relevant activities at ECMWF and EUMETSAT which support the development and testing of reanalysis systems and reflect these dependencies in the scheduling of deliverables where appropriate.

### 3.5 Provision of Data to the Copernicus Climate Data Store

As the primary use for the Level 1 satellite datasets delivered by this contract is to serve as input to C3S reanalyses it is not envisaged that the data will be served through the CDS, but that access to the datasets and documentation will be open to C3S users through clear documentation and links on the C3S website.

It is a condition of EU funding for C3S that ownership of any datasets developed with C3S 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 C3S for any purpose.

All software and products used by the successful Tenderer to produce the C3S datasets will remain the property of the successful Tenderer, except for those components which are acquired or created specifically

for C3S purposes, with C3S funding, and which are separable and useable in isolation from the rest of the successful Tenderers’ production system. The identity and ownership of such exceptional components will be passed to the European Union annually. The successful Tenderer will be granted a non-exclusive licence to use them for any purpose.

### 3.6 Supporting User Engagement

While user engagement and training activities are not part of the scope of ITT C3S2\_314, the contractor shall accommodate for eventual needs in providing technical and scientific expertise in support of these activities. The contractor shall specify in the bid the experts intended to be allocated to provide this support.

Requests to support activities may include, for example, the requirement to:

- 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 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 requested.

## 4 Tender Format

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.

### 4.1 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>	30 (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>	10 (excluding Table 4 and Table 5 in Volume IIIB) + 2 per each Work package description (Table 3 in Volume IIIB)
<i>Pricing Table</i>	No limitation

*Table 4: Page limits*

### 4.2 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.

#### 4.2.1 Executive Summary

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

#### 4.2.2 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.

#### 4.2.3 Quality of Resources to be Deployed

The tenderer shall propose a team providing the skills required for providing operational services that meet the technical requirements set out in Section 2. The team shall include a Service Manager with at least 5 years of experience in management of large-scale projects. The tenderer shall describe the experience of the Service Manager and of the technical project team in performing activities related to the various aspects of this tender.

#### 4.2.4 Technical Solution Proposed

The tenderer shall give a short background to the proposed solution to demonstrate understanding of that solution and of the C3S context. This section shall also include information on any other third-party suppliers that are used as part of the technical solution, and a statement of compliance for each requirement formulated throughout this document, describing how the proposed solution maps to the requirements.

#### 4.2.5 Management and Implementation

The tenderer shall provide a detailed implementation plan of proposed activities for the duration of the framework agreement. Deliverables should be consistent with the technical requirements specified in Section 2. The number of milestones is not restricted, but they should be designed as markers of demonstrable progress in service development and/or quality of service delivery.

As part of the general project management description the tenderer shall consider the following elements (this is not an exhaustive list):

- Monthly teleconferences with ECMWF and a proposal for involvement of ECMWF in major contract reviews shall be provided as part of the management plan.
- A proposed payment plan shall be provided as part of the proposal. The payment plan shall be based on regular payments for routine services work packages and shall be based on milestones completion and associated deliverables for development related activities.
- The following management aspects shall be described: task and resources planning and tracking, quality assurance and control, communication management (ECMWF, stakeholders, internal communication), conflict resolution, subcontractor management, personal data management (i.e. how this meets the requirements of Clause 2.8 and Annex 6 of the Volume V Framework Agreement) and risk assessment and mitigation plans.
- A list of sub-contractors describing their contribution and key personnel, legal names and addresses shall be provided. The tenderer shall describe how the Framework Agreement, in particular Clause 2.9 has been flowed down to all their sub-contractors.

As part of the general contract management description, the Tenderer shall include the following elements in line with the reporting and planning requirements as laid down in the Terms and Conditions of the Framework Agreement. The table below provides the template to be used by the tenderer to describe the complete list of deliverables, milestones and schedules for the management work package (eg.WPO, *cf.* template in Volume IIIB Section 4.5). All milestones and deliverables shall be numbered as indicated and document deliverables shall be periodically updated and versioned as described in the table.

Deliverables for this work package shall include the following administrative and programmatic reports:

<b>WPO Contractual Obligations Template</b>				
#	Responsible	Nature	Title	Due
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	Tenderer	Report	Final report	60 days after end of contract
D0.y.z-YYYY	Tenderer	Other	Preliminary financial information YYYY <i>YYYY being the Year n-1</i>	Annually on 15/01
D0.y.z-YYYY	Tenderer	Report	Draft Implementation plan YYYY <i>YYYY being the Year n+1</i>	60 days after signing of contract for Year N+1  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

Table 5: Administrative and Programmatic Deliverables

Tenderers shall provide preliminary versions of the completed tables as part of their bid.

## 5 Additional information

### 5.1 References

Hersbach, H, Bell, B, Berrisford, P, et al. The ERA5 global reanalysis. *Q J R Meteorol Soc.* 2020; 146: 1999– 2049. <https://doi.org/10.1002/qj.3803>

Saunders, R., P. Rayer and P. Poli, 2017: Update on Satellite Datasets for ERA-CLIM2. ERA-CLIM2 deliverable D3.9, available at [https://drive.google.com/open?id=1ZhWfmmYUq8GPG4Lh7\\_RyRlmyH3vdJlsD](https://drive.google.com/open?id=1ZhWfmmYUq8GPG4Lh7_RyRlmyH3vdJlsD)

### 5.2 Acronyms

AMSU	Advanced Microwave Sounding Unit
ATBD	Algorithm Theoretical Basis Document
AVHRR	Advanced Very High Resolution Radiometer
CDR	Climate Data Record
CDS	Climate Data Store
C3S	Copernicus Climate Change Service
CM SAF	EUMETSAT Climate Monitoring-Satellite Application Facility
CIMSS	Cooperative Institute for Meteorological Satellite Systems
DMSP	Defense Meteorological Satellite Program

ECMWF	European Centre for Medium-Range Weather Forecasts
ERA-CLIM	European Reanalysis of Global Climate Observations
EU	European Union
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
FCDR	Fundamental Climate Data Record
FIDUCEO	Fidelity and uncertainty in climate data records from Earth Observations
HIRS	High-resolution Infrared Radiation Sounder
HRIR	High-resolution Infrared Radiometer
IRIS	Infrared Imaging Spectrograph
ITT	Invitation to Tender
MOOC	Massive Open Online Course
MRIR	Mid-Infrared Instrument
MSU	Microwave Sounding Unit
MVIRI	Meteosat Visible Infra-Red Imager
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
NOAA CLASS	NOAA Comprehensive Large Array-data Stewardship System
NWP SAF	EUMETSAT Numerical Weather Prediction Satellite Application Facility
PMR	Pressure Modulator Radiometer
RT	Radiative Transfer
RTTOV	Radiative Transfer for TOVS
SIRS	Satellite Infra-Red Spectrometer
SSM/I	Special Sensor Microwave/imager
SSMIS	Special Sensor Microwave - Imager/Sounder
SMMR	Scanning Multichannel Microwave Radiometer
SSM/T	Special Sensor Microwave - Temperature
SSU	Stratospheric Sounding Unit
TCWV	Total Column Water Vapour
THIR	Temperature-Humidity Infrared Radiometer
TIROS	Television Infrared Observation Satellites
TOVS	TIROS Operational Vertical Sounder
VTPR	Vertical Temperature Profile Radiometer