ECMWF Copernicus Procurement

Invitation to Tender



Copernicus Climate Change Service

Volume II

Prototype service for decadal climate predictions

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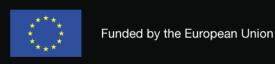




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1 Introduction

ECMWF, as the Entrusted Entity for the Copernicus Climate Change Service (C3S), invites tenders for the development of a prototype service for climate predictions targeting the time horizon of years to decades ahead. C3S currently includes operational predictions for seasonal timescales, as well as infrastructure for accessing climate projections for centennial timescales.

This initiative is driven by requirements from a variety of users of the Copernicus services and encouraged by the recent expansion in quasi-operational activities on decadal climate prediction.

The goal for this tender is to develop the precursor for a decadal prediction service targeting the time horizon when climate variability and anthropogenic climate change are expected to have comparable magnitude, and thus both need to be carefully considered and combined in creating outlooks of relevance to users. The work in this tender will demonstrate capability and applicability of predictive information on such timescales and complement related activities underway in the research community.

2 Background

The purpose of this section is to describe the context of this tender, including the setup of C3S and the outcomes of past activities related to the topic.

2.1 The components of C3S: Climate Data Store, Toolbox and Sectoral Information System

The Copernicus Climate Change Service is designed around a cloud-based Climate Data Store (CDS) that provides users with a single point of access to quality-assured data on climate. The datasets may be physically located at various data centres around the world, or they may be distributed on cloud-based platforms, but this is transparent to users of the CDS. All data are open and free and can be used by anyone for any purpose. (For more details on the CDS, see https://www.ecmwf.int/en/newsletter/151/meteorology/climate-service-develops-user-friendly-data-store. The user interface of the CDS is accessible at https://cds.climate.copernicus.eu.)

To facilitate the transformation of data into tailored information products, the CDS features a toolbox (CDS Toolbox) for creating workflows and applications on-line. The CDS Toolbox provides users with the ability to create interactive web applications tailored to their needs, using C3S datasets. The Toolbox contains a variety of software tools for combining CDS datasets and performing basic operations on the data, including functions for interpolation and re-gridding, simple statistical calculations and visualisation. The climate data contained in the CDS is further tailored to requirements of users from a variety or socio-economic sectors, in the service's Sectoral Information System (SIS).

The content of the CDS spans timescales from past, present to future, and consist of observations, reanalyses, predictions and climate projections. The current tender is a first step towards addition of initialised predictions covering years to decades into the future.

2.2 The scoping of the decadal service prototype

To identify the necessary elements of a decadal prediction service and priorities for implementation, in February 2019 C3S held a workshop on scoping a prototype for a service targeting decadal climate timescales. Based on the recommendations of the workshop, C3S has identified the following priorities:

- robust definition and adoption of methods for post-processing of forecast data and evaluation
 of derived products. While the scientific community has made steps towards understanding
 the complexity of these topics, application of such methods to real user applications has been
 at best limited to date;
- case studies/demonstrators to articulate the benefits of such predictive information to realusers' decision making;
- progress on the technical infrastructure required by ensemble climate predictions. This
 includes the definition and adoption of standards for encoding such data, compatible with the
 currently established practices in the climate science community;
- production of real-time forecasts for 5-10-20 years ahead, and that of associated retrospective forecasts (here referred to as 'hindcasts').

Addressing these high-priority areas is at the core of this invitation to tender, the technical details of which are described in the next section.

3 Technical requirements

ECMWF intends to award a contract for developing or improving elements of infrastructure necessary for a decadal prediction service, based on the C3S principles (of free accessibility to robust, credible, quality-controlled data and information). This includes methodology, technical infrastructure, tools and demonstrators of applicability to user decisions.

An important step in addressing the requirement is a demonstration of how predictive information for a few years to tens of years into the future could be derived, made relevant and put to use by the user community. With real users, and their decisions in mind, data from initialised decadal predictions should be analysed to determine the best way of extracting predictive information from data from model simulations, as well as to understand the skill, reliability, and other relevant attributes of such predictive information. This will be done in the context of case studies of end-to-end demonstrators, from data production, through analysis, to user-relevant applications.

3.1 Areas of work

The tender is therefore expected to contain a small number of **case studies** which illustrate actual and potential benefit of initialised predictions for time horizons up to 10 years ahead. The number of such examples is less important than their quality. It is expected that methods of analysis (post-processing, evaluation, etc) will be developed or optimised during the contract, in the process creating robust software tools fit for use in any future deployment of a full service. Compatibility with the CDS and its Toolbox is an important consideration and will be crucial for the provision of a decadal prediction service in the longer term. However, exclusive use of the CDS infrastructure will not be imposed in this demonstration stage. Any such methods and tools developed for the case studies will need to be well documented, both in terms of meaning and operability.

A second critical part of this work is **enhancing or updating the necessary technical infrastructure for data processing and encoding**. As it is anticipated that this data will reside in the climate science community's repositories, at least at the initial stage, it is important to ensure compatibility of any encoding rules with any well-established standards, where they exist. This area of work - expected to form a separate work package in the tender - will address:

- archiving multiple ensemble members in a single file,
- including forecast reference time in the metadata specifications,
- clearly labelling initialisation methods in file metadata.

Ideally, the technical developments achieved in this contract will be useful, and become the default standard, for the treatment of initialised predictions in the climate community, beyond C3S.

<u>Note</u>: New model runs will not form part of this contract. The underpinning data is expected to come in this phase from existing activities of the Coupled Model Intercomparison Project (CMIP), specifically from components A and B of the Decadal Climate Prediction Project (DCPP). A quasi-operational level of service will clearly require further investment into set up of forecast systems, production of forecasts and even model development, to achieve the highest quality of content possible. This is planned in a longer term and as part of the next phase of Copernicus.

As in the case of long-range predictions for other timescales (for example, months or seasons ahead), combination of data from several sources (for example, the use of the multi-model technique) is likely to offer improved predictions. Also, given that the further the prediction horizon stretches into the future, the more important anthropogenic influences of the climate system become, combination with data from (uninitialized) climate projections may also be appropriate. While methods for such combinations are not yet available in the scientific literature, the topic is currently under investigation in some European scientific research projects (e.g. H2020's EUCP: https://www.eucp-project.eu/). In the longer term, the service aims to capitalize on any such development of methodologies. In the current tender, this is not a requirement but, if appropriate to individual case studies, such option could be exercised, provided the specific resources are clearly documented in the tender.

Lastly, but very importantly, a good analysis and quantification of uncertainties in the predictions - and inclusion of such information in any products - is expected. It is the only responsible way to provide information on which decisions, in the real world, can be based. And since the use of 'uncertain' information in decisions making is a significant challenge for many - if not all - users, any trial/prototype/case study needs to include this consideration from the start.

3.2 Deliverables

The contract is expected to deliver 2-4 case studies of applications of decadal climate predictions in sectors selected from energy, insurance, agriculture and infrastructure. Users will ideally be identified at the tendering stage, to provide immediate sharp focus to the work plans.

To achieve the desired outcomes, ECMWF proposes that bidders organise the work in several work packages:

- a work package to include all project management and coordination tasks,
- a work package focused on the technical infrastructure for data encoding and processing (to address the topics described above).
- one or several work packages to include the work on translation of user needs into candidate products, data analysis, products evaluation and documentation of the case studies. The organisation, by work package, of this part of the work is left to the discretion of the tenderer.

Two sets of deliverables with technical content are expected from this contract:

For each case study,

- description of the application, including the user decision targeted, the products proposed, the analysis of skill and the set up for real-time forecasts;
- software tools for the post-processing applied (e.g. bias correction, verification, downscaling);
- data sets/graphics which constitute the products;
- o documentation for users, describing content and functionality,
- o a real-time prediction product (based on 2020 initialisation);

for the work on technical infrastructure,

- o encoding standards for initialised climate forecasts;
- o encoding standards for products generated;
- o application of these standards to relevant data.

In addition to technical deliverables, contract management-related deliverables are required, to follow the reporting schedule described in section 5.2.5.

For the case studies, the contractor is also expected to

- provide inputs to C3S communication material to promote the results and conclusions of the analysis undertaken, beyond the group of users directly involved in the development;
- organise a dedicated event to showcase the findings of these case studies; this will most likely
 be scheduled at the same time as the C3S General Assembly to be held at the end of 2020 or
 beginning of 2021.

4 General tender requirements

4.1 Schedule

ECMWF intends to award a single framework contract running for 18 months. A detailed time plan and schedule (Pert and Gantt charts) 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.

4.2 Reporting

Regular (monthly) progress meetings will be held with ECMWF during the contract to assess project status, risks and actions. The successful tenderer will also have to report on a quarterly and annual basis and provide contributions to C3S reporting for past and future activities, to an agreed schedule (more details are available in Volume V Framework Agreement for this ITT).

4.3 Meetings

For tenders including subcontractors, it is expected that regular meetings between partners will be required, to ensure consistent approach and execution of tasks. An intermediate review of the contract, with ECMWF, will be organised approximately half-way through its duration, to discuss status and progress and, where necessary and possible, adjust plans. ECMWF will organise annual meetings to bring together all C3S service providers (C3S General Assembly).

The successful tenderer is expected to attend these meetings which, wherever possible, will be teleconferences. The cost of attending all meetings shall be covered by the successful tenderer and should be included in the tendered price.

5 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.

5.1 Page limits

As a guideline, it is expected that individual sections of the tenderer's response do not exceed the page limits listed below. These limits 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	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)	
Management and	10 (excluding Table 4 and Table 5 in Volume IIIB) + 2 per each	
Implementation	Work package description (Table 3 in Volume IIIB)	
Pricing Table	No limitation	

Table 1: Page limits

5.2 Specific additional instructions for the tenderer's response

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

5.2.1 Executive summary

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

5.2.2 Track record

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

5.2.3 Quality of resources to be deployed

The tenderer shall propose a team offering the skills required for providing services that meet the technical requirements set out in Section 3. The team shall include a Service Manager with several years of experience in management. 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.

5.2.4 Technical solution proposed

The tenderer shall give a short background to the proposed solution to demonstrate understanding of the requirements 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 on the requirements.

5.2.5 Management and implementation plan

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 3.2.

The Tenderer is requested to include all management and implementation activities within a dedicated work package (WPO). 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 or as points of decision on choices (of priorities or content) to be agreed with ECMWF. 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.

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

- Quarterly, annual and final reports shall be provided in accordance with the Framework Agreement Article 2.3.
- An implementation plan for the year N+1 shall be provided in February of the year N for ECMWF approval.
- Monthly teleconferences with ECMWF and a bid for involvement of ECMWF in major project reviews shall be provided as part of the management plan.
- A proposed payment plan shall be provided as part of the bid. The payment plan shall be based on milestones completion and associated deliverables for development related activities.
- If relevant, a list of sub-contractors and details of their contribution, key personnel, legal names and addresses shall be provided. The Tenderer shall describe how the Framework Agreement, in particular Clause 2.9, has been communicated down to all their sub-contractors.

The table below provides the template 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 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 (WPO 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				

5.3 Price and payment specifications

The tendered price shall not exceed the maximum price indicated in Contract Notice and shall be based on the number of proposed case studies and a detailed assessment of expected personnel costs, travel expenses and other costs for all work, tasks and deliverables proposed in the response.

Payments shall be conducted on a combination of a cost-reimbursement and fixed-price payment scheme, as decided by ECMWF considering the nature of the activities. Payment milestones shall be aligned with the implementation milestones as proposed in the implementation plan.