Accelerating readiness through data and information

Climate and Disaster Resilience Pilot 2024.2

Open Geospatial Consortium

Climate and Disaster Resilience Pilot 2024.2: Call for Participation (CFP)

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Chapter 1. Introduction

Organizations and individuals worldwide strive to address the challenges created by climate change and increasingly frequent and severe disasters. While the links between increasing climate resilience and managing disasters and emergencies are widely acknowledged, in practice, the geospatial data, services, and systems used in applications across these domains need to be better integrated. There is a critical need to build the capacity to create products, services, and platforms informed by Climate Resilience work, provide actionable information during emergency and disaster management, and feed lessons learned from emergency and disaster management back into Climate Resilience planning. The Open Geospatial Consortium (OGC) Climate and Disaster Resilience Pilot 24 (CDRP24) is a two-phase project that assembles a consortium of partners to address these shared challenges and bridge the use of geospatial data and technologies in Climate Resilience and Emergency and Disaster Management. This Call for Participation heralds the second phase of the pilot (CDRP24.2). The first phase started in January 2024 and will end in September.

The first phase focused on Analysis-Ready Data (ARD) and their integration into analysis workflows and the effective incorporation of contextual and domain-specific knowledge. In the second phase, the focus now shifts to AI tools working on ARD and their integration into analysis workflows. The main challenge of this second phase is exploiting Large Language Models (LLMs) to communicate information about the impacts of climate change and associated risks.

AI tools, particularly generative AI (GenAI) tools, have particular requirements for the data provided. This phase will develop artificial intelligence virtual assistants to explore these requirements, understand the capabilities of current generative AI components, and learn how the necessary context can be provided to make generative AI tools work. The virtual assistants will interact with various sources, service offerings, and platforms, which requires a set of standards-based APIs and information models to ensure reliable interaction and communication between all components.

To effectively use GenAI, all data services must be robust and have high levels of interoperability. As part of this pilot, we will improve GenAI's functionality by analyzing existing services and their information models. This analysis will cover current operational services, Analysis-Ready Data products, and ontologies. The pilot will investigate whether current services and data products support the necessary level of the FAIR principles, which are essential for GenAI. This will involve crosswalks between ontologies and standard API data models.

The challenge of successfully using generative AI tools is more than purely technical. It is a matter of integrating a wide range of interests and requirements, and applying them in an ecosystem of users, policies, services and data. Therefore, this initiative aims to engage a broad cross-section of stakeholders, including data and service providers and users, researchers, responders, and community members, to shape a connected ecosystem of data, technologies and practices. We encourage anyone interested in improving understanding and increasing capacity for informed action by integrating spatial information and technologies across climate, disaster and emergency management-related domains to participate in this pilot. Different ways to participate are described below.
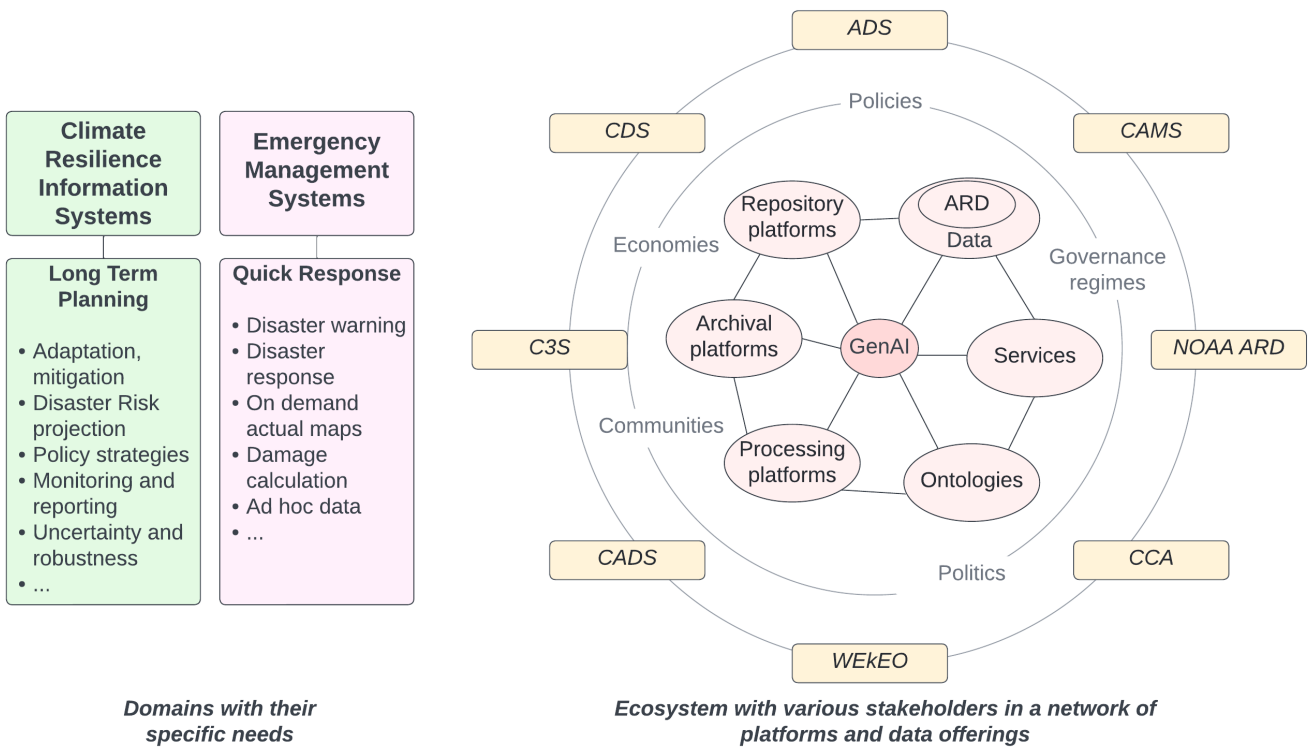
Figure 1. This CDRP24.2 Pilot explores the potential of generative AI in the context of operational platforms and data offerings (right, orange), considering the domain-specific needs of the climate resilience and emergency management communities (left).

Chapter 2. Background

The previous OGC Disaster and Climate Resilience pilots have highlighted the crucial roles of spatial information and spatial data infrastructures (SDI) in helping communities and organizations prepare for and respond to various disasters, such as hurricanes and oil spills. These efforts also aim to improve overall resilience by developing and implementing solutions to enhance infrastructures affected by climate change and disasters across various sectors, including energy, transportation, community services, security, and water management.

Previous efforts have shown that the critical challenge for any environmental development project, risk analysis effort, or disaster response activity is accessing and integrating diverse datasets rapidly and for the location concerned. Operational services have been set up for this purpose, including, for example, the Copernicus Climate Change Service (C3S) or the Copernicus Atmosphere Monitoring Service (CAMS), both working on the Climate and Atmosphere Data Store (CADS). Common to these services is their support for the FAIR principles. Building on a maturing set of standards, these services make the backbone for many decision-making systems, offering robust, standards-compliant interfaces for data discovery, access, processing, and representation. Other efforts focus on Analysis-Ready Data (ARD). ARD is geospatial data that has been pre-processed and formatted to a standard so that it is ready for immediate use in analysis without needing further preparation. This means the data has been cleaned, corrected for errors, standardized, and includes detailed information (metadata) about its source and quality. ARD aims to save users time and effort, allowing them to focus directly on analyzing the data for various applications.

Processing platforms such as WEkEO provide the computing environment for ARD and other data integration and processing. WEkEO uses processes developed to enable remote operations on climate simulations using open community-backed technologies like OGC API processes. This encapsulation helps teams worldwide to access the data and computing power they need to model the impacts of climate change for their applications. All these technologies have been implemented and tested in various OGC Collaborative Solutions and Innovation initiatives. These efforts included the implementations of OGC STAC to enable metadata and data handling, Best Practices developed within the OGC Earth Observation Exploitation Platform to package applications into software containers for remote deployment and execution, or previous OGC Disaster Pilots that collaborated with the Committee on Earth Observation Satellites (CEOS) to standardize Analysis Ready Data (ARD) and to provide the basis for Decision Ready Information (DRI), alongside the creation of OGC Disaster Readiness Guides.

The OGC Testbed-18 Engineering Report (ER) documents the results and recommendations of the Identifiers for Reproducible Science Summary and the Reproducible FAIR Best Practices. The 2023 Climate Pilot and Disaster Pilot reports provide additional insights into requirements and use cases. The Testbed-19 report on Analysis Ready Data describes what ARD means for different types of users, each with their specific view of the world and corresponding requirements.

OGC ERs define draft specifications for interoperability, leveraging OGC APIs and building blocks, and detail the implementation of corresponding components. Implementations of OGC's draft GDC API have been demonstrated with use cases, including integrating terrestrial and marine elevation data and forestry information for Canadian wetlands, which provide practical examples of relevant work. The OGC Testbed-16: Data Access and Processing Engineering Report (20-016) summarizes the results of work to develop methods and apparatus to simplify access to, processing of, and

exchange of environmental and Earth Observation (EO) data from an end-user perspective as exemplified by the openEO initiative's work to develop an open API to connect R, Python, JavaScript, and other clients to big Earth observation cloud back-ends. All this prior work and the FAIR principles provide the framework for the CDRP24. All COSI Program Engineering Reports (ER) are available from the OGC public engineering reports webpage.

Chapter 3. Objectives

This pilot has the following general objectives:

1. Explore how generative artificial intelligence (AI) virtual assistants can be integrated into a given data and service environment. The following questions will be addressed.

    a. To what extent can existing services and platforms be used for the generative AI tools?

    b. What changes are necessary to integrate existing services and platforms into generative AI tools?

2. Develop different prototype generative artificial intelligence (AI) virtual assistants with varying focal points. What all virtual assistants have in common is the goal of understanding the capabilities that can be realistically provided by these AI-supported tools in their data and service environments.

    a. A virtual assistant that can improve the findability of data, information, and resources related to essential European components such as CDS, C3S, CAMS, WEkEO, and associated infrastructures to drive their uptake and use by research and industry.

    b. A virtual assistant linked to a list of approved websites that responds to visitors' questions with plain-language responses, inclusive of associated links and images.

    c. A virtual assistant trained on a curated knowledge base that includes information on coastal flooding with information sources relevant to insurance in Canada.

3. Evaluate the capabilities and maturity of existing platforms and data/service offerings, Analysis-Ready Data products, and ontologies, focusing on those described in the technical requirements section further below.

This pilot, therefore, has three general objectives: The first objective looks at existing services, data, information models, and platforms from the perspective of the generative AI developer. The second objective examines the specific capabilities that can currently be realized through AI tools. The third objective clearly focuses on the various platforms' existing services and data offerings as well as information models. The project examines how these can be optimally developed based on the FAIR principles. Lastly, it is essential to get as many different stakeholders on board as possible.

This CDRP24.2 pilot will enhance the knowledge around generative AI within modern service and platform environments in the context of climate change and disaster resilience. Various services, such as the Copernicus Climate Change Service (C3S), will be evaluated concerning their usage by the global stakeholder community to take impactful action to increase climate resilience and improve emergency and disaster management. Generative AI-based methods will be explored for our collective research, data, models, and services toward FAIR (Findable, Accessible, Interoperable, and Reusable) environments. Through this work, OGC's CDRP2024 supports the UN's Agenda 2023 Global Sustainable Development Goals and the goals of the UN climate resilience policy frames, including the Sendai Framework for Disaster Risk Reduction, the Paris Agreement, the UN SDGs 11, 13, and 15, as well as the UN Framework Convention on Climate Change (UNFCCC).

In practical terms, this pilot will

1. Create practical generative AI technology demonstrators and working prototypes that:

a. Connect climate resilience, disaster, and emergency management information systems, services, or applications and make them more "FAIR."

   b. Transform raw data into information valuable to the stakeholder communities for decision-making.

   c. Create and document reproducible workflows that serve as the basis for newly developed, high-quality data products or analysis.

2. Improve the "FAIR-maturity" of existing services, platforms, and data

3. Publish documentation of technical materials that:

   a. Explains how various technologies can be used to meet stakeholder needs.

   b. Supports the reuse of demonstrators and prototypes to enable uptake by the wider stakeholder community.

   c. Facilitates incorporation of CDRP24.2 outputs into learning materials.

4. Author a publicly available Website and Engineering Report (ER) that:

   a. Summarize all results and lessons learned from this pilot.

   b. Include the generative AI virtual agents and make them persistently available to the public.

   c. Provides critical information on the composition of the stakeholder community.

   d. Serve as a starting point towards a sustainable Climate and Disaster Resilience information platform.

Chapter 4. Benefits to the stakeholder community

The outcomes of the CDRP24.2 initiative will benefit not only its Sponsors and direct Participants, but also the broader stakeholder community through:

- Creating a shared forum for technical experts, domain experts, and users of geospatial data and systems in the Climate Resilience, emergency, and Disaster Management communities.

- Building an integrated source of information on key technologies, standards, and data critical for geospatially-enabled climate and disaster resilience applications.

- Providing insights into where the geospatial data and infrastructure needs of Climate, disaster, and Emergency Management stakeholders intersect and diverge.

- Connecting the Climate, Disaster, and Emergency Management communities and the communities engaged in related OGC initiatives to seed future collaborations and create opportunities for new partnerships.

Chapter 5. Benefits to participants

This initiative provides an outstanding opportunity to connect with stakeholders across the Climate, Disaster, and Emergency Management ecosystem. It allows participants to engage with the latest research on geospatial system design, concept development, and rapid prototyping with organizations (Sponsors & Participants) across the globe. The initiative provides a business opportunity for stakeholders to mutually define, refine, and evolve service interfaces and protocols in the context of hands-on experience and feedback. The OGC Climate and Disaster Resilience Pilot will contribute towards an open, multi-level infrastructure that integrates data spaces, open science, and local-to-international requirements and objectives. It will contribute to the technology and governance stack that enables the integration of data, including historical observations, real-time sensing data, (re-) analyses, forecasts, and future projections. It addresses data-to-decision pipelines, data analysis, and representation for future bundling in climate and disaster resilience building blocks. These building blocks will enable multi-stakeholder decision-making and create public benefits in a changing natural environment.

CDRP24.2 Sponsors are supporting this vision with cost-sharing funds to partially offset the costs associated with developing, engineering, and demonstrating these outcomes. This offers selected Participants a unique opportunity to recoup some of their initiative expenses. OGC COSI Program Participants benefit from:

- Access to funded research & development

- Reduced development costs, risks, and lead-time of new products or solutions

- Close relationships with potential customers

- First-to-market competitive advantage on the latest geospatial innovations

- Influence on the development of global solutions and standards

- Partnership opportunities within our community of experts

- Broader market reach via the recognition that OGC standards bring

Chapter 6. Master Schedule

The following table details the major Initiative milestones and events for the Climate and Disaster Resilience Pilot 2024.2. Dates are subject to change.

Table 1. Master Schedule

Milestones	Date	Description
M01	**07 August July 2024**	*Public Release: Call for Participation*
M02	**29 August 2024**	*Questions due for Bidders Q&A Webinar 9:00 AM EDT* Bidders Q&A Webinar - Recording Bidders Q&A Webinar - Slides Bidders Q&A Webinar - Transcript See Appendix D for written Questions and Answers
M02b	**12 September 2024**	*Second Bidders Q&A Webinar 9:00 AM EDT* Please join the meeting here, Thu Sep 12th 9:00 AM EDT
M03	**18 September 2024**	*Proposals Due at 23:59 EDT*
M04	**07 October 2024**	*3h Kick-off workshop, hybrid session, online attendance possible, physical meeting at the OGC coding sprint, at ECMWF, Bonn, Germany*
M05	**03-05 December 2024**	*Optional in-person demo at OGC Innovation Days Washington DC, USA*
M06	**14 January 2025**	*Virtual demonstration meeting - Engineering Report draft submission*
M07	**31 January 2025**	*Pilot report submitted for evaluation by OGC working group*
M08	**28 February 2025**	*End of CDRP24.2*

During the pilot, weekly check-ins will be held for participants to discuss progress, highlight challenges, and share views on key issues using videoconferences. Participants will contribute to the pilot's final report by providing quick comments after each meeting, capturing discussion and lessons learned, which will complement the technical outcomes included in the report.

It is recommended to attend two in-person events taking place during this stage of the CDRP24.2.

- OGC Coding Spint - FAIR Climate Services, 07-09 October 2024, Bonn Germany

- OGC Innovation Days - Spatial Data Infrastructure Futures, 03-05 December 2024, Washington DC, USA

Chapter 7. Participation

7.1. Who can participate

The OGC welcomes proposals to participate in its initiatives from organizations and individuals active in developing, managing, and using geospatial data, technologies, and systems. Proposers may be active in industry, government (national, regional, local), research, non-profit, community, or other sectors. Past participants have included providers of services and platforms, modelers, end users of platforms and data, researchers, and other stakeholders in relevant domains.

You do not need to be a member of the Open Geospatial Consortium to propose to participate. However, if your organization's proposal is selected, you or your organization must become an OGC member if you are not already one. This ensures all participants have equal access to the tools and documentation developed and shared throughout the project phase.

7.2. How to participate

The CDRP24.2 is designed to enable interested organizations to participate in various ways. Every organization is invited to submit a proposal for the work items and deliverables defined in this Call for Participation, but other forms of participation also exist. These range from simple involvement in the co-design process without resources other than the participants' time, providing funding, in-kind contributions, paid services, or providing resources such as data sets or access to infrastructure. Mechanisms for engagement include:

- Provide technical expertise: Commit staff time to the Pilot to attend meetings regularly, develop data and software components, test and evaluate implementations, or produce documentation. Actively participate in workshops and co-design exercises to contribute your perspective on how tools should be designed and what would meet your needs as a user. Add your perspective as a technical or domain expert by providing feedback on the design and implementation of the architecture.

- Provide a use case: Share a real-world case study that can inform the development of the persistent demonstrator (OSPD) architecture and demonstrate how it can create more FAIR processes and workflows, leading to better user outcomes. Sample use cases may be provided when you make your proposal, with the expectation that these will be refined in consultation with other pilot team members.

- Provide data or tools: Contribute existing data, platforms, research, or other resources (e.g., models, digital infrastructure components) to support the Pilot.

Chapter 8. Technical Objectives

This section identifies the technical objectives of the CDRP24.2 initiative and the corresponding activities and deliverables. All deliverables are identified by the identifier **Dxxx**, with "xxx" being a three-digit number.

It is expected that proposals to achieve these technical objectives will build on and refer to the OGC standards baseline, i.e., the complete set of member-approved Abstract Specifications, Standards including Profiles and Extensions, and Community Standards, where relevant.

Technical Objectives are organized under the following tasks:

- **Task 1**: Enhancing Copernicus Climate Change Service (C3S) and other Copernicus Sectoral Information Systems (CSIS). The CSIS are specialized services developed within the framework of C3S to provide tailored climate information and tools for specific sectors. The goal is to support decision-making processes in various sectors by offering relevant and actionable climate data and projections.

- **Task 2**: Generative AI virtual assistants featuring Large Language Models for Climate Communications

- **Task 3**: Maturity of ARD sources and state-of-the-art Generative AI technology on workflows for wildfire risk, hazard, and impact workflows typical in the insurance sector

- **Task-4**: Ontologies for emergency and disaster management

The outputs of these tasks may be combined into common use cases, workflows, learning materials, or other deliverables. The tasks will be reported in a single collective result, and lessons learned documentation will be implemented as an Engineering Report and Website (D001), which summarizes key findings and provides connections to other outputs and products.

- **D001 Pilot Website/Engineering Report** – Develop a public website and collaboratively edit an OGC Engineering Report (ER), capturing key results and experiences from this project. The website/Engineering Report will contain a plain language executive summary to clearly outline the motivations, goals, and critical outcomes of this Initiative. The report will be produced in collaboration with OGC staff. The website is intended to provide the most accessible possible introduction to the topic. The focus of the website is on the integration of the various generative AI virtual assistants. The technology on which the website is based is freely selectable. The website must be integrated into the OGC website as a subdomain. OGC Staff realizes this integration. OGC will host the final website. Each participant in the CDRP24.2 will contribute to D001 documenting their contributions to the pilot. The Participant(s) co-leading editorial work will:

  ◦ Maintain and regularly update drafts of the report/website in a GitHub repository.

  ◦ Integrate contributions from all participants into the report and help synthesize the main discussion points regularly after each meeting.

  ◦ Format text and graphic files according to the report/website template to produce good-looking documentation.

  ◦ Collaborate closely with the coordinator of the pilot (OGC staff) to produce the final report.

8.1. Task 1: Enhancement of Copernicus Services

The green and digital transition is a core political priority of the European Commission, unveiled by a flagship action plan, the European Green Deal, which is supported by different legislative and regulatory actions. Several of these actions are expected to make a concrete contribution to climate mitigation, climate adaptation, or the prevention of environmental degradation (biodiversity preservation, zero pollution). In this context, efficient and no-barrier access to data and services from different domains that can be further combined and processed to leverage actionable and truthful information, will be the cornerstone to achieving the objectives.

Various data stores, data access services, and platforms have been developed to support the European Green Deal agenda. Among these are the Copernicus Emergency Management Service (CEMS) with the Early Warning Data Store (EWDS), the ECMWF Common Data Store (E-CDS), which supports the Copernicus Climate Change Service (C3S) and Atmosphere Monitoring Service (CAMS), the Copernicus Data and Information Access Services (DIAS) WEkEO, which provides combined access to Copernicus Environmental Services and Sentinels together with computing and storage resources, the Destination Earth Digital Twins Engine, or the Green Deal Data Space (GDDS). Recently, additional systems have been developed on top of these components, such as the Copernicus Thematic Hub for Health (implemented by CAMS) and Thematic Hub for Energy (implemented by C3S).

This broad ecosystem will require trusted and secure platforms for accessing and sharing high-value environmental data, empowering policymakers, businesses, researchers, and citizens from Europe and worldwide to tackle the achievement of the EU Green Deal objectives jointly. An unveiled ecosystem of data and services will be essential to address climate change's potential and actual economic impacts and related disaster and emergency situations.

The system architecture is designed as a distributed system and an open framework that provides web-based and API-based retrieval facilities for a vast catalog of datasets and other digital information. All components adopt the FAIR principles, in which OGC Standards play a pivotal role. By supporting standardized interfaces, the various components can be integrated efficiently and securely, as well illustrated by WEkEO.

EUMETSAT, Mercator Ocean, EEA, and ECMWF implement the WEkEO Data and Information Access Service (DIAS) platform. The WEkEO platform allows users to allocate computing and storage resources, develop experiments in a Jupyter environment, and combine different Copernicus data sources, such as the Copernicus Climate Change Service (C3S), the Copernicus Atmosphere Monitoring Service (CAMS), the Copernicus Marine Environment Monitoring Service (CMEMS), the Copernicus Land Monitoring Service (CLMS), or the Copernicus Emergency Management Service (CEMS). ECMWF Data Stores and WEkEO have complementary capabilities and present functional interlinkages - WEkEO regularly harvests the shared data store catalogs and other configuration files as interactive forms and constraints. The Data Store's technical components "power" the data access via the Harmonized Data Access (HDA) API, and ECMWF toolkits such as "earth kit" or "ClimateLab" are fully compatible with deploying and running on WEkEO allowing users to access, manipulate and visualize data across different services. This close interaction is fostered by adopting FAIR principles on all sides, relying to a large degree on adopting OGC and other international or de facto community Standards across infrastructure components and interfaces.

As part of its modernization, Data Stores set up an ARCO (Analysis Ready, Cloud Optimized) Data

Lake with additional services. A series of ETL (Extract, Transform, Load) workflows continuously updates this ARCO data lake containing sub-sets of data chunked by spatial and geographical dimensions. ARCO data is exposed via standard WMTS Services and consumed primarily by the WEkEO viewer but is publicly open for further consumption. These ARCO capabilities are expected to offer new functional possibilities in the future, which are particularly important for the promotion of responsive visual and interactive applications or AI/ML solutions.

Along with the modernized data stores, ECMWF has launched "earthkit", an open-source Python project providing tools for weather and climate workflows that simplify data access, analysis, and visualization. Earthkit packages are optimized to integrate with Data Stores and WEkEO platforms but can deploy and run everywhere and interact with external data sources and Python libraries.

All these components, platforms, and tools represent building blocks and foundational resources for the envisioned environmental ecosystem, contributing data, services, and infrastructure resources. Improved findability and data access capabilities will enable organizations to build novel transdisciplinary applications and drive innovation that integrates multiple sectors.

This pilot shall showcase, evaluate, and enhance the FAIRness and level of compliance with the standards of the various components with a focus on the data stores and the WEkEO platform. The goal is to explore new, innovative, and more demanding ways of accessing data and services. This pilot shall implement scenarios that feature multi-platform data integration, responsive visual interactive applications, and ML/AI solutions.

8.1.1. Task Specific Objectives

Participants in this task must deliver a complete climate change scenario as an executable demonstrator. The corresponding research activities shall

- Demonstrate how adopting FAIR Principles and OGC Standards can foster the user's uptake of the portfolio of data and services. Use as many services and platforms as possible, including the Climate Change Service (C3S), the Atmosphere Monitoring Service (CAMS), and, in particular, the ECMWF Common Data Store (E-CDS) and the WEkEO DIAS platform.

- Evaluate the capabilities for the programmatic interaction with external platforms and systems via the services mentioned above and platforms' publicly exposed interfaces and endpoints.

- Assess the potential, readiness, and limitations of ECMWF's experimental Analysis Ready, Cloud Optimized (ARCO) capabilities offered as an extension of the portfolio to support highly demanding use case scenarios (e.g., ML/AI, LLM). Analysis Ready, Cloud Optimized (ARCO) refers to data that is pre-processed and standardized for immediate analysis and optimized for efficient access and processing in cloud environments. ARCO data principles enhance usability, scalability, cost efficiency, and interoperability, making them particularly valuable for large-scale data applications such as Earth observation, geospatial analysis, and environmental monitoring. Various Copernicus services provide ARCO data to facilitate climate and atmospheric research, including the Copernicus Climate Change Service (C3S) and Copernicus Atmosphere Monitoring Service (CAMS).

- Evaluate how OGC-compliant data and services provided by external platforms and thematic domains (e.g., INSPIRE-compliant Data and Services) can be exploited with the available portfolio, preferably in the context of health and energy-oriented solutions.

- Identify opportunities, gaps, and barriers to adopting and complying with OGC Standards, providing recommendations for potential areas of improvement.
- Contribute with proposals for the extension or amendment of OGC Standards based on lessons learned from the abovementioned objectives.
- Contribute with recommendations for a FAIR evolution according to the requirements identified while implementing the objectives listed above.

8.1.2. Task-Specific Work Items and Deliverables

The following list identifies all deliverables in this task. In addition to producing the deliverables against which they bid, all participants must participate in all general technical discussions and contribute to developing the Website/Engineering Report (deliverable D001).

All demonstrators shall be delivered on a Website that provides sufficient information for differently experienced stakeholders to understand the demonstration. This includes the following aspects:

- Vision and principles
- Architecture of the solution
- Compilation of consumed data and services
- Feasibility study for operational implementation
- Compliance report, including
    - FAIRness evaluation and gap analysis detailed by principle (Findability, Accessibility, Interoperability, and Reusability).
    - OGC Standards: level of compliance, gap analysis, and proposal for further evolution.

The website shall allow the execution of the demonstrator to experience it "in action." Ideally, the demonstrators enable website users to conduct their experiments. All demonstrators shall work against the Task-Specific Objectives defined above and document their corresponding findings on the demonstrator website. The demonstrator website shall inform about the capabilities of E-CDS, C3S, CAMS, WEkEO, and associated infrastructures to support the aims of the GDDS and make recommendations for updates and alterations of these infrastructures. This demonstrator should be backed by background research and practical tests of the relevant data services and infrastructures. At least for D100, these recommendations should consider requirements for integrating AI and generative AI as tools for data discoverability.

For all deliverables, the Sponsor will provide special permissions to access ARCO resources if they are to be used. Apart from ARCO, all other services are used in their current public form. Pilot participants behave in the same way as other regular users. Ideally, participants use earthkit software packages (https://earthkit.readthedocs.io/en/latest/) where possible for data retrieval, processing, and visualization.

Python is the preferred programming language. Depending on the scope of the demonstrator, the Sponsor might provide a Jupyter environment. WEkEO cloud resources and its development environment (JupyterHub) might also host and run demonstrators in this case.

Several instances of the following deliverables may be funded:

- **D100 - Demonstrator generative AI-enabled virtual assistant** that can improve the findability and usability of the available portfolio of data and services to foster the uptake by different communities and domains. The virtual assistant shall be trained on a curated knowledge base that includes information related to E-CDS, C3S, CAMS, WEkEO, associated infrastructures, and, in particular, ARCO metadata (STAC) and data (ZARR). The primary purpose of the prototype virtual assistant is to improve the findability (discoverability) of relevant transdisciplinary data resources to facilitate the use of cross-domain data and information resources in Green Deal Data Space (GDDS). Themes for data discovery should include two or more of climate, health, and energy and connections between them. The participant provides all results, lessons learned, and the demonstrator in appropriate formats to be embedded into the pilot's main website and Engineering Report (D001).

- **D101 – Demonstrator for sectoral applications**, preferably in the fields of health or energy, combining the available portfolio with OGC-compliant services and data provided by third parties (e.g., INSPIRE data and services). Ideally, the demonstrator illustrates the programmatic integration with workflows for creating and monitoring environmental indicators connected to international climate targets (e.g., Green Deal). The participant provides all results, lessons learned, and the demonstrator in appropriate formats to be embedded into the pilot's main website and Engineering Report (D001).

8.2. Task 2: Generative AI virtual assistants featuring Large Language Models for Climate Communications

The insurance sector can be critical in making communities more climate and disaster-resilient. The risks, hazards, and impacts of disasters change as the climate alters, so communicating new information to a broad audience is essential. Today, the ability to convey accurate, relevant information and respond to questions about increasingly frequent, intense coastal floods and wildfires and their impacts on communities is a priority. A key area of interest for the insurance sector, shared by government agencies sponsoring the CDRP, is the development of trustworthy Large Language Models (LLMs) that may be used to communicate information about the impacts of climate change and associated risks.

The information needed for LLMs to answer questions on these topics is found in many formats, from mentions of places in proximity to one another in written documents to maps depicting the locations of built structures to structured spatial data generated from surface water absorption forecasts. Consequently, it is necessary to enable LLMs to access data and information represented spatially (maps, data visualizations) and textually (documents, attributes, descriptors). While methods to enable LLMs to use textual information are developing rapidly, the specific challenges of extracting a range of spatial data from text, maps, and other spatial representations are less advanced.

The potential of LLMs to improve both the creation and communication of spatial information relevant to climate-driven hazards like coastal flooding and wildfire has been demonstrated. Prior work (e.g., Bokoyo et al. arXiv:2311.04929) illustrates the use of fine-tuned LLMs to improve the accuracy of spatial information extracted in response to a well-engineered prompt, as well as the use of spatial data to improve model tuning. While progress has been made, this is an active

research area, and open questions include:

1. How usable are different sources of spatial information commonly available in the insurance sector (e.g., text, hazard maps, visualizations) for training an LLM intended to respond to questions?

2. How usable are different sources of spatial information commonly available in the insurance sector (e.g., text, hazard maps, visualizations) for training an LLM, which must provide trustworthy (explainable, intelligible, referencing published materials) responses to questions?

3. How can the design of an LLM maximize its capability to use a range of spatial information and answer questions where locational information is relevant?

8.2.1. Task Specific Objectives

To address these questions, the participant(s) working on this task will address the following technical objectives. All participants working on the generative AI virtual assistants are encouraged to work together and share experiences, materials, and LLMs to maximize the research output of this pilot. Two different assistants shall be developed. One assistant answers user queries based on its LLM. The second assistant can also answer queries about specific websites using an LLM.

1. Demonstrate a prototype generative AI (GenAI) virtual assistant capable of providing plain language answers to questions about risks, hazards, and impacts of coastal flooding in Canada and other regions worldwide. The participant(s) developing the prototype shall:

   a. Development of the GenAI knowledge base: Equip the GenAI virtual assistant with a knowledge base incorporating materials approved by the Sponsors (example material). This assistant should be able to communicate information relevant to multiple audiences, including non-experts and experts in different domains (e.g., adjustors).

   b. Evaluate and document the usability of different sources of spatial information (e.g., text, risk and hazard maps, other visualizations, tabular data) to fine-tune or train the LLM. Example information formats could include:

      i. A hazard or risk map based on a risk model run by the Sponsor

      ii. A published map from the Canadian government showing authoritative spatial information

      iii. A map produced by a regional disaster management agency as part of an operational or reporting process

      iv. A written description of places and their comparative risk levels.

   c. Evaluate and document methods for extracting geospatial knowledge relevant to the hazards, risks, and impacts of coastal flooding from the LLM.

2. Further development of a generative artificial intelligence (GenAI) virtual assistant that responds to visitors' queries and requests by offering reliable, plain-language information taken from a curated list of trusted websites offering climate science and impact assessments information as well as guidance on available data, tools, services, and expertise to help support and inform users' plans for adaptation, resilience, and mitigation actions. The participant(s) developing the prototype shall:

   a. Evaluate and document the usability of the assistant to respond to visitors' questions on

specific websites with plain-language responses, including associated links and images.

    i. The images shall be thumbnails linked to the original or more detailed information about these images.

    ii. Searchable by city name, state, zip code, country, or water body names (oceans, gulfs, bays, lakes larger than 1 km in diameter, rivers larger than 0.25 km across)

b. Support the following four use cases:

    i. Virtual assistants identify and contextualize information and resources on the website that are relevant to the visitor's interests.

    ii. If this website does not offer relevant resources, the virtual assistant notes that and identifies and contextualizes resources on other ("whitelisted") websites pertinent to the visitor's interests.

    iii. The virtual assistant can provide plain-language answers to visitors' questions based on textual information found on current or other whitelisted websites.

    iv. The virtual assistant may be able to access and employ predetermined datasets and Python notebooks to answer a limited range of visitors' data-driven questions, such as:

        A. Occurrences of threshold exceedances for a selected variable at a given location or geographical area.

        B. Statistically significant change trends in a selected variable for a given geography and time of year.

c. Develop several questions and associated "explainer pages" that will be shown when the GenAI virtual assistant's user selects these questions.

    i. The length and details should be several paragraphs and include at least one relevant image.

    ii. The page and/or images could be geolocated or regionally relevant based on the IP address location.

    iii. Generated explainer page content should be persistent and reusable.

    iv. The questions and explanations should be relevant to the impacts of climate on fisheries in the US and abroad. Example questions include:

        A. What are normal or typical climate conditions for a given geography?

        B. How have climate conditions for {given geography} been changing over time? (AI may have to prompt the user to indicate the historical period of interest. If a given time span exceeds the AI's capacity, then the AI will report the time period(s) for which it can answer the question.)

        C. How are climate conditions for my location projected to change in the future? (AI may have to prompt the user to indicate the future period of interest. Again, the AI should tell the user its temporal constraints.)

        D. What possible actions can be taken to slow or stop global warming (i.e., mitigation)?

8.2.2. Task-Specific Work Items and Deliverables

The following list identifies all deliverables in this task. In addition to producing the deliverables

against which they bid, all participants must participate in all general technical discussions and contribute to developing the Website/Engineering Report (D001).

All demonstrators shall be delivered on a Website that provides sufficient information for differently experienced stakeholders to understand the demonstration.

- **D120 - Demonstrator generative AI-enabled virtual assistant** that supports the objectives defined in bullet point (1) of the task-specific objectives. The participant provides all results, lessons learned, and the demonstrator in appropriate formats to be embedded into the pilot's main website and Engineering Report (D001). Relevant data sources to be incorporated include:
  - The Intact CCA knowledge base (Reports and Resources – Intact Centre on Climate Adaptation (intactcentreclimateadaptation.ca), specifically: Municipal Flood Risk Check-Up – Intact Centre on Climate Adaptation (intactcentreclimateadaptation.ca)
  - Reports on the upcoming Canadian national flood insurance program: Budget 2024: Federal government details Canada's first national flood insurance program to be launched in partnership with property and casualty insurers (ibc.ca).
- **D110 - Demonstrator generative AI-enabled virtual assistant** that supports the objectives defined in bullet point (2) of the task-specific objectives. The participant provides all results, lessons learned, and the demonstrator in appropriate formats to be embedded into the pilot's main website and Engineering Report (D001).

8.3. Task 3: Maturity of ARD sources and state-of-the-art Generative AI technology on workflows for wildfire risk, hazard, and impact workflows typical in the insurance sector

This task uses elements from the previous task and complements these with additional research.

8.3.1. Task Specific Objectives

1. Evaluate the maturity of crucial NOAA Analysis Ready Data (ARD) sources integral to disaster risk response and, secondarily, climate assessments to ease the agency's uptake of NOAA data, both internally and externally.

   a. Build on existing data maturity matrices used by NOAA and allied government agencies to produce updated criteria and requirements for different ARD maturity levels, e.g., data accessibility, interoperability, and assimilation barriers for specific climate and disaster applications. The updated matrix should be developed to evaluate ARD for climate and disaster resilience applications and, therefore, be developed as a profile of NOAA's general data maturity matrices. The data maturity matrix and associated criteria should consider the following:

      i. FAIRness and AI readiness.

      ii. Storage locations and access protocols (e.g., cloud-native / cloud-optimized storage; object storage; accessible via HTTP from many compute instances; supports lazy access and intelligent subsetting; integrates with high-level analysis libraries and distributed

frameworks)

    iii. Conformance to indexed metadata standards

    iv. Ease of integration into Climate and Disaster applications and analysis by science users.

b. Evaluate selected NOAA data sources (portals) to assess how their data meet the criteria and requirements for Climate and Disaster Resilience ARD maturity developed above.

c. Report on any available tools that a domain scientist could use to assess the extent to which a dataset meets the criteria and requirements defined in an ARD maturity matrix. Capabilities of interest include:

    i. The ability to identify datasets that meet requirements for specified ARD maturity levels, e.g. https://ceos.org/ard/ or https://www.usgs.gov/landsat-missions/landsat-us-analysis-ready-data.

    ii. The ability to provide users with recommendations for improving the data's ARD maturity level, e.g., by indicating the elements that need updates or completion to achieve interoperability.

    iii. The ability to categorize non-pass datasets as needing 'minor adjustments to be assimilated', 'moderate adjustments to be assimilated', or ' substantial adjustments to be assimilated' to meet specified levels in the data maturity model.

2. Evaluate and report on the state-of-the-art use of Generative AI for wildfire risk, hazard, and impact assessment and management for applications and workflows typical of the insurance sector, encompassing the needs of private insurers and governments.

8.3.2. Task-Specific Work Items and Deliverables

- **D010: ARD Maturity Report**: A report that includes an updated data maturity matrix that documents 1) NOAA's criteria and minimum requirements for data sets to be used as ARD for applications in climate assessments and disaster risk response; 2) an evaluation of the extent to which selected datasets meet these criteria, and 3) evaluations of existing tools for self-service assessments of future datasets by NOAA scientists. This report should consider all aspects detailed in the technical objective described in Task 2 Technical Objective 2. The report shall be delivered in the form of a website that can be embedded in the pilot's website D001 and be based on the OGC Engineering Report HTML template.

- **D030: Generative AI for Wildfire State-of-the-Art Report**: A report on the applications of state-of-the-art Generative AI technology on workflows for wildfire risk, hazard, and impact workflows typical in the insurance sector, including workflows that incorporate both publicly (i.e., government) and privately held data sources. This report will build on the GenAI for Wildfires report developed in the current set of CDRP activity, which will be made available to the participant with selected source materials. The report shall be delivered in the form of a website that can be embedded in the pilot's website D001 and be based on the OGC Engineering Report HTML template.

8.4. Task 4: Ontologies for emergency and disaster management

Spatial data and information derived from commercial, civilian government, and NGO sources are increasingly used by entities within the Defense/IC community, including in their activities in support of natural disaster response and emergency management. Conversely, declassified data and information, including imagery, are used by commercial, civilian government, and NGOs for their applications in support of disaster resilience. Recent developments such as the US National Unclassified Data Lake underscore the importance of these cross-community efforts. To facilitate the flow of information between the systems used by commercial, civilian government, and NGO applications and those used by DoD/IC organizations for emergency and disaster management, interoperability between ontologies used to structure information relationships within DoD/IC information infrastructures and metadata supplied by current data retrieval processes, including standards-conformant APIs, by civilian and commercial communities should be maximized.

The DoD/IC uses the Common Core ontology and extensions relevant to emergency and disaster management, including the Atmospheric Feature Ontology, Hydrographic Feature Ontology, and Sensor Ontology to structure their information and facilitate discovery of relevant content. The OGC community has developed API standards, e.g. the OGC API-Features standard and the OGC EDR-API standard, to improve the interoperability of services and applications, including those relevant to emergency and disaster management, and facilitate FAIRness including data discoverability, query, and transfer.

8.4.1. Task Specific Objectives

This task shall produce the information design of a Data Retrieval Service that is conformant to OGC API building blocks standards, e.g., the OGC API-Features standard or the OGC EDR-API standard, and explicitly mapped to the Common Core ontology. The information design work should map between the selected API's content model(s) and the Common Core ontology. It should identify any elements that are not interoperable and elements that are ambiguous, i.e., could be mapped to multiple elements of the API content model or Common Core ontology.

It is expected that this activity will consider how to model the ontology in relation to the JSON-LD context documents used for OGC APIs. To support validation, it should explore methods to map the SHACL shapes generated from OWL to validate graph-based instance data against JSON schema.

8.4.2. Task-Specific Work Items and Deliverables

- **D040 - Information Interoperability Engineering Report**: A report summarizing the methods used for information modelling and evaluation of information interoperability, a gap analysis, lessons learned, and recommendations for improving interoperability. The report shall include a DoD/IC ontologies to OGC API interoperability crosswalk (e.g. API features or EDR). The crosswalk shall include the Common Core ontology's elements and the selected OGC API standards' required and optional elements.

  The participant(s) implementing this task shall make a summary of the results available in D001.

8.5. Deliverables Overview

The following table provides an overview of all deliverables to be provided. Due to specific requirements of the sponsors, some services can only be awarded to organizations based in a Copernicus member state. In principle, however, all organizations can apply for each deliverable on an in-kind basis.

Not all contracts between the OGC and the sponsors have been signed yet. For this reason, some work items are marked with "funding status pending" in the following table. It is expected that all listed work items will be funded. However, this cannot be guaranteed at this time.

Table 2. Overview of all deliverables

Deliverable ID	Deliverable name	Special funding conditions	Funding status
D001	Pilot Website/Engineering Report	Copernicus member states only	pending
D010	ARD Maturity Report	-	-
D030	Generative AI for Wildfire State-of-the-Art Report	-	pending
D040	Information Interoperability Engineering Report	-	-
D100	Demonstrator generative AI-enabled virtual assistant	Copernicus member states only	pending
D101	Demonstrator for sectoral applications	Copernicus member states only	pending
D110	Demonstrator generative AI-enabled virtual assistant	-	-
D120	Demonstrator generative AI-enabled virtual assistant	-	pending

Chapter 9. OGC COSI Program Initiatives

This initiative is being conducted under the OGC Collaborative Solutions and Innovation (COSI) Program, which aims to solve the biggest challenges in location. Together with OGC members, the COSI Team is exploring the future of climate, disasters, autonomy and robots, outer space systems interoperability, defense and intelligence, and more.

The OGC COSI Program is a forum for OGC members to solve the latest and most complex geospatial challenges via a collaborative and agile process. OGC members (sponsors and technology implementers) come together to solve problems, produce prototypes, develop demonstrations, provide best practices, and advance the future of standards. Since 1999, more than 125 funded initiatives have been executed - from small interoperability experiments run by an OGC working group to multi-million dollar testbeds with more than three hundred OGC-member participants.

OGC COSI initiatives promote rapid prototyping, testing, and validation of technologies, such as location standards or architectures. Within an initiative, OGC Members test and validate draft specifications to address geospatial interoperability requirements in real-world scenarios, business cases, and applied research topics. This approach not only encourages rapid technology development but also determines the technology maturity of potential solutions and increases technology adoption in the marketplace.

9.1. Information on bidding, selection, and key requirements

Responding to the Call For Participation (CFP):

To respond to the CFP as a bidder, you will submit an Online Form in which you describe your proposal. This proposal should include your (the bidder's) technical solution(s) for each deliverable, cost sharing request(s) for funding, and proposed in-kind contribution(s) to the initiative.

The CFP includes a description of the deliverables against which bidders may submit proposals. Bidders may address technical deliverables, such as implementing a component of an infrastructure, or participatory deliverables, such as contributing to meetings and to writing documents. The timeline for completion of the deliverables is set out in the Master Schedule.

Proposal Evaluations will take place on a per-deliverable basis. Therefore, it is important that all proposals should all be entered into the form on a per-deliverable basis.

Proposals in response to the CFP should be submitted by the deadline listed in the Master Schedule.

Participant Selection and Agreements: Following the submission deadline, OGC will evaluate received proposals, review recommendations with Sponsors, and negotiate Participation Agreement (PA) contracts, including statements of work (SOWs). Participant selection will be complete once PA contracts have been signed with all Participants.

Required attendance at the Kickoff: The Kickoff is a meeting where Participants, guided by the Initiative Architect, will refine the Initiative architecture and settle on specifics to be used as a baseline for prototype component interoperability. Participants will be required to attend the

Kickoff, including breakout sessions, and will be expected to use these breakouts to collaborate with other Participants.

Required attendance at Regular Telecons and Meetings: After the Kickoff, participants will meet frequently via weekly telecons (videoconferencing) and in person at OGC Member Meetings. As a minimum, participants are required to attend virtual meetings regularly.

Requirements for Development of Deliverables: Development of Components, Engineering Reports, Change Requests, and other deliverables will commence during or immediately after the Kickoff meeting.

Under the Participation Agreement contracts, ALL Participants will be responsible for contributing content to the documents / Engineering Reports (ERs), particularly regarding their component implementation experiences, findings, and future recommendations. Each participant will be required to provide at least one bullet point per week to the ER on work, progress, technical conversations and decisions, etc., while the ER Editor will be the primary compiler and author on the shared sections such as the Executive Summary. The ER editor is further responsible for capturing all design decisions and lessons learned during the whole initiative execution phase. Compiling the whole report at the end of the initiative does not work!

More detailed deliverable descriptions appear under Types of Deliverables.

Final Summary Reports, Demonstration Event and Other Stakeholder Meetings: Participant Final Summary Reports will constitute the close of funded activity. Further development work might take place to prepare and refine assets to be shown at webinars, demonstration events, and other meetings.

Assurance of Service Availability: Participants selected to implement service components must maintain availability for a period of no less than twelve months after the Participant Final Summary Report milestone.

9.2. Q&A option before the call closes

Questions and Requests for clarification: Bidders have the opportunity to submit questions about the CFP for an initial **Q&A Webinar**. Questions can be submitted using this Q&A Form. Bidders who cannot access the Form should send an email to email address: "innovation at ogc.org". The Bidders Q&A Webinar will be held on the date listed in the Master Schedule. The webinar is open to the public, but anyone wishing to attend must register using the provided link. Questions are due on the date listed in the Master Schedule Question submitters will remain anonymous, and answers will be compiled and published in the CFP clarifications.

After the initial **Q&A Webinar** bidders may submit further questions using the same Q&A Form. Again, question submitters will remain anonymous. Ongoing updates and answers to questions will be added to the CFP Corrigenda Table and the CFP Clarifications Table. The HTML version of the CFP will be updated automatically and appear at the same URL as the original version. The PDF file online will be updated following each revision. You should download a new copy for offline work regularly to ensure you are referring to the latest version.

Appendix A: Pilot Organization and Execution

A.1. Initiative Policies and Procedures

This initiative will be conducted within the policy framework of OGC's Bylaws and Intellectual Property Rights Policy ("IPR Policy"), as agreed to in the OGC Membership Agreement, and in accordance with the OGC COSI Program Policies and Procedures and the OGC Principles of Conduct, the latter governing all related personal and public interactions. Specifically:

- This Initiative will be conducted in accordance with OGC Collaborative Solutions and Innovation Program Policies and Procedures.

- OGC Principles of Conduct will govern all personal and public Initiative interactions.

- Participants drafting documents for the Initiative are required to allow OGC to copyright and publish documents following the OGC Collaborative Solutions and Innovation Program Intellectual Property Rights Rules.

Several key requirements are summarized below for ready reference:

- Each selected Participant will agree to notify OGC staff if it is aware of any claims under any issued patents (or patent applications), which would likely impact an implementation of the specification or other work product, which is the subject of the initiative. Participant need not be the inventor of such patent (or patent application) in order to provide notice, nor will Participant be held responsible for expressing a belief which turns out to be inaccurate. Specific requirements are described under the "Necessary Claims" clause of the IPR Policy.

- Each selected Participant will agree to refrain from making any public representations that draft Engineering Report (ER) content has been endorsed by OGC before the ER has been approved in an OGC Technical Committee (TC) vote.

- Each selected Participant will agree to provide more detailed requirements for its assigned deliverables, and to coordinate with other initiative Participants, at the Kickoff event.

A.2. Initiative Roles

The roles generally played in any OGC COSI Program initiative include Sponsors, Bidders, Participants, Observers, and the COSI Program Team. Explanations of the roles are provided in Tips for New Bidders.

The COSI Team for this Initiative will include an Initiative Director and an Initiative Architect. Unless otherwise stated, the Initiative Director will serve as the primary point of contact (POC) for the OGC.

The Initiative Architect will work with Participants and Sponsors to ensure that Initiative activities and deliverables are properly assigned and performed. They are responsible for scope and schedule control, and will provide timely escalation to the Initiative Director regarding any high-impact issues or risks that might arise during execution.

A.3. Types of Deliverables

All activities in this pilot will result in a Deliverable. These Deliverables generally take the form of a persistent demonstrator capability, Documents or Component Implementations.

A.3.1. Documents

Engineering Reports (ER) and Change Requests (CR) will be prepared in accordance with OGC published templates. Engineering Reports will be delivered by posting on the (members-only) OGC Pending directory when complete and the document has achieved a satisfactory level of consensus among interested participants, contributors and editors. Engineering Reports are the formal mechanism used to deliver results of the COSI Program to Sponsors and to the OGC Standards Program for consideration by way of Standards Working Groups and Domain Working Groups.

> **TIP**
>
> A common ER Template will be used as the starting point for each document. Various template files will contain requirements such as the following (from the 1-summary.adoc file):
>
> The Executive Summary shall contain a business value statement that should describe the value of this Engineering Report to improve interoperability, advance location-based technologies or realize innovations.
>
> Ideas for meeting this particular requirement can be found in the CFP Background as well as in previous ER content such as the business case in the Executive Summary.

Document content should follow this OGC Document Editorial Guidance (scroll down to view PDF file content). File names for documents posted to Pending should follow this pattern (replacing the document name and deliverable ID): OGC CDRP24 DocumentName (D001). For ERs, the words Engineering Report should be spelled out in full.

A.3.2. Component Implementations

Component Implementations include services, clients, datasets, and tools. A service component is typically delivered by deploying an endpoint via an accessible URL. A client component typically exercises a service interface to demonstrate interoperability. Implementations should be developed and deployed in all threads for integration testing in support of the technical architecture. If required in the Call for Participation, Participants shall either keep the component operational for at least 12months after the end of the initiative, or deliver the component to OGC with the necessary license to operate the component on behalf of the participant. The concrete modalities for component delivery will be agreed during the initiative.

IMPORTANT

Under the Participation Agreement contracts, ALL Participants will be responsible for contributing content to the ERs, particularly regarding their component implementation experiences, findings, and future recommendations. The ER Editor will be the primary author on shared sections such as the Executive Summary.

Component implementations are often used as part of outreach demonstrations near the end of the

timeline. To support these demonstrations, component implementations are required to include Demo Assets. For clients, the most common approach to meet this requirement is to create a video recording of a user interaction with the client. These video recordings may optionally be included in a new YouTube Playlist on the OGC YouTube channel.

TIP	Videos to be included in a new YouTube Playlist should follow these instructions: Upload the video recording to the designated Portal directory (to be provided), and include the following metadata in the Description field of the upload dialog box: • A Title that starts with "OGC CDRP:", keeping in mind that there is a 100-character limit [if no title is provided, we'll insert the file name], • Abstract: [1-2 sentence high-level description of the content], • Author(s): [organization and/or individuals], and • Keywords: [for example, OGC, CDRP24, machine learning, analysis ready data, etc.].

Since server components often do not have end-user interfaces, participants may instead support outreach by delivering static UML diagrams, wiring diagrams, screenshots, etc. In many cases, the images created for an ER will be sufficient as long as they are suitable for showing in outreach activities such as Member Meetings and public presentations. A server implementer may still choose to create a video recording to feature their organization more prominently in the new YouTube playlist. Another reason to record a video might be to show interactions with a "developer user" (since these interactions might not appear in a client recording for an "end user").

TIP	Demo-asset deliverables are slightly different from Technology Interoperability Experiment (TIE) testing deliverables. The latter don't necessarily need to be recorded (though they often appear in a recording if the TIE testing is demonstrated as part of one of the recorded weekly telecons).

A.4. Proposals & Proposal Evaluation

Proposals are expected to be brief, broken down by deliverable, and precisely addressing the work items of interest to the bidder. Details of the proposal submission process are provided under the General Proposal Submission Guidelines.

Proposals will be evaluated based on criteria in two areas: technical and management/cost.

A.4.1. Technical Evaluation Criteria

• Concise description of each proposed solution and how it contributes to achievement of the particular deliverable requirements described in the Technical Architecture,

• Overall quality and suitability of each proposed solution, and

• Where applicable, whether the proposed solution is OGC-compliant.

Management/Cost Evaluation Criteria

- Willingness to share information and work in a collaborative environment, Contribution toward Sponsor goals of enhancing availability of standards-based offerings in the marketplace,

- Feasibility of each proposed solution using proposed resources, and

- Proposed in-kind contribution in relation to proposed cost-share funding request.

Note that all Participants are required to provide some level of in-kind contribution (i.e. costs for which no cost-share compensation has been requested). As a rough guideline, a proposal should include at least one dollar of in-kind contribution for every dollar of cost-share compensation requested. All else being equal, higher levels of in-kind contributions will be considered more favorably during evaluation. Participation may also take place by purely in-kind contributions (no cost-share request at all).

Once the proposals have been evaluated and cost-share funding decisions have been made, the COSI Team will begin notifying Bidders of their selection to enter negotiations to become and initiative Participant. Each selected bidder will enter into a Participation Agreement (PA), which will include a Statement of Work (SOW) describing the assigned deliverables.

A.4.2. Reporting

Participants will be required to report the progress and status of their work; details will be provided during contract negotiation. Additional administrative details such as invoicing procedures will also be included in the contract.

Monthly Reporting

The COSI Team will provide monthly progress reports to Sponsors. Ad hoc notifications may also occasionally be provided for urgent matters. To support this reporting, each testbed participant must submit (1) a Monthly Technical Report and (2) a Monthly Business Report by the first working day on or after the 3rd of each month. Templates and instructions for both of these report types will be provided.

The purpose of the Monthly Business Report is to provide initiative management with a quick indicator of project health from each participant's perspective. The COSI Team will review action item status on a weekly basis with assigned participants. Initiative participants must remain available for the duration of the timeline so these contacts can be made.

Participant Final Summary Reports

Each Participant should submit a Final Summary Report by the milestone indicated in the Master Schedule. These reports should include the following information:

1. Briefly summarize Participant's overall contribution to the Initiative (for an executive audience),

2. Describe, in detail, the work completed to fulfill the Participation Agreement Statement of Work (SOW) items (for a more technical audience), and

3. Present recommendations on how we can better manage future OGC COSI Program initiatives.

This report may be in the form of email text or an attached document (at the Participant's discretion).

Appendix B: Proposal Submission

B.1. General Proposal Submission Guidelines

This section presents general guidelines for submitting a CFP proposal. Detailed instructions for submitting a response proposal using the *Bid Submission Form* web page can be found in the Step-by-Step Instructions below.

IMPORTANT	Please note that the content of the "Proposed Contribution" text box in the Bid Submission Form will be accessible to all Stakeholders and should contain **no confidential information** such as labor rates.
	Similarly, no sensitive information should be included in the Attached Document of Explanation.

Proposals must be submitted before the deadline indicated in the Master Schedule.

TIP	Non-members or individual members should make a note regarding their intent to join OGC on the Organizational Background page of the Bid Submission Form and include their actual Letter of Intent as part of an Attached Document of Explanation.

Information submitted in response to this CFP will be accessible to OGC and Sponsor staff members. This information will remain in the control of these stakeholders and will not be used for other purposes without prior written consent of the Bidder. Once a Bidder has agreed to become a Participant, they will be required to release proposal content (excluding financial information) to all initiative stakeholders. Sensitive information other than labor-hour and cost-share estimates should not be submitted.

Bidders will be selected for cost share funds on the basis of adherence to the CFP requirements and the overall proposal quality. The general initiative objective is to inform future OGC standards development with findings and recommendations surrounding potential new specifications. Each proposed deliverable should formulate a path for (1) producing executable interoperable prototype implementations meeting the stated CFP requirements and (2) documenting the associated findings and recommendations. Bidders not selected for cost share funds may still request to participate on a purely in-kind basis.

Bidders should avoid attempts to use the initiative as a platform for introducing new requirements not included in Technical Architecture. Any additional in-kind scope should be offered outside the formal bidding process, where an independent determination can be made as to whether it should be included in initiative scope or not. Out-of-scope items could potentially be included in another OGC COSI initiative.

Each selected Participant (even one not requesting any funding) will be required to enter into a Participation Agreement contract ("PA") with the OGC. The reason this requirement applies to purely in-kind Participants is that other Participants will likely be relying upon the delivery of their work. Each PA will include a Statement of Work ("SOW") identifying specific Participant roles and responsibilities.

B.2. Questions and Clarifications

Once the original CFP has been published, ongoing updates and answers to questions can be found in the CFP Corrigenda Table and the CFP Clarifications Table

Bidders may submit questions using the Questions Form. Question submitters will remain anonymous, and answers will be regularly compiled and published in the CFP clarifications.

A Bidders Q&A Webinar will be held on the date listed in the Master Schedule. The webinar is open to the public, but anyone wishing to attend must register using the provided link. Questions are due on the date listed in the Master Schedule.

B.3. Proposal Submission Procedures

The process for a Bidder to complete a proposal is set out in the online Bid Submission Form.

The Bid Submission form will be made available shortly after the CFP release. It will include a series of web forms, one for each deliverable of interest. Bidders should remember to submit one form for each deliverable for which they wish to submit a proposal.

New users must create an account before completing a form.

Once an account is established, the user may log in and will be taken to a home page indicating the "Status of Your Proposal." The user can return to this page at any time by clicking the OGC logo in the upper left corner.

Any submitted bids will be treated as earnest submissions, even those submitted well before the response deadline. Be certain that you intend to submit your proposal before you click the Submit button on the Review page.

IMPORTANT	Please consider making local backup copies of all text you are entering into the form in case anything needs to be re-entered. If you encounter any technical problems, please contact the OGC.

B.3.1. High-Level Overview

Clicking on the "Propose" link will bring you to the Bid Submission Form.

To complete the form, new users should start by providing organizational information on the "Organizational Background" Page and click "Update" and "Continue". Existing users should check and confirm the information on the "Organizational Background" Page is correct and click "Continue".

This will navigate to an "Add Deliverable" page. The user should complete this form for each proposed deliverable.

TIP	For component implementations having multiple identical instances of the same deliverable, the bidder only needs to propose just one instance. For simplicity, each bidder should just submit against the lowest-numbered deliverable ID. OGC will assign

a unique deliverable ID to each selected Participant later (during negotiations).

A "Review" link, located on the far right of the screen, navigates to a page summarizing all the deliverables the Bidder is proposing. This Review tab won't appear until the user has actually submitted at least one deliverable under the Propose tab first.

TIP	Consider regularly creating backup copies of this Review page at various points during proposal creation.

Once the "Submit" button is clicked, the user will receive an immediate confirmation on the website that their proposal has been received. The system will also send an email to the Bidder and to OGC staff.

TIP	In general, up until the time that the user clicks this Submit button, the proposal may be edited as many times as the user wishes. However, this initial version of the form contains no "undo" capability, so please use caution in over-writing existing information.

Under the "Done Adding Deliverables" section at the bottom of this page, a user may attach an additional document with further information and explanations. This document is optional.

IMPORTANT	No sensitive information (such as labor rates) should be included in the Attached Document.

If this attachment is provided, it is limited to one per proposal and must be less than 5Mb.

This document could conceivably contain any specialized information that wasn't suitable for entry into a Proposed Contribution field under an individual deliverable. It should be noted, however, that this additional documentation will only be read on a best-effort basis. There is no guarantee it will be used during evaluation to make selection decisions; rather, it could optionally be examined if the evaluation team feels that it might help in understanding any specialized (and particularly promising) contributions.

B.3.2. Step-by-Step Instructions

The "Propose" link takes the user to the first page of the proposal entry form. This form contains fields to be completed once per proposal such as names and contact information.

It also contains an optional Organizational Background field where Bidders (particularly those with no experience participating in an OGC initiative) may provide a description of their organization. It also contains a click-through check box where each Bidder will be required (before entering any data for individual deliverables) to acknowledge its understanding and acceptance of the requirements described in this appendix.

Clicking the Update and Continue button then navigates to the form for submitting deliverable by deliverable bids. On this page, existing deliverable bids can be modified or deleted by clicking the appropriate icon next to the deliverable name. Any attempt to delete a proposed deliverable will require scrolling down to click a Confirm Deletion button.

To add a new deliverable, the user would scroll down to the Add Deliverable section and click the Deliverable drop-down list to select the particular item.

The user would then enter the required information for each of the following fields (for this deliverable only). Required fields are indicated by an asterisk: * Estimated Projected Labor Hours* for this deliverable, * Funding Request*: total U.S. dollar cost-share amount being requested for this deliverable (to cover burdened labor only), * Estimated In-kind Labor Hours* to be contributed for this deliverable, and * Estimated In-Kind Contribution: total U.S. dollar estimate of the in-kind amount to be contributed for this deliverable (including all cost categories).

TIP	There's no separate text box to enter a global in-kind contribution. Instead, please provide an approximate estimate on a per-deliverable basis.

Cost-sharing funds may only be used for the purpose of offsetting burdened labor costs of development, engineering, documentation, and demonstration related to the Participant's assigned deliverables. By contrast, the costs used to formulate the Bidder's in-kind contribution may be much broader, including supporting labor, travel, software licenses, data, IT infrastructure, and so on.

Theoretically there is no limit on the size of the Proposed Contribution for each deliverable (beyond the raw capacity of the underlying hardware and software). But bidders are encouraged to incorporate content by making reference or linking to external materials where possible (rather than inline copying and pasting). There is also a textbox on a separate page of the submission form for inclusion of Organizational Background information, so there is no need to repeat this information for each deliverable.

IMPORTANT	• A breakdown (by cost category) of the "In Kind Contribution" may be included in the Proposed Contribution text box for each deliverable. • However, please note that the content of this text box will be accessible to all Stakeholders and should contain no confidential information such as labor rates. • Similarly, no sensitive information should be included in the Attached Document of Explanation.

The "Proposed Contribution (Please include any proposed datasets)" field can be used to provide a succinct description of what the Bidder intends to deliver for this work item to meet the requirements expressed in the Technical Architecture. This could potentially include a brief elaboration on how the proposed deliverable will contribute to advancing the OGC standards baseline, or how implementations enabled by the specification embodied in this deliverable could add specific value to end-user experiences.

A Bidder proposing to deliver a Service Component Implementation can also use this field to identify what suitable datasets would be contributed (or what data should be acquired from another identified source) to support the proposed service.

TIP	• In general, please try to limit the length of each Proposed Contribution to about one text page per deliverable.

- Note that images cannot be pasted into the field Proposed Contribution textbox. Bidders should instead provide a link to a publicly available image.

A single bid may propose deliverables arising from any number of threads or tasks. To ensure that the full set of sponsored deliverables are made, OGC might negotiate with individual Bidders to drop and/or add selected deliverables from their proposals.

B.3.3. Tips for New Bidders

Bidders who are new to OGC initiatives are encouraged to review the following tips:

- In general, the term "activity" is used as a verb describing work to be performed in an initiative, and the term "deliverable" is used as a noun describing artifacts to be developed and delivered for inspection and use.

- The roles generally played in any OGC COSI Program initiative are defined in the OGC COSI Program Policies and Procedures, from which the following definitions are derived and extended:

  - Sponsors are OGC member organizations that contribute financial resources to steer Initiative requirements toward rapid development and delivery of proven candidate specifications to the OGC Standards Program. These requirements take the form of the deliverables described herein. Sponsors' representatives help serve as "customers" during Initiative execution, helping ensure that requirements are being addressed and broader OGC interests are being served.

  - Bidders are organizations who submit proposals in response to this CFP. A Bidder selected to participate will become a Participant through the execution of a Participation Agreement contract with OGC. Most Bidders are expected to propose a combination of cost-sharing request and in-kind contribution (though solely in-kind contributions are also welcomed).

  - Participants are selected OGC member organizations that generate empirical information through the definition of interfaces, implementation of prototype components, and documentation of all related findings and recommendations in Engineering Reports, Change Requests and other artifacts. They might be receiving cost-share funding, but they can also make purely in-kind contributions. Participants assign business and technical representatives to represent their interests throughout Initiative execution.

  - Observers are individuals from OGC member organizations that have agreed to OGC intellectual property requirements in exchange for the privilege to access Initiative communications and intermediate work products. They may contribute recommendations and comments, but the COSI Team has the authority to table any of these contributions if there's a risk of interfering with any primary Initiative activities.

  - Supporters are OGC member organizations who make in-kind contributions aside from the technical deliverables. For example, a member could donate the use of their facility for the Kickoff event.

  - The COSI Team is the management team that will oversee and coordinate the Initiative. This team is comprised of OGC staff, representatives from member organizations, and OGC consultants.

  - The COSI Team communicates with Participants and other stakeholders during Initiative

execution, provides Initiative scope and schedule control, and assist stakeholders in understanding OGC policies and procedures.

- The term Stakeholders is a generic label that encompasses all Initiative actors, including representatives of Sponsors, Participants, and Observers, as well as the COSI Team.

- Suppliers are organizations (not necessarily OGC members) who have offered to supply specialized resources such as cloud credits. OGCs role is to assist in identifying an initial alignment of interests and performing introductions of potential consumers to these suppliers. Subsequent discussions would then take place directly between the parties.

• Proposals from non-members or individual members will be considered provided that a completed application for organizational membership (or a letter of intent) is submitted prior to or with the proposal.

- Non-members or individual members should make a note regarding their intent to join OGC on the Organizational Background page of the Bid Submission Form and include their actual Letter of Intent as part of an Attached Document of Explanation.

• Any individual wishing to gain access to the Initiative's intermediate work products in the restricted area of the Portal (or attend private working meetings / telecons) must be a member approved user of the OGC Portal system.

• Individuals from any OGC member organization that does not become an initiative Sponsor or Participant may still (as a benefit of membership) observe activities by registering as an Observer. Prior initiative participation is not a direct bid evaluation criterion. However, prior participation could accelerate and deepen a Bidder's understanding of the information presented in the CFP.

• All else being equal, preference will be given to proposals that include a larger proportion of in-kind contribution. All else being equal, preference will be given to proposed components that are certified OGC compliant.

• All else being equal, a proposal addressing all of a deliverable's requirements will be favored over one addressing only a subset. Each Bidder is at liberty to control its own proposal, of course. But if it does choose to propose only a subset for any particular deliverable, it might help if the Bidder prominently and unambiguously states precisely what subset of the deliverable requirements are being proposed.

• The Sponsor(s) will be given an opportunity to review selection results and offer advice, but ultimately the Participation Agreement (PA) contracts will be formed bilaterally between OGC and each Participant organization. No multilateral contracts will be formed. Beyond this, there are no restrictions regarding how a Participant chooses to accomplish its deliverable obligations so long as these obligations are met in a timely manner (whether a 3rd-party subcontractor provides assistance is up to the Participant).

• In general, only one organization will be selected to receive cost-share funding per deliverable, and that organization will become the Assigned Participant upon which other Participants will rely for delivery. Optional in-kind contributions may be made provided that they don't disrupt delivery of required, reliable contributions from the assigned Participants.

• A Bidder may propose against one, several, or all deliverables. In past projects, more participants were assigned one deliverable, and fewer were assigned multiple deliverables.

• In general, the Participant Agreements will not require delivery of any component source code

to OGC.

- ◦ What is delivered to OGC is the behavior of the component installed on the Participant's machine, and the corresponding documentation of findings, recommendations, and technical artifacts contributed to the Engineering Report(s).

- ◦ In some instances, a Sponsor might expressly require a component to be developed under open-source licensing, in which case the source code would become publicly accessible outside the Initiative as a by-product of implementation.

- Results of other recent OGC initiatives can be found in the OGC Public Engineering Report Repository.

Appendix C: Abbreviations

The following table lists all abbreviations used in this CFP.

AI	Artifical Intelligence
API	Application Programming Interface
ARD	Analysis Ready Data
CADs	Climate and Atmosphere Data Store
CAMS	Climate and Atmosphere Monitoring Service
C3S	Climate Change Service
CDRP	Climate and Disaster Resilience Pilot
CEOS	Commitee on Earth Observation Satellites
CFP	Call for Participation
COSI	Collaborative Solutions and Innovation Program
CR	Change Request
CRIS	Climate Resilience Information System
DER	Draft Engineering Report
DRI	Decision Ready Indicators
DWG	Domain Working Group
EO	Earth Observation
ER	Engineering Report
FAIR	FAIR Findable Accessible Interoperable Reusable
GPKG	GeoPackage
GDDS	Green Deal Data Service
IPPC	Intergovernmental Panel on Climate Change
OGC	Open Geospatial Consortium
ORM	OGC Reference Model
OSPD	Open Science Persistent Demonstrator
OWS	OGC Web Services
NSG	National System for Geospatial Intelligence
PA	Participation Agreement
POC	Point of Contact
Q&A	Questions and Answers
RM-ODP	Reference Model for Open Distributed Processing
SDI	Spatial Data Infrastructure

SIF	Sensor Integration Framework
SOW	Statement of Work
SWG	Standards Working Group
TBD	To Be Determined (at a later date)
TC	OGC Technical Committee
TEM	Technical Evaluation Meeting
TIE	Technology Integration / Technical Interoperability Experiment
URL	Uniform Resource Locator
WFS	Web Feature Service
WPS	Web Processing Service
WG	Working Group (SWG or DWG)

Appendix D: Corrigenda & Clarifications

The following table identifies all corrections that have been applied to this CFP compared to the original release. Minor editorial changes (spelling, grammar, etc.) are not included.

Section	Description
no entries	

The following table identifies all clarifications that have been provided in response to questions received from organizations interested in this CFP.

Question	Clarification
What does the special funding conditions 'copernicus member states only' mean?	It means that the deliverables which are related to the climate service from ECMWF that's restricted to the European Union member states and associated European Union space program countries including Iceland, Norway and United Kingdom.
In the CFP, is there a description of the standards that are to be used either for things like knowledge graphs, exchanging information, training data, that sort of thing? So I'm just wondering if the expected exchange formats or schemas have been articulated.	Yes, you are in general pretty flexible and in what to use, As we have seen on this initial diagram of the CFP. One important piece of CDRP is to investigate the Copernicus services. So, in this case, we are for sure bound to the formats that are offered by these various Copernicus services and the WekEO platform. But if we look at other data sources, and I mean, we do have quite a number of use cases which are not Copernicus related, you are flexible to suggest what you think fits best.
question concerning the timeline, given that it overlaps with the number of holidays. It just seems a bit aggressive and I was just wondering what was driving that.	Yes, the main reason for this rather aggressive timeline was to have an initiative that doesn't take too much of your time because we know it's a rather condensed. And we have made the experience that if we do have an initiative that takes about six to nine months, then often it becomes difficult for the participants with the funding or the amount of funding that we can offer to really stay engaged at the same level the whole time. That's why we said, okay, well, let's try to have a more condensed initiative. If you say, well, this is very, very condensed and you recommend an extension for the following reasons, just please put this into your proposal. And if we see these requests more than once, we will definitely discuss it with the sponsors and maybe relax the timeline again.