

# A user-centric approach to validate the EVER-EST Virtual Research Environment infrastructure for the Earth Science

**Federica Foglini**, ISMAR-CNR (Bologna, Italy), federica.foglini@bo.ismar.cnr.it

**Francesco De Leo**, ISMAR-CNR (Bologna, Italy), francescodeleo64@yahoo.it

**Jose Manuel Gómez**, Expert System (Spain), jmgomez@expertsystem.com

**Valentina Grande**, ISMAR-CNR (Bologna, Italy), valentina.grande@bo.ismar.cnr.it

**Rosemarie Leone**, European Space Agency ESOC (Germany), rosemarie.Leone@esa.int

**Fulvio Marelli**, Terradue (Italy), fulviomarelli@me.com

## The EVER-EST Virtual Research Environment (VRE)

The EVER-EST project aims to develop a generic Virtual Research Environment (VRE) tailored to the needs and validated by the Earth Science domain. To achieve this the EVER-EST VRE provides earth scientists with the means to seamlessly manage both the data involved in their computationally intensive disciplines and the scientific methods applied in their observations and modellings, which lead to the specific results that need to be attributable, validated and shared within the community e.g. in the form of scholarly communications.

Central to this approach is the concept of Research Objects (ROs) as semantically rich aggregations of resources that bring together data, methods and people in scientific investigations. ROs enable the creation of digital artifacts that can encapsulate scientific knowledge and provide a mechanism for sharing and discovering assets of reusable research and scientific assets as first-class citizens. Though several e-laboratories are incorporating the research object concept in their infrastructure, the EVER-EST VRE is the first RO-centric native infrastructure leveraging the notion of ROs and their application in observational rather than experimental disciplines and particularly in Earth Science (Fig.1)

By deploying research object technologies in Earth Science, we aim to enhance the portability of scientific materials and methods, the collaboration capabilities within and between teams of earth scientists, the quality and long-term preservation capabilities of the methods, and the means to communicate, validate and measure the impact of scientific outcomes.

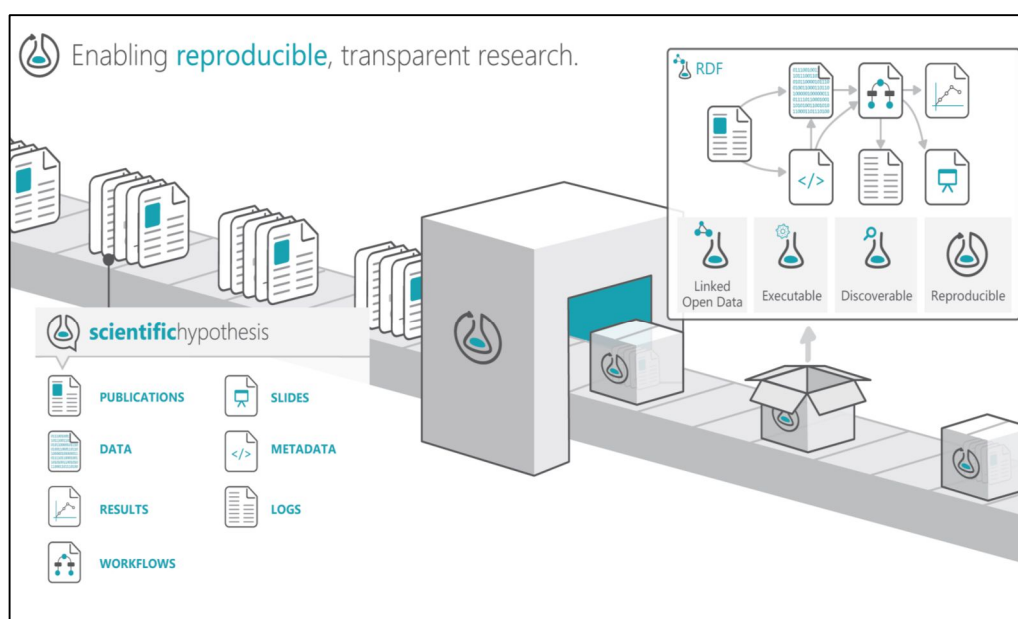


Fig. 1 – Example of RO schema.

The EVER-EST VRE offers a framework based on advanced services which are delivered both at the infrastructure and domain-specific level, with the objective of supporting each described phase of the Earth Science Research and Information Lifecycle. It provides innovative e-research services to Earth Science user communities for new forms of scholarly communication, cross-validation and the sharing of knowledge and science outputs.

### **The EVER-EST Virtual Research Communities (VRCs)**

The project follows a user-centric approach. Real use cases, taken from pre-selected communities covering different Earth Science research scenarios drive the implementation of the proposed system's services and capabilities. The EVER-EST VRE user community ranges from marine researchers (Sea Monitoring use case), to Common Foreign and Security Policy institutions and stakeholders (Land Monitoring use case), natural hazards forecasting systems (Natural Hazards use case), and disaster and risk management teams (Supersites use case). The resulting requirements for data management (e.g. accessibility of heterogeneous data sources), preservation of data and data-intensive methods and workflows, user experiences, data exploitation and other important e-research services for communication, cross-validation, and sharing of science products, will be addressed through the proposed solution.

Each identified Virtual Research Community (VRC), represents a different research area and is constantly involved in the project for the purposes of validating the EVER-EST infrastructure. This user-centric approach allows an assessment to be made of the capability for the proposed solution to satisfy the heterogeneous needs of a variety of Earth Science communities for more effective collaboration, and higher efficiency and creativity in research. Each of the identified VRCs involves different categories of users both within and outside the Earth Science domain (e.g. general public, policy and decision makers). This allows the piloting and testing of the infrastructure in real-life scenarios which may significantly differ from each other. Data providers and value adders are constantly involved in this process during the project to maximize its scientific and societal return.

### **The Sea Monitoring VRC**

The Institute of MARine Science (ISMAR-CNR) is a scientific partner providing the EVER-EST project with a direct link to the targeted users with the definition of real use cases to be carried out through the VRE solution. In particular, ISMAR-CNR provides useful and applicable contributions to the identification and definition of variables indicated by the European Commission in the Marine Strategy Framework Directive (MSFD) to achieve the Good Environment Status (GES). ISMAR-CNR is willing to deliver practical methods, procedures and protocols to support coherent and widely accepted interpretation of the Descriptors 1, 2 and 6. The three use cases deal with 1. the *Posidonia* meadows along the Apulian coast, 2. the deep-sea corals along the Apulian continental slope and 3. the jellyfish abundance in the Italian water.

Research objects play a significant role in key aspects related to data-intensive science like long-term data preservation. The SeaMonitoring VRC created specific RO for bathymetric data implementing a data preservation plan and a specific vocabulary for metadata. The metadata elements are defined taking into account several international metadata standards such as the PREMIS, Dublin Core standards and vocabularies and Long Term Preservation of Earth Observation Space Data - Definitions of Acronyms and Terms.