ECMWF Copernicus Procurement

Invitation to Tender

Copernicus Climate Change Service

Volume II

Climate Data Store (CDS) maintenance and usability

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Table of Contents

Table of figures

1   Introduction

The European Commission (EU) has entrusted ECMWF with the implementation of the Copernicus Climate Change Service (C3S). The C3S shall provide information to increase the knowledge base to support adaptation and mitigation policies. It, in particular, contributes to the provision of Essential Climate Variables (ECVs), climate analyses, projections and indicators at temporal and spatial scales relevant to adaptation and mitigation strategies for various sectoral and societal benefit areas.

The C3S service uses state of the art data analysis tools to generate the reference applications required to analyse, monitor and predict the patterns of both the climate drivers and impacts. The service accommodates the needs of a highly diverse set of users including experts, scientists and policy makers.

The Climate Data Store (CDS) constitutes one of the main building blocks of the C3S and is at the heart of the C3S infrastructure. It provides improved access to information about past, present and future climate in terms of ECVs and derived climate indicators. The CDS is designed as a distributed system brokering information from existing databases in Europe and elsewhere. It offers a one-stop shop with a documented catalogue of many datasets and products, including:

- observation collections (processed and reprocessed);
- observation gridded products;
- global and regional climate reanalyses;
- seasonal forecasts;
- global and regional climate projections.

The CDS also provides a set of generic software (the **Toolbox**) that allows the users to develop applications that make use of the data content of the CDS.

Implementation of the CDS, which is based on a **Service-Oriented Architecture**, has been realised in two 'service contracts':

- C3S_23a - **Software Infrastructure for the Climate Data Store (CDS);** which was responsible for the development and the implementation of the CDS infrastructure (see Figure 1).
- C3S_25 - **Software Development for the Climate Data Store (CDS) Toolbox;** which was responsible for the development and the implementation of a set of generic tools, workflows and applications within the CDS infrastructure itself.

The CDS was launched and made accessible to the public **on 14th of June 2018**. Nine months after, the CDS is used by almost 10000 registered users. The service is being constantly improved by adding new tools in the Toolbox and new datasets in the CDS catalogue.

> **The tenderer is invited to explore the operational Climate Data Store and to use its Toolbox for a better understanding of its current features. To access the Climate Data Store, please use the following address: cds.climate.copernicus.eu**

> **The current ITT is dedicated to the improvement of the Climate Data Store and its Toolbox service to users. It is structured in several work packages which are described in detail in the sections below.**

1.1   Definitions

In this document the following definitions shall apply for the purpose of this ITT. Where there is a difference between the definitions below and the definitions in Volume I of the ITT documents (Instructions and Conditions), the definitions below shall take precedence.

Name	Definitions
API	An acronym for Application Programming Interface
Application	An interactive web page that displays maps, graphs and/or textual information that are the results of computations performed on the data and products of the Climate Data Store
Broker	A middleware software component which will schedule and forward requests from the web portal to remote repositories
CDS	An acronym for Climate Data Store
CDM	An acronym for Common Data Model
Data	The raw data collected
Data Repository	A generic name for a system that holds data and/or products. This can be a database, a collection of files, etc.
Data Supplier	An organisation that make its data and products available through the Climate Data Store
Developer	The type of CDS users adding tools to the CDS Toolbox framework
EQC	An acronym for Evaluation & Quality Control
ESGF	An acronym for Earth System Grid Federation
Expert	The type of CDS Toolbox users writing CDS Toolbox workflows to build applications
Metadata	Ancillary information about the data
Product	A derived, valued added piece of information, usually generated from raw data
Product Catalogue	A list of available products
Proof of Concept	The realization of a certain method or idea to demonstrate its feasibility or a demonstration in principle, whose purpose is to verify that some concept or theory has the potential of being used
QoS	An acronym for Quality of Service
SOA	An acronym for Service-Oriented Architecture
Tool	A software that performs computations on some input data or products and produces some output data or products
Toolbox	The set of available tools, workflows and applications within the CDS
URL	An acronym for Uniform Resource Locator
Users	The internal and external Users of the C3S infrastructure
UX	An acronym for User experience
Web portal	The web page to the CDS portal that enables the users to view information, access/perform tasks on the Product Catalogue, Toolbox and CMS
Workflow	A series of invocations of software tools whereby the output of the preceding tool becomes the input for the one which follows it until the required processing chain is completed

1.2   The Climate Data Store and its Toolbox

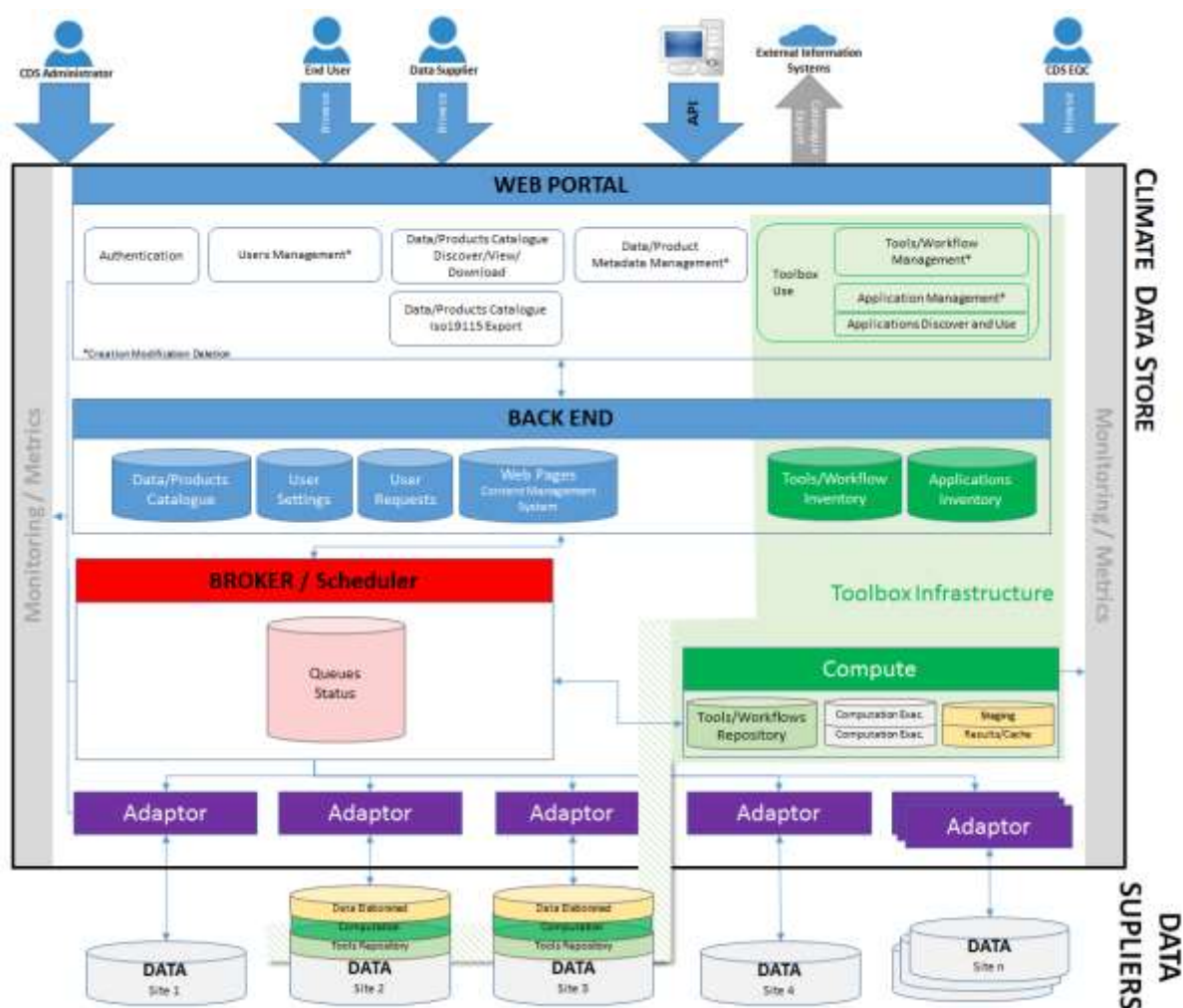The functional view of the CDS infrastructure can be illustrated as following:

Figure 1: The CDS Infrastructure (see also https://www.ecmwf.int/en/newsletter/151/meteorology/climate-service-develops-user-friendly-data-store)

The aim of this infrastructure is to provide a single point of entry for users to discover and manipulate the data and products which are provided through the distributed data repositories in the CDS. It also provides the required environment to manage users, catalogues and the Toolbox.

As shown on the figure above, the CDS infrastructure consists of:

- a **distributed data store** built upon the infrastructure available at the data suppliers;
- a **web portal** to allow the users to browse and search for data and products of the CDS, perform data retrievals and invoke tools from the toolbox;
- a **brokering software** that schedules and forwards data and compute requests, and guarantees quality of service;
- a centralised **catalogue** that describes the data and products of the CDS;
- a **back-end** that holds the databases to support the portal service: a content management system (CMS), a data and product catalogue, a toolbox catalogue and status of requests;
- a **Toolbox** infrastructure (highlighted in green in Figure 1) that contains software components to enable computations on the datasets and products of the CDS:

- o   a dedicated section of the web portal called the Toolbox editor that invokes/manages tools, workflows and applications on the data and products;
- o   a number of back-end catalogues that describe the tools, workflows and applications;
- o   a compute layer that performs computations on a combination of data and products retrieved from several remote data repositories. This compute layer is part of the CDS and the computations are done in that layer when they cannot be performed at the data location.

The Toolbox concept and infrastructure is described in more details in the next section.

- A **REST API** that allows remote access to the CDS functionality, such as data and product retrieval and invocation of the Toolbox.

The CDS includes functionality to export the product catalogue to ISO-19115 compliant metadata records, which ensures interoperability with external systems such as the World Meteorological Organization Information System (WIS) and the Global Earth Observation System of Systems (GEOSS).

Figure 2: The CDS portal

The CDS Toolbox:

The CDS Toolbox is a platform that can be used by developers to create web-based applications that use the datasets and products available in the CDS catalogue. These applications can subsequently be made available to end-users. Users are given some control over the applications by interacting with web form elements. For instance, this could enable selection of a range of dates or a geographical area of interest, which are then used to parameterise the application.

All computations are executed within the CDS infrastructure in a distributed, service-oriented architecture (SOA). The data used by the applications does not leave the CDS, and only the results are made available to the users. These results are typically in the form of tables, maps and graphs on the CDS data portal. Users may also be offered the ability to download these results to their local system.

The CDS contains a wide variety of climate datasets, such as reanalyses, seasonal forecasts, climate projections, observations, etc. These datasets are distributed and located at many data suppliers and

are accessible via adaptors using a range of protocols such as bespoke REST APIs, OpenDAP or OGC WPS.

Datasets are encoded in files using various formats, such as WMO GRIB or NetCDF-CF, or they may be stored in relational SQL databases. The data types range from single point observations or time series at a given location, to multi-dimensional global fields.

The variety of data types, formats and structures make their combined use highly challenging. The aim of the Toolbox is to provide a set of high-level utilities that allow developers to implement applications without the need to know about the specifics of the different data encodings used.

The Toolbox also hides the physical location of the datasets, their access methods, formats, units, etc. from those who are developing the applications. Developers are presented with an abstract view of the data based on the Toolbox Common Data Model (CDM), which is capable of representing all the datasets available in the CDS.

The Toolbox also provides a series of tools to perform basic operations on the datasets, such as averaging, calculating differences, sub-setting, etc. For performances reasons, some tools are specialised for certain datasets (e.g. sub-setting GRIB data and sub-setting NetCDF-CF data) and may be executed next to the data. This aspect is also hidden from the application developer, who is only provided with a single view of a tool (e.g. only one sub-setting operation can be selected). All tools are registered in a database and documented within the CDS.

Application developers can create workflows using Python and the tools and datasets available to them on the CDS (see Figure 3). They can associate the workflow with a web page containing input widgets (check boxes, drop down menus, etc.) used to parameterise the workflow, as well as output elements (tables, maps or graphs, etc.) generated by the parameterised workflow when it is executed (see Figure 4). The output elements are then dynamically updated as end-users interact with the widgets.

Figure 3: The CDS Toolbox editor. From this interface, users can edit and write workflows and applications. They can also access examples and documentation.
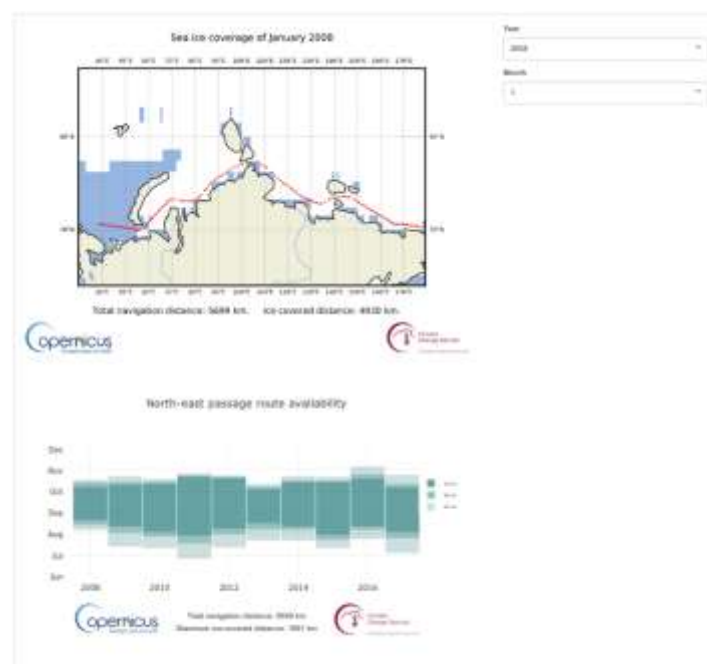
Figure 4: Example of a CDS Toolbox application: Overview of the arctic route availability. The dotted red line represents the standard north-east passage route. The white region is the average ice coverage for the selected month and year. The bar plot depicts the time window during which the standard north-east passage route is considered navigable. Different shades of green correspond to different route availability thresholds, i.e. the ratio between the ice-covered distance and total navigation distance.

2   Scope of the contract

2.1   Goals

The main goal of this ITT is to ensure that the services offered by the CDS will continue to improve and meet the users' needs and expectations. To achieve this, the successful Tenderer shall:

- Improve and maintain the current CDS Toolbox;
- Enhance the CDS Toolbox experience (UX, design, documentation for the Toolbox editor and the generated applications);
- Develop a set of CDS Toolbox applications for non-expert users;
- Maintain and consolidate the CDS infrastructure.

These actions drive the work packages content required in this ITT

2.2   Work Packages

The Tenderer is expected to complete the following work packages:

Work package 0: Contract management

This work package shall focus on contract management, including internal controls and coordination of subcontractors, risk management and tracking of the key performance indicators. Updates of the progress on contract implementation, planning, controls and key performance indicators shall be provided by the successful Tenderer via the deliverables as indicated below. The Tenderer shall provide a short description of the key elements to be taken into consideration and provide a risk and mitigation plan.

If relevant, a list of sub-contractors 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 flowed down to all their sub-contractors.

The expected schedule of review and progress meetings is attached to the work packages delivery. A proposed payment plan shall be provided as part of the proposal. The payment plan shall be based on milestones completion and associated deliverables.

The table below provides the template to be used by the contractor to describe the minimum 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 table. Tenderers shall provide preliminary versions of the completed tables as part of their bid.

Deliverables for this work package shall include the following reports:

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 15/01, 15/04, 15/07 and 15/10
D0.y.z-YYYY	Tenderer	Report	Annual Implementation Report YYYY *YYYY being the Year n-1*	Annually on 28/02
D0.y.z	Tenderer	Report	Final report	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

Work package 1: Climate Data Store Toolbox maintenance and improvement

Objective:

The purpose of this work package is to maintain and improve the Climate Data Store Toolbox to ensure that it continues to meet user requirements.

Description of work:

- ➢ Perform CDS Toolbox **adaptive** maintenance by modifying it to cope with changes in the CDS software environment (software component versions upgrades);
- ➢ Deliver CDS Toolbox **perfective** maintenance by implementing new requirements which concern functional enhancements. It may also concern the performance enhancement;
- ➢ Perform CDS Toolbox **corrective** maintenance by diagnosing and fixing errors;

- ➢ Deliver CDS Toolbox **preventive** maintenance by increasing its robustness, performance and reliability (i.e. prevent issues in the future).
- ➢ Participate to CDS Toolbox training if needed.

Among the *functional* improvements (perfective maintenance) required for the current CDS Toolbox, the following items are included (but not limited to):

- Implementation of new tools, especially the tools family on diagnostics and performance metrics for the evaluation of Earth System Models;
- Extension and improvement of the front-end application framework to accommodate complex user interface needs;
- Exploration and implementation of capability to run the CDS Toolbox offline;
- Implementation of the CDS Toolbox provenance tracking mechanisms;
- Exploration and implementation of capability for users to upload their data to be used in a workflow;
- Support for CDS API improvements to the interface to the CDS Toolbox;
- Implementation of a capability for sharing workflows among users;
- Exploration and implementation of scheduling in the CDS Toolbox (user dashboards creation).

Among the *technical* improvements (perfective, corrective and preventive maintenance) required for the current CDS Toolbox, the following items are included (but not limited to):

- Implementation of performance monitoring using the CDS ECMWF dashboard;
- Enhancement of performance in the workflow executions;
- Support for CDS infrastructure consolidation and harmonisation (i.e. centralisation of CDS Toolbox knowledge databases, etc.).

> **Necessary Toolbox improvements may also be informed by new user requirements (as conveyed by other C3S contractors involved in Evaluation and Quality Control). In that case, and in accordance with the ECMWF product owner, the contractor will have to cater to these and be flexible to update their priorities and their roadmap.**

Minimum expected deliverables:

- Monthly progress briefs, including efforts provided, states of completion and clear updates of roadmaps;
- Quarterly face-to-face meeting at ECWMF premises;
- Continuous codes delivery (task-based) in the ECMWF/C3S repositories;
- Related CDS Toolbox documentation.

Date of delivery:

The developments shall be planned according to priorities as agreed with ECMWF. The majority of developments will be requested for implementation by June 2020, remaining ones shall be implemented at the latest by the end of **June 2021**.

Expected workload:

The successful Tenderer shall provide a **minimum** of **two** Full Time Equivalent developers the first year, followed by **one** Full Time Equivalent developer the second year.

Requirements:

The Tenderer shall:

- Have solid knowledge in:
  - Service Oriented Architectures;
  - Geospatial data handling within a Linux and Python environment;
  - Advanced Python;
  - Data structures and algorithms;
  - netCDF and GRIB formats.
- Have an adequate understanding of the CDS Infrastructure and the CDS Toolbox concepts.
- Work with the C3S CDS Toolbox product owner and the CDS Infrastructure developers to define the needed improvements of the system and their priorities. To this end, face-to-face meetings shall be held on ECMWF premises on a monthly basis and teleconferences on a weekly basis;
- The use of a Kanban methodology for this work package is strongly recommended. The Kanban team, which will include the CDS Toolbox product owner, will only focus on the work that is actively in progress. Once the team completes a work item, they take the next work item off the top of the backlog. The cycle time will be the amount of time it takes for a unit of work to go through the team's workflow. The CDS Toolbox product owner will be free to re-prioritize work at any time without disrupting the team;
- Deliver and manage the developed code via the ECMWF/C3S repositories.

Work package 2: Climate Data Store Toolbox user experience enhancement

Objective:

The purpose of this work package is to improve the overall user experience related to the CDS Toolbox as well as the user experience related to the CDS Toolbox public applications.

Description of work:

- Analyse and evaluate the end-user's interaction with the CDS Toolbox editor;
- Analyse and evaluate the end-user's interaction with the public CDS Toolbox applications;
- Illustrate design ideas using storyboards, process flows and sitemaps;
- Design graphic user interface elements, such as menus, tabs and widgets;
- Define and deliver an actionable list of tweaks and enhancements (specifications) that, once implemented, will result in measurable improvements to the CDS user experience. The enhancement may be related to the CDS Toolbox editor and public applications, as well as look and feel. The specifications delivered will constitute an input to the CDS Toolbox developers (Work package 1).

Minimum expected deliverables:

- UX reports related to the CDS Toolbox editor assessment;
- UX reports related to the CDS Toolbox public applications. It is anticipated to have about forty public applications in the CDS;
- Specifications document suitable for use by the CDS Toolbox developers (Work package 1);
- Weekly progress briefs, including efforts provided, states of completion and clear updates of roadmaps;
- A minimum of two meetings on ECMWF premises.

Date of delivery:

This work package shall complete within 6 months from the beginning of the contract. The deliverables are expected to be requested by **January 2020**.

Requirements:

The Tenderer shall have a proven work experience as a UI/UX Designer and demonstrate a portfolio of design projects.

Work package 3: Climate Data Store Toolbox documentation

Objective:

The purpose of this work package is to improve the CDS Toolbox documentation in order to improve user understanding, taking into account specific user requirements. Currently, CDS Toolbox documentation is rudimentary and can only be accessed via the CDS Toolbox editor. A high-level strategy for an improved documentation system shall be defined and high-quality Toolbox documentation shall be produced.

Description of work:

- ➢ Deliver a strategy to improve the CDS Toolbox documentation. This strategy shall be extendable to the overall CDS documentation.
    - o The CDS Toolbox documentation shall be easy-to-search, easy-to-browse and easy-to-support/extend;
    - o The CDS Toolbox documentation shall be learning-oriented (Tutorials);
    - o The CDS Toolbox documentation shall be problem solving-oriented (How-to guides);
    - o The CDS Toolbox documentation shall be information-oriented (Galleries, References);
- ➢ Produce CDS Toolbox documentation in accordance with the defined strategy, describing how to use the tools available in the CDS Toolbox and how to use the public applications.

Minimum expected deliverables:

- Strategy document and implementation roadmap;
- Continuous updates of CDS Toolbox documentation (including CDS Toolbox editor, CDS Toolbox tools, CDS Toolbox applications) in the ECMWF/C3S repositories;
- Monthly progress briefs, including efforts provided, states of completion and clear updates of roadmaps;
- Quarterly face-to-face meetings on ECWMF premises.

Date of delivery:

The documentation shall be continuously delivered to the CDS Toolbox end-users, once ready and formally accepted by ECMWF. The deliverables shall be requested by **June 2020**.

Expected workload:

The successful Tenderer shall provide a **minimum** of **one** Full Time Equivalent person.

Requirements:

The Tenderer shall have proven experience in technical content writing.

Necessary improvements in documentation may also be informed by new user requirements (as conveyed by other C3S contractors involved in Evaluation and Quality Control). In that case, and in accordance with the ECMWF product owners, the contractor will have to cater these and be flexible to update their priorities and their roadmap.

Work package 4: Climate Data Store Toolbox applications aimed at mass media and general public

Objective:

The purpose of this work package is to develop new CDS Toolbox applications for non-expert users targeted for use by the media and general public. The applications to be developed shall include (but not be limited to) applications that can support C3S climate change assessments (i.e. the annual European State of Climate (https://climate.copernicus.eu/CopernicusESC) and the monthly climate bulletins (https://climate.copernicus.eu/climate-bulletins)).

Description of work:

➢ Specify a set of CDS Toolbox applications to support climate change assessments, including (but not limited to) the assessments routinely conducted by C3S. The target audience shall be the general public (i.e. non-expert users) and the underlying datasets will be provided by the CDS.

The applications must be visually appealing and easy-to-use.

➢ Deliver and implement the specified CDS Toolbox applications. The workflow should be easily expanded to different Essential Climate Variables.

Minimum expected deliverables:

- List and description of the CDS Toolbox applications to be developed;
- Related CDS Toolbox applications;
- Continuous codes delivery in the CDS Toolbox.
- Weekly progress briefs, including efforts provided, states of completion and clear updates of roadmaps;
- Bimonthly face-to-face meeting on ECMWF premises;

Date of delivery:

The CDS Toolbox applications shall be delivered to the CDS Toolbox end-users, once ready and formally accepted by ECMWF. The deliverables are expected to be submitted between the start of the contract and **June 2020**.

Expected workload:

The successful Tenderer shall provide a **minimum** of **two** Full Time Equivalent application developers.

Requirements:

The Tenderer shall have proven work experience as a Python developer with a focus on visualisation of scientific datasets. Experience working with climate data used to assess climate change is a distinct advantage.

Work package 5: Climate Data Store infrastructure maintenance and consolidation

Objective:

The improvement of the CDS is a continuous and necessary process to meet the user requirements. The CDS infrastructure provides a real-time operational platform on which the CDS Toolbox and the data access relies on. Therefore, robustness and performance are key features.

Description of work:

➢ Perform CDS **adaptive** maintenance by modifying it to cope with changes in the CDS software environment (software component versions upgrades);
➢ Perform CDS **corrective** maintenance by diagnosing and fixing errors.
➢ Improve the CDS framework;
➢ Consolidate and harmonise the code. A non-negligible part of the code contains "dead" code which should be cleaned up. Also, two different ecosystems co-exist in the system (Java and Python). Some refactoring shall be undertaken to harmonise the CDS software stack. Finally, as the CDS infrastructure is a sustainable system, any technical debts detected should be discussed and mitigated;
➢ Rationalise the deployment. The deployment should be made from the ECMWF/C3S repositories respecting the best practices per programming language ecosystems;

Minimum expected deliverables:

• Monthly progress briefs, including efforts provided, states of completion and clear updates of roadmaps;
• Every two months face-to-face meeting at ECWMF premises;
• Continuous codes delivery (task-based) in the ECMWF/C3S repositories;
• Related CDS documentation.

Date of delivery:

The developments shall be planned according to priorities as agreed with ECMWF. The majority of developments will be requested for implementation by June 2020, remaining ones shall be implemented at the latest by the end of **June 2021**.

Expected workload:

The successful Tenderer shall provide a **minimum** of **one** Full Time Equivalent developer.

Requirements:

The successful Tenderer shall:

• Have the following skills:
  o a strong knowledge of the CDS infrastructure programming languages used (i.e. Java, Python for the back-end, Angular and Drupal for the front-end)
  o an adequate knowledge of the CDS architecture and internal mechanisms
  o an additional experience of the CDS usage would be a distinctive advantage
• Work with the C3S CDS product owner and the ECMWF CDS team to define the needed improvement of the system and the relevant priorities, in order to meet the user requirements related to the CDS. Regular meetings shall be held in ECMWF during the contract (every two months) and weekly teleconference shall be organised;
• Use a Kanban methodology for this work package. The Kanban team, which will include the CDS product owner, will only focus on the work that is actively in progress. Once the team completes a work item, they take the next work item off the top of the backlog. The cycle time will be the amount of time it takes for a unit of work to travel through the team's workflow. The CDS product owner will be free to re-prioritize work at any time without disrupting the team.

Throughout the development and implementation process, the successful Tenderer is required to work closely with the ECMWF CDS Team for each of the work packages

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2.3   CDS features

2.3.1   Programming Languages

The programming languages used in the CDS are derived from the two technical ecosystems that initiated the CDS implementation: Java and Python for the back-end and React.js and Angular.js for the front-end JavaScript frameworks.

The CDS Toolbox is based on a Python framework, whereas the main CDS infrastructure components are Java based.

The programming language used to write the actual workflow in the CDS Toolbox editor is Python.

Most of the CDS Toolbox tools are scripts or executables (Unix/Linux) developed in Python and possibly R. As described previously in the document, the tools are intended to be called as services. Therefore, existing tools may have to be wrapped into a thin software layer:

- to ensure interoperability with the CDS broker
- to comply with the Common Data Model of the CDS

The programming language used for the workflow is preferably a standard scripting language such as Python or R.

Open Source Software:

If a software component is needed, the Tenderer shall propose software solutions which it considers to be the most practical and cost effective for ECMWF's intended use. ECMWF expects the Tenderer to propose open source software, whenever it is available and can provide or contribute to a practical solution. A considerable amount of open source software exists, which the Tenderer shall consider as opportunities for use.

As part of the proposal for each work package, the Tenderer must provide a list of:

- all Open Source software considered;
- all Open Source software proposed for use;
- all components being developed;
- all programming languages that will be used;
- any proprietary or non-Open Source item that may be used.

If a proposed solution would require the modification of Open Source software, the successful Tenderer will first inform and consult with ECMWF about the permissions or restrictions imposed by the relevant open source licence and the risk that the modified software will become obsolete and unsupported over time. Although ECMWF would prefer a solution based on Open Source software, it is possible to make use of commercial software. In this case, the cost of said software, and any associated support costs, must be taken into account when costing the overall solution.

2.3.2   CDS Catalogue

In order for the Tenderer to discover the content of the CDS catalogue, the following link can be used: https://cds.climate.copernicus.eu/

2.3.3 Common Data Model (CDM)

> **In order for the Tenderer to discover the common data model, the following link can be used:**
> **https://confluence.ecmwf.int//display/COPSRV/CDM%3A+Common+data+model+specification+-+v1.0**

2.3.4 Support

The Tenderer must propose their warranty agreement in respect of all software developed under this tender. As a minimum, a one-year warranty is required to apply from acceptance.

The Tenderer must provide information about the support services they would provide for software after it has been developed, tested and commissioned. ECMWF is expecting on-call support during ordinary working hours (Monday to Friday, 9am to 5 pm UK local time), for one year after acceptance, as a minimum.

2.4 Contract timeline

The Tenderer must provide as part of the proposal a detailed schedule of the activities to be carried out within the contract including proposed reviews, milestones, and validation and verification points.

The expected end-dates and anticipated workload are attached to each of the work packages description.

> **The Tenderer is required to describe in the proposal any dependencies that will need to be managed and controlled in the development process.**

3 Contract Delivery Methodology

3.1 Contract delivery methodology

Given the developmental nature of this contract, ECMWF anticipates that the adoption of an iterative and incremental approach (including prototyping) will be needed to ensure its successful delivery. This would typically involve a design framework comprising of:

- requirements gathering;
- prototyping;
- visual designs;
- functionality.

As mentioned in the work package descriptions, the Kanban approach is strongly recommended but ECMWF welcomes suggestions from the Tenderer on what methodology they propose to apply for the support and any software development based on their knowledge and experience with software projects of a similar nature. They must provide examples of how they applied this approach in similar contracts they have previously worked on. The development methodology proposed by the Tenderer must ensure that the final delivery is fit for purpose and remains within the contract cost and schedule.

3.2 Tasks to be performed

The successful Tenderer is required to:

- Implement the work packages described in this ITT;
- Deliver related WP deliveries following the CDS processes and requirements;

- Deliver all required documentation (in English);
- Carry out training of ECMWF personnel if required (transfer of knowledge).

3.3   Development team

3.3.1   Tenderer contract team

The Tenderer will appoint a Service Manager, responsible for the delivery of the contract, to oversee the progress of this contract.

The Tenderer must outline the contract team. The outline must contain the following:

- relevant experience of key staff and management personnel;
- names of service manager and developers and number of work hours dedicated to the contract team for the duration of the contract;
- the Tenderer must state if there are any sub-contractors, and define their roles;
- an indication of how many staff will be part of the contract team and at what level.

The successful Tenderer's contract team is expected to work very closely with ECMWF team for the duration of the contract.

3.3.2   ECMWF contract team

ECMWF will appoint a Product Owner and a technical lead to oversee the development of this contract. The Product Owner will be the point of contact for the successful Tenderer. The Product Owner will:

- monitor the successful Tenderer's work execution;
- review the successful Tenderer's specifications and architectures to ensure that they are "fit for purpose";
- be the focal point to provide the successful Tenderer with the ECMWF inputs required at each stage;
- validate and prioritise the requirements list;
- set customer priorities;
- be the focal point to support the incremental testing of each iterative phase;
- sign off key milestones and deliverables.

The ECMWF team will attend meetings as deemed necessary for the monitoring of the successful Tenderer's activities, and will be granted unrestricted access by prior agreement to the successful Tenderer's facilities where the work is being carried out.

Weekly progress teleconferences will be held with the ECMWF teams.

4   Tender Format and Content

General guidelines for the Tender are described in Volume III. Specific requirements for this particular ITT 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.

Table 1 Page limits per section

Section	Page Limit
Executive Summary	2
Track Record	2 (for general) and 2 per entity
Quality of Resources Applied	2 (excl. Table 1 in Volume IIIB and CV's with a maximum length of 2 pages each)
Technical Solution Proposed	30 pages in total for the technical solution and Work Packages (Table 2 in Volume IIIB, the section on reference, publications, patents and any pre-existing IPR are excluded from the page limit and have no page limit)
Management and Implementation	10 (excl. Table 4 and Table 5 in Volume IIIB) + 2 per each Work package template (Table 3 in Volume IIIB)
Pricing table	No limitation

4.2   Specific additional instructions for the Tender

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 III. 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 the availability of expertise as required for the implementation of the services in line with the work package descriptions.

The Tenderer shall demonstrate for itself, and for any proposed subcontractors that they have participated in national or international research and private sector software development projects in the last 5 years for the activities for which this Tender is proposed. 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 Applied

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

- A Service Manager with more than 5 years of experience in managing activities related to an ITT of this size, with experience in the appropriate delivery methodology proposed in Section 3;
- A technical project team with more than 5 years of experience on performing activities related to the various aspects of this ITT.

The CVs, proven track record and certification of key individuals is required, including a brief description of the role these individuals will play in the contract.

4.2.4   Technical Solution Proposed

The Tenderer is expected to provide a short background to their proposed solution to demonstrate their understanding.

An exhaustive and detailed description of the proposed solution for all work packages described in Section 2, should be given.

The Tenderer should include in this section any other third party suppliers that will be used as part of this solution.

The Tenderer should include a statement of compliance for each requirement formulated throughout this document (including those from section 3 above), describing how the proposed solution maps to the requirement. This statement can be provided in the form of a summary compliance table.

4.2.5   Management and Implementation Plan

The Tenderer shall provide a detailed implementation plan for the proposed solution broken down per work package using the table in Volume IIIB as a template. The Tenderer shall provide a table for each work package describing the main objectives, proposed activities and set of deliverables and milestones.

A detailed breakdown of the following is required:

- the design and development methodology proposed;
- staff resources per work package;
- budget breakdown for each staff member;
- overhead costs to be incurred.