

Grant Proposal

Author-formatted document posted on 06/06/2023

Published in a RIO article collection by decision of the collection editors.

DOI: <https://doi.org/10.3897/arphapreprints.e107578>

Dashboard for the State of the Environment

Alex Vermeulen,  Dick Schaap,  Angeliki Adamaki,  Tjerk Krijger, Raul Bardaji, Andreu Fornos, Ivan Rodero, Damien Boulanger, Cathrine Myhre, Richard Rud, Zois Zogopoulos, Claudio D'Onofrio,  Gwenaëlle Moncoiffé

Dashboard for the State of the Environment

Alex T. Vermeulen[‡], Dick M.A. Schaap[§], Angeliki Adamaki[‡], Tjerk Krijger[§], Raul Bardaji[‡], Andreu Fornos[‡], Ivan Roderol[‡], Damien Boulanger[¶], Cathrine Lund Myhre[#], Richard Olav Rud[#], Zois Zogopoulos[‡], Claudio D'Onofrio[‡], Gwenaelle Moncoiffe[□]

[‡] ICOS ERIC - Carbon Portal, Department of Physical Geography and Ecosystem Science, Lund University, Lund, Sweden

[§] MARIS, Nootdorp, Netherlands

[¶] EMSO ERIC, Rome, Italy

[¶] Observatoire Midi-Pyrénées, Université Toulouse III - Paul Sabatier, CNRS, Toulouse, France

[#] NILU, Norwegian Institute for Air Research, P.O. Box 100, N-2027, Kjeller, Norway

[□] British Oceanographic Data Centre, Joseph Proudman Building, 6 Brownlow Street, Liverpool L3 5DA, United Kingdom

Corresponding author: Alex T. Vermeulen (alex.vermeulen@nateko.lu.se), Dick M.A. Schaap (dick@maris.nl), Angeliki Adamaki (angeliki.adamaki@nateko.lu.se), Tjerk Krijger (tjerk@maris.nl)

Abstract

The Environmental Research Infrastructure (ENVRI) community is a cluster of European research infrastructures focused on the environment and Earth system science. The ENVRI-FAIR project aims to advance the FAIRness of their data and services with emphasis on interoperability and connect the ENVRI community to the European Open Science Cloud (EOSC). In this article, we present a proposal for a science project that will develop and launch a dashboard for environmental indicators as a contribution from the ENVRI cluster to the EOSC platform. The dashboard will provide easy access to environmental data and services from multiple research infrastructures and disciplines and support interdisciplinary Earth system science and societal challenges. The proposal describes the objectives, implementation, impact, and dissemination measures of the project, as well as the partners involved and the target groups that can benefit from the dashboard service. We explain how the dashboard will showcase the usefulness and relevance of the observations provided by the research infrastructures, and how it will engage a larger community of researchers and potential data providers in co-creation processes. We also discuss how the dashboard will make use of existing and new EOSC services and resources, and how it will contribute to several EU initiatives and directives related to the environment and climate change.

Keywords

State of the environment, Environmental indicators, Dashboard, Essential Climate Variables, Atmosphere, Ocean, Ecosystem, Climate change, ENVRI Science Cluster, ENVRI-FAIR, ENVRI-Hub, EOSC Future, Science Projects, EOSC, FAIR data and services, Cross-domain research, Green Deal

Description

Existing situation

Each of the Research Infrastructures (RIs) working in the Environmental Research Infrastructure (ENVRI) science cluster gathers and manages a wealth of environmental data and model results, divided over 4 sub-domains: Atmosphere, Marine, Solid Earth and Biodiversity-Ecosystems and thus the Earth system in its full complexity. As part of the ENVRI-FAIR project they are working together on assessing and improving the FAIRness of their RIs, with the aims to make the data and associated services for discovery and access as open as possible, and to apply FAIR [1] practices for achieving interoperability and re-usability of the data sets. These are fundamental requirements for policy, science, industry, and the public to be able to rely on the environmental data as made available by these RIs. The environmental data together provides a major opportunity to determine the state of the environment and follow trends and drivers in the development of our Earth system. This way, keeping a close watch on environmental boundary conditions and informing society stakeholders on short to long term developments therein, will be of imminent economic value. This can be implemented by means of a 'dashboard' with a set of easily understandable real-time indicators which inform public and policy makers on the state of the environment. For example, with regards to current and predicted state of climate in vulnerable regions, the progress in mitigation of greenhouse gas emissions, earthquake risks, algae bloom in coastal waters, etc. The dashboard should serve as the main switchboard to drill down to underlying data and models and to give visibility to the contributions of elaborated products provided by scientific communities and external parties. The dashboard should be visible as a front-end of the EOSC portal, giving easy access to environmental indicators, generated by analytical workflows operated by ENVRI and making use of the ENVRI-Hub, a virtual common platform for ENVRI data and services.

Objectives

The project aims to

1. develop and launch a dashboard for environmental indicators by setting up analytical workflows for different environmental disciplines and integrating their outputs,
2. connect the analytical frameworks to the Dashboard service, integrated in the EOSC portal, to mobilise and empower a larger community of researchers and potential data providers,
3. demonstrate and promote the benefits and potential of web-based science using EOSC.

Compliance to criteria developed by EOSC Future

The Dashboard is developed within the second Science Project (SP2) of the EOSC Future as contribution from the ENVRI cluster to the EOSC platform.

Eligibility

This SP has a truly interdisciplinary and cross-domain character. It involves many research groups which are organized in several RIs and ERICs. The Dashboard will also be open for external scientist groups which are not members of the EOSC Future Consortium to connect additional environmental indicators. It will make full use of previous experiences of the ENVRI in many related projects.

Contribution to EOSC

The SP will demonstrate how different services and multi-disciplinary data resources from multiple research groups can be combined and used to generate scientifically justified environmental indicators in an easy way. The components will make use of existing RI services that will be on-boarded to EOSC, while also the new Dashboard service components will be integrated in EOSC for wider access and possible re-use by other research groups. Moreover, use will be made of several EOSC core services, including the EOSC AAI federation, the monitoring service and the EOSC Helpdesk.

Quality

In this SP use will be made of high-quality data resources as managed by the ENVRI and of analytical workflows which have a scientific basis, mobilizing the long experience of researchers involved in the RIs.

Relevance

The environmental data as managed by the ENVRI provide a major source of information to determine the state and following trends and drivers in the development of our Earth system. This will facilitate to monitor environmental boundary conditions and to inform users from all levels of society on short to long term developments. This will be of imminent environmental, economic, and societal value. It will contribute to several EU initiatives and Directives such as the Green Deal [2].

Implementation, Plan of work

This Science Project aims at bringing to the EOSC Future platform engagement of the ENVRI cluster and external research communities as well as multidisciplinary and web-based use cases which are of major interest for the society. To achieve the goals, the project will

- Determine the scope and range of environmental indicators, feasible within the Science Project and attractive for society and for co-creation,
- Specify and develop the analytical pipelines for each of the environmental indicators, determining which datasets are needed, how these must be processed,

curated, and elaborated, and combined with ancillary data in comprehensive models,

- Specify how use can be made of datasets, algorithms, and models as managed and operated by the ENVRI-FAIR RIs and scientific communities, as well as by external researchers, possibly in other domains, such as socio-economy, and possibly also from industry, and how co-creation processes can be supported,
- Bundle the analytical pipelines and data sources,
- Develop and design a flexible Dashboard service as a front-end that will be integrated into the EOSC portal for publishing the environmental indicators,
- Promote the dashboard for attracting more participation of scientific groups, refining quality of indicators as well as expanding number of indicators.

Use of resources

Open-access and FAIR data sets are provided by RI partners in the ENVRI cluster and other relevant RIs and data repositories. Technical support is provided by the EOSC for on-boarding, computing resources, and interactions with several technical groups to facilitate the integration with EOSC core services.

Partners

ICOS ERIC (member of ENVRI cluster); Lund University (on behalf of ICOS, member of ENVRI cluster); MARIS (on behalf of SeaDataNet, member of ENVRI cluster); EMSO ERIC (member of ENVRI cluster); OGS (on behalf of SeaDataNet, member of ENVRI cluster); IFREMER (on behalf of EuroArgo, member of ENVRI cluster); NOC-BODC (on behalf of SeaDataNet, member of ENVRI cluster); NILU (on behalf of ACTRIS, member of ENVRI cluster); NERC-CEH (on behalf of eLTER, member of ENVRI).

Impact

The Dashboard can serve both scientists and the public by giving access to environmental data and services that are developed at the infrastructure level. The ENVRI services will be developed further within the EOSC environment and the user communities will continue growing. The impact of the project can be seen at strategic, scientific and policy level.

Strategic

The Dashboard for the State of the Environment will provide the EOSC with a highly relevant societal service and it will demonstrate how multiple research communities can be orchestrated and supported by EOSC to generate and operate a common service.

Scientific/User communities

With the Dashboard the ENVRI aims to engage a vast scientific community from research and industry sectors addressing analyses of environmental processes by means of data gathering and processing, and modelling. Through ENVRI-FAIR, and within the EOSC-

FUTURE framework, new services will be added to the EOSC portal, which will attract both additional researchers as co-creators and end-users from policy, management, and economic activities.

EU policies

The Dashboard for the State of the Environment will be an excellent dissemination platform to showcase the usefulness and relevance of the observations provided by the infrastructures to societal issues like Climate Change, eutrophication of surface waters by pollution by nutrients and air pollution. It will generate insights for the general public and policy makers on the current state of the environment and the recent trends and will lead the interested audience to additional services and data that the infrastructures can offer.

The elements of the dashboard that will be developed are all extremely relevant to the Sustainable Development Goals of the United Nations [3] and directly target the goals of the European Green Deal on Climate Change.

Engagement plan

Two of the most important issues that concern modern societies are climate change and trustworthy information. The role of the ENVRI is to provide good quality data and services to the scientific communities. In this project data and services from ENVRI will be used to produce several environmental indicators, i.e. physical variables resulting from measurements, trends calculated using data etc. which are provided to the EOSC users in the form of a Dashboard. With this new service the EOSC user can combine the environmental indicators in a customised collection that is visualised on an easy-to-use interactive interface, the Dashboard front-end. This way the EOSC users (regardless of their scientific background) can capture the current state of the environment and understand the impacts of a changing climate on the environment and the societies. More advanced scientific users will get the chance to explore the elaborated data products and models offered by the ENVRI by getting access to their services via the Dashboard. Authenticated and authorised users will be able to further interact with the Dashboard by contributing relevant indicators with simple and well documented workflows that are offered to them via the interactive interface. This way more scientific communities will be engaged, in and around the environmental field. Advanced EOSC users from computer sciences or IT fields that support other infrastructures will have access to the design and source codes of the Dashboard to engineer similar workflows and create services using the EOSC resources.

Target groups

This Science Project targets involvement of scientists who work in environmental research fields as well as in data science, not only in academia but also in the industry. Being related to climate change this Science Project also targets scientists from social sciences, people working with policy makers or in citizen science projects. While the front-end of the Dashboard service will target the wider society (citizens, policy makers, environmental

managers among others) as it gives easy access to an increasing range of environmental indicators and trends.

Dissemination measures

The project partners use all EOSC and ENVRI channels to promote the Environmental Dashboard as a showcase of collaboration within the ENVRI cluster (with the initial contributions covering 3 environmental domains, ocean, atmosphere, and ecosystem/biodiversity) as well as demonstrating the benefits of being active partners in the establishment of the EOSC platform. In particular:

1. The description of the Science Project is submitted for publication with the other EOSC Future Science Projects for publication in this special issue.
2. (Technical) white papers describing the analytical workflows set up by the ENVRI providers as well as the engineering of the Dashboard design as a new (integrated) EOSC service are considered once the services reach the required technical level.
3. The Dashboard has been presented as one of the cross-domain ENVRI use cases in ENVRI-FAIR Workshops that took place in 2022-2023. More of these events will be scheduled as the ENVRI-FAIR project is reaching completion.
4. The motivation and prototype of the Dashboard was presented in sessions related to interdisciplinary science at the International ENVRI Summer School 2022 (July 2022, Lecce, Italy).
5. At the conference of EGU23 (European Geoscience Union General Assembly, April 2023, Vienna, Austria) the Dashboard was invited to participate at the session "Open Interoperability Frameworks Built by Scientists for Scientists to Meet Global Societal Challenges". This is an annual event that gathered 19K scientists from all over the world and provided an excellent opportunity to promote the Science Project and the EOSC platform. There were many opportunities for dissemination like the session the ENVRI community organised, public talks at the EGU exhibition, and other sessions open to a broader audience.
6. More webinars are being scheduled as part of the more general EOSC dissemination plan, but also thanks to the project partners who are already well-established research infrastructures in their fields and use their communication channels to demonstrate the Science Project. The Dashboard is also invited by other EU projects and initiatives to be presented or demonstrated. Webinars as part of training activities will also be organised once the training material and tutorials on the use of the Dashboard are published.
7. Social media dissemination takes place by EOSC and ENVRI communication teams.
8. Research Infrastructures being hosted by universities will schedule more outreach activities once the Dashboard is populated with more environmental indicators.

References

- [1] Wilkinson M.D., Dumontier M., Aalbersberg I.J., Appleton G., Axton M., Baak A., Blomberg N., Boiten J.-W., da Silva Santos L.B., Bourne P.E., Bouwman J., Brookes A.J., Clark T., Crosas M., Dillo I., Dumon O., Edmunds S., Evelo C.T., Finkers R., Gonzalez-Beltran A., Gray A.J.G., Groth P., Goble C., Grethe J.S., Heringa J., 't Hoen P.A.C, Hooft R., Kuhn T., Kok R., Kok J., Lusher S.J., Martone M.E., Mons A., Packer A.L., Persson B., Rocca-Serra P., Roos M., van Schaik R., Sansone S.-A, Schultes E. (2016) **The FAIR Guiding Principles for scientific data management and stewardship**. Scientific Data, 3: 160018.
- [2] European Commission (2019) **Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions: The European Green Deal**. COM/2019/640 final.
- [3] Sachs J.D., Schmidt-Traub G., Kroll C., Lafortune G., Fuller G. (2019) **Sustainable Development Report 2019**. New York: Bertelsmann Stiftung and Sustainable Development Solutions Network (SDSN).

Endnotes

The Dashboard for the State of the Environment will be developed as a central ENVRI service, using EOSC core services and open-source software. The Dashboard will be populated by environmental indicators which result from data and services provided by the contributing Research Infrastructures by means of analytical workflows which will be developed by the RIs following the agreed Dashboard architecture.

Acknowledgements

The EOSC Future project is co-funded by the European Union Horizon Programme call INFRAEOSC-03-2020 - Grant Agreement Number 101017536.

Conflicts of interest

The authors have declared that no competing interests exist.