Implementing Open Science for the GEO Geohazard Supersites scientific community through the integrated use of Research Objects in the EVER-EST Virtual Research Environment

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The Geohazard Supersites and Natural Laboratory initiative (GSNL) is a voluntary international partnership established in GEO (Group on Earth Observation), which aims to improve geophysical scientific research and geohazard assessment, promoting rapid and effective uptake of the new scientific results for enhanced societal benefits in Disaster Risk Reduction (DRR).

GSNL promotes international scientific collaboration and Open Access to a variety of space and ground data, focusing on Supersites with important scientific problems and high seismic/volcanic risk. The GSNL network aims to use an Open Science approach to ensure transfer of knowledge, research results, data, personnel, tools, best practices for optimal research uptake, among the Supersite scientific communities.

To facilitate the implementation of the Open Science principles, GSNL is experimenting on the use of Research Objects (RO) . The concept of Research Object was first proposed in 2010 as a new digital-era tool for sharing scientific results (see www.researchobject.org for a bibliography), and soon expanded to include also the reuse, reproducibility and preservation of research work, through the concept of workflow-centric ROs. ROs are virtual aggregations of resources that bring together data, methods, results and people to document scientific investigations. Their goal is to encapsulate digital knowledge and provide a structured mechanism for sharing, reproducing, reusing and preserving research. The Research Object repository is available at www.rohub.org.

The content of a RO can be for instance:

• a set of scientific articles and/or grey literature reports/bulletins concerning a specific subject, event and/or area (e.g. all information on a specific eruption at one volcano Supersite);

• an aggregation of datasets used for a specific investigation (to be shared to facilitate reproducibility and reuse);

• a complete representation of a processing workflow, including e.g. reference to input data, executable code, results, information on the procedure, information on attribution and provenance of the research (through a DOI and the researcher's ORCID ID).

To fully exploit the potential of the ROs to enable Open Science, the EVER-EST Virtual Research Environment (VRE) was developed in a H2020 project (www.ever-est.eu).

The EVER-EST VRE is a web-based platform providing collaborative services to Earth Science communities; it has been made available in November 2017 and is currently undergoing demonstration by four different scientific communities, including the Geohazards Supersites one. EVER-EST provides a number of collaboration services which integrate the use of ROs in the researcher's work. Using EVER-EST a researcher can access ROs created by other colleagues, create their own ROs including data, results or workflows, assign a DOI to the RO to maintain IPRs and share it with the community. EVER-EST makes available a UNIX/WINDOWS processing environment in which scientists can access, modify and execute workflow-centric ROs created by colleagues working on other Supersites, effectively providing a way to reuse scientific knowledge developed in different Supersites and by scientists located in different parts of the world.

Examples of how ROs are used by the Supersite community within the EVER-EST platform will be presented at the conference.