

# ECMWF Copernicus Procurement

## Invitation to Tender



## Copernicus Climate Change Service

Operational Copernicus Climate Change  
Agriculture Service

## Volume II: Specification of Requirements

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# Table of Contents

1.	Introduction .....	3
2.	Context.....	3
2.1.	The Climate Data Store .....	3
2.2.	Earthkit .....	3
3.	Service Scope and Objectives .....	4
3.1.	Key Objectives of the Service .....	4
3.2.	Summary of Work Packages .....	5
3.3.	Contract Summary .....	7
4.	Background Information .....	7
4.1.	Existing Products .....	7
4.2.	Other Relevant Data Sources in CDS and upcoming information .....	8
4.3.	Missing elements from current C3S offer for the agriculture sector .....	9
5.	Technical Specifications .....	10
5.1.	WP1: Climate Data for Agriculture Services .....	10
5.2.	WP2: User interface, tailored indicators and impact stories .....	13
5.3.	WP3: Regular monitoring reports (agriculture-relevant climate bulletins and associated material).....	15
5.4.	WP4: Exploratory new products (adaptation and mitigation) .....	17
6.	General Requirements .....	19
6.1.	WP0: Management and Coordination.....	19
6.2.	Provision of data to the Climate Data Store .....	20
6.3.	Bug fixing and maintenance of all service elements .....	20
6.4.	Support to user engagement activities.....	21
6.5.	Contribute to L2 support to Copernicus User Support Team .....	21
6.6.	Evaluation and Quality Control.....	22
6.7.	Communication .....	22
6.8.	Data and IPR .....	22
6.9.	Implementation Schedule .....	22
6.10.	Deliverables and Milestones.....	23
6.11.	Key Performance Indicators .....	23
6.12.	Payment Plan.....	23
7.	Tender Format and Content .....	23
7.1.	Page limits .....	24
7.2.	Specific additional instructions for the Tenderer’s response .....	24
7.2.1.	Executive summary.....	24
7.2.2.	Track record .....	24
7.2.3.	Quality of Resources to be deployed.....	24
7.2.4.	Technical Solution Proposed .....	25
7.2.5.	Management and Implementation .....	25
8.	Additional Information.....	25
8.1.	Appendices .....	25
8.1.1.	Appendix 1 How to submit Jupyter Notebook based training material to the CDS/ADS/CADS .....	25
8.1.2.	Appendix 2 Application Style Guide .....	25
8.1.3.	Appendix 3 Guidelines for Data Integration .....	25

## 1. Introduction

Copernicus is the European Union's flagship Earth-observation programme created to achieve operational monitoring of the atmosphere, oceans, and continental surfaces. It aims to provide reliable, validated information services for a range of environmental and security applications. The Copernicus Climate Change Service (C3S) responds to environmental and societal challenges associated with climate change. The service gives access to information for monitoring and predicting climate change and thus helps support adaptation and mitigation. C3S produces and brokers a wide range of data and products describing the past, present, and future of the climate system. This includes global and regional reanalysis, Essential Climate Variables (ECVs), near-term climate predictions, climate projections and a variety of sectoral climate information. The data are offered to users through the Climate Data Store (CDS) and the Atmosphere Data Store (ADS).

## 2. Context

During the first phase of Copernicus (COP1), the Copernicus Climate Change Service (C3S) focused on addressing the needs of various sectors, including agriculture. Through the Sectoral Information System (SIS) initiatives, C3S provided tailored climate-related information and services to a global audience, ensuring valuable support beyond Europe.

In the second phase of Copernicus (COP2), C3S established operational datasets for the agriculture sector and operational water sector activities at the seasonal timescale, which are highly relevant for agricultural planning and management. A new service for the water sector across timescales (historical, seasonal forecast, climate projections) will be established in 2025-2026.

### 2.1. The Climate Data Store

The backbone of the C3S is the cloud-based Copernicus [Climate Data Store](https://cds.climate.copernicus.eu)<sup>1</sup> (CDS) that provides users with a single point of access to quality assured climate and meteorology data. The datasets may be stored in different data centres worldwide or in remote servers, but this complexity will be transparent to CDS users. C3S data is offered with open access and is free to use under the Copernicus data licence. Data are properly documented and enriched by appropriate quality attributes provided by the EQC (Evaluation & Quality Control). All CDS data and tools are accessible from the C3S website as well as via open Application Programming Interfaces (APIs).

The CDS data catalogue provides access to climate datasets via a searchable catalogue. Categories of data include Climate Data Records (CDRs) and Interim Climate Data Records (ICDRs), quality-controlled archives of in-situ climate observations, reprocessed satellite data records, data from climate reanalysis, seasonal forecasts, climate model simulations, and a variety of derived climate impact indicators. Multiple datasets will be available in each category, e.g., for most of the Global Climate Observing System (GCOS) Essential Climate Variables (ECVs), on global or regional domains, with varying spatial resolutions and temporal coverage, from different data providers, based on different methodologies, etc. Several entry catalogues are relevant in the context of this tender, including: the ERA5 and ERA5 Land global reanalysis, CERRA European regional reanalysis, WFDE5 bias-corrected reanalysis, different river discharge information at the historical timescale and seasonal forecast timescale, and related indicators at the climate projection timescale.

### 2.2. Earthkit

**EARTHKIT** is an open-source python project led by ECMWF which provides powerful and easy-to-use tools for working with earth system data. Earthkit users can access CDS and ADS datasets directly and use a range

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<sup>1</sup> <https://cds.climate.copernicus.eu>

of processing, analysis and visualisation tools without having to worry about data formats. The development design of earthkit is modular and open source to encourage contributions from the wider community and contracted partners. The packages are fully documented and available for the whole world to use. Initial documentation is available [here](#)<sup>2</sup>.

### 3. Service Scope and Objectives

The goal of the service is to provide the agricultural community with tailored, operational climate data products and tools across multiple timescales (historical, real-time, seasonal, long-term projections). This service will support decision-making in agriculture by offering relevant datasets and climate indicators, enhancing users' ability to manage risks related to climate variability and extremes, and improving long-term planning for crop productivity and water management. It will ensure that relevant and actionable information on key meteorological and climate variables is accessible on the C3S infrastructure, targeting the agriculture sector at local, regional, and global scales. The information provided will be open, timely, and grounded in scientific research, facilitating informed decision-making for stakeholders at all levels.

#### 3.1. Key Objectives of the Service

##### Data and tools

- Deliver **tailored global climate data products** for agriculture across multiple timescales, after analysis of gaps and user requirements.
- Provide user-friendly tools for easy **data customization and visualization**.
- Enable **near real-time data** for informed operational decisions, extending up to seasonal forecast timescales.
- Include **extreme weather indicators** (drought, heatwaves, wildfires) to aid risk mitigation.

##### Integration and Interoperability

- Support to integrate cross-sector data (e.g., water, biodiversity) as well as local information for holistic decision-making.
- Integration of this operational climate information with relevant soil and land monitoring information also available via other Copernicus Services (e.g. soil moisture, land suitability assessment based on climate conditions for crop selection...).
- Support to use this operational information **to build downstream** crop-specific recommendations and decision support tools.
- The service will guarantee interoperability with systems managed by key organizations such as FAO, WFP, EFSA...

##### Engagement and Accessibility

- Establish a micro-site with a forum for accessing climate products and sharing impact stories.
- Offer operational climate bulletins for relevant climate information, tailored to the agriculture sector jointly with key stakeholders. The climate-related info to be included in the bulletin and where to publish them (for example, at user's premises) is co-designed with key users and stakeholders (see Task 1.1 in WP1 and the description in WP3).
- Support for adaptation and mitigation strategies through specialized tools and climate projections and to assess sustainable farming practices.
- Regular updates to data and products, to track evolving climate risks and agricultural impacts.

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<sup>2</sup> <https://earthkit.readthedocs.io/en/latest/index.html>

- Mobile-friendly app and web-based platform for exploring the available information, for farmers to access insights, together with webinars and training modules. The website can also be used as a collaboration framework for user stories and open-data sharing.

### 3.2. Summary of Work Packages

The contract will be implemented through a series of work packages (WPs), as detailed below. These WPs are proposed as recommendations and should be regarded as a flexible framework rather than a rigid formal requirement.

<b>WP1: Climate Data for Agriculture Services</b>	
<b>Objective</b>	Analyze the agricultural sector’s climate information needs across various temporal scales (historical to long-term projections) and diverse user communities (e.g., policymakers, farm unions, service providers), and develop high-quality climate datasets specifically tailored to the agriculture sector, focusing on historical, present, and future climate conditions based on the identified gaps and user needs.
<b>Activities</b>	
<ul style="list-style-type: none"> <li>• Identify critical climatic variables and agro-climatic indicators essential for decision-making, after engagement with key stakeholders (e.g. FAO, WFP, EFSA..).</li> <li>• Evaluate current capabilities of C3S (e.g., CDS, IPCC Climate Atlas) and identify gaps in data products and services.</li> <li>• Develop a user engagement strategy, including workshops, surveys, and stakeholder interaction, to capture evolving needs.</li> <li>• Continuously refine user requirements and align service development with these findings. Findings will inform subsequent work packages (WP2: User Interface &amp; Impact Stories, WP3: Monitoring Bulletins; please note that C3S ESOTC may co-define the bulletin information).</li> <li>• Provide operational datasets (historical, seasonal forecasts, climate projections) tailored for agricultural needs.</li> <li>• Deliver methods for bias adjustment, downscaling, and skill assessments to enhance data usability.</li> <li>• Ensure consistency of selected indicators (e.g., soil moisture) across past, seasonal, and long-term projections, where relevant, especially for the regular monitoring reports (WP3).</li> <li>• Publish documentation ensuring full traceability and alignment with user workflows.</li> </ul>	

<b>WP2: User Interface, tailored Indicators, and impact stories</b>	
<b>Objective</b>	The primary goal of WP2 is to make climate datasets and derived information more accessible and user-friendly for diverse agricultural stakeholders by developing tools, interactive applications, examples, demonstrators, all accessible via a centralised micro-site. This micro-site is designed to attract a wide range of users, from researchers to decision-makers, to simplify access to those practical applications, and targeted resources that support the agriculture sector. WP2 aims to demonstrate real-world applications of climate data and create a demonstrator for the Mediterranean region, addressing its specific challenges.
<b>Activities</b>	
<b>User Interface Development:</b> Design interactive tools (e.g., web applications, Jupyter Notebooks) for engaging with WP1 datasets and CDS data, by using modern frameworks and by following ECMWF style guidelines accompanied by robust documentation for users and developers.	

<p><b>Impact Stories:</b> Create and publish practical, data-driven case studies demonstrating how C3S products address real agricultural challenges. Those case studies may also use AI-based tools for showcasing how to assess the impact of climate conditions on specific crops, for example, or for pest and disease predictions, or for water resource optimisation, if relevant for users.</p> <p><b>C3S Agriculture Micro-Site:</b></p> <ul style="list-style-type: none"> <li>• Develop a unified website linking to the relevant datasets and tools tailored to agricultural users.</li> <li>• Create a strong link with existing platforms to feed those ones with WP1 tailored products.</li> <li>• Serve as a collection of resources, user guides, and host a knowledge-sharing forum.</li> <li>• Organize content by themes (e.g., Droughts, Food Security), regions, or timescales.</li> </ul> <p><b>Mediterranean service demonstrator:</b></p> <ul style="list-style-type: none"> <li>• Co-design a demonstrator of a tailored service for the Mediterranean region, with partners like the Union for Mediterranean and liaising with initiatives such as MedClivar.</li> <li>• Include tools for monitoring, forecasting, and addressing region-specific climate challenges such as heatwaves and droughts.</li> </ul>
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<b>WP3: Regular monitoring reports (agriculture-relevant climate bulletins)</b>	
<b>Objective</b>	The primary objective of WP3 is to deliver timely and actionable climate information tailored to the agriculture sector through monthly bulletins (co-defined with key stakeholders), custom reports, and interactive webinars. These outputs aim to bridge gaps identified in WP1, offering users a seamless integration of climate data across temporal scales (historical, seasonal, and long-term projections and including Earth Observation data, where relevant) and fostering better decision-making through consistent, user-relevant updates. WP3 seeks to enhance accessibility and usability by developing mobile app features, and via engaging dissemination methods like webinars.
<b>Activities</b>	
<p><b>Monthly / quarterly Bulletins, co-designed with key stakeholders:</b></p> <ul style="list-style-type: none"> <li>• Summarise current and seasonal climate conditions, including key variables (e.g., temperature, precipitation) and agro-climatic indicators.</li> <li>• Compare predictions with actual observations to improve decision-making.</li> <li>• Incorporate Earth Observation data for real-time assessments, for example, of vegetation health and water stress, where relevant.</li> <li>• Relevant indicators across timescales, including reanalysis, seasonal predictions and climate projections. Please note that climate projections can be used to contextualise monitored events that have been observed in recent past.</li> <li>• AI-based chatbots and virtual assistants can be used in support of operational bulletins delivery.</li> </ul> <p><b>Custom Reports:</b> Provide tailored reports on specific climate phenomena (e.g., ENSO impacts on crops).</p> <p><b>Webinars:</b> Host interactive sessions to explain new data, products, bulletin content, answer user questions, and gather feedback.</p> <p><b>If agreed with key stakeholders, develop an App (mobile-friendly):</b> Develop an app to distribute bulletins, featuring push notifications, personalised reports, and interactive tools.</p> <p><b>Dissemination material:</b> Create factsheets illustrating seamless integration of climate data across timescales for agricultural decision-making.</p>	

**Cross-sector collaboration:** Coordinate with other Copernicus services (e.g., CLMS) to enhance data accuracy and scope.

**Present the results of the validation for selected products:** By using observations, present the results of all the forecast evaluation activities done by WP1, to build user trust.

**Integration with WP2:** Feed bulletins, reports, and dissemination material into the user interface platform developed in WP2.

<b>WP4: Exploratory new products (adaptation and mitigation)</b>	
<b>Objective</b>	Propose innovative climate products for agricultural adaptation and mitigation.
<b>Activities</b>	
<p><b>Adaptation to Climate Impacts:</b> Identify innovative tools and datasets to help agriculture adapt to changing climate conditions, focusing on resilience and mitigation.</p> <p><b>Mitigation of agricultural emissions:</b> in collaboration with CAMS, explore monitoring emissions and surface and atmospheric concentrations of pollutants, like ammonia and nitrogen oxides.</p> <p><b>Cross-cutting themes</b> will integrate both adaptation and mitigation solutions for a holistic agricultural service.</p>	

### 3.3. Contract Summary

This Invitation to Tender (ITT) aims to establish **an operational climate service** at the global scale for agriculture that meets the objectives described above.

ECMWF intends to award a single Framework Agreement for a period of **34 months**, which shall be implemented via a single Service Contract expected to commence in Q3 2025.

Tenderers shall include in their Tender any necessary computing and storage needs and associated estimated costs (Pricing Tables Excel file). The modernised CDS may offer some cloud resources, subject to evaluation at the negotiation phase.

## 4. Background Information

To plan and implement the agriculture service, Tenderers are encouraged to consider both the existing C3S products and the identified gaps in the offering, as outlined below.

### 4.1. Existing Products

There are several Copernicus Climate Data Store (CDS) products available for global agriculture monitoring and decision-making. Key datasets include:

**AgERA5: Climate Data for Agricultural Analysis:** AgERA5 provides daily surface meteorological data from 1979 to the present, designed for agriculture and agro-ecological studies. This dataset, derived from ECMWF ERA5 data, aggregates data to daily time steps, adjusted for finer topography at a 0.1° spatial resolution. It simplifies the process for users, delivering pre-processed and aggregated data for direct use in analysis and agricultural impact models. A specific contract supports the maintenance and extension of AgERA5, with plans to introduce AgERA6. This includes upgrading the dataset, adding new variables, and conducting a gap analysis to better meet agricultural user needs. An evolution of the AgERA5 information with ERA6 is also expected.

Previously, an interactive web application allowed users to explore AgERA5 agro-meteorological indicators (1979–present), download data, and view global variables. However, this tool is no longer available under the current CDS infrastructure.

**Agroclimatic Indicators:** This dataset provides indicators that describe plant-climate interactions, essential for understanding climate variability in agricultural terms. It includes data from the ERA-Interim reanalysis and bias-corrected CMIP5 climate projections, covering the period 1951-2099. The indicators are available at a 0.5° x 0.5° resolution and are used for species distribution modeling, crop development analysis, and agricultural impact modeling.

Current limitations include outdated global projections, a limited number of indicators, and the use of older-generation reanalysis data. More details on this dataset can be found in [this publication](#)<sup>3</sup>. A set of Jupyter Notebooks to compute those indicators will also be available.

**Crop Productivity and Evapotranspiration Indicators (dataset to be deprecated):** This dataset provides crop productivity indicators up to near real-time and evapotranspiration indicators ending in 2018 with high-resolution coverage of agricultural regions with dominant cropping patterns from around the globe.

The crop productivity indicators provide insight into the phenological development (periodic events in biological life cycles), total biomass and yield (crop weight per unit area of land) of four major crops (wheat, maize, soybean, rice) at high grid resolution (0.1° x 0.1°) and with global coverage. Those crop productivity variables are intended **as an example on what can be derived downstream** of weather processed data like AgERA5.

The evapotranspiration indicators provide the actual and potential vegetation and soil evapotranspiration and are based on satellite and reanalysis inputs. The product provides insight into regional and interannual variability in vegetation water use (actual and potential) and water stress. It can be used as an indicator to determine the impact of water stress on crops and vegetation in general.

Limitations for the evapotranspiration indicators include a lack of near-real-time updates and the use of old reanalysis. Reported limitations on the crop productivity indicators are that those are based on simple crop modeling choices. However, their scope is to illustrate the potential of weather and climate data for agricultural modeling, and they are not intended to be an operational state-of-the-art product. The scope could be clarified, also in the view of new AI-based crop modeling approaches.

## 4.2. Other Relevant Data Sources in CDS and upcoming information

**SPI and SPEI from ERA5:** A set of SPEI indices computed using ERA5 and climate projections is available through the C3S Atlas. These are only available for the 6-month integration period. An expanded offering, but only for ERA5, is accessible via ECMWF, which includes 3-, 6-, 12-, 24-, and 48-month accumulations for both SPEI and SPI.

**Essential Climate Variables (ECVs):** Satellite-derived ECVs relevant to agriculture include precipitation, land cover classification, surface radiation budget, soil moisture, land surface temperature, LAI, albedo, snow cover, fPAR and AGB, evapotranspiration.

**Reanalysis-derived ECVs:** Some variables, among the ones mentioned above, are also available via global reanalysis datasets (ERA5 and ERA5-Land).

**Processed datasets Associated with extremes/risk indicators:** A set of other variables is also of interest, including indices related to extreme heat (such as the ERA5-HEAT dataset), datasets that assess landscape flammability (ERA5-Fire from CEMS) and its connection to increased wildfire risk, which could impact agriculture production, and datasets related to flood probability (ERA5-Floods from CEMS). Not all these

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<sup>3</sup> <https://www.sciencedirect.com/science/article/pii/S2405880723000353>



hazards datasets are available across all timescales, with reanalysis and seasonal forecasts being generally accessible, while climate projections for various sectors are typically not available globally through the CDS. Ongoing projects include wind extremes and temperature extremes (linked to climate attribution studies) and wildfire data.

**The Upcoming C3S water service across timescales is planned to start in Q1 2025.** This service covers the provision of three contracts to produce timely, high-quality information for the water sector encompassing historical data, a seasonal forecasting component (Lot 1), a collection of climate projection outlooks (Lot 2) and a user-oriented service and interface (Lot 3). Its design is flexible, ensuring the provision of consistent climate inputs for hydrological modelling (supporting both hydrological science and downstream operations), alongside a suite of pre-computed hydrological variables (from a multi-model composition, with possibility to include AI-based models) and indicators (supporting e.g. policy and decision-makers).

### 4.3. Missing elements from current C3S offer for the agriculture sector

To better serve the needs of the agriculture sector, several key elements should be enhanced or added to the C3S and Climate Data Store offerings. Below is an initial list based on general user feedback. This contract will determine which of these issues should be addressed and how, following a dedicated gap analysis and feasibility study. This is an initial list of reported gaps. Additional major gaps will also be identified during the service development process and a selection of them addressed by the current service.

**Dedicated agriculture microsite:** A user-friendly, centralised microsite tailored to the agriculture sector that consolidates all relevant datasets, tools, and applications, making navigation easier for a diverse range of users, from farmers to policymakers. The platform could also host a forum, providing a space for agricultural practitioners to exchange information, solutions, and experiences regarding the best use of the data.

**Upgrade of existing tailored datasets:** Continuous improvement and updates to selected existing datasets, excluding AgERA5 (which is managed separately), based on the latest user requirements to ensure relevance and accuracy.

**Sector-specific guidance and use cases:** Practical examples, tutorials, and guides that illustrate how C3S data can be applied to a variety of agricultural challenges and crop impact models, including AI-based applications.

**Data customization and simplification tools:** User-friendly tools that allow for easy customisation of data (e.g., selecting specific regions, variables, or time periods) and simplified downloads in common formats (e.g., CSV) would enhance accessibility for users lacking technical expertise.

**Real-time data and indicators:** Integration of near real-time data for agriculture-specific indicators such as drought, evapotranspiration, and crop yields, which would enhance decision-making, especially for operational purposes. Dashboards displaying real-time climate anomalies affecting agriculture would be particularly valuable.

**Tools for investigating extremes:** Development of tools to investigate or report on selected extreme events and compound extremes—such as droughts, wildfires, or heatwaves—specifically for the agriculture sector, facilitating better preparedness and response strategies.

**Integration of sub-seasonal to seasonal (S2S) and decadal forecasts:** Incorporating reliable seasonal and sub-seasonal forecasts tailored for agriculture would support long-term planning and risk management, helping users with planting schedules, irrigation timing, and crop resilience strategies.

**Examples of data Integration:** Guidance on how to best integrate C3S data with other Copernicus-based data sources, such as the Copernicus Land Monitoring Service, to provide a more comprehensive view of downstream-estimated agricultural impacts and strategies to address them.

**Cross-sector integration:** Providing tools that integrate agricultural data with other relevant sectors, such as water management, biodiversity, and energy, would enable more comprehensive decision-making and resource management.

**Support for adaptation and mitigation strategies:** Climate variability and change significantly impact crops, livestock, soil, water resources, rural communities, and agricultural workers. Additionally, the agriculture sector itself contributes to greenhouse gas emissions that exacerbate climate change. To address these challenges, there is need to help users adopt more sustainable practices, reducing their environmental footprint while enhancing resilience against climate-related impacts.

**User engagement and feedback mechanisms:** An enhanced feedback loop that actively gathers input from agriculture stakeholders to ensure that future services and datasets meet their evolving needs. Hosting sector-specific forums, workshops, or surveys could help refine services over time.

**Enhanced data visualisation tools:** Advanced visualisation capabilities that allow users to explore data interactively through maps, graphs, and dashboards would help communicate complex climate information in a more intuitive way.

**Training and support resources:** Provision of training sessions, webinars, and help resources for users at various skill levels to empower them in utilising the available data effectively in their decision-making processes.

## 5. Technical Specifications

The proposal should include, as a minimum, the following work packages (WPs) and tasks. The WPs are proposed as recommendations and should be regarded as a flexible framework rather than a rigid formal requirement. Additional tasks can be included as deemed appropriate.

### 5.1. WP1: Climate Data for Agriculture Services

#### Task 1.1: Gap analysis of agricultural user needs across temporal scales and user communities

The objective of this task is to conduct a thorough gap analysis of the agricultural sector's needs across various temporal scales (historical data, sub-seasonal, seasonal, multi-year forecasts, and long-term projections) and across different user communities. This analysis will identify key climatic variables and agro-climatic indicators and their corresponding decision-making processes where weather and climate information play a crucial role.

This task involves evaluating agricultural user requirements both, in relation to and beyond, the current C3S data products and applications available through the CDS, as well as other relevant C3S services and indicators related to agriculture (e.g., IPCC Climate Atlas, EEA, ECDE). The resulting report will provide a comprehensive description of the user needs, highlighting the priorities identified by stakeholders within the agriculture sector. Please, also refer at the section "User engagement strategy" in description of Task 1.1.

The Successful Tenderer must ensure the collection of requirements from a wide array of agricultural users (e.g. from policymakers or high-level decision bodies to farm unions or cooperatives, as well as services providers and other relevant bodies), including those involved in food security and water scarcity. The findings of this gap analysis will directly inform and feed to:

- Data production within **WP1**;
- **WP2**: User Interface, tailored indicators, and impact stories;
- **WP3**: Regular monitoring reports.

At the proposal submission phase and during the contract execution phase, the (Successful) Tenderer will propose elements, based on their expertise and on the results of the gap analysis, to be integrated into the

service under development. Those elements should be selected in agreement with ECMWF and will include, at least, key climate variables and agro-climatic indicators. Tenderers must also explain how their proposed solution addresses the identified gaps and aligns with the missing elements from the current C3S offer for the agriculture sector listed in Section 4.3.

#### ***Main expected outcomes of T1.1:***

##### **User needs and requirements analysis, with gap analysis report**

The success of the C3S agriculture service, like all C3S services, depends on ensuring that the datasets and applications developed are relevant and usable by the target community. To this end, WP1 will conduct a comprehensive assessment of user needs and decision-making processes linked to those user needs, aiming to identify key climatic variables and agro-climatic indicators relevant for the development of the service. The proposal should continuously gather user requirements throughout the first 18 months of the contract.

This task will incorporate input from a variety of sources, including the Copernicus User Intelligence contracts, the European State of the Climate (ESOTC), FAO activities (e.g., the [WapoR project](#)<sup>4</sup>), EU policies, ECMWF, and other C3S initiatives, such as those supporting the EEA, EIB, EC Joint Research Centre, EFSA and other key users.

- **Version 1 (due M3):** This version will be based on desk research and an assessment of relevant user requirements from the C3S User Requirements Database (URDB). It will highlight the needs and priorities of key users and serve as the foundation for the C3S agriculture service specification. The deliverable will clearly map user needs to both data and functional requirements of the applications.
- The deliverable will also include an initial gap analysis, identifying gaps in the existing agroclimatic indicators and applications published in the CDS. It will highlight missing functionalities and data products required to support the C3S agriculture service. This analysis will also consider upcoming products from the water sector and extremes when they become available. This analysis will continue for the updated versions 2 & 3.
- **Versions 2 and 3 (last one due at M18):** These updated versions will be based on interactions with key stakeholders and users, gathered through a dedicated user engagement strategy. As the C3S agriculture service evolves, the gap analysis will be continuously refined, informing WP1 and WP2 to define the timeline for service delivery.

##### **User engagement strategy (including training elements)**

In collaboration with the Copernicus User Engagement team and the User Intelligence contract, the Successful Tenderer will develop a detailed plan for gathering needs and requirements from key stakeholders across the agriculture sector. This strategy will build upon existing activities in research, policy, and C3S, and may include workshops, surveys, and outreach at relevant conferences.

Tenderers must provide a preliminary user engagement strategy during the proposal phase, which should outline key users, timelines, and processes to ensure their needs and requirements are captured. The final strategy will be used to assess and update the evolving user requirements and will feed into updates to “User needs and requirements analysis, with gap analysis report”.

Moreover, working with Copernicus User Engagement and training activities, the contract will develop bespoke training and outreach materials to showcase the developments in the C3S agriculture service.

#### ***Expected Milestones in T1.1:***

At least one milestone is expected in T1.1, which involves transferring the newly identified user requirements to the URDB once identified, with updates to coincide with user feedback activities and refinements. Requirements will be collated over the duration of the contract, with at least biannual updates to the URDB.

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<sup>4</sup> <https://data.apps.fao.org/wapor>

In synthesis, the gap analysis starts by analysing requirements already available in the URDB and any new identified requirement will be included in the URDB, for traceability.

**Task 1.2: Definition, computation and publication of operational climate information and products for agricultural communities**

***Main expected outcomes of T1.2:***

**Delivery of operational datasets and indicators across timescales: historical, multi-system seasonal forecasts, multi-model climate projections**

Based on the gap analysis (T1.1), this task will define, compute and make available in the CDS operational climate information and products (at least key climatic variables and agro-climatic indicators) relevant to agricultural communities across various timescales: historical data, multi-system seasonal forecasts, and multi-model climate projections<sup>5</sup>. Any necessary steps to incorporate climate information into user workflows will be included. This may involve bias adjustment, downscaling, forecast quality assessments, and other metrics relevant to evaluate the suitability of specific datasets for workflow applications. At the proposal phase, Tenderers are requested to propose an estimation of the computational resources needed for producing and storing the operational products delivered within WP1.

If needed, this task will propose and implement one or more methods for interpolation on common grids, bias adjustment, skill metrics, and downscaling of climate forcing fields, as appropriate, suitable for downstream applications. These methods will be grounded in established scientific literature and will include descriptions of any proposed reference datasets. Given that various methods yield different outcomes and may be suitable for distinct downstream applications, the selected methods will be integrated and accompanied by guidance outlining limitations and recommendations for users.

**Task 1.3: Identification of additional operational data from extended forecasts and other sources**

***Main expected outcomes of T1.3:***

**Potential additional data sources for the operational service report**

This task will assess whether additional post-processed information from ECMWF datasets, which are not currently available in the CDS, can complement the operational agricultural service delivered in T1.2. This may include sub-seasonal to seasonal (S2S) data, multi-year to decadal predictions.

***Indicative list of deliverables for WP1:***

The following table provides an indicative list of deliverables, the responsible party, nature of the deliverable, and the due dates for WP1. This is not an exhaustive list; Tenderers may propose additional or amended deliverables and timelines depending on their specific approach. We encourage Tenderers to separate the due dates of the deliverables so that they are not all delivered in the same month.

<b><i>Deliverable</i></b>	<b><i>Responsible</i></b>	<b><i>Nature</i></b>	<b><i>Deliverable / Milestone title</i></b>	<b><i>Due date</i></b>
WP1-D1	Tenderer	Report	User engagement strategy	By the end of month 3, updated at month 12 and 24
WP1-D2	Tenderer	Report	User needs and requirements analysis,	By the end of month

<sup>5</sup> **Note on the selection of models:** The selection of a multi-model ensemble of global and regional simulations, based on CDS CMIP data (and the selected resolutions), aims to better sample the matrix of climate forcing. This approach spans the uncertainty in projected variables relevant to the applications in the agriculture sector and fits the selected regional area, while also aligning with the C3S strategy to operationally serve climate projections to a wider community of users. All choices will be carefully documented and fully traceable. The choice of the models will prioritise selection of global climate projections that is in line with the data presented in the [C3S Climate Atlas](#).

			with gap analysis report version 1, 2 & 3	3, updated at month 12 and 18
WP1-D3	Tenderer	Dataset	Operational dataset delivery to the CDS, including all elements needed for the publication.  This deliverable may be split in more deliverables and their updates, depending on the proposed delivery strategy of datasets.	By the end of month 12, 24, end of the contract
WP1-D4	Tenderer	Report	Complementary information through other ECMWF products	By the end of the contract

## 5.2. WP2: User interface, tailored indicators and impact stories

Large climate datasets, like those produced in WP1 or already available in the CDS, offer valuable insights for a broad range of end users. While experienced users such as researchers and consultants are familiar with data repositories and complex file formats, many practical decision-makers lack the technical skills and computational resources to download, process, and visualise such extensive datasets. WP2 aims to collaborate with WP1 to develop user-friendly, interactive applications that build on the CDS, making it easier and more intuitive for users to explore the information provided by the C3S agriculture service. To summarise, WP2 focuses on making the climate datasets produced identified in WP1, as well as those already available in the CDS, more accessible and practical for a wide range of users.

The primary objectives of WP2 are to:

- **Create a centralised micro-site for agricultural products:** Develop a coordinated space that brings together relevant datasets and tools to support climate change monitoring and adaptation in the agriculture sector. This platform will be tailored to different user communities, from farmers to policymakers.
- **Support a broad user base:** Provide tools and guidance to help a wide range of users—farmers, policymakers, agri-researchers—navigate the complexity of C3S information. Clear examples of how these products add real value to decision-making will be included.
- **Demonstrate practical Applications:** Showcase examples of how datasets from the CDS and WP1 can be effectively applied to solve real-world problems in agriculture.
- **Design a demonstrator for an agriculture service in the Mediterranean:** Draft the elements of a service tailored to the Mediterranean region, including monitoring reports, forecasting products, and other key features that address the region's specific challenges.

To achieve these goals, WP2 will:

- **Develop a user interface:** Create intuitive software tools/applications to interact with the datasets from WP1 and other relevant sources. This may include static and interactive web applications and a collection of Jupyter Notebooks (examples are provided [here](https://ecmwf-projects.github.io/copernicus-training-c3s/intro.html)<sup>6</sup>). For the applications, at the proposal phase, the Tenderer is requested to propose novel user-interfaces to be developed within this contract – using the published C3S applications as inspiration, as well as other C3S user-oriented services, such as the [Copernicus Interactive Climate Atlas](https://climate.copernicus.eu/copernicus-interactive-climate-atlas-guide-powerful-new-c3s-tool)<sup>7</sup> (developed on the Data Store Service Infrastructure), or [seasonal forecast charts](https://climate.copernicus.eu/charts/packages/c3s_seasonal/)<sup>8</sup>. Interactive web-applications will use JS-react for the front-end and will be deployed as Docker Images within a Kubernetes framework. The applications should follow the guidelines described at Appendix 2 (Application Style Guide), which includes instructions on the components

<sup>6</sup> <https://ecmwf-projects.github.io/copernicus-training-c3s/intro.html>

<sup>7</sup> <https://climate.copernicus.eu/copernicus-interactive-climate-atlas-guide-powerful-new-c3s-tool>

<sup>8</sup> [https://climate.copernicus.eu/charts/packages/c3s\\_seasonal/](https://climate.copernicus.eu/charts/packages/c3s_seasonal/)

libraries to use. Any new components developed should be written generically such that they could be added to an ECMWF components library. The applications should be appropriately documented with a view that this documentation may also be published on user facing websites. In case agreed, cloud resources may be requested. All requests for cloud resources are submitted via ECMWF's Jira system and must include a data management plan following the guidelines provided by ECMWF. All applications should have undergone extensive debugging and internal review to ensure delivery of quality applications which are optimised in terms of performance prior to final review and publication by technical teams at ECMWF. This review process will cover many aspects including evaluation of adequateness of the application in terms of usability, accuracy, description of input and output variables, appearance, coding standards and style, functionality, and scientific quality. The Tenderer shall ensure that a sufficient provision is made to cover this activity.

- **Produce impact stories:** Develop practical, data-driven stories that demonstrate how the agricultural products can be used to address specific challenges. These stories will integrate C3S data with other open-source datasets, including those from other Copernicus services (e.g. soil moisture, land suitability assessment based on climate conditions for crop selection). The stories could serve as an example on how to integrate cross-sector data as well as local information for holistic decision-making. And to support the use of this operational information to build downstream crop-specific recommendations and decision support tools. Those case studies **may also use AI-based tools** for showcasing how to assess, for example, the impact of climate conditions on specific crops, based on the CDS information, or for pest and disease predictions or for water resource optimisation, if relevant for users.
- **Launch a micro-site:** Create a C3S agriculture service micro-site that consolidates all relevant resources, including documentation, data access, and user guidance. The site will be designed in coordination with ECMWF to ensure alignment with Copernicus branding. It could be organised thematically (e.g., Droughts and Food Insecurity), by timescales (e.g., historical, seasonal), by regions (e.g., global, Mediterranean), etc... The site may also include a forum for agriculture practitioners and decision-makers to share climate-related knowledge and data experiences.
- **Develop a Mediterranean thematic service (demonstrator):** The Mediterranean region is particularly vulnerable to climate extremes like heatwaves, droughts, and wildfires, often occurring together and amplifying impacts. These compound events create cascading effects that threaten agriculture and water insecurity in the region. The proposed Mediterranean demonstrator will be co-designed with key partners like the Union for Mediterranean (UfM) and relevant meteorological services, offering monitoring reports, forecasts, and other climate-related information.

**Indicative list of deliverables for WP2:**

The following table provides an indicative list of deliverables, the responsible party, nature of the deliverable, and the due dates for WP2. This is not an exhaustive list; Tenderers may propose additional or amended deliverables and timelines depending on their specific approach. We encourage Tenderers to separate the due dates of the deliverables so that they are not all delivered in the same month.

<b>Deliverable</b>	<b>Responsible</b>	<b>Nature</b>	<b>Deliverable / Milestone title</b>	<b>Due date</b>
WP2-D1	Tenderer	Report	Micro-site structure	By the end of month 3, updated at month 12 and 24
WP2-D2	Tenderer	Other	Web-applications to navigate selected relevant data / indicators	By the end of month 12 and updates at 24 and 30
WP2-D3	Tenderer	Other	Micro-site	By the end of month 24
WP2-D4	Tenderer	Other	# of impact stories produced (at least 2 per year)	By the end of month 12 and updates at 24 and 30



WP2-D5	Tenderer	Other	Demonstrator of a Mediterranean agriculture service	By the end of month 24 and updates at month 30
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### 5.3. WP3: Regular monitoring reports (agriculture-relevant climate bulletins and associated material)

The goal of WP3 is to provide users with timely and actionable climate information tailored to the agriculture sector through a series of regular bulletins, custom reports on demand and webinars. All these elements will be designed following gap analysis in WP1 and will feed the user interface platform and microsite developed in WP2.

#### *Main expected outcomes of WP3:*

##### **Monthly crop-related monitor bulletins and associated dissemination:**

These bulletins will provide a summary of both current and upcoming seasonal climate conditions of key variables and agro-climatic indicators defined in WP1 and their anticipated effects on the agriculture sector (aligned with WP1 collection of requirements). The content of the bulletins and where to publish them will be co-defined with key stakeholders and with the C3S Climate Intelligence team. Bulletins may include:

- **Current conditions** (using reanalysis data) for temperature, precipitation, soil moisture, and relevant climate indicators.
- **Seasonal forecasts** (up to several months ahead) offering outlooks for selected climate-agriculture relevant indicators.
- **Historical comparison:** A feature comparing past predictions with actual observations, allowing farmers to reassess decisions if discrepancies occur. This would provide valuable feedback for improving decision-making.

Please note that the climate bulletins are not intended to overlap with already existing tools, such as the [JRC MARS Bulletins](#)<sup>9</sup>, but rather they are designed to complement those reports with selected products and focus on climate-relevant information for the agricultural sector, ensuring consistency across timescales. The final content and its publication format are co-designed with key stakeholders based on their requirements (WP1).

**AI-based chatbots and virtual assistants** can be used in support of operational bulletins delivery.

**Incorporation of Earth Observation data:** Where relevant, Tenderers may propose the inclusion of Earth observation (EO) data that will be integrated into the bulletins to provide a real-time assessment, including for example vegetation health and water stress information. This data will complement climate information and offer a comprehensive view of environmental conditions affecting crops.

**Short to long-term agriculture impact indicators:** Drought, wildfire and heatwaves, among others, are major risks for the agricultural sector, so indicators on these conditions will be part of climate reporting when relevant to users, together with any other according to user needs and requirements obtained in WP1. These indicators will be based on:

- **Reanalysis data** for monitoring past and present heat drought and wildfire conditions.
- **Seasonal forecasts** to assess future risk.
- **Climate projections** multi-decades ahead.
- A consistency check between **reanalysis, seasonal forecasts and projections** will be included to ensure reliability across timescales, improving users' confidence in the data.

<sup>9</sup> [https://joint-research-centre.ec.europa.eu/monitoring-agricultural-resources-mars/jrc-mars-bulletin\\_en](https://joint-research-centre.ec.europa.eu/monitoring-agricultural-resources-mars/jrc-mars-bulletin_en)

**If needed by users, App (mobile friendly) for bulletin distribution:** To make the bulletins more accessible, an **App** could be developed where users can easily access the latest climate reports. Features could include:

- Push notifications for new bulletins.
- Personalised reports based on user location.
- Interactive tools for exploring specific climate data relevant to their needs.

**Integration with existing CDS products:**

Wherever possible, bulletins will build on **existing CDS products**, leveraging available datasets for climate and agriculture indicators. This could reduce the need for new datasets and focus efforts on creating meaningful summaries, forecasts, and actionable insights.

**Timescale consistency and indicators:**

To meet the diverse needs of agriculture stakeholders, the bulletins will explore the possibility of integrating the **same indicator** (e.g., soil moisture, temperature anomalies, or evapotranspiration) across multiple timescales, including:

- **Past** (reanalysis data)
- **Seasonal forecasts**
- **Multi-decadal projections** (climate projections are not operationally updated, so they are not expected to be part of the operational monthly bulletin, but may be included to contextualise the events that have been observed in recent past. e.g., “last month event is unusual in present day climate but climate projections suggest these event will become much more likely as the climate warms up”)
- **Sub-seasonal and decadal predictions** timescales are not expected to be operationally delivered to the bulletin, but can be explored to be included.

This approach would provide a holistic view of the short-term, medium-term, and long-term climate relevant information for the agriculture sector.

**On demand custom reports:**

The WP3 team will offer **customised reports** on specific topics or climate phenomena relevant to the agriculture and food security sector in agreement with WP1, so based on user’s most relevant requests, such as:

- Information about the **impact of ENSO (El Niño-Southern Oscillation)** and associated climate anomalies on regional crop productivity.
- Other climate variabilities or extreme events impacting global food security.

**Interactive webinars for user engagement:**

To enhance the understanding and usability of the bulletins and the data, **webinars** will be held where users will have the opportunity to:

- Engage with experts in real-time.
- Ask questions about the climate data, its interpretation, and potential agricultural impacts.

These sessions will also provide a platform for gathering user feedback, enabling continuous improvement of the delivered products.

**Additional Considerations:**

- **Data validation:** The consistency between observed data and forecasts will be regularly reviewed.
- **Cross-sector collaboration:** Coordination with other Copernicus services, such as **Copernicus Land Monitoring Service (CLMS)**, can provide additional data sources, enhancing the scope and accuracy of the bulletins.



- **Selected information**, analysis and plots from the climate bulletins may contribute to the yearly C3S ESOTC report.
- The bulletins will build on existing CDS products, wherever possible, leveraging available datasets for climate and agriculture indicators.
- Production and delivery of other dissemination material for the agriculture sector: The dissemination material produced in WP3 will be delivered to the users through the user interface platform developed within WP2. This material should include, at least, the following: Factsheets or diptychs illustrating the seamless time integration of climate information for agricultural decision-making processes. This seamless integration should include information across multiple timescales: past (reanalysis data), next weeks and months (sub-seasonal and seasonal forecasts), and next years and decades (decadal predictions and climate change projections). The production of this material can stimulate the feedback from users regarding user requirements across temporal-scales that will feed T1.3.

#### **Indicative list of deliverables for WP3:**

Deliverables and outcomes from WP3 will directly support decision-makers, farmers, and other agricultural stakeholders, offering critical information for managing the effects of climate variability and change.

The following table provides an indicative list of deliverables, the responsible party, nature of the deliverable, and the due dates for WP3. This is not an exhaustive list; Tenderers may propose additional or amended deliverables and timelines depending on their specific approach. We encourage Tenderers to separate the due dates of the deliverables so that they are not all delivered in the same month.

<b>Deliverable</b>	<b>Responsible</b>	<b>Nature</b>	<b>Deliverable / Milestone title</b>	<b>Due date</b>
WP3-D1	Tenderer	Report	Design of the Bulletins with key stakeholders	By the end of month 12
WP3-D2	Tenderer	Report	Description of webinars / App	By the end of month 12
WP3-D3	Tenderer	Report	Design of the dissemination material including customized reports and factsheets	By the end of month 12
WP3-D4	Tenderer	Reports & Other	Operational delivery of: bulletins, bulletin distribution, webinars, app, dissemination material	By the end of month 24 and updates at month 30

#### **5.4. WP4: Exploratory new products (adaptation and mitigation)**

The objective of WP4 is to explore innovative climate and atmosphere products that address emerging user needs in the agricultural sector, particularly in the areas of **adaptation** to climate change and **mitigation** of greenhouse gas emissions. This work package will focus on identifying new datasets, tools, and methodologies that could eventually be integrated into the C3S service evolution, depending on their feasibility and value. At this stage, WP4 will serve as a research and development phase, exploring these ideas before deciding on their potential integration.

#### **Main expected outcomes of WP4:**

WP4 focuses on identifying innovative products and approaches to help the agricultural sector adapt to changing climate conditions while addressing mitigation goals. A key aspect of this work involves leveraging data and tools from the **Copernicus Atmosphere Monitoring Service (CAMS)** to understand and address the dual challenges of climate change and air quality impacts.

## **Integrated Activities:**

### **Monitoring agricultural emissions and atmospheric pollutants:**

Collaborate with CAMS to utilise CAMS emissions datasets for the agricultural sector for monitoring key agricultural pollutants, such as ammonia (NH<sub>3</sub>), nitrogen oxides (NO<sub>x</sub>), and nitrate particulate matter. The emissions, influenced by farming practices, livestock and fertilizer use, significantly impact air quality and climate.

### **Integration of atmospheric composition and climate data:**

Investigate the integration of CAMS atmospheric composition products with climate data to assess the impact of pollutants on agriculture. This includes examining pollutant concentrations, deposition, and their influence on crop health and productivity. For example, explore CAMS datasets on surface ozone concentrations to assess their potential impacts on crop yields and devise strategies to minimise losses.

### ***Key Areas of Exploration, with key information provided by CAMS:***

- **Assessing Agricultural Losses:**
  - Illustrate how to quantify losses due to air pollution, using data on primary pollutants (e.g., NO<sub>x</sub>, NH<sub>3</sub>) and secondary pollutants (e.g., ozone, PM<sub>2.5</sub>) provided by CAMS.
- **Reducing Air Pollution Impacts:**
  - Develop modules to use emission monitoring products, from CAMS, in relation to synoptic and climate conditions, including the role of pollen.
- **Optimizing agricultural production:**
  - Illustrate how CAMS data on solar irradiance and photosynthetically active radiation (PAR) can be used to optimize crop production and match agricultural outputs with demand.
- **Contributing to climate mitigation:**
  - Discuss how to utilise CAMS data on anthropogenic greenhouse gas emissions to design practices that align with climate change mitigation goals.

If successful, these exploratory activities could form the foundation of a dedicated service module addressing both adaptation and mitigation needs. This module could offer tailored solutions for the agricultural sector, enhancing resilience and sustainability in the face of climate challenges.

### **Cross-cutting Themes for Adaptation and Mitigation:**

The exploratory phase will consider how products developed for adaptation (e.g., climate projections, adaptation tools) and those for mitigation (e.g., emission monitoring) can complement each other. This synergy is critical for creating holistic solutions for the agriculture sector.

### **Exploring Long-Term Sustainability of Products:**

WP4 will assess the feasibility of possible future implementation of the proposed products, including their integration into C3S operational workflows, and gauge their potential for scaling and expanding to different regions, especially in high-impact zones like the Mediterranean.

### ***Indicative list of deliverables for WP4:***

The following table provides an indicative list of deliverables, the responsible party, nature of the deliverable, and the due dates for WP4. This is not an exhaustive list; Tenderers may propose additional or amended deliverables and timelines depending on their specific approach. We encourage Tenderers to separate the due dates of the deliverables so that they are not all delivered in the same month.

<b><i>Deliverable</i></b>	<b><i>Responsible</i></b>	<b><i>Nature</i></b>	<b><i>Deliverable / Milestone title</i></b>	<b><i>Due date</i></b>
WP4-D1	Tenderer	Report	Report on exploratory new components	By the end of month 24 and updated at month 30

## 6. General Requirements

### 6.1. WPO: Management and Coordination

This work package includes overall responsibility for day-to-day service management and coordination.

The following contract management aspects shall be briefly described in the proposal:

**Plans** for the mandatory reporting on implementation and forward planning.

**Meetings (classified as tasks and listed in a separate table as part of the proposal):**

- Organise quarterly teleconference meetings to discuss C3S service provision, service evolution and other topics, prepare corresponding summary minutes of these meetings and maintain a list of agreed actions and their status.
- ECMWF organises annual C3S General Assemblies. The Successful Tenderer is expected to attend these meetings with maximum 3 team members and contribute to discussions related to the topic of this ITT.
- Tenderers can propose additional contract internal meetings (e.g. kick-off meeting, regular meetings to monitor contract performance) as part of their response. Most such meetings should be held by remote participation.

**Quality assurance and control:** the quality of reports and Deliverables shall be equivalent to the standard of peer-reviewed publications. The timely delivery as well as final quality check of the deliverables shall be ensured by the Successful Tenderer (in terms of content, use of ECMWF reporting templates for deliverables and reports (Microsoft Word), format, deliverable numbering and naming, typos...); all reports in this project shall be in English. Unless otherwise specified the specific contract Deliverables shall be made available to ECMWF in electronic format.

**Communication management** (incl. external and internal communication). Any external communication activity must be agreed with the ECMWF Copernicus Communication team in advance. This includes, but not exhaustively, communication planning, branding and visual style, media outreach, website and social media activity, externally facing text and graphical content and events. Agreed activity would also need to be evaluated and reported on once complete so that success measures and KPIs could be provided to the European Commission (cf. Clause 2.4.6 of the Framework Agreement).

**Set of Key Performance Indicators (KPIs)** suitable for monitor contract performance. The proposed KPIs shall be SMART (specific, measurable, actionable, realistic and time bound). The Successful Tenderer shall report to ECMWF on these KPIs as part of the Quarterly and Annual Implementation Reports. The proposed set of KPIs is expected to be updated regularly with ECMWF during the contract.

**Risk Management:** The proposal shall include a risk register that describes identified risks for each work package, along with a mitigation strategy for each of the identified risks. This mitigation strategy shall be composed by both preventive and corrective measures. The risk register shall be updated regularly by the Successful Tenderer, and any update (related to new risks, likelihood or impact) shall be reported during the progress review meeting, as well as part of the quarterly and annual implementation reports.

**Resources planning** and tracking using the appropriate tools.

**Subcontractor management**, including conflict resolution, e.g. the prime contractor is responsible for settling disagreements, although advice/approval from ECMWF may be sought on the subject. A list of subcontractors describing their contribution and key personnel shall be provided, as well as backup names for all key positions in the contract. Tenderers shall describe how the Framework Agreement; in particular Clause 2.9 on Sub-contracting has been flowed down to all their subcontractors.

**Management of personal data** and how this meets the requirements of Clause 2.8 on Personal Data Protection and Annex 6 of the Framework Agreement.

**List of minimum deliverables and milestones** required as part of WPO, covering the contractual and financial reporting obligations towards ECMWF in line with the Terms and Conditions of the Framework Agreement (cf. Clause 2.3 and Annex 5):

<b>WPO Deliverables</b>				
<i>Deliverable#</i>	<i>Responsible</i>	<i>Nature</i>	<i>Title</i>	<i>Due</i>
D0.y.z-YYYYQQ	Tenderer	Report	Quarterly Implementation Report QQ YYYY <i>QQ YYYY being the previous quarter</i>	Quarterly on, 15/04, 15/07 and 15/10
D0.y.z-YYYY	Tenderer	Report	Annual Implementation Report YYYY [Part 1] <i>YYYY being the Year n-1. Shall include:</i> <ul style="list-style-type: none"> <li>Quarterly Implementation Report Q4 YYYY ; <i>YYYY being the Year n-1</i></li> <li><i>Preliminary financial information YYYY ; YYYY being the Year n-1</i></li> </ul>	Annually on 15/01
D0.y.z-YYYY	Tenderer	Report	Annual Implementation Report YYYY [Part 2] <i>YYYY being the Year n-1</i>	Annually on 28/02
D0.y.z-YYYY	Tenderer	Report	Annual Implementation plan YYYY <i>YYYY being the Year n+1</i>	Annually on 30/09
D0.y.z-YYYY	Tenderer	Other	Copy of prime contractor's general financial statements and audit report YYYY <i>YYYY being the Year n-1</i>	Annually around June (no associated cost)
D0.y.z	Tenderer	Report	Final report	60 days after end of contract

<b>WPO Milestones</b>			
<i>Milestone#</i>	<i>Title</i>	<i>Means of verification</i>	<i>Due</i>
M0.1.1.MX	Progress Review meeting with ECMWF / Payment milestones	Minutes of meeting	At each Payment Milestone due date (~every 6 months)
M0.1.2.MX	Kick off meeting	Minutes of meeting	Month 1
M0.2.1	Updated KPIs (list, targets...) after review with ECMWF	Technical note	One year after start of contract

## 6.2. Provision of data to the Climate Data Store

Data delivery includes the provision of data and files containing abstracts, detailed descriptions of datasets, variables, etc., following the integration process detailed at Appendix 3 (Guidelines for Data Integration).

## 6.3. Bug fixing and maintenance of all service elements

The Successful Tenderer shall be responsible of debugging and maintaining the datasets, the applications as well as updating relevant user guides and associated documentation, as required.

The Successful Tenderer will ensure **quality of all scripts and tools** used to generate and publish C3S datasets and applications, through an internal quality control procedure to be delivered together with datasets and applications. As detailed above, workflow quality includes aspects such as optimised performance of the software, adequateness of the applications and workflows in terms of usability, accuracy, description of input and output variables, appearance, coding standards and style, functionality, and scientific quality.

## 6.4. Support to user engagement activities

Tenderers shall accommodate for eventual needs in providing technical and scientific expertise in support of User engagement and training activities. Tenderers shall specify in their proposal the experts intended to be allocated to provide this support. Requests to support activities may be raised on, for example:

- Contribute with content specific input to training, education, and capacity building material: development and/or review of learning resources in the domain of the contract, participation in train-the-trainer events and MOOCs.
- Contribute with content specific input to user-oriented communication material such as slides, story maps and user testimonials.
- Contribute and attend User Uptake workshops and stakeholder meetings. Presentations in languages other than English (e.g. mother tongue of named experts) may be asked to be provided.
- Input to the C3S collection of user requirements (template will be provided to the successful Tenderer at the start of contract), as well as sharing needs and aspirations as raised by potential new user communities.
- Provide input to conceptual assessments and developments of specific user engagement plans and actions as launched by ECMWF.
- Provide input to user stories and user testimonials.

A small, dedicated budget shall be allocated in the pricing table to accommodate for these needs. Details on the expected activities and the budget shall be refined during the negotiation phase with the preferred Tenderer.

## 6.5. Contribute to L2 support to Copernicus User Support Team

Quality control procedures shall be put in place to check the quality of data before transmission to ECMWF. The precise methods should be proposed by Tenderers and will be agreed on as part of the negotiations. In the case of ECMWF detecting potential problems with the data, providers are required to give timely support to resolve problems quickly, and at the latest 24 hours before the product release date. Each data and application version needs to be documented, at a level which defines how the data/application were produced and allows users to understand version changes. The data providers will be responsible for making this documentation available as required.

The contract shall provide support to C3S on several fronts.

1. Technical support to the CDS team, on matters related to the operation of the infrastructure. As this is a service with operational status, this means timely responses in case of problems detected using an efficient workflow to get the answer and possible fixes quickly.
2. Support to specific user questions which relate to the hosting, archiving and the quality control of the original data and which go beyond the expertise of Copernicus User Support (CUS). A procedure should be defined and implemented to accommodate such requests and provide timely answers. Level-2 support is provided through the Copernicus User Support (operating a Jira ticketing system) with agreed Key Performance Indicators (KPIs; for example, 85% of Level-2 tickets should be resolved within 15-working days). The Successful Tenderer shall provide an email address which acts as the single contact point.
3. The Successful Tenderer is requested to provide and maintain user documentation where appropriate. User documentation is an integral part of the CDS catalogue entries and should be key to answering users' questions about the products/services provided by the Successful Tenderer. Copernicus User Support will provide template and guide the Successful Tenderer on creating and updating such documentation. For the time being, documentation is managed using Atlassian Confluence and is in the HTML format.

4. Support is also required for related C3S activities, including communication and outreach. While for most such cases the needs on this contract are expected to be minimal, consideration should be given to allowing resources to cover these aspects. Any communication activity related to this work must be agreed with the ECMWF Copernicus Communication team in advance. This includes, but does not exhaustively cover, communication planning, branding and visual style, media outreach, website, and social media activity, externally facing written and graphical content and events.
5. Provide support to users through the user forum upon request.

## 6.6. Evaluation and Quality Control

Evaluation and Quality Control (EQC) is a central component of C3S to establish the service as a trusted source of climate information, delivering quality-assured and authoritative service outputs such as datasets and applications that are traceable and reproducible. In parallel to this ITT, another ITT will be issued regarding EQC for tools, applications and derived data including indicators.

EQC checks are independent from data providers and SIS Successful Tenderers, hence no specific commitment is expected. However, the EQC programme provides the general requirements framework and independent technical and/or scientific evaluation of the delivered services (datasets, applications, indicators etc.). The Successful Tenderer shall foresee providing support to the EQC function as necessary.

## 6.7. Communication

The Successful Tenderer shall support ECMWF in its communication activities for the C3S services, where they are related to the activities described in this ITT. Additional activities such as C3S website news items, C3S brochures and flyers, may be discussed on a case-by-case basis during the contract implementation. All communication activity must be agreed with the ECMWF Copernicus Communication team in advance. This includes, but not exhaustively, communication planning, branding and visual style, media outreach, website and social media activity, externally facing written and graphic content and events. Such agreed communication activity would also need to be evaluated and reported on, once complete, so that success measures and KPIs can be provided to the European Commission.

## 6.8. Data and IPR

It is a condition of EU funding for Copernicus that ownership of any datasets/software developed with Copernicus funding passes from the suppliers to the European Union via ECMWF. Ownership will pass from the date of creation of the datasets/software. Suppliers will be granted a non-exclusive license to use the datasets/software which they have provided to Copernicus for any purpose.

All software and products used by the Successful Tenderer to produce the Copernicus datasets/software will remain the property of the Successful Tenderer, except for those components which are acquired or created specifically for Copernicus purposes, with Copernicus 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 European Union annually. The Successful Tenderer will be granted a non-exclusive license to use them for any purpose.

## 6.9. Implementation Schedule

Tenderers shall provide a detailed implementation plan of proposed activities for the full period of the contract.

## 6.10. Deliverables and Milestones

Deliverables should be consistent with the technical requirements specified in this document. A deliverable is a substantial, tangible or intangible good or service produced because of the contract. In other words, a deliverable is an outcome produced in response to the specific objectives of the contract. Deliverables are subject to acceptance by the technical contract officers at ECMWF. All contract reports and documentation for this ITT shall be produced in English. The quality of reports and deliverables shall be equivalent to the standard of peer-reviewed publications and practice. Unless otherwise specified in the specific contract, deliverables shall be made available to ECMWF in electronic format (PDF/Microsoft Word/Microsoft Excel or HTML) via the Copernicus Deliverables Repository portal. The details will be agreed at the negotiation stage.

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

Milestones should be designed as markers of demonstrable progress in service development and/or quality of service delivery, as applicable. They should not duplicate deliverables.

Tenderers shall complete the relevant table in Volume IIIA as part of their Tender, which includes the details of deliverables and milestones for all work packages and the schedules for each work package. Volume IIIA will be used by Tenderers to describe the complete list of deliverables, milestones, and schedules for each work package. All milestones and deliverables shall be numbered as indicated. All document deliverables shall be periodically updated and versioned as described in the tables.

## 6.11. Key Performance Indicators

The Successful Tenderer shall report to ECMWF on a set of Key Performance Indicators (KPIs) suitable for monitoring various aspects of service performance (by using the template included in Volume IIIB). The KPIs shall be designed to quantify various aspects of quality of service against the requirements described in this document. As part of the Tender, Tenderers shall specify a proposed set of KPIs appropriate for the service, e.g., relating to operational service delivery, quality, data access, user support, user satisfaction, etc., aligned with the requirements expressed above. These initial specifications shall be refined together with ECMWF during the first 6 months of the contract.

## 6.12. Payment Plan

Tenderers can propose a Payment Plan in ITT Volume IIIA “Pricing and deliverables” (cf. Excel spreadsheet “Payment Plan preparation”):

- The Payment Milestones should relate to the deliverables and milestones delivered during the corresponding Payment Milestone period (e.g. the payment covering the period January-June would only relate to the deliverables and milestones whose due dates are part of the same period).
- The frequency of Progress Review Meetings might be adapted to synchronise with the anticipated date of completion of each Payment Milestone.
- In case of request for a payment at contract signature, please note that this should be duly substantiated (e.g. in terms of necessary investment prior to implementation or during first weeks/months for ensuring the initial set up of the project). It is necessary to relate this payment to activities subject to other Payment Milestones.

## 7. 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.

## 7.1. Page limits

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

<i>Section</i>	<i>Page Limit</i>
<i>Executive Summary</i>	2
<i>Track Record</i>	2 (for general) and 2 (per entity)
<i>Quality of resources to be Deployed</i>	2 (excluding Table 1 in Volume IIIB and CVs with a maximum length of 2 pages each)
<i>Technical Solution Proposed</i>	2 + 3 per Work package (Table 2 in Volume IIIB, the section on references, publications, patents and any pre-existing IPR is excluded from the page limit and has no page limit)
<i>Management and Implementation</i>	6 (excluding Table 4 and Table 5 in Volume IIIB) + 2 per each Work package description (Table 3 in Volume IIIB)
<i>Pricing Table</i>	No limitation

Table 1: Page Limits

## 7.2. 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.

### 7.2.1. Executive summary

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

### 7.2.2. Track record

Tenderers 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.

### 7.2.3. Quality of Resources to be deployed

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

- A senior team member with more than 5 years of experience in managing activities related to this ITT (referred to as Service Manager). This person will be the point of contact on technical matters.
- A team member with experience of managing projects and contracts of this type and size (referred to as Contract Manager). This person will be the main point of contact for administrative matters.
- Team members with demonstrated experience in performing activities related to the various aspects of this ITT.

These team members shall be involved in the activities of this ITT at a minimum level of 10% of their total working time.



#### 7.2.4. Technical Solution Proposed

Tenderers are expected to provide a short background to the proposed technical solution to demonstrate understanding of the solution proposed, as well as an exhaustive and detailed description of the proposed technical solution and its organisation into work packages.

#### 7.2.5. Management and Implementation

As part of the general project management description, and in addition to the guidance provided in Volume IIIB, Tenderers shall consider the elements described in section 6.1 above.

## 8. Additional Information

### 8.1. Appendices

#### 8.1.1. Appendix 1 How to submit Jupyter Notebook based training material to the CDS/ADS/CADS

Tenderers should refer to the separate document attached. Note that the document may include links to other ECMWF and/or web resources, some of which may not be publicly available. This document is provided to facilitate Tenderers' understanding of what is expected in terms of standards, content and the information and deliverables required for the submission of training material in the form of Jupyter Notebooks, as well as to facilitate the assessment and costing of resources which Tenderers should allocate in their response for any such activities. Full access to ECMWF internal resources shall be provided to the successful Tenderer at the start of the contract.

#### 8.1.2. Appendix 2 Application Style Guide

Tenderers should refer to the separate document attached. Note that the document may include links to other ECMWF and/or web resources, some of which may not be publicly available. This document is provided to facilitate Tenderers' understanding of the general guidance that should be followed by contractors when designing Copernicus-branded web applications and to facilitate the assessment and costing of resources which Tenderers should allocate in their response for any such activities. Full access to ECMWF internal resources shall be provided to the successful Tenderer at the start of the contract.

#### 8.1.3. Appendix 3 Guidelines for Data Integration

Tenderers should refer to the separate document attached. Note that the document may include links to other ECMWF and/or web resources, some of which may not be publicly available. This document is provided to facilitate Tenderers' understanding of the data integration process and to facilitate the assessment and costing of resources which Tenderers should allocate in their response for any such activities. Full access to ECMWF internal resources shall be provided to the successful Tenderer at the start of the contract.

**C3S2\_414 Volume II**  
**Appendix 1**

**How to submit Jupyter Notebook based training material to  
the CDS/ADS/CADS**

Copernicus Contractors

Exported on 02/19/2025

## Table of Contents

1	Overview .....	3
2	Notebook contents and standards .....	4
2.1	Notebook templates .....	5
2.2	Hint and tips .....	5
2.2.1	Cross-references and placeholder hyperlinks.....	5
2.2.2	HTML tags .....	5
3	Delivery .....	6
4	Training material integration workflow .....	7
5	TEMPLATE Training material checklist for COPCO-???	8
5.1	Note to Reviewers and Editors:.....	8
5.2	Instructions to Contractors: .....	8
5.3	Review Checklist .....	9
5.4	The components below this point are for internal CDS use only.....	11
5.4.1	Delivery/submission checklist (for CDS team) .....	11
5.4.2	Editorial Board Decisions .....	12

# 1 Overview

So that users can make best use of the data available in the CDS/ADS/CADS, data providers can provide training material in the form of Jupyter Notebooks which can be included in the [Copernicus training inventory](#)<sup>1</sup>, with accessible links added to the relevant dataset pages.

This page describes what is expected in terms of notebook standard and content and the information and deliverables required for the submission.

---

<sup>1</sup> <https://ecmwf-projects.github.io/copernicus-training-c3s/intro.html>

## 2 Notebook contents and standards

All training material delivered by the contractors need to be compliant with the CDS/ADS/CADS standards. The ultimate aim of the delivery is to publish the training material on the Copernicus and CDS/ADS/CADS websites. In order to be published, the training material needs to be SWUMP:

- **Self-explanatory**
  - All steps are clearly, correctly and succinctly explained
- **Well structured**
  - The flow of the notebook should make logical sense and produce an aesthetically pleasing page in a style that is similar to the existing training material
  - A good balance between markdown and code as you progress through the notebook
- **Usable**
  - The notebook MUST run to completion without errors
  - The notebook MUST only include output and widgets which are compatible with JupyterBooks, see Hints and tips section.
  - The notebook MUST NOT contain html tags which conflict with JupyterBooks, see Hints and tips section.
- **Meaningful**
  - The content of the notebook should be relevant and provide a meaningful application of the data
  - The training material should provide a use-case with added value to the data available in the CDS
- **Proficient**
  - The notebook MUST meet our code standards tests which can be checked prior to submission using the commands provided below

To assist with your notebook development please see the review checklist that indicates what is expected from the delivered Notebooks: [TEMPLATE Training material checklist for COPCO-???](#) (see page 8)

### Code standards tests

```
# install necessary packages
pip install flake8-nb

# execute tests with CDS configuration options:
flake8_nb --max-line-length 100 --max-doc-length 100 $NOTEBOOK
```

## 2.1 Notebook templates

We recommend that you use one of the already [published training notebooks](#)<sup>2</sup> as a template to help you get started. It may even be useful to work through several of the Jupyter notebooks to help get a better understanding of what is expected.

## 2.2 Hint and tips

### Widgets and output

The widgets and output included in the Notebook must be compatible with JupyterBooks. JupyterBooks do not have a running python kernel, therefore they are not compatible with interactive widgets which require a running kernel, e.g. a number of ipywidgets, as documented here:

<https://jupyterbook.org/en/stable/interactive/interactive.html?highlight=widgets#ipywidgets>

### Inline images

Any additional images included in the notebook should be added using markdown hyperlink syntax, html syntax does not work with our jupyter-books.

#### Example image link

```

```

### 2.2.1 Cross-references and placeholder hyperlinks

Please avoid using placeholder hyperlinks using (the HTML `<a>` tag without a href provided) and within notebook cross-references (links between sections of the notebook). Due to platform differences they are not rendered correctly on JupyterBook pages and causes many compilation warnings and errors. This means it is much harder for us to identify real issues in the notebook, slowing down the integration process.

### 2.2.2 HTML tags

Please refrain from using HTML tags in general as they often interfere with the HTML config that JupyterBook builds and do not necessarily produce the intended effect when deployed in different environments. Markdown should offer all the text formatting required for the purposes of these training notebooks.

---

<sup>2</sup> <https://ecmwf-projects.github.io/copernicus-training-c3s/intro.html>

## 3 Delivery

The method for delivering training material will be via ECMWF Contractors Portal ([COPCO](#)<sup>3</sup>), please select the Training Material option, [or click this link](#)<sup>4</sup>. You must have an ECMWF account to open a ticket, you can register [HERE](#)<sup>5</sup>.

As each piece of training material will have to go through the review process it is best to open a ticket for each piece submitted such that it is easier for everyone to follow the progress of submission.

The ticket should be created with the following information:

1. **Subject**

- The proposed title of the training material.

2. **Description**

- This should include the following:
  - Short description (1 or 2 sentences) of the contents of the notebook. This is for reference to help participants follow the progress of integration.
  - *Optional:* In lieu of an attached Jupyter notebook, you can provide a link to a github repository containing the Notebooks.

3. **C3S Contract category and number**

- Select the contract category and number associated with this submission

4. **Request participant**

- Any colleagues who may want to follow the progress of the submission. (They must also have an ECMWF account to be added as a participant)

5. **Attachment**

- a. Jupyter Notebook(s) containing training material
- b. Completed checklist
- c. Any other supporting documents and/or images?

The delivery of training material does not guarantee publication of the training material. All training material are subject to an internal review process which will ensure that the published content is of the standards expected (SWUMP).

---

<sup>3</sup> <https://jira.ecmwf.int/plugins/servlet/desk/category/cds-apps>

<sup>4</sup> <https://jira.ecmwf.int/plugins/servlet/desk/portal/12/create/233>

<sup>5</sup> [https://accounts.ecmwf.int/auth/realms/ecmwf/protocol/openid-connect/registrations?client\\_id=apps&response\\_type=code&scope=openid%20email&redirect\\_uri=https://www.ecmwf.int](https://accounts.ecmwf.int/auth/realms/ecmwf/protocol/openid-connect/registrations?client_id=apps&response_type=code&scope=openid%20email&redirect_uri=https://www.ecmwf.int)

## 4 Training material integration workflow

1. **The training material is developed inline with the objectives of the relevant contract(s)**
  - A technical officer will be assigned to ensure that the scientific and informative content of the training material is suitable.
  - The submitted version of the training material must be SWUMP
2. **The training material is delivered via a CDSAPP Jira ticket**
  - Please see the [Delivery \(see page 6\)](#) section
3. **The training material is checked and reviewed**
  - See [TEMPLATE Training material checklist \(see page 8\)](#)
  - The delivery is checked by the CDS team
    - i. Have all required fields been provided
    - ii. Does the notebook run to completion and meet the coding standards (Usable and Proficient)?
  - The training material is reviewed by **1/2** ECMWF members of staff
    - i. Is the notebook Self-explanatory, Well structured and Meaningful?
    - ii. We try to ensure reviewers are NOT specialist in the field to ensure that is understandable to non-experts
  - A final editorial decision is made
4. **The training material is published in the C3S/CAMS training library**



## 5 TEMPLATE Training material checklist for COPCO-???

JIRA	link for reviewing training material in the development pages

### 5.1 Note to Reviewers and Editors:

**Instructions:**

- To edit the page see the edit button at the top right
- If you are happy with an field (e.g. Title) just tick the box and move on
- If you are not happy with an element please list specific points that you would like address
- Start typing next to the checkbox, when you hit return you will get a new checkbox for a second point
- Leave these checkboxes unticked, this means the person responding to your review can tick them as they address the points
- The purpose of the review is to ensure that the content of the material is good enough, the CDS team will ensure that the notebook is functional and runs
- But don't let this stop you downloading and playing yourself if you are interested

### 5.2 Instructions to Contractors:

- Please respond to all the reviewer comments in the checklist table, unless there is a comment from the CDS team that states otherwise
  - When you have addressed the comment please tick the checkbox
  - If you have any comments please add them green below the relevant review comment
  - If you feel the review comment is not addressable please leave the box unchecked and provide an explanation why it has not been addressed.
- When you have completed the responses please inform your technical officer on the JIRA ticket.

## 5.3 Review Checklist

<b>Instructions for reviewers:</b> <b>If you are happy with a component please put a tick in the box.</b> <b>If you are not satisfied it is helpful if the comments are provided as a list of specific items which can be addressed.</b> <b>This is not to discourage general comments if, for example, a component is generally lacking in direction/purpose/clarity.</b>	<b>Technical Officer</b>	<b>Expert Review</b>	<b>User support</b>
<b>Title</b> <i>Is the title concise and correct?</i> <b>good example:</b> <i>"Tutorial on climatologies using ERA5 data"</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Introductory text</b> <i>Is the introductory text clear and understandable?</i> <i>It should explain what the notebook does and provide an outline of the order of computation</i>	<input type="checkbox"/>		
<b>Data description text</b> <i>Summary of the data used in the notebook</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>All other text in the notebook.</b> <b>Specific comments regarding any of the other text in the notebook, e.g. spelling, capitalisation and grammar or any other comments.</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Notebook flow</b> <i>Does the order of the Notebook make sense?</i> <i>Are the steps taken in an increasing order of complexity?</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<p><b>Notebook appearance</b>  <i>Is the layout of the Notebook clear and well structured?</i>  <i>Are the the plots/tables and other outputs of sufficient quality?</i></p>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>Notebook relevance</b>  <i>Is the output produced by the Notebook meaningful, is it a useful application of the data?</i></p>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>Notebook self-description</b>  <i>Is the Notebook self-explanatory, you do not need to go to other source to undertand the steps taken and why.</i>  <i>This does NOT mean the data or underlying software has to be fully explained, just clear reasoning for thhe steps taken within the Notebook</i></p>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>Notebook code comments (Optional)</b>  Please provide any comments you have regarding the code quality and structure.  Please note that this is optional and all notebooks will be automatically screened for general code quality.</p>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>Contents side bar controls (right hand side)</b>  <i>Do the controls on the right hand work and have sensible headings?</i></p>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>Any other comments</b></p>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<p><b>Decision</b>  <i>Review should choose one of the following:</i></p> <ol style="list-style-type: none"> <li>1. <b>Accepted - The resource will go straight to the Editorial board</b></li> <li>2. <b>Accept, minor changes - The resource will go to the Editorial board after your points have been addressed</b></li> <li>3. <b>Reject, major changes required - The resource will be <b>returned to you</b> for evaluation that your points have been adequately addressed</b></li> </ol>			
---	--	--	--

## 5.4 The components below this point are for internal CDS use only

### 5.4.1 Delivery/submission checklist (for CDS team)

Item <i>This is to check that the provider has made a sufficient submission prior to starting any review process. In some cases it will be best to make the changes</i>	CDS Team/ Training Contract representative:
<b>Ready for review</b>	<input type="checkbox"/>
<b>JIRA Description and title</b> <i>Is the description good enough to follow progress, e.g. is it clear what the notebook contains and is it clear which Chapter the TM should be placed?</i>	<input type="checkbox"/>
<b>Notebook runs to completion</b> <ul style="list-style-type: none"> <li>▪ No references to local locations in Notebook</li> <li>▪ Data downloads correctly, requests are still valid</li> </ul>	<input type="checkbox"/>
<b>Package install and import</b> <i>No output produced by package install. Packages should only be imported if they are used</i>	<input type="checkbox"/>

<b>Data access</b> <i>Accessing the data should follow our guidelines:</i> 1. <i>cdsapi to download, unzip with ZipFile, then open with xarray/pandas</i> 2. <i>earthkit-data to do all of the above in a single step</i>	<input type="checkbox"/>
<b>Notebook passes code standard tests (desirable)</b>	<input type="checkbox"/>
<b>IF THE ABOVE TEST PASS WE ADD THE NOTEBOOK INTO THE APPROPRIATE REPOSITORY AND BUILD THE REVIEW VERSION OF THE JUPYTER BOOK</b>	
<b>Assign to appropriate chapter</b>	<input type="checkbox"/>
<b>Give appropriate sidebar link title</b>	<input type="checkbox"/>
<b>Any other business</b>	

## 5.4.2 Editorial Board Decisions

<b>The role of Editors is to ensure that:</b> <ul style="list-style-type: none"> <li>• <b>The training material provides added value to Copernicus (it is worth publishing)</b></li> <li>• <b>The review process has been followed</b></li> </ul> <b>Comments and suggestions are still welcome</b>	
<b>Agree on chapter and sidebar title (left)</b>	<input type="checkbox"/>
<b>Decision</b>	<input type="checkbox"/>
<b>Comments</b>	

**C3S2\_414 Volume II**  
**Appendix 2**

**Applications Style Guide**

Copernicus Contractors

Exported on 02/19/2025

# Table of Contents

1	Introduction .....	3
2	General Style .....	4
2.1	Colours .....	4
2.2	Fonts .....	4
3	Controls and Settings .....	5
3.1	Dropdowns .....	5
3.2	Buttons .....	5
3.3	Modals .....	6
3.4	Side panels .....	7
4	Interactive maps .....	8
4.1	General Layout .....	8
4.2	Mobile Layout.....	8
4.3	Interactivity .....	9
4.4	Projections .....	9
4.5	Visualisation Style.....	10
5	Static Maps .....	11
5.1	Software .....	11
5.2	Projections .....	11
6	Graphs and Plots.....	12
6.1	Software .....	12
6.2	Climate Projections .....	12
7	Logos and Attribution .....	14
8	Disclaimers.....	15

# 1 Introduction

This page provides general guidance that should be followed when designing Copernicus-branded web applications. These guidelines are not necessarily meant to be interpreted as a set of hard-and-fast rules, but rather a series of recommendations and principles that should help maintain a **consistent look and feel** across Copernicus interactive web content.

## Table of Contents



## 2 General Style

Copernicus applications should be **simple** and **clear**, and not **over-complicated**.

### 2.1 Colours

All application widgets should have a **white** background with **black** text.

### 2.2 Fonts

C3S-branded applications should use the font **Calibri**.

Content text should have a font size of **14px**; headings should have a font size of **18px**.

## 3 Controls and Settings

When developing control panels and user-input sections, consider how each component guides the user to find the information that's useful to them.

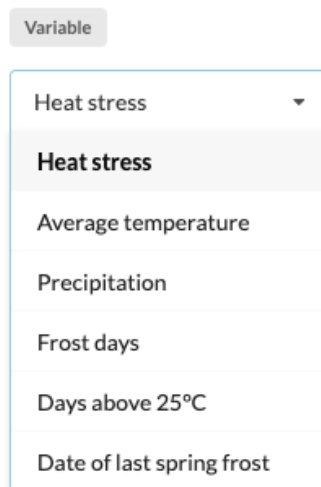
---

### 3.1 Dropdowns

Use a dropdown when:

- selection options are **naturally discrete**, e.g. data variables;
- the list of available options is **long** (>5).

Dropdowns hide non-selected options until the user interacts with them, creating a clear separation between each choice in the interface. This makes dropdowns most useful for input fields which are not intended for direct comparison.



### 3.2 Buttons

Use a series of buttons when selection options **naturally follow on from each other**, such as time horizons or emission scenarios - unless there is a long list of options available, in which case a dropdown might be more suitable.

Buttons show the user all available options at all times, encouraging interaction and comparison more than a dropdown would. Based on this principle, it's worth considering whether a series of buttons or a dropdown would be more appropriate for each input choice field.



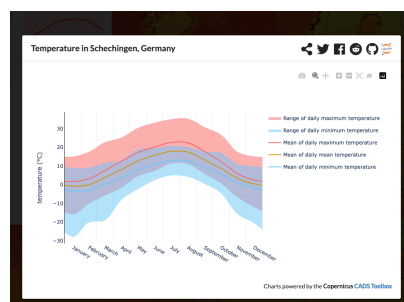
### 3.3 Modals

Use a modal to display **large blocks of text**, such as help or detailed information text.

Longer passages of text should always be delegated to modals where possible, to avoid cluttering the main interface with large amounts of text.

Modals should be **launched from buttons**; for example, instead of including a "How to use this application" section in the main interface, consider having a "How to use this application" button which triggers a modal containing the detailed text.

Modals can also be used for graphics and visualisations which demand lots of space or attention - for example, in some interactive map applications, clicking on a point can launch a modal to display statistics and graphs at the selected point.



## 3.4 Side panels

Use a side panel in an **interactive map** when there are lots of user-selectable options.

Side panels should always appear on the **left-hand side** of interactive maps.

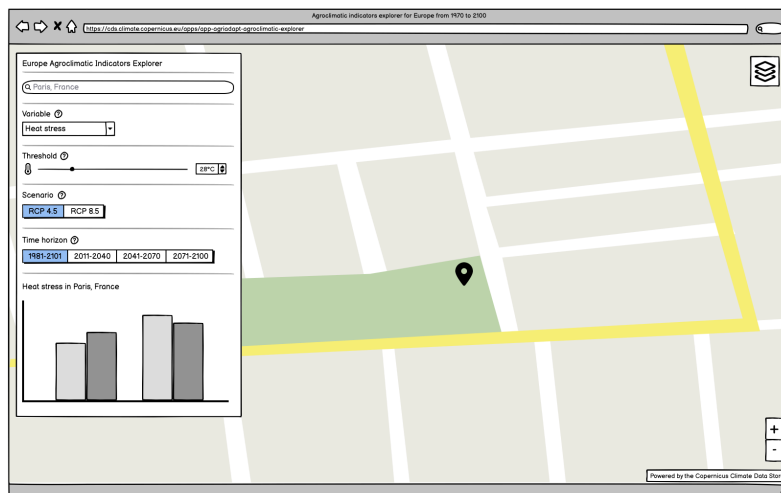
Side panels can contain plots and figures if appropriate - especially when it's important to see both the map and the figure in the same frame.



## 4 Interactive maps

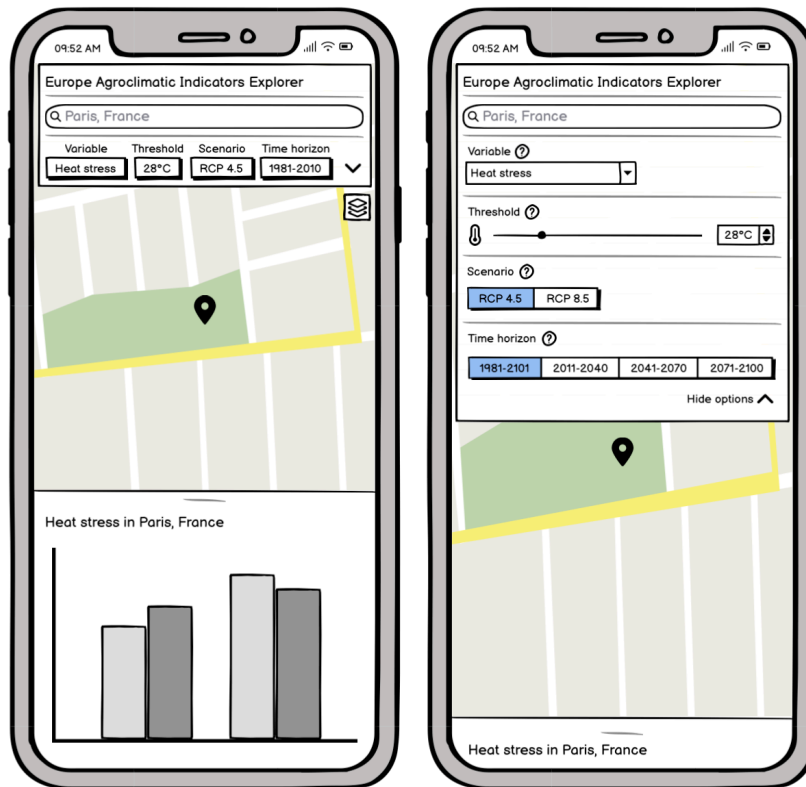
### 4.1 General Layout

- Interactive maps should be **full screen** unless there is a very good reason not to be (for example if the map is not the main focus of the application).
- Interactive map **controls**, such as zoom and pan, should be placed in the **bottom right-hand corner**.
- **Layer selection options** should be placed in the **top right-hand corner**.
- If the application has user selection options (e.g. to change variables, temporal aggregations, statistics etc.), these should be placed in a **side panel** on the **left-hand side** of the map.



### 4.2 Mobile Layout

- Interactive maps should be **full screen** unless there is a very good reason not to be (for example if the map is not the main focus of the application).
- **Layer selection options** should be placed **at the top of the screen**. They should be **minimisable** in such a way that the selection remains visible, but the selection *widgets* are hidden so as to save space (see mockup below).
- In general, graphs, statistics and results returned from interacting with the application should appear in a **drawer** widget at the **bottom** of the application, much like Google Maps (see mockup below).



### 4.3 Interactivity

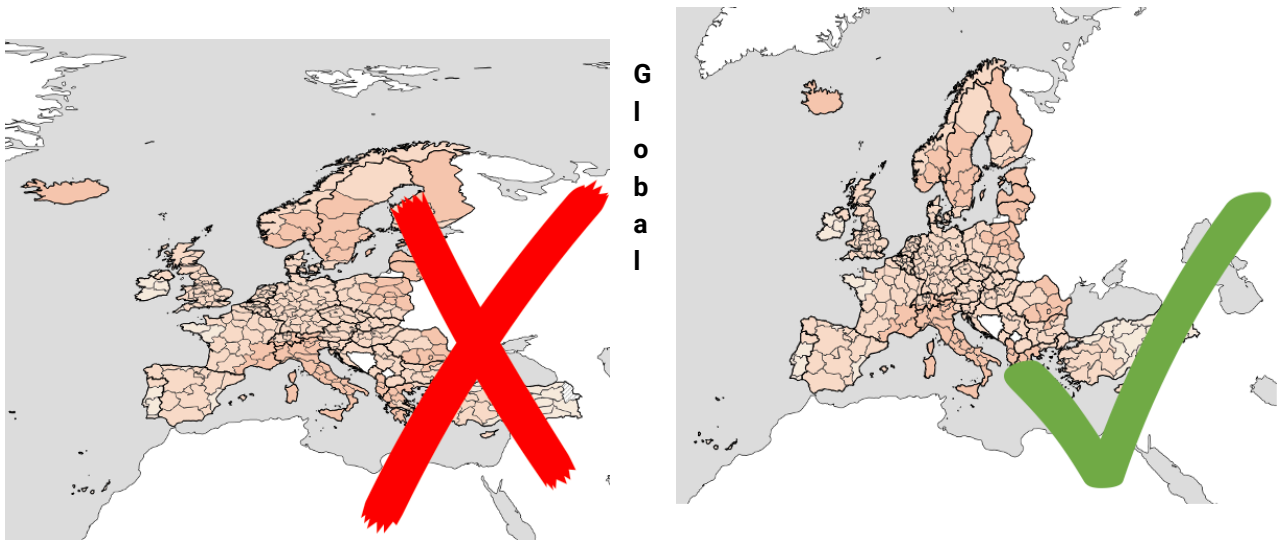
Interactive maps should always be **zoomable** and **pannable**, but appropriate limits should be set for maximum/minimum zoom - for example, if data is aggregated on European countries, the maximum zoom level should comfortably fit the smaller countries within the window.

### 4.4 Projections

Interactive maps should use a projection suitable for the data being visualised – for example, data focused on the North Pole should use a polar stereographic projection.

Projection choice is left to the discretion of the application designer, except for **European** and **Global** maps:

- **European** maps should use **EPSG:3035**



maps should use **EPSG:3857**

## 4.5 Visualisation Style

Data layers visualised on interactive maps should always be **opaque**, unless there is a very good reason for the layer to be transparent. Semi-transparent data layers on top of satellite/map layers are hard to interpret and often look messy.

Background map layers should have the **right level of detail** to compliment the data being visualised. In general, satellite/maps layers with roads, towns and buildings are **not** appropriate for use with climate model data, as the detail of these layers indicates a level of precision that is not consistent with the resolution and uncertainty in climate models.

## 5 Static Maps

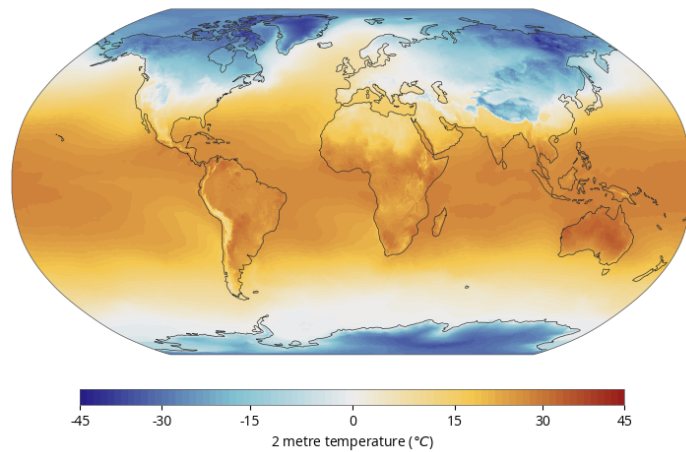
### 5.1 Software

Static maps should be generated using **earthkit-maps** or **matplotlib** and **cartopy**.

### 5.2 Projections

The same projection rules outlined for interactive maps above also apply to static maps - that is, the projection used should be suitable for the data being visualised. As with interactive maps, European maps should use **EPSG:3035** where possible; but global *static* maps should use the **Robinson** projection, as below.

ERA5 2 metre temperature monthly mean - January 2020





## 6 Graphs and Plots

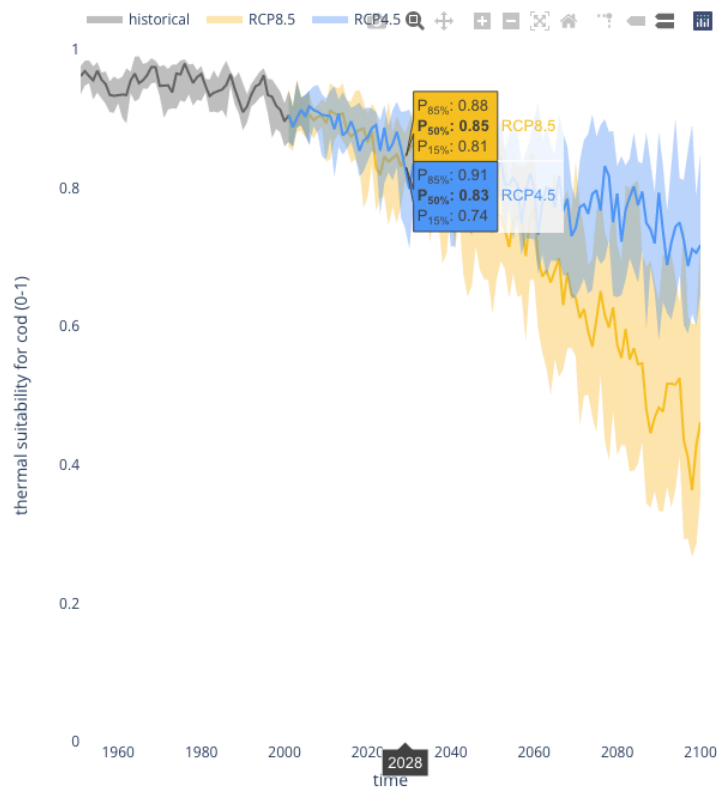
### 6.1 Software

Statistical graphs and plots should be generated using **earthkit-plots** or **Plotly**.

### 6.2 Climate Projections

Climate projection time series plots are one of the most common graphs produced in C3S applications. In order to maintain a consistent look and feel, and in order to help make our applications more directly comparable, we follow a style guide for these plots:

- each scenario should be represented by a **solid line** representing the multi-model "average" (usually the **50th percentile**) on top of a **semi-transparent shaded region** (40% opacity) representing the multi-model spread (usually the **15th - 85th percentile**)
- when using Plotly, the hover labels for climate projections should be **grouped** (see example below) - i.e. the labels for each percentile should be included in a single hover label for each emissions scenario. This is to avoid overcrowding the plot with hover labels (by default, 3 scenarios x 3 percentiles = 9 hover labels!)



The colours selected above are **grey** ( #666666 ) for **historical** data; **pink** ( #c31ff9 ) for **low-emissions scenario** data (not shown above); **blue** ( #5197f8 ) for **medium-emissions scenario** data; and **yellow** ( #f9c31f ) for **high-emissions scenario** data. These colours are not enforced, but have been selected to be **colourblind-friendly**, while also removing colour-emphasis from each scenario (i.e. plotting high-emission scenarios in red is likely to bias the interpretation of that scenario as "dangerous" or "hot", which should be avoided - even if accurate - because the data should speak for itself).

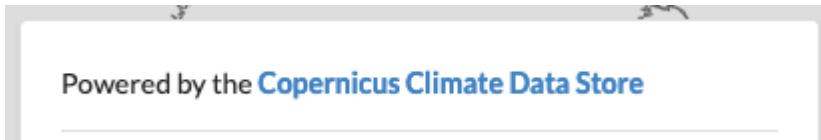
## 7 Logos and Attribution

All C3S-branded applications should include the text "**Powered by the Copernicus Climate Data Store**". Equivalently, all CAMS-branded applications should include the text "**Powered by the Copernicus Atmosphere Data Store**".

In interactive map applications, this text should be added to the standard "attribution" section in the bottom right-hand corner:



This text can also be placed at the top of a side panel, unless the application has a lot of controls and settings:



## 8 Disclaimers

In applications which show political boundaries, our legal department has recommended that we include the following text (usually best-placed inside a modal):

**"The designations employed and the presentation of material on the map do not imply the expression of any opinion whatsoever on the part of the European Union concerning the legal status of any country, territory or area or of its authorities, or concerning the delimitation of its frontiers or boundaries."**

**C3S2\_414 Volume II**  
**Appendix 3**

**If you are a provider of data**

Copernicus Services

Exported on 02/19/2025

## Table of Contents

1 Provider's role: summary .....	4
2 How to start the integration of your data in the CDS Catalogue.....	5
3 Main processes in which you are expected to participate .....	6
4 Manifests, deprecation of data, versions, DOI, citation, acknowledgement and licence.....	9
5 Publishing under FAIR principles .....	17

### About this page

Scope	This page describes the main steps needed to integrate data in the CDS Catalogue. It <b>does not describe</b> what is needed to integrate documentation, the role of the technical officers and other aspects that are very important for a successful integration but that are the scope of other wiki pages.
Intended audience	<i>Copernicus CDS data providers.</i>
Outline	<i>The focus of this page is on what the data provider needs to supply to the CDS team and how to do it.</i>
Disclaimer	<i>The information in this page is not guaranteed to describe exactly the actual processes which are subject to change from time to time. But, the CDS team intends to keep the information in this page as close as possible of the actual practices.</i>

# 1 Provider's role: summary

## List of the expected contributions

The provider is expected to work closely with CDS team and the technical officer in order to resolve any issues that come up during the various stages of the publication process and afterwards. Communication is preferred through Jira ticket.

Below there is a list that had been laid out in chronological order with the main contributions.

1. Registers the Dataset: / [Dataset registration](#)<sup>1</sup> (*Integration process*)
2. Supplies the Information document: [Information document template](#)<sup>2</sup> (*Integration process*)
3. Supplies manifest file (See more about manifests below at *Manifest and pseudo-manifest files. Integration process.*)
4. Help the CDS team member to reply to the reviewer's and Editorial Board's comments (*Review process*)
5. Provide previous existent DOIs, licences and citations associated with each part of the data (see below: *DOI, citation and licence. Review process.*)
6. After entry published in the CDS Catalogue, the data provider should keep the manifest's filename and path exactly the same for the whole duration of the contract, even when the contents of the manifest is changed. (*Complementary processes: automatic updates*)
7. The data provider is expected to help the CDS team on keeping the entry working as expected when the data provider has the knowledge and the resources to do it (*Complementary processes: Maintenance*)
8. Follows CDS procedures for deprecating data ( see below: *Versions, deprecation of entries, replacement of data. Complementary processes: Maintenance*)

---

<sup>1</sup> <https://confluence.ecmwf.int/pages/viewpage.action?pageId=402643456>

<sup>2</sup> <https://confluence.ecmwf.int/display/COPSRV/Information+document+template>



## 2 How to start the integration of your data in the CDS Catalogue

### JIRA ticket, Information document and manifest file

Provider's role	Description
<p><b>JIRA</b> When asked by the CDS management <a href="https://confluence.ecmwf.int/display/COPSRV/Dataset+registration">registers the dataset</a><sup>3</sup> and create a JIRA ticket at <a href="https://jira.ecmwf.int/servicedesk/customer/portal/5">https://jira.ecmwf.int/servicedesk/customer/portal/5</a></p>	<p>All information concerning the creation, modification, merging, updating, deprecation, additions of data or documentation, DOIs, Citations, etc, is supposed to be managed through the JIRA ticket.</p>
<p><b>Manifest</b> Have a pseudo-manifest file (or a <a href="#">manifest file</a>) prepared.</p>	<p>This is the central piece of information needed by the CDS. So important that we have a whole section about it at the bottom of this page.</p>
<p><b>Information document</b> Attach to the JIRA ticket an "Information document" filled in with the information associated to the data that you are delivering for publication in the CDS Catalogue. The template for the information document can be found here: <a href="https://confluence.ecmwf.int/display/COPSRV/Information+document+template">Information document template</a><sup>4</sup>.</p>	<p>The information document is the starting point for the integration process. In order to arrive at an agreed draft entry to submit for review, additional inputs may be required. The document contains fields and tables that should be completed with the information relevant for your data. Guidelines are provide along those fields and tables intending to help you to understand exactly which information is required and in which format.</p>

<sup>3</sup> <https://confluence.ecmwf.int/display/COPSRV/Dataset+registration>

<sup>4</sup> <https://confluence.ecmwf.int/display/COPSRV/Information+document+template>

### 3 Main processes in which you are expected to participate

#### Pre-publication process

The aim of this step is to check and agree on the main inputs for the subsequent publication process:

- path and filename conventions,
- the size of the files,
- the number of variables per file,
- where the data will be stored,
- manifest file

The CDS team expects to have access to the information in the list above as soon as possible through a JIRA ticket and at least 2 month before the actual delivery of the data.

For data for which the contents and the container is still modifiable, the CDS team expects to interact with the provider in order to influence the way the data is stored making it more suitable for the needs of the Catalogue and the needs of the Toolbox.

#### Publication process

The process that goes from the initial trigger of the integration of your data, to the publication of the Catalogue entry in the public Catalogue, is referred as the "publication process".

The publication process has two processes in sequence: the integration process and the review process. Your role in these two processes is summarised below.

Provider's role	Process	Description	
Creates JIRA ticket Supplies the Information document Supplies manifest file Replies to CDS team queries	<b>Integration process</b> (analogous to creating a draft of a paper to be submitted to a scientific journal)	Inputs	JIRA ticket and Information document
		Outputs	Draft Catalogue entry judged to be good enough to be submitted to review by the CDS team, the technical officer and the data provider
		Work	Based on the manifest file and the Information Document, a CDS team member (or associated) creates one or more possible drafts for the future entry in the Catalogue. When agreed that the draft is good enough to be submitted for publication this process ends.

Help the CDS team member to reply to the reviewer's and Editorial Board's comments.	<b>Review process</b> (analogous to the review process of a paper submitted to a scientific journal)	Inputs	Draft entry
		Outputs	Modified entry reviewed and approved by the Editorial Board published in the public CDS Catalogue
		Work	A CDS team member (or associated) runs an internal review process to guarantee that the entry respects the CDS expectations.

**Post-publication processes**

After publication there are frequently some additions to be made or some issues to be addressed on the entry associated to your data. These are the two main processes where you may be asked to participate:

Provider's role	Process	Description	
Keep the manifest's filename and path exactly the same. Contents of the manifest is expected to change. But new additions to the contents, other than time extensions, should be discussed with the CDS team. See more about manifests below at <i>Manifest and pseudo-manifest files</i> .	<b>Automatic updates</b> (Updates date and time related widgets in the download form. This allows the automatic release of time extensions of data. Does not work for other widget's updates like new variables. new versions etc. )	Inputs	Entry already published in the Catalogue Manifest file or equivalent Update frequency agreed EC-Flow suite implemented
		Outputs	Entry updated with new dates
		Work	EC-Flow suite will read the manifest file and run CDS scripts able to recreate the download form.

<p>The data provider is expected to help the CDS team on keeping the entry working as expected. The main observed issues with published datasets are:</p> <ul style="list-style-type: none"> <li>• download form not providing the expected data</li> <li>• documentation tab not providing the expected documentation</li> <li>• mismatch between data and documentation</li> </ul> <p>When this or other issues are detected by the data provider, the CDS team will be grateful if the provider could notify the CDS team using the JIRA help desk (<a href="https://jira.ecmwf.int/servicedesk/customer/portal/5">https://jira.ecmwf.int/servicedesk/customer/portal/5</a>)</p> <p>Sometimes these issues are detected by users or the CDS team itself, in which case the CDS team will ask the data provider to help to fix the issue only when the data provider has the knowledge or the resources to do it</p>	<p><b>Maintenance</b> (new programmed versions, new documentation, deprecating data, unexpected issues with the data and the documentation, licences, etc)</p>	<table border="1"> <tr> <td data-bbox="735 311 922 461">Inputs</td> <td data-bbox="922 311 1422 461">Published entry Request for modification of the published entry</td> </tr> <tr> <td data-bbox="735 461 922 551">Outputs</td> <td data-bbox="922 461 1422 551">Modified entry</td> </tr> <tr> <td data-bbox="735 551 922 763">Work</td> <td data-bbox="922 551 1422 763">A CDS team member (or associated) modifies the entry as requested. The CDS team evaluates when the required modification needs agreement from the Editorial Board.</td> </tr> </table>	Inputs	Published entry Request for modification of the published entry	Outputs	Modified entry	Work	A CDS team member (or associated) modifies the entry as requested. The CDS team evaluates when the required modification needs agreement from the Editorial Board.
Inputs	Published entry Request for modification of the published entry							
Outputs	Modified entry							
Work	A CDS team member (or associated) modifies the entry as requested. The CDS team evaluates when the required modification needs agreement from the Editorial Board.							

## 4 Manifests, deprecation of data, versions, DOI, citation, acknowledgement and licence

### Manifest and pseudo-manifest files

#### Content of the Manifest

The manifest should contain the path and the file name for every file that the CDS catalogue is supposed to provide to the users. **Nothing more nothing else.** No empty lines, no comments.

For instance:

#### First lines of a manifest for cmip6 data saved in ESGF

```
- path: CMIP/NUIST/NESM3/historical/r1i1p1f1/Amon/evspsbl/gn/v20190705
  ds_id: c3s-
cmip6.CMIP.NUIST.NESM3.historical.r1i1p1f1.Amon.evspsbl.gn.v20190705
  var_id: evspsbl
  array_dims: time lat lon
  array_shape: 1980 96 192
  time: 1850-01-16T12:00:00 2014-12-16T12:00:00
  latitude: -88.57 88.57
  longitude: 0.00 358.12
- path: ScenarioMIP/CNRM-CERFACS/CNRM-CM6-1-HR/ssp245/r1i1p1f2/Amon/pr/gr/
v20191202
  ds_id: c3s-cmip6.ScenarioMIP.CNRM-CERFACS.CNRM-CM6-1-
HR.ssp245.r1i1p1f2.Amon.pr.gr.v20191202
  var_id: pr
  array_dims: time lat lon
  array_shape: 1032 360 720
  time: 2015-01-16T12:00:00 2100-12-16T12:00:00
  latitude: -89.62 89.62
  longitude: 0.00 359.50
- path: CMIP/CNRM-CERFACS/CNRM-CM6-1/historical/r1i1p1f2/Amon/tas/gr/v20180917
  ds_id: c3s-cmip6.CMIP.CNRM-CERFACS.CNRM-
CM6-1.historical.r1i1p1f2.Amon.tas.gr.v20180917
  var_id: tas
  array_dims: time lat lon
  array_shape: 1980 128 256
  time: 1850-01-16T12:00:00 2014-12-16T12:00:00
  level: 2.00 2.00
  latitude: -88.93 88.93
  longitude: 0.00 358.59
```

#### First ten lines of a manifest file for a dataset accessible through URL addresses

```
head ./Integration_of_satellite-earth-radiation-budget/manifest_c3s_312b_lot1_erb_c3s_icdr_latest.txt
http://gws-access.ceda.ac.uk/public/cds\_c3s\_cloud/c3s\_312b\_lot1/data/erb/c3s/icdr/r01/monthly/2017/01/C3S-312bL1-L3C-MONTHLY-ERB-SLSTR\_ORAC\_Sentinel-3a\_201701\_fv3.1.nc
http://gws-access.ceda.ac.uk/public/cds\_c3s\_cloud/c3s\_312b\_lot1/data/erb/c3s/icdr/r01/monthly/2017/02/C3S-312bL1-L3C-MONTHLY-ERB-SLSTR\_ORAC\_Sentinel-3a\_201702\_fv3.1.nc
http://gws-access.ceda.ac.uk/public/cds\_c3s\_cloud/c3s\_312b\_lot1/data/erb/c3s/icdr/r01/monthly/2017/03/C3S-312bL1-L3C-MONTHLY-ERB-SLSTR\_ORAC\_Sentinel-3a\_201703\_fv3.1.nc
```

[http://gws-access.ceda.ac.uk/public/cds\\_c3s\\_cloud/c3s\\_312b\\_lot1/data/erb/c3s/icdr/r01/monthly/2017/04/C3S-312bL1-L3C-MONTHLY-ERB-SLSTR\\_ORAC\\_Sentinel-3a\\_201704\\_fv3.1.nc](http://gws-access.ceda.ac.uk/public/cds_c3s_cloud/c3s_312b_lot1/data/erb/c3s/icdr/r01/monthly/2017/04/C3S-312bL1-L3C-MONTHLY-ERB-SLSTR_ORAC_Sentinel-3a_201704_fv3.1.nc)  
[http://gws-access.ceda.ac.uk/public/cds\\_c3s\\_cloud/c3s\\_312b\\_lot1/data/erb/c3s/icdr/r01/monthly/2017/05/C3S-312bL1-L3C-MONTHLY-ERB-SLSTR\\_ORAC\\_Sentinel-3a\\_201705\\_fv3.1.nc](http://gws-access.ceda.ac.uk/public/cds_c3s_cloud/c3s_312b_lot1/data/erb/c3s/icdr/r01/monthly/2017/05/C3S-312bL1-L3C-MONTHLY-ERB-SLSTR_ORAC_Sentinel-3a_201705_fv3.1.nc)  
[http://gws-access.ceda.ac.uk/public/cds\\_c3s\\_cloud/c3s\\_312b\\_lot1/data/erb/c3s/icdr/r01/monthly/2017/06/C3S-312bL1-L3C-MONTHLY-ERB-SLSTR\\_ORAC\\_Sentinel-3a\\_201706\\_fv3.1.nc](http://gws-access.ceda.ac.uk/public/cds_c3s_cloud/c3s_312b_lot1/data/erb/c3s/icdr/r01/monthly/2017/06/C3S-312bL1-L3C-MONTHLY-ERB-SLSTR_ORAC_Sentinel-3a_201706_fv3.1.nc)  
[http://gws-access.ceda.ac.uk/public/cds\\_c3s\\_cloud/c3s\\_312b\\_lot1/data/erb/c3s/icdr/r01/monthly/2017/07/C3S-312bL1-L3C-MONTHLY-ERB-SLSTR\\_ORAC\\_Sentinel-3a\\_201707\\_fv3.1.nc](http://gws-access.ceda.ac.uk/public/cds_c3s_cloud/c3s_312b_lot1/data/erb/c3s/icdr/r01/monthly/2017/07/C3S-312bL1-L3C-MONTHLY-ERB-SLSTR_ORAC_Sentinel-3a_201707_fv3.1.nc)  
[http://gws-access.ceda.ac.uk/public/cds\\_c3s\\_cloud/c3s\\_312b\\_lot1/data/erb/c3s/icdr/r01/monthly/2017/08/C3S-312bL1-L3C-MONTHLY-ERB-SLSTR\\_ORAC\\_Sentinel-3a\\_201708\\_fv3.1.nc](http://gws-access.ceda.ac.uk/public/cds_c3s_cloud/c3s_312b_lot1/data/erb/c3s/icdr/r01/monthly/2017/08/C3S-312bL1-L3C-MONTHLY-ERB-SLSTR_ORAC_Sentinel-3a_201708_fv3.1.nc)  
[http://gws-access.ceda.ac.uk/public/cds\\_c3s\\_cloud/c3s\\_312b\\_lot1/data/erb/c3s/icdr/r01/monthly/2017/09/C3S-312bL1-L3C-MONTHLY-ERB-SLSTR\\_ORAC\\_Sentinel-3a\\_201709\\_fv3.1.nc](http://gws-access.ceda.ac.uk/public/cds_c3s_cloud/c3s_312b_lot1/data/erb/c3s/icdr/r01/monthly/2017/09/C3S-312bL1-L3C-MONTHLY-ERB-SLSTR_ORAC_Sentinel-3a_201709_fv3.1.nc)  
[http://gws-access.ceda.ac.uk/public/cds\\_c3s\\_cloud/c3s\\_312b\\_lot1/data/erb/c3s/icdr/r01/monthly/2017/10/C3S-312bL1-L3C-MONTHLY-ERB-SLSTR\\_ORAC\\_Sentinel-3a\\_201710\\_fv3.1.nc](http://gws-access.ceda.ac.uk/public/cds_c3s_cloud/c3s_312b_lot1/data/erb/c3s/icdr/r01/monthly/2017/10/C3S-312bL1-L3C-MONTHLY-ERB-SLSTR_ORAC_Sentinel-3a_201710_fv3.1.nc)

### First line of a manifest file for a dataset saved in MARS

head reanalysis-uerra-europe-soil-levels/mars.list

```
class=ur,expver=prod,levtype=sol,origin=eswi,stream=oper,type=an,param=260199/260360,levelist=1/2/3,time=00:00:00/06:00:00/12:00:00/18:00:00,date=1961-01-01/1961-01-02/1961-01-03/1961-01-04/1961-01-05/1961-01-06/1961-01-07/1961-01-08/1961-01-09/1961-01-10/1961-01-11/1961-01-12/1961-01-13/1961-01-14/1961-01-15/1961-01-16/1961-01-17/1961-01-18/1961-01-19/1961-01-20/1961-01-21/1961-01-22/1961-01-23/1961-01-24/1961-01-25/1961-01-26/1961-01-27/1961-01-28/1961-01-29/1961-01-30/1961-01-31
class=ur,expver=prod,levtype=sol,origin=eswi,stream=oper,type=an,param=260199/260360,levelist=1/2/3,time=00:00:00/06:00:00/12:00:00/18:00:00,date=1961-02-01/1961-02-02/1961-02-03/1961-02-04/1961-02-05/1961-02-06/1961-02-07/1961-02-08/1961-02-09/1961-02-10/1961-02-11/1961-02-12/1961-02-13/1961-02-14/1961-02-15/1961-02-16/1961-02-17/1961-02-18/1961-02-19/1961-02-20/1961-02-21/1961-02-22/1961-02-23/1961-02-24/1961-02-25/1961-02-26/1961-02-27/1961-02-28
class=ur,expver=prod,levtype=sol,origin=eswi,stream=oper,type=an,param=260199/260360,levelist=1/2/3,time=00:00:00/06:00:00/12:00:00/18:00:00,date=1961-03-01/1961-03-02/1961-03-03/1961-03-04/1961-03-05/1961-03-06/1961-03-07/1961-03-08/1961-03-09/1961-03-10/1961-03-11/1961-03-12/1961-03-13/1961-03-14/1961-03-15/1961-03-16/1961-03-17/1961-03-18/1961-03-19/1961-03-20/1961-03-21/1961-03-22/1961-03-23/1961-03-24/1961-03-25/1961-03-26/1961-03-27/1961-03-28/1961-03-29/1961-03-30/1961-03-31
```

### Pseudo-manifest

Dataset suppliers to the CDS shall provide a comprehensive description of their data at least two months prior to delivery, using a data registration process established by ECMWF.  
 For the CDS team this means the delivery of a pseudo-manifest file.

A pseudo-manifest is a manifest file with expected path and filenames for the expected data to be created. Note that the pseudo-manifest should be as close as possible of the final delivery but the CDS team understands that modifications may be needed.  
 If a pseudo-manifest is provided, then a Catalogue entry can be created and its design agreed and tested. Filenames and paths can be checked to see if they allow a good building of the download form.

### Name of the manifest and updates of the contents of the manifest

The manifest should be named "manifest\_<Contract tag>\_<ECV\_name\_tag or SIS\_name\_tag>\_<optional\_tag>\_yyyymmdd.txt" where yyyymmdd is the date where this manifest was created.

It is expected that the providers replace the strings <...> in the manifest filename with the actual names for the dataset they are providing.

When a new manifest file is added to the providers site, that manifest should also be copied to "manifest\_<Contract tag>\_<ECV\_name|SIS\_name>\_<optional\_tag>\_latest.txt".  
Remove the date and leave just the string "latest".

This convention is central for the CDS computers to find and access the correct manifest.

### Where to save the manifest file:

The manifest should be in a directory named <http://web><sup>5</sup> address/c3s\_manifest/ accessible through wget and http(s) or the CDS computers to automatically download/check it.  
Old manifest files may be removed from the providers site. The idea is to store 2 or 3 previous manifest files to track back any issues.  
At least one manifest file should be always present and that providers site: the latest manifest file.

### Why the CDS values so much the manifest file:

For the Catalogue a dataset is a manifest file. Not the description in the contracts, not overviews.  
Nothing else is so central and important than the manifest: it tells the CDS computers what should be present in the public Catalogue.

### How the download form is directly related with filenames and paths in the manifest?

The widgets in the download pages of the CDS Catalogue are the way by which the user builds the name and the path of the file that corresponds to the data the user wants to download.

In other words, there is a direct link between the filename and path convention and what we can offer for the user to click in the download form.

To see it better let's consider the CIMP5 datasets which has addressed like:

[:/output1/NOAA-GFDL/GFDL-CM3/historical/day/atmos/day/r3i1p1/ua/v20120227/ua\\_day\\_GFDL-CM3\\_historical\\_r3i1p1\\_19800101-19841231.nc](http://output1/NOAA-GFDL/GFDL-CM3/historical/day/atmos/day/r3i1p1/ua/v20120227/ua_day_GFDL-CM3_historical_r3i1p1_19800101-19841231.nc)<sup>6</sup>

the path and filename convention is:

```
/output1/(?P<__organisation>[\-\w]+)/(?P<model_1>[\-\w]+)/(?P<experiment_1>[a-zA-Z0-9]+)/(?P<frequency>[a-z0-9]+)/(?P<__realm>\w+)/(?P<__cmor_table_1>[a-zA-Z0-9]+)/(?P<ensemble_member_1>[a-zA-Z0-9]+)/(?P<variable_1>[a-zA-Z]+)/(?P<__version>[v0-9]+)/(?P<variable_2>[a-zA-Z]+)/(?P<__cmor_table_2>[a-zA-Z0-9]+)/(?P<model_2>[a-zA-Z0-9\-\-]+)/(?P<experiment_2>[a-zA-Z0-9]+)/(?P<ensemble_member_2>[a-zA-Z0-9]+)/(?P<period>\d{8}-\d{8}).nc
```

When one looks at <https://cds.climate.copernicus.eu/cdsapp#!/dataset/projections-cmip5-daily-pressure-levels?tab=form> it is easy to notice that the widgets on that download page are the ones defined in the convention.

By clicking on the boxes the user is in fact providing values to each part of the convention and building the name of the file that will be downloaded. Each part of the convention will eventually lead to a widget in the Catalogue for the dataset.

### CDS preferences:

The CDS prefer long names than short names. We prefer understandable than smart. For instance we prefer [L3-U.nc](http://l3-u.nc/)<sup>7</sup> than [L3U.nc](http://l3u.nc/)<sup>8</sup> since in the first case it is clear that 2 things are at play.

<sup>5</sup> <http://web/>

<sup>6</sup> [http://ua\\_day\\_gfdl-cm3\\_historical\\_r3i1p1\\_19800101-19841231.nc/](http://ua_day_gfdl-cm3_historical_r3i1p1_19800101-19841231.nc/)

<sup>7</sup> <http://l3-u.nc/>

<sup>8</sup> <http://l3u.nc/>

Filenames should follow conventions. More than one convention is OK. Different main variables should be preferably in different files.

Examples of what would be desirable for the filename conventions:

*If possible, in the filenames the underscore "\_" should be used to split between place holders and hyphen "-" to say that different words belong in fact to the same placeholder.*

*For instance:*

[sfcWind\\_climatology\\_prevaling/01/sfcWind\\_climatology\\_prevaling\\_01\\_v0.0.nc](#)<sup>9</sup>

*would be better as:*

[sfcWind-prevaling\\_climatology/01/sfcWind-prevaling\\_climatology\\_01\\_v0.0.nc](#)

<sup>10</sup>By using this grouping and splitting *this will help to design more well organised filenames that will be easier to use by the CDS scripts.*

**Warning:**

*The same thing should be named in the same way whenever it is referenced.*

*For instance, for a computer "version\_0.0" is different from "v0.0". If we mean the same thing then the string should be exactly the same, no differences in capitalisation, or more letters or less letters. One can choose either v0.0 or version\_0.0 or another string one finds convenient but should then keep it the same everywhere when the same thing is meant.*

**Versions, deprecation of entries, replacement of data**

Amount of data to deprecate	Provider's role	CDS team
Large amount of data	<ul style="list-style-type: none"> <li>• Provide old and new data in the same updated manifest file</li> <li>• Keep old and new data</li> <li>• Remove deprecated data and corresponding lines from the manifest at the end of the deprecation period</li> </ul>	<ul style="list-style-type: none"> <li>• Deprecate the whole entry and create a new one. The deprecated entry will not be searchable in the CDS, but API request will continue to work. ( This prevents new users to find and download deprecated data, allowing at the same time scientific traceability and reproducibility ), Example: <a href="#">Deprecated SST</a><sup>11</sup>. New entry with corrected data: <a href="#">Corrected SST</a><sup>12</sup></li> <li>• Remove the deprecated data after 1 to 3 year deprecation period</li> </ul>

<sup>9</sup> [http://global-shipping.copernicus-climate.eu/shipping\\_metocean\\_variables\\_monthly\\_climatology/v0.0/sfcWind\\_climatology\\_prevaling/01/sfcWind\\_climatology\\_prevaling\\_01\\_v0.0.nc](http://global-shipping.copernicus-climate.eu/shipping_metocean_variables_monthly_climatology/v0.0/sfcWind_climatology_prevaling/01/sfcWind_climatology_prevaling_01_v0.0.nc)

<sup>10</sup> [http://global-shipping.copernicus-climate.eu/shipping\\_metocean\\_variables\\_monthly\\_climatology/v0.0/sfcWind-prevaling\\_climatology/01/sfcWind-prevaling\\_climatology\\_01\\_v0.0.nc](http://global-shipping.copernicus-climate.eu/shipping_metocean_variables_monthly_climatology/v0.0/sfcWind-prevaling_climatology/01/sfcWind-prevaling_climatology_01_v0.0.nc)

<sup>11</sup> <https://cds-test.climate.copernicus.eu/cdsapp#!/dataset/satellite-sst-esa-cci?tab=overview>

<sup>12</sup> <https://cds.climate.copernicus.eu/cdsapp#!/dataset/satellite-sea-surface-temperature?tab=overview>



Small amount of data	<ul style="list-style-type: none"> <li>• Create new files with a different version tag for the corrected data</li> <li>• Include those files in the manifest</li> <li>• Manifest should contain both old and new versions</li> <li>• Remove deprecated data and corresponding entries in the manifest at the end of the deprecation period</li> </ul>	<ul style="list-style-type: none"> <li>• Deprecate the version of the data corresponding to the wrong data</li> <li>• Modify overview to explain the deprecation or use a new widget called "Known issues" under the Documentation tab</li> <li>• Modify the download form making clear the deprecated version of the data. (When the CDS will have the tools to do it: the deprecated data will only be accessible through the API).</li> <li>• Remove the deprecated data after 1 to 3 year deprecation period</li> </ul>
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## DOI, citation, licence and acknowledgement

### DOI

Type of data in the CDS Catalogue entry	Provider's role	CDS team
Data <b>without</b> DOI issued before the publication in the CDS Catalogue	<ul style="list-style-type: none"> <li>• No active role</li> </ul>	<ul style="list-style-type: none"> <li>• Provides a DOI to the Catalogue entry (which can be seen as a DOI for the data themselves)</li> </ul> <p>Example:  <a href="https://cds.climate.copernicus.eu/cdsapp#!/dataset/cems-glofas-reforecast?tab=overview">https://cds.climate.copernicus.eu/cdsapp#!/dataset/cems-glofas-reforecast?tab=overview</a></p>
Data <b>with</b> DOIs issued before publication in the CDS Catalogue	<ul style="list-style-type: none"> <li>• Provides a mapping between the data and the previous DOIs</li> </ul>	<ul style="list-style-type: none"> <li>• Create a DOI box allowing for multiple DOIs.</li> <li>• DOI's box will show <ul style="list-style-type: none"> <li>• all the DOIs supplied by the data provider (with a clear association to which data they refer to)</li> <li>• the DOI of the Catalogue entry itself</li> </ul> </li> </ul> <p>Example:  <a href="https://cds-test.climate.copernicus.eu/cdsapp#!/dataset/satellite-total-column-water-vapour?tab=overview">https://cds-test.climate.copernicus.eu/cdsapp#!/dataset/satellite-total-column-water-vapour?tab=overview</a>  <a href="https://cds-dev.copernicus-climate.eu/cdsapp#!/dataset/satellite-cloud-properties?tab=overview">https://cds-dev.copernicus-climate.eu/cdsapp#!/dataset/satellite-cloud-properties?tab=overview</a></p>

<p>Mixing of data <b>with and without</b> DOIs issued before the publication in the CDS Catalogue</p>	<ul style="list-style-type: none"> <li>• Provides a mapping between the data and the DOIs</li> </ul>	<ul style="list-style-type: none"> <li>• Create a DOI box allowing for multiple DOIs.</li> <li>• DOI's box will show                         <ul style="list-style-type: none"> <li>• all the DOIs supplied by the data provider (with a clear association to which data they refer to)</li> <li>• the DOI of the Catalogue entry itself</li> <li>• data with no DOI attribute will be associated with the string: "no specific DOI"</li> </ul> </li> </ul> <p>Example:  <a href="https://cds-dev.copernicus-climate.eu/cdsapp#!/dataset/satellite-surface-radiation-budget?tab=overview">https://cds-dev.copernicus-climate.eu/cdsapp#!/dataset/satellite-surface-radiation-budget?tab=overview</a></p>
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### Citations

Citations are like file formats, there are a few available, no one better than all the others in all situations.

The "Citation" link in the Catalogue entry **does not say how** people should cite the data, that depends on the journal, site and publisher where the data will be cited.

The "Citation" link in the Catalogue entry **is the Catalogue citing** the contents that it is exposing.

In this way it also shows how to cite the data, but that is just an example of how to cite the data and contents from where **people can extract all information** required to cite the data using other formats in other places.

<p><b>Type of data in the CDS Catalogue entry</b></p>	<p><b>Provider's role</b></p>	<p><b>CDS team</b></p>
<p>Data <b>without</b> citation issued before the publication in the CDS Catalogue</p>	<ul style="list-style-type: none"> <li>• Interact with the CDS team on this. Most probably you will be asked for the names of the authors of the data.</li> </ul>	<ul style="list-style-type: none"> <li>• Interact with the provider and create a Citation following the Catalogue citation format</li> </ul>

<p>Data <b>with</b> citation issued before publication in the CDS Catalogue</p>	<ul style="list-style-type: none"> <li>Provides those citations to the CDS team</li> </ul>	<ul style="list-style-type: none"> <li>Create a Citation box allowing for multiple citations.</li> <li>Citation's box will show                             <ul style="list-style-type: none"> <li>all the Citations supplied by the data provider (with a clear association to which data they refer to)</li> <li>the Citation of the Catalogue entry itself</li> </ul> </li> </ul> <p>Example:  <a href="https://cds-test.climate.copernicus.eu/cdsapp#!/dataset/satellite-total-column-water-vapour?tab=overview">https://cds-test.climate.copernicus.eu/cdsapp#!/dataset/satellite-total-column-water-vapour?tab=overview</a>  <a href="https://cds-dev.copernicus-climate.eu/cdsapp#!/dataset/satellite-cloud-properties?tab=overview">https://cds-dev.copernicus-climate.eu/cdsapp#!/dataset/satellite-cloud-properties?tab=overview</a></p>
<p>Mixing of data <b>with and without</b> citations issued before the publication in the CDS Catalogue</p>	<ul style="list-style-type: none"> <li>Provides those citations to the CDS team</li> </ul>	<ul style="list-style-type: none"> <li>Create a Citation box allowing for multiple citations.</li> <li>Citation's box will show                             <ul style="list-style-type: none"> <li>all the Citations supplied by the data provider (with a clear association to which data they refer to)</li> <li>the Citation of the Catalogue entry itself</li> </ul> </li> </ul> <p>Example:  <a href="https://cds-dev.copernicus-climate.eu/cdsapp#!/dataset/satellite-surface-radiation-budget?tab=overview">https://cds-dev.copernicus-climate.eu/cdsapp#!/dataset/satellite-surface-radiation-budget?tab=overview</a></p>

**Licence**

Provider's role	CDS team
<p>Provide all licences related to the data and a mapping between the licences and the parts of the data they are related to</p>	<p>For datasets with multiple licences use a "Origin" button in the download form making related to the name of the licence                      Example:  <a href="https://cds-dev.copernicus-climate.eu/cdsapp#!/dataset/satellite-surface-radiation-budget?tab=form">https://cds-dev.copernicus-climate.eu/cdsapp#!/dataset/satellite-surface-radiation-budget?tab=form</a></p>

**Acknowledgement**

Provider's role	CDS team

<p>No active role but may want to have a look at: <a href="#">How to acknowledge and cite a Climate Data Store (CDS) catalogue entry and the data published as part of it</a><sup>13</sup> <a href="https://cds-test.climate.copernicus.eu/cdsapp#!/dataset/satellite-total-column-water-vapour?tab=overview">https://cds-test.climate.copernicus.eu/cdsapp#!/dataset/satellite-total-column-water-vapour?tab=overview</a></p>	<p>For datasets with multiple licences use a "Origin" button in the download form making related to the name of the licence Example: <a href="https://cds-dev.copernicus-climate.eu/cdsapp#!/dataset/satellite-surface-radiation-budget?tab=form">https://cds-dev.copernicus-climate.eu/cdsapp#!/dataset/satellite-surface-radiation-budget?tab=form</a></p>
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<sup>13</sup> <https://confluence.ecmwf.int/display/CKB/How+to+acknowledge+and+cite+a+Climate+Data+Store+%28CDS%29+catalogue+entry+and+the+data+published+as+part+of+it>

## 5 Publishing under FAIR principles<sup>14</sup>

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<sup>14</sup> <https://confluence.ecmwf.int/display/PS/Publishing+under+FAIR+principles>

# **Publishing under FAIR principles**

Production Section

Exported on 02/19/2025

## Table of Contents

1 Core interpretation of the FAIR principles .....	4
2 ECMWF data: Extending the FAIR principles to all our data .....	6





# 1 Core interpretation of the FAIR principles

The core principles of the FAIR guidelines have not changed since they were first published in 2016 (\*), and have since been widely adopted by the scientific community as a way to improve the quality and usability of research data. However, the principles are intended to be flexible and adaptable, and different organizations and communities may have different interpretations and implementations of the principles. It's also possible that the principles may be updated or refined over time as the field of data science and technology evolves.

FAIR principles are a set of guidelines for making data more Findable, Accessible, Interoperable, and Reusable:

1. Is the data Findable?  
Can the data be easily discovered by those who need it, using relevant keywords and metadata?
2. Is the data Accessible?  
Can the data be accessed, read, and understood by a machine or a human? Is it available in a widely used, open format?
3. Is the data Interoperable?  
Can the data be easily integrated with other data sources, using common standards and formats?
4. Is the data Reusable?  
Can the data be used and reused for multiple purposes, without significant effort or additional licensing restrictions?

If the data meets all of these criteria, it can be considered "FAIR." It's important to note, however, that the FAIR principles are guidelines rather than strict rules, and different organizations and communities may have different interpretations and implementations of the principles.

(\*) Wilkinson, M., Dumontier, M., Aalbersberg, I. *et al.* The FAIR Guiding Principles for scientific data management and stewardship. *Sci Data* **3**, 160018 (2016). <https://doi.org/10.1038/sdata.2016.18>



Source : Australian National Data Service (ANDS)

Entire FAIR resources graphic is licensed under a Creative Commons Attribution 4.0 International License

## 2 ECMWF data: Extending the FAIR principles to all our data

At the ECMWF, we are committed to making our data as useful and accessible as possible. That's why we aim to publish all our data in accordance with the FAIR principles.

Our data is carefully curated and described using relevant metadata, that provides detailed information about the variables and parameters included in the data. For each variable, we provide a clear definition, specify the units, and include any relevant notes or caveats that users should be aware of, ensuring that the data can be used accurately and reliably.

We use DOIs (Digital Object Identifiers) to provide persistent, stable links to our data, allowing users to easily find and access the data they need. We also use open, standardized formats for our data and provide API (Application Programming Interface) access, allowing users to easily integrate our data with other systems and applications.

And we provide clear licensing information, enabling users to freely reuse and repurpose the data for their own purposes.

By following the FAIR principles, we are helping to make our data more valuable and useful for a wide range of users, from meteorologists and researchers to policymakers and the general public. We are proud to be part of the growing community of organizations that are working to make data more FAIR (\*).

(\*) OGC FAIR Climate Services: [ECMWF is co-chair for the OGC Climate Resilience Domain Working Group](#)<sup>1</sup>

- [Decommissioning plan of ECMWF public datasets service](#)<sup>2</sup>

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<sup>1</sup> <https://www.ogc.org/blog/4460>

<sup>2</sup> <https://confluence.ecmwf.int/display/PS/Decommissioning+plan+of+ECMWF+public+datasets+service>