BUILDING EFFECTIVE CLIMATE RESILIENCE INFORMATION SYSTEMS

CLIMATE RESILIENCE INFORMATION SYSTEMS ASSEMBLE, PROCESS, VISUALISE AND COMMUNICATE HUGE VOLUMES OF DATA FROM MANY DIFFERENT SOURCES TO HELP US DEAL WITH CLIMATE CHANGE. BUT THEY CAN ONLY WORK EFFECTIVELY IF THE DATA AND SYSTEMS INVOLVED ADHERE TO AGREED-UPON STANDARDS. **NILS HEMPELMANN** REPORTS

As climate change is a global phenomenon that has effects felt at every scale, producing and providing reliable and actionable climate information requires huge volumes of data from different scientific ecosystems and data providers to be assembled, processed, visualised and communicated.

The systems that develop and provide this information are coming to be known as climate resilience information systems (CRIS). CRIS enable users to search, fetch, fuse, process and visualise data related to the effects of climate change so as to better inform climate resilience actions. They also enable access to and understanding and use of federal data, facilitate integration of federal and state data with local data, and serve as local information hubs for climate resilience knowledge sharing. One notable example in operation is the Copernicus Climate Change Service with the Climate Data Store.

CRIS combine multiple sources of information, such as future climate projections from data modelling centres, remotely sensed data from satellite instruments and ground measurements from observation networks. CRIS use this to then create – or provide processing services that enable users to create – climate products and services, including visualisations and other communication tools, that are tailored to decision-makers' needs. Although the tailoring process is specific to local contexts, all climate change services face similar challenges: namely that integrating such vast amounts of data from different sources is too often unnecessarily time consuming and difficult.

As conditions worsen due to climate change, the need for well-informed climate resilience strategies and actions grows. Photo by mk. s

Every step of data exchange in the pipeline – from building value from raw data through to information visualisation and interpretation – will only work effectively if the data and systems involved adhere to agreed-upon standards that allow them to interoperate and exchange information with each other.

Climate building blocks

CRIS architectures can therefore be enhanced by providing climate scientific methods and visualisation capabilities as "climate building blocks" – separate, specialised FAIR (Findable, Accessible, Interoperable, and Reusable) systems that can interoperate via Standardised APIs, such as OGC APIs, and thus work together to form a cohesive whole.

Climate building blocks based on FAIR data principles and related Standards enable the simple reuse of CRIS features and capabilities across countries, organisations, and administrative levels, improving both productivity and decision-making capabilities. Reusability is an essential component when goals, expertises, and resources are aligned from the national to the local level. Framework conditions differ between areas, but building blocks enable as much reuse of existing Best Practices, tools, data, and services as possible, reducing duplicated work and improving consistency.

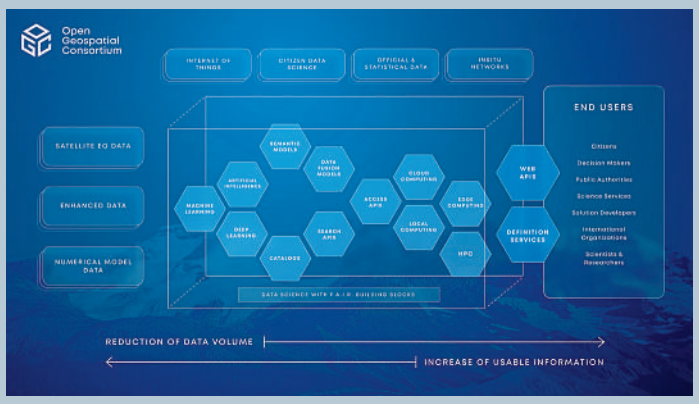
As such, OGC is supporting the development of FAIR climate building blocks, services, and CRIS in a few different ways.

A meeting place for the Climate Resilience community

Most recently, OGC formed a Climate Resilience Domain Working Group (DWG) as a public forum for the climate resilience community – not just OGC members, but decision makers, scientists, policy-makers, data providers, software developers, service providers and more – to meet and exchange knowledge, experience and ideas.

The DWG serves as a means to monitor the evolution of the functional and implementation needs behind CRIS,

The OGC Climate Resilience DWG and Pilot are bringing the climate resilience community together with infrastructure providers, policy makers, commercial companies, and the scientific community



Schematic architecture of a climate resilience information system. By respecting FAIR principles for the climate building blocks the architecture enables open infrastructures to produce and deliver information to meet different users' needs

while working to identify and promote a standard set of interfaces, specifications and best practices that will maximise the interoperability of climate change services and information systems. The Climate Resilience DWG will also work to find synergies and align their efforts with other OGC Working Groups, such as the new Analysis Ready Data and Geo-datacube Standards Working Groups (SWG), the OGC API SWGs, and beyond.

The discussions around FAIR Climate Services in OGC have so far been fuelled by contributions from ESA, NASA, WMO, ECMWF, NRCan, Ordnance Survey and many others, and we're looking forward to engaging with more organisations and groups in the future.

Developing FAIR solutions

In addition to the formation of the Climate Resilience DWG, OGC's Collaborative Solutions and Innovation Program (COSI – formerly the Innovation Program) has run or supported several Initiatives relevant to Climate resilience, the most recent being the OGC Climate Resilience Pilot. The OGC COSI process is an open community process that uses OGC as the governing body for collaborative activities among our members.

Launched in September 2022, the OGC Climate Resilience Pilot will help develop an open, multi-level infrastructure that integrates data spaces, open science, and local-to-international requirements and objectives. The pilot's efforts in defining an open technology and governance stack will enable the easy integration of diverse data, including historical observations, real-time sensing data, reanalyses, forecasts or future projections. It addresses data-to-decision pipelines, data analysis and representation, and bundles everything into climate building blocks. These building blocks are complemented by best practices, guidelines and 'cook-books' that aid multi-stakeholder decision-making in a changing natural environment.

The outcomes of the Climate Resilience Pilot will contribute to establishing an OGC "climate resilience concept store" for the community where all the appropriate information required to build CRIS as FAIR building block infrastructures can be found in one place. This would include the aforementioned guides and cook-books, information about data services, tools, and software, and serve as a place to discuss experiences and needs. The concept store will cover all phases of Climate resilience: starting with initial hazards identification and mapping, then to vulnerability and risk analysis, on to options assessments, prioritisation and planning, and finishing with implementation planning and monitoring capabilities.

In addition to the Climate Resilience Pilot, OGC is also invested in several other projects related to climate: the series of OGC Disaster Pilots are developing ways to more efficiently get the right information to the right people at the right time during a disaster; CLINT is using Artificial Intelligence to enhance climate services with a focus on extreme event detection; CLIMOS is providing a bridge to the health community with prediction of vector-borne diseases transmitted by sandflies; AllData4GreenDeal will better exploit the existing European data spaces in support on the EU Green deal; and the GEOE3 Geospatially Enabled ecOsystem for Europe is establishing cross-border data exchange mechanisms to enhance planning processes.

Reliable climate information requires data from different scientific ecosystems and data providers to be efficiently assembled, processed, visualised, and communicated. Photo by NOAA

Underscoring all of this work is a wealth of OGC Standards that enable the vast amounts of climate data and services to align with the FAIR data principles.

Climate Change remains the biggest challenge that humanity faces. Climate Resilience Information Systems built on FAIR climate building blocks offer an efficient way to maximise value – on-demand – from the masses of relevant data out there, resulting in better-informed policy and climate resilience actions.

If you would like to contribute to the development and deployment of FAIR CRIS, contact OGC to join our Climate Resilience DWG, attend a Member Meeting, or participate in a Climate Initiative.

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Photo by William Bossen