



WMO Hydrological Observing System (WHOS): a collaborative implementation approach

Enrico Boldrini (1), Paolo Mazzetti (1), Stefano Nativi (1), Mattia Santoro (1), Fabrizio Papeschi (1), Roberto Roncella (1), Massimiliano Olivieri (1), Fabio Bordini (2), and Silvano Pecora (2)

(1) National Research Council of Italy - Institute of Atmospheric Pollution Research, Sesto Fiorentino (FI), Italy (enrico.boldrini@cnr.it), (2) Regional Agency for Prevention, Environment and Energy of Emilia-Romagna, Italy, Parma (PR), Italy (specora@arpae.it)

This work finds its context in the Commission for Hydrology (CHy) working group of the World Meteorological Organization (WMO), whose major task is to establish the WMO Hydrological Observing System (WHOS): a services-oriented System of Systems (SOS) linking hydrological data providers and users enabling data registration, discovery and access at global scale.

Many National Hydrological Services (NHS) are willing to participate to WHOS providing their data to the benefit of a larger audience. The effort required from them is to be the lowest possible, according to WHOS approach and principles: a NHS wanting to join needs only to provide the endpoint of a web service publishing hydrological data, along with optional descriptive information. WHOS already supports a large list of service types (e.g. CUAHSI HydroServer, OGC Sensor Observation Service, THREDDS Data Server, Web Accessible Folders, ...). In case the newly added service type is not yet supported, the work needed will be achieved by WHOS: no additional effort is required from NHS side.

Many different user types and use cases benefit from WHOS services as WHOS publishes many service interfaces and APIs, making it compatible and usable through the common hydrological applications (e.g. CUAHSI HydroDesktop, 52 North Helgoland, R language WaterML library, ...).

Custom views of the entire data offering can be defined in WHOS: within a view only a predefined subset of WHOS data resources will be available, the more interesting for users of that view. Example given, basin level views (e.g. focusing on La Plata river basin), regional views (e.g. focusing on Europe) or transnational views (e.g. focusing on requirements coming from specific WMO Global Data Centres such as the Global Runoff Data Centre) have been created. The WHOS portal is the entry point to learn about WHOS functionalities and the available views.

CHy is in charge of making WHOS actors work together in a collaborative and inclusive way, interacting between NHSs from a side and communities of users (scientists, decision makers, app developers) from the other side. Successful workshops had taken place (e.g. at INMET, in Brasilia and at SMN and INA, in Buenos Aires) to present WHOS architecture and encourage participation. CHy is also in charge of selecting interesting trans-national and global scenarios serving as guidelines to show WHOS capabilities to hydrological communities and NHSs. Examples of latest work includes: data sharing across South American countries; interoperability with OSCAR system, based on WIGOS metadata standard; accessing GroundWaterML2 (GWML2) based services; enabling support to USGS GWIS JS API.

An enabler technology and key component of WHOS architecture is the WHOS broker component designed and realized by ESSI-Lab of CNR-IIA. It achieves interoperability between the heterogeneous systems used by data producers and consumers, by means of harmonization and mediation capabilities.

WHOS broker framework addresses the multi-organizational requirements of hydrological data sharing:

- Easing data producers to share data through their favorite services
- Easing data consumers to search and access data using their favorite applications
- Being a reliable and performant broker between many producers and consumers
- Being flexible to cope with rapidly evolving technological scenario and updated requirements