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ABSTRACT: 45 Geological Survey Organizations (GSOs) from 32 European countries developed an ERA-NET Co- Fund Action: Establishing the European Geological Surveys Research Area to deliver a Geological Service for Europe (GeoERA). The GeoEra project HOVER (Hydrogeological processes and Geological settings OVER Europe controlling dissolved geogenic and anthropogenic elements in groundwater of relevance to human health and the status of dependent ecosystems) aims to gain understanding of the controls on groundwater quality across Europe using the combined expertise and data held by member states. Objectives of the HOVER work package 7 (WP7) are i) review of existing index methods for assessing the vulnerability of the upper aquifer to pollution and selection of the methods to be applied at the pilot and pan-EU scale, ii) compilation and harmonization of input data sets required for assessing vulnerability, and iii) assessment of aquifer vulnerability to pollution (both in maps and 2-d schematic cross sections).

BACKGROUND

The HOVER project is focused on groundwater (GW) management and related with drinking water, human and ecosystem health in relation to both geogenic elements and anthropogenic pollutants. It is organized in 6 technical work packages (WP) (Figure 1).

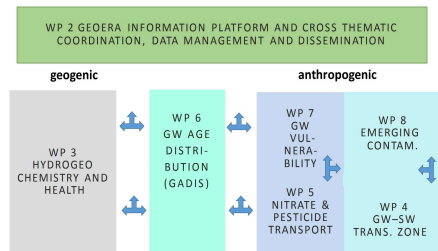


Figure 1. Flow-chart diagram of HOVER project.

- WP3 considers natural geogenic processes.
- WP4, 5, 7 and 8 consider the anthropogenic impacts on GW.
- WP6 is focused on the GW age distribution and considers both geogenic and anthropogenic water types and the location of the modern water interface.

WP7 aims at GW vulnerability assessment of upper shallow aquifers as a tool for groundwater management and protection at drinking water wells and springs.

OBJECTIVES AND APPROACH

The main goals of HOVER WP7 are the following:

- Compile and evaluate internationally available parametric system methods for assessing GW vulnerability to pollution and identify the respective parameters required.
- Prepare a GW vulnerability to pollution map of the uppermost aquifer at pan-EU scale (1:1.5M) using the DRASTIC method (Figure 2).
- Prepare comparable DRASTIC maps of GW vulnerability to pollution at national, national/cross-border (1:250k) and at regional (1:50k) scales by harmonizing methods and parameters. Also apply the specific COP method for GW vulnerability assessment in some karst aquifers.
- Apply a *Lumped* index method based on 2D conceptual cross sections to summarize in a harmonized way the affected aquifer volumes per DRASTIC class (Figure 2).
- Analyze the feasibility of using GW nitrate concentration data and/or GW age distribution to validate maps of GW vulnerability to pollution.

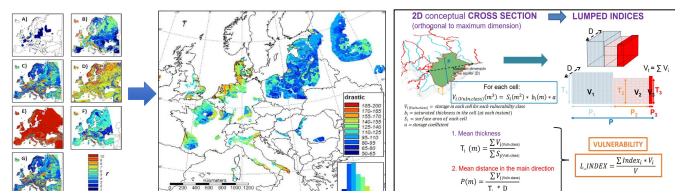


Figure 2. On the left preliminary pan-EU DRASTIC application with readily available data. Parameters are: A) Depth to water table, B) Topography, C) Impact of vadose zone, D) Aquifer by F) Aquifer conductivity, G) Soil type. On the right conceptual picture of the Lumped index method applied to summarize GW vulnerability to pollution classes.

THE COMPLETE LIST OF HOVER WP7 TEAM

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PILOT AREAS

Harmonized GW vulnerability to pollution assessment will be applied in 11 pilot areas at 10 different EU countries (Table 1 and Figure 3).

- In 11 the DRASTIC method will be applied in scales between 1:10k and 1:250k. 5 of these pilot areas include karst aquifers, which will be assessed using the COP method
- In 3 pilot areas from Denmark and Spain validation tests using GW nitrate data and GW age distribution will be carried out
- 4 pilot areas from Spain, Denmark and Ireland will apply the Lumped index method
- For the pan-EU DRASTIC map, WP7 partners will contribute with new depth to water table data covering their national territory at 10x10 Km grid size.

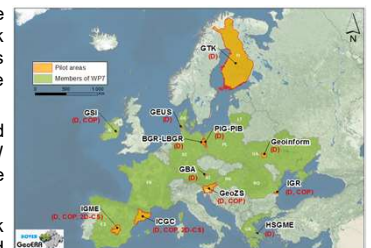


Figure 3. EU members contributing to HOVER WP7 and pilot areas distribution. D (DRASTIC), COP, 2D-CS (Cross Sections).

GeoERA PARTICIPANT	COUNTRY	PM	PILOT AREA	DRASTIC	COP	AREA (km²)	SCALE	CROSS-BORDER
Non-funded	BGR	12	Groundwater catchment of the Lower Oder/Odra river German part	X	-	4500	1:250000	Yes
51	ICGC	4.5	Catalunya	X	X	32112	1:100000	No
49	GeZIS	5.5	Slovenia	X	X	20273	1:250000	No
50	IGME	5	Upper Guadiana basin	X	X	-	-	No
3	GBA	4.5	Traun-Enns-Platte	X	X	400	1:50000	No
28	CSI	4.5	The Curragh	X	X	110	1:50000	No
44	PIG-PIB	3.5	Groundwater catchment of the Lower Oder/Odra river Polish part	X	-	7400	1:250000	Yes
46	IGR	2.7	Coldrain-Margalia	X	X	2192	1:200000	No
12	GEUS	2.5	Tender	X	-	293	-	No
14	Geotform	1	Stanojević	X	-	5302	1:100000	No
40	LGT	1.4	No pilot area	-	-	-	-	-
27	MBFSZ	5	No pilot area	-	-	-	-	-
15	BRGM	2.5	No pilot area	-	-	-	-	-
22	LBEG	4.5	No pilot area	-	-	-	-	-
Non-funded	IGME	4.5	Alluvial aquifer Alavertli	X	X	50	1:10000	No

Table 1. Summary of HOVER WP7 partners, countries, geographical surveys person month contributions (PM) and pilot areas main characteristics: name, area, representative scale and use of DRASTIC and/or COP for vulnerability assessment.

RESULTS AND CONCLUSIONS

HOVER WP7 achievements are the following:

- Agreement on selecting DRASTIC and COP methods to assess GW vulnerability to pollution.
- A pan-EU and 16 GW vulnerability maps at the pilot scale (11 for DRASTIC and 5 for COP) will be produced using harmonized input data and common legends to ensure comparable results.
- Tests on vulnerability maps validation using GW nitrates data and/or GW age distribution.
- Reports on comparison of internationally applied index methodologies and an examination of the obtained results will be produced
- All outcomes (reports and datasets of input data and GW vulnerability assessment index maps) will be disseminated through the Information Platform of the GeoERA consortium

EXPECTED IMPACTS

- Exchange and increase the level knowledge among HOVER WP7 partners
- Providing a basis for European-wide comparability & interoperability of input data, interpretation of results and definition of vulnerability ranges contributing to a common EU policy and regulation for GW protection

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