

## MAKING GROUNDWATER VISIBLE: A CONTRIBUTION FOR CLASSIFYING HYDROGEOLOGICAL RESEARCH AND KNOWLEDGE BY KINDRA H2020 PROJECT

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The H2020 KINDRA project (Knowledge Inventory for hydrogeology research, Grant Agreement 642047, [www.kindraproject.eu](http://www.kindraproject.eu)), funded by the HORIZON2020 Framework Programme, is dealing at European level with research and knowledge in groundwater, the hidden component of the water cycle, fundamental for the environment and for human uses. The project intends to contribute for improvement of the Water Framework Directive (WFD) and the Groundwater Framework Directive (GWD), by an accurate assessment of the state of the art in hydrogeology research and knowledge.

Hydrogeology-related research activities cover a wide spectrum of research areas at EU and national levels, but they are widespread into several projects, plans, actions, fragmented into wider programs generally related to water, environment or ecology. At the same time, the management of groundwater brings additional challenges to the implementation of WFD, GWD and of the Circular Economy approach.

In the first year, a terminology and classification methodology on groundwater research and knowledge based on a keyword list has been realized. The Hydrogeological Research Classification System (HRC-SYS) has been developed categorizing groundwater research in three main categories: 1) Societal Challenges, 2) Operational Actions and 3) Research Topics. Each of these main categories includes 5 overarching sub-categories for an easy overview of the main research areas. The complete merged list of keywords, about 240, selected from WFD, GWD and from high impact scientific journals, has been organized in a tree hierarchy.

The classification system maps the relation between the three main categories through a 3D approach, where along each axis the 5 overarching groups are plotted. To facilitate analysis and report show the relationships, this approach also allows for a 2D representation for each of the 125 intersections among the three main categories in a 5x5 matrix.

The European Inventory of Groundwater Research (EIGR) is a tool which allows the application of the proposed classification. The EIGR is intended to be used in three different ways: i) for insertion of information pertaining to groundwater research and other available knowledge by the National Experts of the European Federation of Geologists (EFG); ii) for consultation during and after the project by people and organizations dealing with

groundwater research, but also possibly by non-experts; iii) for analyzing collected and stored information to identify trends, challenges and gaps in groundwater research by KINDRA partners. The EIGR contains metadata, referring and providing links to research that has been performed in Europe since 2000. The uploaded metadata, about 2000 records at the end of 2016, distinguish between ‘research’ and ‘knowledge’ according to four different classes identified by the level of the performed quality assurance.

The proposed classification system allows the immediate comparison of the two categories Operational Actions and Research Topics with the Societal Challenges identified by the European Commission in Horizon2020. The adopted set of performance indicators (classes of research/knowledge, technology readiness level, grants, etc.) are used for a trend&gap analysis on-going at the last stage of the project during 2017. The identification of research gaps will give useful suggestions for the actualization and continuous development of research and innovation agendas in line with WFD.

