

ECMWF Copernicus Procurement

Invitation to Tender



Copernicus Climate Change Service

Climate Hazard Information to support Physical
Climate Risk Assessments

Volume II: Specification of Requirements

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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 C3S Climate Data Store (CDS) and the Atmosphere Data Store (ADS).

2 Context

During the initial phase of Copernicus (COP1), C3S focused on meeting the requirements of various sector-specific activities. Through the Sectoral Information System (SIS) initiatives, C3S catered to the needs of users across different sectors, serving not only Europe but also extending its support to a global user base. This involved providing tailored climate-related information and services that were valuable and relevant to users in diverse fields and regions, ensuring a broader reach and impact beyond Europe's borders.

During COP2, ECMWF forged a partnership with the European Investment Bank (EIB or Bank) aimed at aiding the EIB in integrating climate change issues and generally supporting their ambition to make financial flows compatible with resilient, low-carbon pathways (see next section for details). Climate risk screening and assessments of investment projects are becoming increasingly important because the underlying value of assets included in an investment portfolio are subject to climate-related risks (or opportunities), potentially affecting the value of portfolios and impacting the EU's public policy goals for which the EIB provides financing. The notion of risk screening is at the forefront of two recent international initiatives for sustainable finance: The Task Force on Climate-Related Financial Disclosures (TCFD) and the EU Taxonomy. The TCFD, set up by the Financial Stability Board (FSB), was launched in 2015 to offer a reporting framework for transitional (transitioning to a low-carbon world) and physical (adapting to a warmer world) risks. It outlines various types of risks, including physical risks (acute or chronic) and transition risks (related to technology, policy/legal, market, and reputation). It provides financial institutions with a structured way of assessing and integrating climate risks into decision-making. The TCFD was established to help investors and asset managers gain a clear understanding of the climate-related risks and opportunities linked to their portfolios. Even more recently, in 2022, the EU taxonomy regulation was published with the objective to direct investment towards projects and funds which contribute to environmental objectives or at least which *Do No Significant Harm*, through the implementation of a mandatory reporting framework.

The EU Taxonomy includes specific mitigation and adaptation objectives, the latter of which is based on a list of climate hazards for which eligible activities must be screened and, where necessary, assessed in detail.

2.1 Description of the ECMWF – EIB partnership

The EIB is the lending arm of the European Union created by the Treaty on the Functioning of the European Union. The role of the EIB is to support investments consistent with EU policy objectives. As part of the EIB Group Climate Bank Roadmap 2021-2025, the EIB committed to increase substantially adaptation efforts and to ensure that all the operations it supports are adapted to current weather variability and future climate change impacts, in line with the adaptation objectives of the Paris Agreement and the EU Taxonomy. Enhanced use of climate information, data and tools support the implementation of these objectives. The EIB Climate Adaptation Plan identifies the use of robust climate data and information as an essential part of

supporting smart adaptation inside and outside the EU. EIB's Climate Risk Assessment (CRA) system is a cornerstone of EIB's approach to assessing and managing climate risk. The CRA provides for a systematic assessment of the physical climate risk in direct lending and helps the EIB and its clients understand how climate change may affect their projects and identify adaptation measures. Through the CRA, the EIB cooperates with public and private climate service providers and aims to leverage the latest findings in climate science for the benefit of clients' and its own decision-making.

The Copernicus Climate Change Service operated by ECMWF supports society by providing authoritative information about the past, present and future climate in Europe and the rest of the world, by offering free and open access to climate data and tools based on the best available science. The C3S offer in terms of data and projections of future climate changes are crucial for climate resilient development. C3S empowers the finance sector with essential tools, data, and expertise to integrate climate risk considerations into their operations, risk management practices, and investment strategies.

In November 2021, ECMWF and EIB signed a [Memorandum of Understanding](#)¹ to set out a framework of cooperation between the Parties in the context of enhanced use of Copernicus owned or brokered data, information and tools.

This contract plans to shape the C3S offer to support the EIB CRA. The activity will design and deliver specific climate impact indicators to support the EIB in assessing the climate risks accurately, allowing the Bank but also any financial institutions to evaluate the impact of modelled potential future climate scenarios on investments and portfolios. Any dataset, indicator or workflow will be (principally) based on the C3S infrastructure and data.

2.2 The Climate Data Store (CDS)

The backbone of the C3S is the cloud-based 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 will be 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 the majority of 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: Global and regional reanalysis, CMIP6 global and CORDEX regional climate model data, climate projection dataset underpinning the C3S Climate Atlas, Climate indicators for Europe derived from reanalysis and climate projections. Additionally, the CDS shares an API with the Atmosphere Data Store (ADS), hence all the CAMS dataset can be accessed in a single workflow, succinctly.

2.3 Earthkit

EARTHKIT is an open-source python project led by ECMWF which provides powerful and easy-to-use tools

¹ <https://www.eib.org/attachments/documents/mou-eib-ecmwf-en.pdf>

for working with earth system data. Earthkit users can access CDS and ADS datasets directly and use a range 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.

3 Contract summary

This Invitation to Tender (ITT) encompasses the procurement of a single contract aimed at facilitating the development and supply of climate hazard information crucial for assisting the EIB in its climate risk assessment (CRA). The deliverables consist of: data accompanied by documentation, contributions to training resources, support for Copernicus users regarding the data and products generated under this contract, creation of an interactive application for EIB to explore climate-derived indicators hosted by ECMWF and offering guidance to the EIB team developing a customized software solution for processing ECMWF-provided data, as needed.

ECMWF intends to award a single framework agreement for a period of 24 months (2 years), which shall be implemented via a single service contract (subject to negotiation) that is expected to commence in Q3 2024.

3.1 Summary of activities

The activities include collaboration with ECMWF and EIB personnel to establish a specialized service dedicated to support the EIB in its climate risk assessments. This involves undertaking various tasks and work in several areas:

- **Identification of Climate Indicators:** Create a comprehensive catalogue of indicators focusing on matching ECMWF data with climate hazards relevant for the EIB's CRA, based on the EU Taxonomy (https://finance.ec.europa.eu/publications/sustainable-finance-package_en, Annex I, appendix A). These indicators will serve as crucial input to inform the screening and assessing of potential climate-related risks in EIB projects.
- **Leveraging best practices:** In close collaboration with the EIB specialists, draw from recommendations and exemplary practices found in existing initiatives and research projects within the climate risk domain, such as TCFD, United Nations Environment Programme Finance Initiative (UNEP-FI), [ClimInvest](#)², and publications from leading rating agencies. This involves building upon existing knowledge and successful methodologies.
- **Integration with ECMWF initiatives:** Collaborate with other C3S activities, such as the [European Climate Data Explorer](#)³ (ECDE) designed with the Environment Agency (EEA) and the C3S Climate Atlas, <https://atlas.climate.copernicus.eu> – (initial data are available at this [link](#)⁴), to ensure consistency in the utilization of climate data and indicators where applicable. Exploring examples of how the recent development of Destination Earth could be operationalized by C3S in a way that is directly relevant to the needs of the users within the Bank.
- **Developing a solution for global-scale Indicators:** Develop and implement a strategy aimed at generating indicators for EIB at both European and global scales. This involves ensuring adherence to best practices and maintaining consistency across products to facilitate a comprehensive assessment of climate risks.

² <https://www.wur.nl/en/project/climinvest-tools-for-climate-resilient-investment.htm>

³ <https://climate-adapt.eea.europa.eu/en/knowledge/european-climate-data-explorer>

⁴ <https://cds.climate.copernicus.eu/cdsapp#!/dataset/projections-climate-atlas?tab=overview>

- **Defining all relevant data sources:** Utilize C3S data as the primary source for all products. However, where demonstrated benefits exist, incorporate data from other Copernicus services, to enhance the relevance and quality of the assessments.
- **Enhancing software capability:** Contribute to the ECMWF and C3S software capability by providing reusable tools along with comprehensive documentation and Jupyter notebooks. These tools aim to facilitate the process and promote consistency in the analysis of climate risks.

3.2 Summary of objectives

- The provided service must align with the EIB's needs for climate data, information, and indicators across various sectors within the Bank. These needs may evolve, possibly becoming more specific as the service is being prepared, thus necessitating regular collection, documentation, and, whenever feasible, alignment in consultation with ECMWF and the EIB through a co-design process.
- The delivered products must be operationally ready, supported by comprehensive documentation and support in accordance with C3S and ECMWF standards. Particular attention should be directed towards presenting uncertainties and documenting the utilization and interpretation of indicators.
- Computational efficiency is key in the implementation and execution of these services.
- Clarity in documentation, its ongoing maintenance, and thorough updates are imperative for these services.
- Some information crucial for service development will remain confidential, as agreed upon with EIB. Other details within the finance domain will be accessible to C3S users. The selected Tenderer must obtain confidentiality guidelines from the EIB and ensure their application throughout all tasks.

Tenderers shall demonstrate in their bids how they intend to achieve these objectives.

4 Technical Specification

The contract will be implemented in work packages (WPs). Preliminary list of WPs and timetable of major deliverables are proposed below. These work packages and deliverables are indicative at this stage and Tenderers are free to propose a more refined work package list and timetable.

4.1 Work Package 1 (WP1): From climate data to climate indicators relevant to the EIB operating sectors

The Successful Tenderer shall engage with the EIB, always involving ECMWF, to define the requirements for the service.

4.1.1 Task 1: Definition of the workflows

The Successful Tenderer shall perform activities that will lead to a requirement analysis report. This report shall provide a detailed description of the requirements that shall be considered in this contract and their priority as identified by the EIB. The Successful Tenderer shall, in cooperation with ECMWF: define suitable data (ensemble of models, reanalysis), reference periods, timescale of the information related to the duration of the assets; define the uncertainty levels and the appropriate scientific algorithm to ensure the Climate Indicators made available either as published applications, datasets in the CDS catalogue and ultimately brokered to the EIB for their sector specific financial risk screening assessment, are based on best practice, are scientifically robust and are supported by high quality product user guides. This phase includes a thorough evaluation of the fitness of C3S data and workflows for EIB's purposes. For this task, the successful Tenderer is expected to provide expertise in appropriate use of climate model data. For the choice of models,

it is recommended to be aligned with the models used in the C3S Climate Atlas. About the indicators, consistency with the information available through the C3S Climate Atlas and the ECDE is required.

The definition of the Climate Indicators relevant to describe the climate hazard will be delivered through an analysis of the confidential EIB Sector Sensitivity Information (describing the connection between the EIB sectors and subsectors with the selected climate hazards) and other sector-specific assumptions for processing the data in the software to be developed by the EIB team in parallel to the activities of the successful Tenderer under this Work Package 1. The EIB Climate Sensitivity Matrix categorizes economic activities according to the Statistical Classification of Economic Activities in the European Community, known as NACE codes (from the French term "nomenclature statistique des activités économiques dans la Communauté européenne"), based on their sensitivity to climate change. These sectors encompass various areas such as agriculture, fisheries, forestry, electricity, transportation infrastructure, water and waste infrastructure, financial and insurance activities, and more.

The deliverable required under this Task shall comprise both text and tables. It must also incorporate referenced information, explicitly tracing the origins of specific details. For instance, when defining a temperature-related acute hazard indicator for heatwaves within the railway sector, the precise definition of the indicator (for example, the maximum value of daily maximum temperature) must be thoroughly explained and traced back to its source, whether from scientific literature or technical references. Initially, the focus will be on a restricted set of approx. 200 EIB-relevant sectors and subsectors that relate to infrastructure and networks such as energy, mobility, urban and regional development, natural resources, health, communication, and manufacturing, the specifics of which will be determined in collaboration with the EIB.

The initial list of hazards is provided in Table 1.

Category	Chronic Hazards	Acute Hazards
Temperature - related	Changing temperatures (air, freshwater, marine)	Heat wave
	Heat stress	Cold wave frost
	Temperature variability	Wildfires
	Permafrost thawing	
Wind - related	Changing wind patterns	Cyclone, hurricane, typhoon
		Storms (including blizzards, dust and sandstorms)
		Tornadoes
Water - related	Changing precipitation patterns and types (rain, hail, snow/ice)	Drought
	Precipitation or hydrological variability	Heavy precipitation (rain, hail, snow, ice)
	Ocean acidification	Flood (coastal, fluvial, pluvial, ground water)
	Saline intrusion	Glacier Lake outburst
	Sea level rise	
	Water stress	
Solid-mass related	Coastal erosion	Avalanche
	Soil degradation	Landslide
	Soil erosion	Subsidence
	Solifluction	

Table 1: Classification of climate related hazards as defined by the EU Taxonomy regulation

If there are gaps in the current data offer, this work package will clearly document those gaps and propose a roadmap on how the identified gaps will be bridged within the timeframe of the contract. The gap analysis and the roadmap to fill the gaps will include a feasibility study.

Deliverables required:

- A concise table outlining the relationship between climate hazards used by the EIB and the existing set of indicators available to ECMWF, as referenced in current literature. This first version of this Table will be completed at month 3 from the start of the contract, with six-monthly updates provided thereafter to monitor evolving user requirements. For example:

Category	Chronic Hazard	Candidate Indicator	Definition	Sources
Temperature-related	Heat stress	Heat index Humidex Universal Thermal Climate Index Wet-bulb temperature Wet-bulb globe temperature Number of days with Heat index > certain thresholds	For each indicator: its exact definition and any pre-processing needed, depending on the source of data (e.g. bias-adjustment, threshold definition, data aggregation)	For each indicator: List of scientific and technical literature; its context of use

- A concise report that summarizes the EIB's needs. The report is based on user engagement activities, done via interviews and small user workshops, involving ECMWF, EIB, and their respective teams. It will assess these requirements, outlining the necessary service definitions and data needs, encompassing a comprehensive list of indicators. The report will distinctly identify any existing gaps in the current service provisions. This first version of this report will be completed month 3, with six-monthly updates provided thereafter to monitor evolving user requirements. The assessed requirements should include the C3S data sources and any other data sources, possibly available via other Copernicus services. The report will include a concise sub-table outlining the relationship between the climate hazards defined in the point above and the selected indicators within the specific sector/subsector from the EIB Sector Sensitivity Information. For example:

EIB reporting Sector level	Sub-sector	Hazard	Selected Indicator / indicators	Definition	Sources
Infrastructure	Transport	Wildfire (Temperature related / Acute)	Fire Weather Index	For each indicator: its exact definition (in agreement with the previous Table)	For each indicator: List of scientific and technical literature; its context of use for that sector / subsector

The two tables above serve as an indication of the required information. Tenderers are expected to propose an initial version of these tables as part of their response. The final form of these tables will be delivered at month 3 of the contract.

- Activities in points 1) and 2) above will be used to deliver, at month 3, the first version of a detailed workplan that clearly outlines the implementation schedule covering the duration of the contract. The complete data delivery is expected by the end of month 12, with applications expected to be finalized by month 18. Data may be delivered in batches to facilitate the EIB in their workflow testing and utilization. The workplan will include an assessment of the associated resources, development schedule, reviews, deliverables (which will include climate impact indicators and associated workflows), documentation and user guides, risk identification and management, and acceptance criteria. Where elements of the service require ongoing support (i.e., production of new workflow to implement additional Indicators), the Successful Tenderer will need to determine the feasibility of adding new climate impact indicators and include this in the implementation schedule. The workplan should justify which user requirements will

be addressed within the duration of the contract and those that can be met by (potential) future developments (post contract, for example those which are subject to new variables from projections or subject to toolbox evolution). To achieve this, the Successful Tenderer must assess the impact, cost/effort and time required to address the requirements. As with the requirements document, bi-annual (six-monthly) updates are expected to reflect the incorporation of new high priority datasets or service elements to support the EIB.

4.2 Work Package 2 (WP2): Computations and operational Interface

This work package will build on the outcomes of WP1; implement the workflows, based on peer-reviewed literature and best coding practice, to develop suitable indicators to support the EIB climate risk assessments, whilst contributing to ECMWF software strategy, and develop a library of climate impact indicators in earthkit. The successful Tenderer will undertake a thorough assessment of the data and tools available via the CDS and earthkit and document how they will lead to value-added services addressing the key requirements of the user.

Successful Tenderer is encouraged to use existing earthkit python packages where possible. In cases where a required functionality is not present in earthkit, the successful Tenderer should either contribute to code to an appropriate existing earthkit package or develop a new python package hosted in an ECMWF github repository. This decision should be made in consultation with an ECMWF representative. In the case of a new python package, the Successful Tenderer should use an ECMWF package template and adhere to the coding standards included in the template package and include readthedocs documentation with notebook examples. This approach is taken with the anticipation that these developments might become part of earthkit in the future. This strategy allows the Successful Tenderer the freedom to swiftly and autonomously develop tools outlined in the contract, with the potential to contribute to existing tools.

Interactive web-applications will use JS-react for the front-end and will be deployed as DockerImages via Kubernetes. The applications should follow guidelines set by ECMWF, which includes instructions on the components libraries to use and the deployment procedure. Any new components developed should be written generically such that they could be added to an ECMWF components library. In instances where the Successful Tenderer produces a novel output which is to be served to users directly (e.g. a new dataset or product, a plot or visualisation or a simple numeric result), delivery should be accompanied by a Jupyter notebook which demonstrates how to reproduce the output. Notebook delivery should follow guidelines set by ECMWF, for examples of the standards we expect for notebooks please refer to the C3S (<https://ecmwf-projects.github.io/copernicus-training-c3s>) and CAMS (<https://ecmwf-projects.github.io/copernicus-training-cams>) training material. This approach is taken such that the notebook[s] may be published either within an existing ECMWF JupyterBook (library of notebooks) or in a new JupyterBook dedicated to the contract. This decision should be made in consultation with an ECMWF representative.

Bidders shall include in their bid 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.

The complete data delivery is expected by the end of month 12, with applications expected to be finalized by month 18. Data may be delivered in batches to facilitate the EIB in their workflow testing and utilization.

4.2.1 Task1: Implementation plan and Software strategy.

This activity will inform ECMWF staff and earthkit developers about the pieces of code which are planned to be developed within the contract. This plan serves as a guide for ECMWF and the Successful Tenderer to shape a software implementation strategy, highlighting existing tools, pinpointing gaps, and outlining a timeline for development. To facilitate this, the successful Tenderer will receive earthkit development plans

and a catalog of current functionalities at the start of the contract.

To minimize duplication of effort, the Successful Tenderer needs to liaise closely with contracts contributing to other C3S activities producing climate hazard information. This task's main objective is to ensure there is early communication with ECMWF software developers and other contractors (where appropriate).

Deliverables required:

- Software strategy plan

4.2.2 Task 2: Computation of Climate Indicators

In this task, the Climate Hazard Indices and related tools outlined in WP1 will be computed in alignment with the approved software strategy established in Task 1 of WP2.

The Successful Tenderer will actively contribute to building a comprehensive library of climate impact indicators, leveraging existing code whenever feasible. All code developed will be systematically added to GitHub and accompanied by thorough documentation.

Deliverables required:

- Climate Hazard Indices provided to the CDS, with their documentation
- Software suite for computing climate impact indicators, complete with relevant libraries and documentation.

4.2.3 Task 3: Interface with EIB

This activity will utilize earthkit backend functionality, maps components and C3S applications framework to develop a dedicated application, or applications to allow EIB to interface with the climate hazard data developed within this contract. The interface will be co-designed with the EIB and ECMWF, according to user requirements and optimizing user experience. It is expected that a CDS dedicated catalogue entry is generated. The catalogue entry will allow data users to download the data products that underpin the applications, promoting reuse by EIB and the broader C3S community.

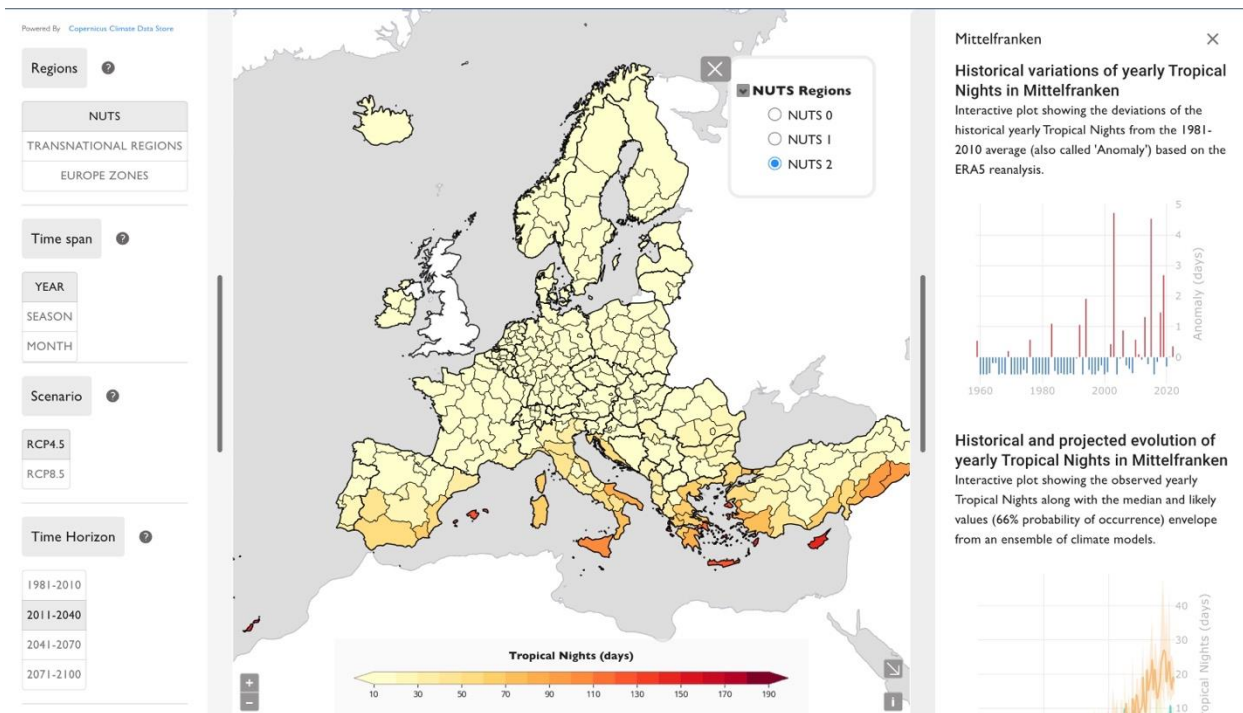


Figure 1: Example of a prototype application based on new CDS infrastructure

Figure 1 represents an example of a prototype application based on new CDS infrastructure. This application supports the C3S contribution to the EEA's Climate Adapt portal. This 'Tropical Nights' application is one that makes up the European Climate Explorer and is underpinned by earthkit back end and open-source java component front-end. Note, the interactive application development libraries will be finalised during 2024.

Deliverables required:

- Interactive web-application, published on a C3S website

4.2.4 Task 4: The indicators for the energy sector

The Energy Sector Group at the EIB focuses on financing projects and initiatives related to energy. This group plays a significant role in supporting investments across various facets of the energy sector, including electricity generation through renewable energy sources, energy efficiency, sustainable energy infrastructure including electricity grids, and energy transition projects.

ECMWF has initiated the definition of specific indicators for the EIB Energy Sector Group and has commenced outlining a delivery mechanism. This work package focuses on operationalizing the delivery of a set of specific climate impact indicators, which have been co-designed with the EIB Energy Sector Group. Tenderers are requested to give priority to this sector and operationalize the ongoing work. The process will involve various phases, including:

- An engagement phase and the delivery of an agreed-upon initial set of indicators derived from CDS data (aligned with the models used in the C3S Climate Atlas, ECDE indicators, and new indicators based on CORDEX Europe raw data). These indicators will be presented as maps with specified confidence levels, aggregated over NUTS2 regions ([Nomenclature of territorial units for statistics](#)⁵).

Missing elements, to be included in this Task:

- Delivery of a comprehensive roadmap mapping C3S indicators to EIB climate hazards for the EIB energy sectors and subsectors group, along with preliminary EIB rules for processing the indicator data.
- Development of a full methodology outlining confidence level determinations based on a thorough literature review.
- Operational provision of indicator maps for Europe.
- Completion of a gap analysis, including effort estimation, timeline projection, and feasibility assessment.

Deliverables required:

- List of climate indices and workflows for the energy group
- Climate Hazard Indices provided to the CDS, with their documentation
- Software suite for computing climate impact indicators, complete with relevant libraries and documentation.
- Maps and plots delivered to the EIB

4.2.5 Task 5: Revise the Global Country Filter Matrix with CDS Data

This task will update the EIB country and regions matrix, NUTS0/NUTS1/NUTS2, with the climate hazard indices produced in this contract. The Matrix is a static table providing conservative evaluations of climate hazards expected to affect each region, addressing the question: based on current literature and climate data, is the specific hazard impacting the selected area (Yes or No)? The Matrix aids the EIB in conducting initial risk screenings.

The matrix update will involve:

⁵ <https://ec.europa.eu/eurostat/web/nuts/overview>

- Identifying key climate data for the assessment.
- Establishing a workflow that progresses from climate data to a simple pre-screening assessment, employing a straightforward algorithm, co-designed with EIB.
- Generating an interactive map illustrating the assessment results.
- Upgrade outcomes from phase 1 for global application in the context of the EIB CRA system (see WP3)

Deliverables required:

- Workflows and maps provided to ECMWF and the EIB.

4.2.6 Task 6: Global scale information

This contract aims to provide climate hazard data and information for the EIB's climate risk assessment, with a primary focus on Europe. While the emphasis is on Europe, it's crucial to note that the EIB's interests span globally. Therefore, this task requires adapting the indicators developed for Europe to the global scale, provided it's scientifically sound and data are available, with a focus on low- and middle-income countries to address the broader scope of the EIB's assessments.

Deliverables required:

- Extended workplan for the indicators to be delivered at the global scale.
- Extended data and application to the global scale.

4.3 Work Package 3 (WP3) Support to integrate the indicators in the EIB climate risk assessment system

The EIB intends to integrate the delivered climate impact indicators into its internal climate risk assessment (CRA). For this purpose, the EIB will develop a map-based software for processing the ECMWF and other data into EIB-internal screening and assessment of physical climate risk associated with a project undergoing EIB technical due diligence. While the CRA belongs to the EIB and will be developed by the EIB, this endeavor aims to facilitate the seamless integration of climate-derived information produced in the above Work Packages into the EIB's decision-making system. This effort might also involve specialized training on the climate indicators, encompassing their interpretation, utilization, and acknowledgment of their identified limitations.

This task will involve gathering the EIB's needs by linking data accessible through C3S with other potential requirements of the bank. For instance, in various projects, the EIB might require data pertaining to adaptation. In cases where this information is available in the CDS, the Successful Tenderer will facilitate the transfer of relevant information to support the Bank's activities.

Deliverables required:

- An assessment report at month 6 and an updated report at the end of the contract, on the implementation of EIB needs down the line

4.4 On-demand tasks and developments

This is an optional set of activities to be activated for any of the following implementations, should such be required: updating the regional climate impact indicators and applications using the latest climate projections from the CDS, testing new reanalysis data (regional reanalysis, or the ERA6 global reanalysis), testing new Destination Earth data from the Digital Twin on climate change adaptation. These on-demand tasks will be activated in case new methods or new data proven to add value in this context will be available at C3S or other pertinent Copernicus Services. For example, if activated these activities could explore examples of how

the recent developments of the Destination Earth adaptation digital twin could be operationalized by C3S in a way that is directly relevant to the needs of the users within the Bank.

Additionally, these activities may be triggered if there's a requirement for new information, such as new climate impact indicators for characterizing compound extreme events.

The activation of further developments will be subject to a contract amendment.

4.5 Work Package 0 (WPO): Management and Coordination

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

Meetings:

- Kick-off meeting
- ECMWF will organise monthly progress review meetings (by videoconference).
- ECMWF organises annual C3S General Assemblies. The Successful Tenderer is expected to attend these meetings and contribute to discussions related to the topic of this ITT.
- Tenderers can propose additional project internal meetings, as they deem needed, as part of their response.

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 prime contractor (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):

WPO Deliverables		
<i>Deliverable#</i>	<i>Title</i>	<i>Due</i>
D431.0.1.1.QX	Quarterly Report QQ YYYY; <i>QQ YYYY being the previous quarter</i>	Quarterly on 15/04, 15/07 and 15/10
D431.0.1.2.YYYY	Annual Report YYYY [Part 1]; <i>YYYY being the Year n-1</i> This includes: 1) Quarterly implementation Report for the previous quarter Q4 YYYY 2) Preliminary financial information form for the previous year	Annually on 15/01
D431.0.1.3.YYYY	Annual Report YYYY [Part 2]; <i>YYYY being the Year n-1</i>	Annually on 28/02
D431.0.1.4	Final implementation report	End date of the contract
D431.0.1.5.YYYY	Annual Implementation Plan YYYY; <i>YYYY being the Year n+1</i>	Annually on 30/09
D431.0.1.6.YYYY	Copy of prime contractor's general financial statements and audit report YYYY; <i>YYYY being the Year n-1</i> <i>(no price shall be associated to this deliverable)</i>	Annually

WPO Milestones			
<i>Milestone#</i>	<i>Title</i>	<i>Means of verification</i>	<i>Due</i>
M431.0.1.1.MX	Progress Review meeting with ECMWF	Minutes of meeting	Monthly
M431.0.1.2.MX	Kick off meeting	Minutes of meeting	Month 1
M431.0.2.1	Updated KPIs (list, targets...) after review with ECMWF	Technical note	One year after start of contract

5 Other requirements

5.1 Provision of data to the Climate Data Store

Data delivery includes the provision of data and files containing abstracts, detailed descriptions of dataset, variables, etc., following the integration process detailed at Annex 1 (Guidelines for Data Integration).

5.2 Development of Applications

All applications must be developed starting from the template examples provided by ECMWF. As with datasets to be published, all applications are to be delivered through the ECMWF's Jira system. The Successful Tenderer or an assigned person in charge of making the publication request shall be responsible to ensure that the material provided is fit for purpose. The delivery of an application or set of applications does not guarantee the publication itself. All applications should have undergone extensive internal review by the Successful Tenderer 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.

Tenderer shall ensure that a sufficient provision is made in their response to cover this activity.

The Successful Tenderer is responsible of de-bugging and updating published toolbox workflows, implemented as python scripts, calling libraries developed within the Climate Data Store Toolbox environment and data within the CDS.

In case agreed, cloud resources may be requested. All requests for cloud resources are submitted via JIRA and must include a data management plan following the guidelines provided by ECMWF.

5.3 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.

EQC checks are independent from data providers and SIS contractors, 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 bidder shall foresee providing support to the EQC function as necessary.

5.4 User requirements & Service evolution

The Successful Tenderer shall be responsible for the synthesis of user requirements in order to define the service offering and provide recommendations for the evolution of the service. Based on gap analysis and collected user requirements, including C3S products evolution (IPCC climate atlas, EEA ECDE etc.), the Successful Tenderer shall provide summary of scientific developments that assure the evolution of products and the service.

5.5 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 in point 2 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.

5.6 Support to user engagement activities

While user engagement and training activities are not part of the scope of this contract (except those activities in 4), Tenderers shall accommodate for eventual needs in providing technical and scientific expertise in support of these 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 your mother tongue 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.

5.7 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 requests.

The contract management activities shall be managed in a separate work package; the structure and content expected from this work package are described in section 4.5.

5.8 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.

5.9 Implementation schedule

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

5.10 Deliverables and milestones

Deliverables should be consistent with the technical requirements specified in section 4. 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 bid, 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.

5.11 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 bid, 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 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.

6.1 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 2: Page limits

6.2 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.

6.2.1 Executive summary

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

6.2.2 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.

6.2.3 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.

6.2.4 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.

6.2.5 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 4.5 above.

Annex 1 Guidelines for Data Integration

Tenderers should refer to the separate document attached. Note that the document includes 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.

If you are a provider of data

Copernicus Services

Exported on 02/19/2024

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About this page

Scope	<p>This page describes the main steps needed to integrate data in the CDS Catalogue. It does not describe 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.</p>
Intend ed audience	<p><i>Copernicus CDS data providers.</i></p>
Outline	<p><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></p>
Disclaimer	<p><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></p>

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](#)¹ (*Integration process*)
2. Supplies the Information document: [Information document template](#)² (*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*)

¹ <https://confluence.ecmwf.int/display/COPSRV/Dataset+registration>

² <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>JIRA When asked by the CDS management registers the dataset³ and create a JIRA ticket at https://jira.ecmwf.int/servicedesk/customer/portal/5</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>Manifest Have a pseudo-manifest file (or a manifest file) 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>Information document 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: Information document template⁴.</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>

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

⁴ <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	Integration process (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.	Review process (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> .	Automatic updates (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"> • download form not providing the expected data • documentation tab not providing the expected documentation • mismatch between data and documentation <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 (https://jira.ecmwf.int/servicedesk/customer/portal/5)</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>Maintenance (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/2017/05/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/2017/07/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/2017/09/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

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>⁵ 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)⁶

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-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-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/)⁷ than [L3U.nc](http://l3u.nc/)⁸ since in the first case it is clear that 2 things are at play.

⁵ <http://web/>

⁶ http://ua_day_gfdl-cm3_historical_r3i1p1_19800101-19841231.nc/

⁷ <http://l3-u.nc/>

⁸ <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](#)⁹

would be better as:

[sfcWind-prevaling_climatology/01/sfcWind-prevaling_climatology_01_v0.0.nc](#)

¹⁰By 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"> • Provide old and new data in the same updated manifest file • Keep old and new data • Remove deprecated data and corresponding lines from the manifest at the end of the deprecation period 	<ul style="list-style-type: none"> • 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: Deprecated SST¹¹. New entry with corrected data: Corrected SST¹² • Remove the deprecated data after 1 to 3 year deprecation period

⁹ http://global-shipping.copernicus-climate.eu/shipping_metocean_variables_monthly_climatology/v0.0/sfcWind_climatology_prevaling/01/sfcWind_climatology_prevaling_01_v0.0.nc

¹⁰ http://global-shipping.copernicus-climate.eu/shipping_metocean_variables_monthly_climatology/v0.0/sfcWind-prevaling_climatology/01/sfcWind-prevaling_climatology_01_v0.0.nc

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

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

Small amount of data	<ul style="list-style-type: none"> • Create new files with a different version tag for the corrected data • Include those files in the manifest • Manifest should contain both old and new versions • Remove deprecated data and corresponding entries in the manifest at the end of the deprecation period 	<ul style="list-style-type: none"> • Deprecate the version of the data corresponding to the wrong data • Modify overview to explain the deprecation or use a new widget called "Known issues" under the Documentation tab • 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). • Remove the deprecated data after 1 to 3 year deprecation period
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DOI, citation, licence and acknowledgement

DOI

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

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

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

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

Licence

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

Acknowledgement

Provider's role	CDS team

<p>No active role but may want to have a look at: How to acknowledge and cite a Climate Data Store (CDS) catalogue entry and the data published as part of it¹³ https://cds-test.climate.copernicus.eu/cdsapp#!/dataset/satellite-total-column-water-vapour?tab=overview</p>	<p>For datasets with multiple licences use a "Origin" button in the download form making related to the name of the licence Example: https://cds-dev.copernicus-climate.eu/cdsapp#!/dataset/satellite-surface-radiation-budget?tab=form</p>
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¹³ <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 principles¹⁴

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

Publishing under FAIR principles

Production Section

Exported on 02/21/2024

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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](#)¹

- [Decommissioning plan of ECMWF public datasets service](#)²

¹ <https://www.ogc.org/blog/4460>

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