ECMWF Copernicus Procurement

Invitation to Tender



Copernicus Climate Change Service Volume II

Essential Climate Variable products derived from observations

ITT Ref: C3S_312b

ISSUED BY: ECMWF Administration Department Procurement Section

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Implemented by



Table of Contents

1	Intr	Introduction					
2	Technical Requirements						
	2.1	Service scope and requirements	4				
	2.2	Work to be undertaken	7				
	2.3	Data access via the CDS	.14				
	2.4	WP0: Management and Implementation	.16				
3	Ten	der Format and Content	.21				
	3.1	Page limits	.21				
	3.2	Executive Summary	.21				
	3.3	Track Record	.21				
	3.4	Quality of Resources to be Deployed	.21				
	3.5	Technical Solution Proposed	. 22				
4	Add	litional information	.22				
	4.1	References	. 22				
	4.2	Acronyms	. 22				

1 Introduction

ECMWF is building a Climate Data Store (CDS) that will provide open and free access to quality-assured climate observations, global and regional Essential Climate Variable (ECV) products derived from observations, global and regional climate reanalyses, seasonal forecast data and model-generated future climate change scenarios. The CDS infrastructure has been designed to allow users with diverse levels of expertise to connect with climate datasets hosted at various data centres around the world. The CDS will provide online tools for creating workflows and bespoke information products to support climate change adaptation and mitigation in different sectors of society. The CDS catalogue of datasets, tools and information products will be accessible via the C3S web portal and supported by an open Application Programming Interface (API). A beta version of the CDS will be completed in June 2017, followed by a first public release in January 2018.

To support analysis and monitoring of climate change, CDS users need access to state-of-the-art Climate Data Records (CDRs) and Interim Climate Data Records (ICDRs) for a variety of ECVs (Bojinski et al. 2014). The recent update of the Global Climate Observing System (GCOS) Status Report (GCOS-SR 2015) includes brief sections for each ECV that describe commonly used data products and the observations used to produce them. Target requirements for many ECV products, in terms of uncertainty, stability, temporal and spatial resolution, are defined in the GCOS 2016 Implementation Plan (GCOS-IP 2016).

ECMWF secures reliable access to ECV products via the CDS by procuring services related to production, quality assurance, data access, documentation and user support. Procurement is competitive based on criteria designed to ensure the highest possible quality for all products, guided by GCOS requirements and best practices. Accordingly, a first Invitation to Tender (ITT), C3S_312a, was issued in 2016 for delivery of ECV products derived from Earth observations. It resulted in 9 contracts addressing 12 ECVs, as shown in Table 1 using green colouring. All C3S_312a contracts will have ended by 2018 Q4.

Once C3S reaches full operational status in 2018, CDS users shall have access to a large number of data products derived from Earth observations only, associated with 22 ECVs as indicated in Table 1. All of the ECVs listed there have been globally observed for a decade or more, either from space, *in situ*, or both. For each of them, existing capabilities in Europe can be exploited to provide reliable access to quality-assured and regularly updated CDRs with global or near-global coverage. Additional ECVs (not listed in Table 1) will be addressed using model-based reanalyses and/or *in situ* observation networks.

The aim of the present ITT is twofold: (1) to address 10 additional ECVs not yet covered by C3S_312a, and (2) to consolidate and simplify the framework agreements for all 22 ECVs to be addressed in the operational phase of C3S. Accordingly, this ITT comprises 5 Lots, as indicated in Table 1 using blue colouring, which combine multiple ECVs related to atmospheric physics (Lot 1), atmospheric composition (Lot 2), ocean (Lot 3), land hydrology and cryosphere (Lot 4) and land biosphere (Lot 5). All except Lot 2 include one or more ECVs not yet covered by C3S_312a; all except Lot 1 include one or more ECVs already addressed by C3S_312a.

The target contract start date for Lots 1, 3, 4 and 5 is 1 February 2018. For those Lots, production and delivery of CDRs associated with ECVs not yet covered by C3S_312a shall start as soon as possible after contract signature. The target contract start date for Lot 2 is 1 October 2018.

For Lots 2, 3, 4 and 5, contractors shall ensure that no deterioration of service occurs when the current C3S_312a framework agreements end, in Q4 of 2018. This may be achieved, for example, by absorbing

various activities initiated with ITT C3S_312a within the new framework agreements, and/or by initiating new activities that lead to a better product.

As indicated in Table 1, all C3S_312a Lot 1-9 activities are expected to continue as planned until the end of the C3S_312a contracts. Current C3S_312a (sub)contractors can be included in bids for the new C3S_312b Lots; should the bids be successful they will then start working under the new contract once their C3S_312a contracts terminate.

			C35_	312a			
					C35_	312b	
		GCOS	2017	2018	2019	2020	2021
Atmos	pheric physics						
	Precipitation	4.3.5					
	Surface Radiation Budget	4.3.6					
	Water Vapour	4.5.3		Lot 1			
	Cloud Properties	4.5.4					
	Earth Radiation Budget	4.5.5					
Atmos	spheric composition						
	Carbon Dioxide	4.7.1	Lot 6				
	Methane	4.7.2	Lot 6		In	* 2	
	Ozone	4.7.4	Lot 4				
	Aerosol	4.7.5	Lot 5				
Ocean	1						
	Sea Surface Temperature	5.3.1	Lot 3				
	Sea Level	5.3.3	Lot 2	Lot 3			
	Sea ice	5.3.5	Lot 1				
	Ocean Colour	5.3.7					
Land h	ydrology & cryosphere						
	Lakes	6.3.4					
	Glaciers	6.3.6	Lot 8		In	* 4	
	Ice sheets and ice shelves	6.3.7					
	Soil moisture	6.3.16	Lot 7				
Land b	biosphere						
	Albedo	6.3.9	Lot 9				
	Land Cover	6.3.10					
	Fraction of Absorbed Photosyntheti	6.3.11	Lot 9	Lot 5			
	Leaf Area Index	6.3.12	Lot 9				
	Fire	6.3.15					
	· · · · · · · · · · · · · · · · · · ·		2017	2018	2019	2020	2021

Table 1: Consolidation of C3S_312a and C3S_312b Lots for the operational phase of C3S. The column labelledGCOS shows the relevant section in the GCOS Status Report (GCOS-SR 2015).

2 Technical Requirements

2.1 Service scope and requirements

This ITT is for services ensuring reliable access via the CDS to high-quality, consistent and homogeneous global climate data products associated with a specified set of atmospheric, oceanic and terrestrial ECVs.

The scope of services provision includes:

- Generation and/or brokering of data products;
- Quality assurance and documentation;

- Providing access to products and documentation via the CDS;
- Providing user support for all products delivered.

Work packages, tasks and deliverables are described in detail in Section 2.2.

All data products shall:

- be suitable for use as CDRs, i.e. be of sufficient length, consistency, homogeneity and continuity to represent past climate variability and change;
- have global or near-global coverage;
- be derived from observations only (satellite and/or in situ);
- provide the best achievable spatial coverage and resolution given available observations;
- provide the best achievable length of record and frequency of output given available observations;
- be frequently updated to incorporate newly available input observations (ICDRs);
- be periodically reprocessed using improved algorithms and/or newly available input data;
- include meaningful estimates of uncertainty, in terms of accuracy and precision;
- include metadata on data provenance to ensure full traceability of information;
- be delivered using data formats, metadata and protocols as described in Section 2.3;
- be fully documented as detailed in Section 2.2;
- be backed up with specialised user support as described in Section 2.2.4.

Contractors shall:

- ensure that each ECV product delivered represents the best that can be obtained given the current state of research;
- select input observations with care to ensure maximum consistency, homogeneity and continuity of the product;
- undertake any actions needed to ensure a smooth transition of service delivery currently provided under C3S_312a Lots 1-9;
- take maximum advantage of existing capabilities for production of CDRs in Europe, including those developed under the ESA CCI programme and the EUMETSAT SAFs;
- consider data requirements for other Copernicus services (CAMS, CMEMS, CLMS) and ensure there is no duplication of work;
- work together with ECMWF to ensure full integration of data products within the CDS;
- participate in the Cross-CDR Working Group led by ECMWF (see Section 2.2.4);
- contribute to relevant international coordination activities such as the ECV Inventory maintained by CEOS/CGMS WG Climate;
- deliver an operational service that is timely, reliable and well supported.

The service shall be organised in 5 Lots as follows:

2.1.1 Lot 1: Atmospheric physics

ECMWF intends to award a single framework contract (maximum 41 months) for this Lot, with a target starting date of **1 February 2018**. The contractor for this Lot shall, in accordance with the requirements described in Section 2.1, ensure timely access to data products associated with the following ECVs:

- **Precipitation** (GCOS-SR Section 4.3.5)
- Surface Radiation Budget (GCOS-SR Section 4.3.6)
- Water Vapour (GCOS-SR Section 4.5.3)
- **Cloud Properties** (GCOS-SR Section 4.5.4)

• **Earth Radiation Budget** (GCOS-SR Section 4.5.5)

Table 23 of GCOS-IP 2016 provides guidance on viable data products and requirements related to resolution, accuracy and stability.

2.1.2 Lot 2: Atmospheric composition

ECMWF intends to award a single framework contract (maximum 33 months) for this Lot, with a target starting date of **1 October 2018**. The contractor for this Lot shall, in accordance with the requirements described in Section 2.1, ensure timely access to data products associated with the following ECVs:

- **Carbon Dioxide** (GCOS-SR Section 4.7.1)
- Methane (GCOS-SR Section 4.7.2)
- **Ozone** (GCOS-SR Section 4.7.4)
- Aerosol (GCOS-SR Section 4.7.5)

Table 23 of GCOS-IP 2016 provides guidance on viable data products and requirements related to resolution, accuracy and stability.

2.1.3 Lot 3: Ocean

ECMWF intends to award a single framework contract (maximum 41 months) for this Lot, with a target starting date of **1 February 2018**. The contractor for this Lot shall, in accordance with the requirements described in Section 2.1, ensure timely access to data products associated with the following ECVs:

- Sea Surface Temperature (GCOS-SR Section 5.3.1)
- Sea Level (GCOS-SR Section 5.3.3)
- Sea Ice (GCOS-SR Section 5.3.5)
- Ocean Colour (GCOS-SR Section 5.3.7)

Table 24 of GCOS-IP 2016 provides guidance on viable data products and requirements related to resolution, accuracy and stability.

2.1.4 Lot 4: Land hydrology and cryosphere

ECMWF intends to award a single framework contract (maximum 41 months) for this Lot, with a target starting date of **1 February 2018**. The contractor for this Lot shall, in accordance with the requirements described in Section 2.1, ensure timely access to data products associated with the following ECVs:

- Lakes (GCOS-SR Section 6.3.4)
- Glaciers (GCOS-SR Section 6.3.6)
- Ice Sheets and Ice Shelves (GCOS-SR Section 6.3.7)
- Soil Moisture (GCOS-SR Section 6.3.16)

Table 25 of GCOS-IP 2016 provides guidance on viable data products and requirements related to resolution, accuracy and stability.

2.1.5 Lot 5: Land biosphere

ECMWF intends to award a single framework contract (maximum 41 months) for this Lot, with a target starting date of **1 February 2018**. The contractor for this Lot shall, in accordance with the requirements described in Section 2.1, ensure timely access to data products associated with the following ECVs:

- Albedo (GCOS-SR Section 6.3.9)
- Land Cover (GCOS-SR Section 6.3.10)
- Fraction of Absorbed Photosynthetically Active Radiation (GCOS-SR Section 6.3.11)
- Leaf Area Index (GCOS-SR Section 6.3.12)
- Fire (GCOS-SR Section 6.3.15)

Table 25 of GCOS-IP 2016 provides guidance on viable data products and requirements related to resolution, accuracy and stability.

2.2 Work to be undertaken

For all Lots, the contractor shall carry out the following tasks:

- Develop product specifications with target requirements for all CDRs and ICDRs to be delivered, using GCOS requirements as a starting point, but reflecting C3S user needs, availability and timeliness of input observations, the current state of research (e.g. CCI outcomes), technical capabilities, etc.;
- Ensure that product specifications duly account for synergy and complementarity with existing capabilities in Europe;
- Implement processes and systems for product generation, brokering and data handling as needed to deliver CDRs and ICDRs to C3S users via the CDS, taking full advantage of existing capabilities where possible;
- Develop an operational strategy for delivering timely and frequent updates of ICDRs, with the shortest possible delay based on availability of input data;
- Make all necessary arrangements with input data suppliers to meet the requirements of operational production, data delivery and regular updates;
- Develop and implement well-defined operating schedules and procedures, addressing routine operation, response to system failures, input data interruptions, implementing system upgrades, reprocessing requirements, etc.;
- Plan and implement system improvements and upgrades to maintain the state of the art, e.g. incorporating improved algorithms, new data sources, etc.;
- Implement a systematic approach to ensuring the highest possible scientific quality of data products, e.g. using input data quality control, routine monitoring of data production, assessment of CDRs for continuity, accuracy and stability, etc.;
- Develop complete documentation of all aspects of the production systems, data products, quality assessments, etc.;
- Provide specialised user support for all products via the C3S Service Desk.

For all Lots, key deliverables shall be organised in work packages as described in the following sections. A separate work package (WPO) shall be defined for management and implementation activities, as described in Section 2.4 of this document.

2.2.1 WP1: Generation of data products

The objective of this work package is to implement all processes and systems needed for generating (or brokering) the CDRs and ICDRs to be delivered to the CDS.

Deliverables for this work package include the following reports:

Target Requirements Document (TRD): Defines evolving target requirements for CDRs and associated data products based on GCOS requirements and C3S user needs.

Gap Analysis Document (GAD): Describes gaps and limitations to the data fitness-for-purpose according to target requirements, and identifies opportunities and needs to improve the datasets. It addresses limitations in existing coverage, processing algorithms, methods for estimating uncertainties, and identifies scientific research needs, and opportunities for exploiting new observations, in particular from the Sentinels, etc.

Algorithm Theoretical Basis Document (ATBD): (for coherent groups of ECV products). Describes the physical and mathematical basis of algorithms and systems used to generate data products, e.g. data dependencies; use and source of auxiliary data; all aspects of data processing and quality control; calibration and bias adjustment; filtering, interpolation, transformation; uncertainty estimation, etc. It shall contain sufficient detail to be able to serve as a reference document for implementing the production systems.

The table below provides a template to be used by the contractor to describe the complete list of deliverables and delivery schedules for this work package. All deliverables shall be numbered as indicated in the table. All document deliverables shall be periodically updated and versioned as described in the table. Tenderers shall provide a preliminary version of the completed table as part of their bid.

WP1 Delivera	bles Temp	late	
#	Туре	Title	Due
D1.1.1-YYYY	Report	Target Requirements Document YYYY YYYY being the Year n	Annually in December
D1.1.2-YYYY	Report	Gap Analysis Document YYYY YYYY being the Year n	Annually in December
D1.2.1-v1		Algorithm Theoretical Basis Document Version 1 for: - ECV 1 / Product A - Version 1 - ECV 1 / Product B - Version 1	
D1.2.1-v2	Report	Algorithm Theoretical Basis Document Version 2 for: - ECV 1 / Product A - Version 2 - ECV 1 / Product B - Version 2	At each new product release (v1) and each reprocessed release (v2, v3)
D1.2.1-v			
D1.2.2-v1	Report	Algorithm Theoretical Basis Document Version 1 for: - ECV 2 / Product A - Version 1	At each new product release (v1) and each reprocessed release (v2,
D1.2.2-v2		Algorithm Theoretical Basis Document Version 2 for: - ECV 2 / Product A - Version 2	v3)
D1.2.2-v			

2.2.2 WP2: Quality assurance

The objective of this work package is to ensure the technical and scientific quality of the CDRs and ICDRs delivered to the CDS.

Deliverables for this work package include the following reports:

Product Quality Assurance Document (PQAD): (for coherent groups of ECV products). Describes the approach to product quality assurance and methods used for product validation, including the validated products and reference datasets used. May include a few cases of data validation results as an illustration if available at the time of data delivery.

Quality Assessment Report (QAR): (for coherent groups of ECV products). Describes all assessments performed on the provided datasets, including any application-specific assessments if available. Reviews the quality of the products against the data requirements, and provides recommendations on data usage.

System Quality Assurance Document (SQAD): (for coherent groups of ECV products). Provides an overview of the system elements and interfaces, including a description of the hardware, of the procedures for upgrading the production cycle for data reprocessing, and for handling system maintenance and system failures, and of the support to users.

The table below provides a template to be used by the contractor to describe the complete list of deliverables and delivery schedules for this work package. All deliverables shall be numbered as indicated in the table. All document deliverables shall be periodically updated and versioned as described in the table. Tenderers shall provide a preliminary version of the completed table as part of their bid.

WP2 Deliverables Template						
#	Туре	Title	Due			
D2.1.1-v1		Product Quality Assurance Document Version 1 for: - ECV 1 / Product A - Version 1 - ECV 1 / Product B - Version 1				
D2.1.1-v2		Product Quality Assurance Document Version 2 for: - ECV 1 / Product A - Version 1 - ECV 1 / Product B - Version 1	At each new product			
D2.1.1-v3		Product Quality Assurance Document Version 3 for: - ECV 1 / Product A - Version 2 - ECV 1 / Product B - Version 2	updates (v2, v3)			
D2.1.1-v						
D2.2.1-v1		Product Quality Assurance Document Version 1 for: - ECV 2 / Product A - Version 1				
D2.2.1-v2	Report	Product Quality Assurance Document Version 2 for: - ECV 2 / Product A - Version 1	At each new product release (v1) and annual updates (v2, v3)			
D2.2.1-v						

D2.1.2-v1		Quality Assessment Report Version 1 for: - ECV 1 / Product A - Version 1 - ECV 1 / Product B - Version 1	
D2.1.2-v2	Report	Quality Assessment Report Version 2 for: - ECV 1 / Product A - Version 1 - ECV 1 / Product B - Version 1	3 months after each new
D2.1.2-v3	heport	Quality Assessment Report Version 3 for: - ECV 1 / Product A - Version 2 - ECV 1 / Product B - Version 2	annual updates (v2, v3)
D2.1.2-v			
D2.3.1-v1		System Quality Assurance Document Version 1 for: - ECV 1 / Product A - Version 1 - ECV 1 / Product B - Version 1	
D2.3.1-v2	Report	System Quality Assurance Document Version 2 for: - ECV 1 / Product A - Version 1 - ECV 1 / Product B - Version 1	At each new product release (v1) and annual updates (v2, v3)
D2.3.1-v		System Quality Assurance Document Version 3 for: - ECV 1 / Product A - Version 2 - ECV 1 / Product B - Version 2	

2.2.3 WP3: Providing access to data

The objective of this work package is to ensure reliable and timely access to all data products via the CDS.

Deliverables for this work package include provision of data access to versioned ECV products via the CDS. Section 2.3 contains important information on data access methods supported by the CDS, use of standards, data formats, and metadata requirements.

Deliverables for this work package also include the following reports:

Product User Guide and Specification (PUGS): (for coherent groups of ECV products). Description of each data product, including a list of instruments the data product refers to, auxiliary data used in the retrieval process, and any information needed for traceability (e.g. algorithm name and version, processing level, etc.). It shall include the data specification, and any specific information and aspects to consider when using the data, including data format and file names, product content and attributes (an example of data template could be useful), quality indicator and flags, data masks and filtering (including information on gap filling strategy), any known issues, data disclaimers and/or suitability for specific sectors/applications.

The tables below provide templates to 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. Tenderers shall provide preliminary versions of the completed tables as part of their bid.

WP3 Deliverables 1	Template		
#	Туре	Title	Due
D3.1.1-YYYY	Other	For each ECV product, input for the ECV Inventory maintained by the CEOS/CGMS WG Climate - YYYY YYYY being the Year n	Month 1 Updated annually
D3.1.2-YYYY	Other	Product specification for each ECV product - YYYY <i>YYYY being the Year n</i> (Spreadsheet containing main defining characteristics of all distinct data products to be generated by the service)	Month 1 Updated annually
D3.1.3-v1		Dataset registration with ECMWF - ECV 1 / Product A - Version 1	
D3.1.3-v2	Other	Dataset registration with ECMWF - ECV 1 / Product A - Version 2	2 months prior to each new product release
D3.1.3-v			
D3.1.4-v1	Other	Dataset registration with ECMWF - ECV 2 / Product A - Version 1	2 months prior to each new product
D3.1.4-v			release
D3.2.1-v1	Data access	ECV 1 / Product A - Version 1 (Period covered by the dataset)	
D3.2.1-v2	Data access	ECV 1 / Product A - Version 2 (Period covered by the dataset)	
D3.2.1-v	Data access	ECV 1 / Product A - Version (Period covered by the dataset)	
D3.2.2-v1	Data access	ECV 1 / Product B - Version 1 (Period covered by the dataset)	
D3.2.2-v2	Data access	ECV 1 / Product B - Version 2 (Period covered by the dataset)	
D3.2.2-v	Data access	ECV 1 / Product B - Version (Period covered by the dataset)	
D3.3.1-v1	Data access	ECV 2 / Product A - Version 1 (Period covered by the dataset)	
D3.3.1-v2	Data access	ECV 2 / Product A - Version 2 (Period covered by the dataset)	
D3.3.1-v	Data access	ECV 2 / Product A - Version (Period covered by the dataset)	
D3.3.1-v1	Data access	ECV 2 / Product B - Version 1 (Period covered by the dataset)	
D3.3.1-v2	Data access	ECV 2 / Product B - Version 2 (Period	

		covered by the dataset)		
D3.3.1-v	Data access	ECV 2 / Product B - Version (Period covered by the dataset)		
D3.4.1-v1		Product Specification and User Guide Version 1 for: - ECV 1 / Product A - Version 1 - ECV 1 / Product B - Version 1		
D3.4.1-v2	Report	Product Specification and User Guide Version 2 for: - ECV 1 / Product A - Version 2 - ECV 1 / Product B - Version 2	At each new product release (v1) and annual updates (v2, v3)	
D3.4.1-v				
D3.4.2-v1		Product Specification and User Guide Version 1 for: - ECV 1 / Product C - Version 1		
D3.4.2-v2	Report	Product Specification and User Guide Version 2 for: - ECV 1 / Product C - Version 2	At each new product release (and annual updates (v2, v3)	
D3.4.2-v				
D3.4.3-v1		Product Specification and User Guide Version 1 for: - ECV 2 / Product A - Version 1 - ECV 2 / Product B - Version 1		
D3.4.3-v2	Report	Product Specification and User Guide Version 2 for: - ECV 2 / Product A - Version 2 - ECV 2 / Product B - Version 2	At each new product release (v1) and annual updates (v2, v3)	
D3.4.3-v				

WP3 Milestones Template							
#	Title Means of verification						
M3.1.3-v1	Data access - ECV 1 / Product A - Version 1		1 month before				
M3.1.3-v2	Data access - ECV 1 / Product A - Version 2	Verifiable access to the data product via the CDS	each product delivery				
M3.1.3-v							
M3.1.4-v1	Data access - ECV 2 / Product A - Version 1	Verifiable access to the data	1 month before each product				
M3.1.4-v			delivery				

2.2.4 WP4: User support

The objective of this work package is to provide specialised 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 C3S data, products, tools and services. The C3S Service Desk is used for ticketing user requests and distributing these requests to specialists as needed. Dedicated staff at ECMWF provides basic support in the form of self-help facilities (FAQs, knowledge bases, tutorials etc.) as well as individualised support on technical queries related to the CDS, data formats, data access etc. In addition, ECMWF staff provide specialised scientific support to address questions related to its industrial contributions to C3S, e.g. in the areas of global reanalysis and seasonal forecasting.

All C3S 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 C3S Service Desk facility, as well as contributions to FAQs, user guides and knowledge bases.

As part of the bid, Tenderers shall describe the level of user support service on C3S Service Desk tickets (refer to Section 2.4.1 – User Support KPIs), with sufficient flexibility to be improved depending on user requirements. Tenderers shall also address development of user guides and any other form of user support, such as video tutorials, user workshops, etc.

The tables below provide templates to 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. Tenderers shall provide preliminary versions of the completed tables as part of their bid.

WP4 Deliverables Template							
#	Nature	Title	Due				
D4.y.z	Other	Specialised user support via the C3S Service Desk (Respond to user support queries requiring expertise specific to the ECV products provided)	Continuous				
D4.y.z-v1 D4.y.z-v2		Specialised User Support - Period 1 Specialised User Support - Period 2	At Payment milestone 1 At Payment milestone 2				

WP4 Milestones Template						
#	Title	Means of verification	Due			
M4.y.z	Link with C3S User Support team established; service desk set-up completed	Specialised Service Desk up and running	Month 2			

2.3 Data access via the CDS

The CDS has been designed as a distributed system that provides access to datasets and tools through a unified web interface. A general description of the design and functionality can be found in Raoult et al. (2017).

2.3.1 Dataset registration

Dataset suppliers to the CDS shall provide a comprehensive description of their datasets at least two months prior to delivery, using a dataset registration process established by ECMWF. Details of the registration process, which serves to collect all CDS relevant information (to define metadata, user forms and necessary adaptors) will be provided to the preferred bidder during negotiation.

2.3.2 Access methods

Data access to CDRs, ICDRs, ancillary data and metadata, can be implemented in the CDS distributed infrastructure either by:

(a) **Push mode:** uploading datasets to a designated ECMWF CDS server.

ECMWF will not accept data in push mode if the initial volume exceeds 1 TB or if the annual increase in volume exceeds 0.5 TB. Upper bounds on data volume are subject to change and may be negotiable in exceptional circumstances.

(b) **Pull mode:** providing datasets via web services.

ECMWF has a strong preference for pull mode, which is consistent with the distributed architecture of the CDS and simplifies management of access, traceability and updates of an evolving data collection.

ECMWF strongly recommends use of the OPeNDAP protocol to implement pull mode. Tenderers who are not able to do so are requested to explain this in their bids.

2.3.3 Use of standards

ECMWF will only accept service protocols that follow internationally recognised standards. Such standards must be open (i.e. non-proprietary), managed by a recognised international standardization 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 data and products if they implement very simple protocols (e.g. REST), as long as the results returned by these APIs are compatible with the results of a dataset upload via push mode. It should be noted that requests for these web services will mostly originate from the CDS 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 C3S.

2.3.4 Data formats

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 standardization body (e.g. ISO, WMO, OGC, etc.), or any de-facto standard. Open source software must be available that can read and write files following these standards. Serialization 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 CDS catalogue.

ECMWF strongly recommends that datasets be encoded in NetCDF according to the recommendations described in the "ECMWF metadata recommendations for NetCDF" document, available at https://software.ecmwf.int/wiki/display/DGOV/ECMWF+Convention. Tenderers who are not able to do so are requested to explain this in their bids.

2.3.5 Data ownership

It is a condition of EU funding for C3S that ownership of any datasets developed with C3S funding passes from the suppliers to the EC, via ECMWF. Ownership will pass on delivery of the datasets. In return, the suppliers will be granted a non-exclusive licence to use the datasets which they have provided to C3S for any purpose except one which conflicts with the aims of C3S.

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 Tenderer's production system. The identity and ownership of such exceptional components will be passed to the EC via ECMWF annually, but in return the successful Tenderer will be granted a non-exclusive licence to use them for any purpose except one which conflicts with the aims of C3S.

A distinction ought to be made between those datasets (or relating documentation) specifically created as a result of this ITT, which, as Deliverables, will be fully owned by the EU. On the other hand, if pre-existing datasets (or documentation) are simply brokered / passed on to the EU, such datasets (or documentation) will continue to be owned by its original owner. The successful Tenderer will sub-licence the relevant data/documentation to ECMWF/EU or will broker a licence for ECMWF/EU directly from the owner. Wherever possible, such sub-licence/licence will allow unrestricted use and distribution of the relevant data/documentation. In such a case, ECMWF is procuring a service, rather than the datasets (or the documentation) themselves.

The proposal shall thus provide a clear distinction between both cases by setting the nature of:

- the datasets (or relating documentation) specifically created as a result of this ITT to "Dataset" or "Report",
- the datasets (or relating documentation) brokered / passed on to the EU to "Dataset provision" or "Report provision".

Please note that, in both cases, the bidder has to warrant that it has all necessary rights to either pass on ownership to the EU or, alternatively, that it has all necessary rights to sub-license ECMWF and EU. Generally, redistribution of datasets and documentation should be possible under the terms of such a license. Please refer to the Framework Agreement for details of the license required.

The source datasets of each ECV product and associated Intellectual Property Rights (IPR) shall in addition be detailed as follows in the proposal:

Deliverable number	ECV title	Product title	Version number	Source	Description of IPR on the source dataset (licensing)
				Brokered from xxx / Produced in	

		house based on datasets from xxx	

Foreseen Assets, Pre-existing Technology and Integrated Technology (as defined in Framework Agreement Clause 3) shall also be described in the proposal.

Detailed contractual terms, including terms to give effect to the arrangements described above, are set out in the terms and conditions for this ITT (Volume V of the ITT documents).

2.4 WPO: Management and Implementation

For each Lot, the Tenderer shall provide a detailed implementation plan of proposed activities for the duration of the framework contract. Deliverables should be consistent with the technical requirements specified in Section 2.

Milestones should be designed as markers of demonstrable progress in service development and/or quality of service delivery.

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.

The following management aspects shall be described in the proposal: quality assurance and control, communication management (ECMWF, stakeholders, internal communication), conflict resolution, subcontractor management, personal data management.

A list of subcontractors describing their contribution and key personnel, legal name and address shall be provided. The Tenderer shall describe how the Framework Agreement, in particular Clause 2.9 has been flowed down to all their subcontractors.

As part of the general project management description, the Tenderer shall include the following elements:

- Contractual obligations as described in the Framework Agreement Clauses 2.1, 2.3 and 2.4.
- Monthly teleconferences with ECMWF and a proposal for involvement of ECMWF in major project reviews.
- Proposal for payment milestones (linked to major project reviews/milestones).

2.4.1 Key performance indicators

Contractors shall report to ECMWF on a set of Key Performance Indicators (KPIs) suitable for monitoring various aspect of service performance, including (but not limited to):

- Data quality
- Service delivery
- Contract management
- User support

The tables below provide templates to be used by the Tenderer to describe the KPIs, together with performance targets, delivery schedules and explanations if needed. These templates reflect KPI specifications as used in current C3S contracts supplying ECV products. These specifications are subject to review by ECMWF and may be updated if necessary.

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.

Note that the KPIs for user support will be measured by the ECMWF User Support team. There is no need for the contractor to report on them. The list of KPIs shall be reviewed with ECMWF in the second year of the contract and updated if necessary.

Data quality KPI #	KPI Title	Performance Target and Unit of Measure	Frequency of Delivery	Explanations / Comments
KPI.D1.1	Accuracy ECV Product #1 In latest Quarter	According to Target Requirements (TRs)	Quarterly	TR s can evolve over time
KPI.D1.2	<i>Stability</i> ECV Product #1 In latest Quarter	According to TRs	Quarterly	
KPI.D2.1	Accuracy ECV Product #2 In latest Quarter			
KPI.D2.2				

Service delivery KPI #	KPI Title	Performance Target and Unit of Measure	Frequency of Delivery	Explanations / Comments
KPI.S1.1	CDR Product Timelines In latest quarter	Percentage (guideline 100%) delivered on time	Quarterly	
KPI.S1.2	ICDR Product Timelines Fraction delivered on time In latest Quarter	Percentage (guideline 90%) delivered on time	Quarterly	
KPI.S2	Number of QA-Checked products In latest Quarter	Percentage (guideline 95%) checked	Quarterly	Checks on completeness, reasonable values, format,
KPI.S3	Resolved Data Product Verified Problems in latest Quarter	Percentage (guideline 80%) resolved	Quarterly	Successful correction of reported production issues
KPI.S4.1	Service availability In latest Quarter	Percentage (guideline 95%) availability	Quarterly	Availability of data server
KPI.S4.2	Server download speed In latest Quarter	95% transactions exceeding 10 Mbit/s	Quarterly	
KPI.S5.1	User uptake In latest Quarter	Number of users. To large extent beyond reach contractor, but indicates popularity of data set. For information	Quarterly	Possibly stratify according to type of user (all/new/returning). Possibly directly logged by CDS

KPI.S5.2	Evolution of downloads In latest Quarter	Number of downloads; Again, to large extent beyond reach of contractor. For information.	Quarterly	
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User support KPI #	KPI Title	Performance Target and Unit of Measure	Frequency of Delivery	Explanations / Comments
KPI.U1	User Support ticket acknowledgement in latest Quarter	100% within 3 working days	Quarterly	Notification of user
KPI.U2	User Support ticket response in latest Quarter	85% within 3 working weeks	Quarterly	Resolve user issue
KPI.U3	User satisfaction in latest Quarter	90% score 3 or above	Quarterly	Provided feedback by users on voluntary basis, 1 (very unsatisfied) to 5 (very satisfied)
KPI.U4	Number of tickets in latest Quarter	For information	Quarterly	

Contract management KPI #	KPI Title	Performance Target and Unit of Measure	Frequency of Delivery	Explanations / Comments
KPI.C1	Deliverables delivered on time during last Quarter	Guideline 100%	Quarterly	
KPI.C2	Number of achieved deliverables relative to the number due so far	Guideline 100%	Quarterly	

2.4.2 Service dashboard

The Tenderer shall develop a web-based service status dashboard accessible to ECMWF to provide a quick overview of the current status of the contract and of the ECV products. The service dashboard shall be updated on a continuous basis.

The dashboard shall consist of two or three main blocks:

• Block-A shall contain two tables listing the CDR Products and all other deliverables (reports, documents...).

The tables shall show the deliverable number, nature, title, description, due date and status (e.g. delivered, approved by ECMWF). The status shall be indicated by means of "Traffic-light" colours (grey--> doesn't apply yet, green--> OK, orange-->anticipated problem, red-->not delivered on time). The status of a pending report deliverable (indicating cause, description and action plan) shall be made available in case of red or orange status.

- Block-B shall contain the KPIs as defined in Section 2.4.1.
- Block-C is optional and depends on contractor's needs (user statistics, time series, etc.).

2.4.3 Support for EQC

The C3S Evaluation and Quality Control (EQC) function has been designed to provide continuous independent assessments of the technical and scientific quality of the service and its value to users. As part of the implementation of EQC, ECMWF intends to award a separate contract for production of independent scientific assessments of ECV products derived from observations and model-based reanalyses (ITT C3S_511).

The Tenderer shall:

- Support pertinent EQC activities to a reasonable degree, by providing information and test data on request;
- Respond with best effort to outcomes and recommendations from EQC activities.

2.4.4 Cross-CDR Working Group

ECMWF has established a Cross-CDR Working Group (CWG) in order to:

- Ensure that all Tenderers are fully informed of C3S developments and requirements;
- Share information among the different Lots;
- Identify common requirements and technical specifications for ECV product generation;
- Ensure that suitable existing standards, formats and metadata are adhered to across services;
- Ensure maximum consistency among all ECV products, e.g. by using common input datasets for product generation;
- Share expertise and lessons-learnt to avoid duplication of work;
- Identify economies of scale in system implementation;
- Maintain links with CCI, e.g. its working groups on data and system harmonization;
- Maintain links with other international initiatives and activities related to CDR production.

The Service Manager of each Lot shall participate in this group and allocate resources to this critical coordination task. The group shall meet via teleconference on a monthly basis.

2.4.5 Deliverables and milestones

The tables below provide templates to 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. Tenderers shall provide preliminary versions of the completed tables as part of their bid.

Deliverables for this work package shall include the following report:

System Verification Report (SVR). Verification of PUGS compliance, description of any support provided to users, assessment of operability at the interfaces. This document shall also report any problem or issue related to Service Management aspects against the Service Specification (e.g. a problem in one element of the processing chain and/or with the service provider (ECMWF) that had consequences for the service provision), actions taken and current status.

WP0 Contractual	WP0 Contractual Obligations Template				
#	Responsible	Nature	Title	Due	
D0.y.z-YYYYQQ	Tenderer	Report	Quarterly Implementation Report QQ YYYY QQ YYYY being the previous quarter	Quarterly on 20/01, 20/04, 20/07 and 20/10	
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	60 days after end of contract	
D0.y.z-YYYY	Tenderer	Other	Preliminary financial information YYYY YYYY being the Year n-1	Annually on 15/01	
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 from auditor specific to C3S contract YYYY YYYY being the Year n-1	Annually	

WP0 Deliverables Template					
#	Nature	Title	Due		
D0.y.z	Other	Updated KPIs (list, targets) after review with ECMWF	March 2019		
D0.y.z	Other	Dashboard	Month 3		
D0.y.z	Report	Short summary report describing support to EQC activities, including response to EQC outcomes and recommendations.	At each payment milestone		
D0.y.z-YYYYQQ	Report	System Verification Report, to be included in Quarterly Implementation Report* - QQ YYYY QQ YYYY being the previous quarter *See table above	Quarterly on 20/01, 20/04, 20/07 and 20/10		

WP0 Milestones Template					
#	Responsible	Title	Means of verification	Due	
M0.y.z	Tenderer	Kick-Off meeting	Minutes of meeting	Month 1	
M0.y.z	Tenderer	Cross-CDR meetings (monthly teleconferences with ECMWF)	Minutes of meeting	Monthly	
M0.y.z	Tenderer	Progress review meetings with ECMWF / Payment milestones	Minutes of meeting	~ Every 6 months	

	Tenderer		First agreement on	
M0.v.z		Link with EQC group	information and datasets	Month 3
		established	to be provided to EQC	
			group	

3 Tender Format and Content

General guidelines for the tender are described in Volume IIIB. This section describes specific requirements to prepare the proposal for this particular tender, along with guidelines for minimum content expected to be included in the proposal, 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.

3.1 Page limits

As a guideline, it is expected that individual sections of the Tenderer's response do not exceed the page limits listed below. These are advisory limits and should be followed wherever possible, to avoid excessive or wordy responses.

Section	Page Limit
Executive Summary	2
Track Record	2 (for general) and 2 (per entity)
Quality of Resources to be	2 (excluding Table 1 in Volume IIIB and CVs with a maximum
Deployed	length of 2 pages each)
Technical Solution Proposed	20 (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	6 (excluding Table 3, Table 5 and Table 6 in Volume IIIB) + 2
Implementation	per each work package description (Table 4 in Volume IIIB)
Pricing Table	No limitation

Table 2: Page limits

3.2 Executive Summary

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

3.3 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.

3.4 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 the technical project team in performing activities related to the various aspects of this tender.

3.5 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 Additional information

4.1 References

- GCOS-SR 2015: Status of the Global Observing System for Climate. GCOS-195. Available at http://www.wmo.int/pages/prog/gcos/Publications/GCOS-195 en.pdf
- GCOS-IP 2016: GCOS Implementation Plan 2016. GCOS-200. Available at https://library.wmo.int/opac/doc_num.php?explnum_id=3417
- Bojinski, S., M. Verstraete, T.C. Peterson, C. Richter, A. Simmons, M. Zemp, 2014: The Concept of Essential Climate Variables in Support of Climate Research, Applications, and Policy. Bull. Amer. Meteor. Soc., 95, 1431–1443. Available at http://journals.ametsoc.org/doi/pdf/10.1175/BAMS-D-13-00047.1
- Raoult, B., C. Bergeron, A. López Alós, J-N. Thépaut, D. Dee, 2017: Climate service develops userfriendly data store. ECMWF Newsletter No. 151, 22-27. Available at <u>https://www.ecmwf.int/sites/default/files/elibrary/2017/17181-newsletter-no-151-spring-2017.pdf</u>

4.2 Acronyms

API	Application Programming Interface
CAMS	Copernicus Atmosphere Monitoring Service
CCI	Climate Change Initiative
CDR	Climate Data Record
CDS	Climate Data Store
CLMS	Copernicus Land Monitoring Service
CMEMS	Copernicus Marine Environment Monitoring Service
C3S	Copernicus Climate Change Service
ECMWF	European Centre for Medium-Range Weather Forecasts
ECV	Essential Climate Variable
EQC	Evaluation & Quality Control
ESA	European Space Agency
EU	European Union
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
FAQ	Frequently Asked Questions
GFCS	Global Framework for Climate Services
GCOS	Global Climate Observing System

GCOS-IP	GCOS Implementation Plan
GCOS-SR	GCOS Status Report
GRIB	General Regularly-distributed Information in Binary form
ICDR	Interim Climate Data Record
ISO	International Organization for Standardization
ITT	Invitation to tender
JSON	JavaScript Object Notation
KPI	Key Performance Indicator
NetCDF	Network Common Data Form
NetCDF CF	NetCDF Climate and Forecast metadata conventions
NOAA	National Oceanic and Atmospheric Administration
OGC	Open Geospatial Consortium
OGC WFS	OGC Web Feature Service Interface Standard
OGC WMS	OGC Web Map Services Interface Standard
OGC WPS	OGC Web Processing Service Interface Standard
OpenDAP	Open Source Project for a Network Data Access Protocol
PDF	Portable Document Format
SAF	Satellite Application Facility
UTF-8	Unicode Transformation Format using 8-bit blocks
WCF	Windows Communication Foundation
WMO	World Meteorological Organisation
REST	Representational State Transfer
XML	Extensible Markup Language