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eWater: Multilingual cross-border access to ground water databases

Organisation of ground water data management in the participating countries

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Table of content

1	Executive summary.....	3
2	Objectives.....	4
3	The aim of hydrogeological data collection, databases and metadatabases.....	4
4	The aim and the main characteristics of the questionnaire	5
5	Existing data types	6
6	Well data.....	8
6.1	Well data management on local level.....	8
6.2	Well data management on regional level.....	8
6.3	Well data management on national level.....	9
7	Exploitation data.....	9
8	Monitoring data	10
8.1	Groundwater level.....	10
8.2	Groundwater quality	12
9	Hydrogeological maps	12
10	Metadatabases.....	13
11	Relationship between the organizations and data flow in the different countries ..	13
11.1	The Netherlands	14
11.2	Austria.....	15
11.3	Italy.....	16
11.4	Slovenia.....	16
11.5	Denmark.....	17
11.6	Spain	18
11.7	Czech Republic.....	19
11.8	Slovak Republic	20
11.9	Sweden.....	20
11.10	Lithuania	20
11.11	France	21
11.12	Hungary	22
12	Conclusion.....	23
13	References	24
Annexes		
	Annex I. Figures	26
	Annex II. Tables	35
	Annex III. Flowcharts of the relationships between the most important organizations in each country and flowcharts of the dataflow.....	40
	Annex IV. The questionnaires filled by of each country – on CD enclosed	



1 Executive summary

Collection of hydrogeological data, their verification, the back sending of the validated data, the construction of the databases and data service are strictly regulated in each country participating in the eWater project.

The institutions conducting activities (mostly field survey) that result in hydrogeological data are of similar type in the different countries. Subsequently, these data are collected and structured in databases by various state institutions (municipalities, water and environmental authorities and research institutes). Due to the wide thematic range and different types of hydrogeological data (point data, time series, maps) various data sets are managed in different ways and they are frequently stored in different databases. The specific data types are managed occasionally by different institutions.

In order to review different data management processes a questionnaire was created then distributed to and filled by the representatives of the eWater partner countries. In the frame of this inquiry five hydrogeological data types have been distinguished, such as wells, water exploitation, monitoring and metadata, as well as maps. The specific data types were further divided in subgroups in professional terms.

Data collection is conducted in various ways in the countries on local, regional and national levels. Data collected on the lower levels are transmitted in the frame of obligatory data supply to the national level or they are directly loaded in the national database. The national database or databases have already been set up and are continually developed in each country. Data collected on regional level are managed in some countries in a regional database though the provision of free access for regional institutions to the national database is substantially more frequent. Local databases also exist but they serve only local needs without being free accessible.

Most data are public though some data types – first of all exploitation data – are with the exception of a few countries not free accessible. There are some data sets in almost all of the participating countries the accessibility of which is restricted by the data supplier (e. g. oil companies). In general the data are available in traditional form printed on paper (mostly maps). Simultaneously, web-based access is also quite common but only for some of the data sets. The data can be procured in digital format upon special request in almost all of the participant countries.

Hydrogeological data can mostly be procured free of charge but data service (e. g. maintenance of the database) and data pre-processing must frequently be paid. The price policy of the countries is quite different. In some cases the price is calculated upon the amount of data, whereas in other cases data service is provided upon single contracts for a yearly flat rate. Printed maps and digital map databases have their own proper prices.

Databases are registered in metadatabases mostly accessible on the Internet in almost all of the participating countries. They are invariably managed by the geological survey of the related country.



2 Objectives

To increase the cross-border availability, accessibility and re-usability of spatial data on quality, location and use of subsurface waters the eWater project will develop an Internet system that will provide cross-border multi-lingual access to ground water spatial data sets stored in the national databases of the participating countries. The data is currently stored in national databases and available exclusively for a national user in a local language. Countries have installed various kinds of institutional systems, to organize the collecting, storage and dissemination of ground water data.

The objective of WP3 of the eWater project (Organisation of ground water data management at the national levels) is to study in detail the organisation of ground water data management in the participating countries. In the frame of this task we made an overview on the institutions responsible for collecting, storing and disseminating data on subsurface waters, on their relationships, as well as on the data flow from data providers to end-users. We compared the methods of the management of subsurface water data in the participating countries and determined the related common and different features. This overview is indispensable for the successful completion of the coming parts of the project in order to set up the common aspects of data and database management.

3 The aim of hydrogeological data collection, databases and metadatabases

The surveillance of the state as well as the quantitative and qualitative characteristics of subsurface waters is an especially important issue of water management and the protection of the environment. It starts with field survey including the collection of both static and dynamic data. Static data sets provide information on the morphological and geological setting together with the characteristics of engineering constructions of the area, whereas dynamic data concern water resources.

Collection of field data is a fairly costly endeavour, the resulting information is thus expensive and mostly irreparable. Therefore each follow-up procedure facilitating better utilisation and more versatile interpretation of already available data is of high value. It is thus advisable to organise measurement data of a given geographic unit (local area, region, country) in one or several databases and their descriptive data in a metadatabase.

Hydrogeological investigations concern a wide range of environmental parameters. The measured parameters can be attributed to a point (e. g. borehole, well, spring, etc.), they can characterise an area (e. g. surface or subsurface river basin area, recharge area, evaporation area, outcrop of rocks, etc.) or a 3D spatial unit (e. g. aquifer/aquitard formations, geological formations, etc.). Processes changing in time can be featured by complex measurement data sets and time series (e. g. groundwater heads, chemical composition, temperature, etc.). Different data require various management methods. They are thus organised in tables of different structure. The link between these tables is provided by a unique identifier.

Each country elaborates its databases according to its means and the requirements while the primary aspects are the specific hydrogeological features, traditions of the profession and the demands arising during the solution of the related tasks. Given that these databases are tailored to the specific structure and requirements of the related



organisations they have different characteristics in each country. The institution system engaged in subsurface water management varies also country by country.

In the following chapter data management and the responsible institutions will be presented in the participating countries. Those with similar data management will be grouped and the differences between the groups will be analysed. The overview concerns each participating country.

4 The aim and the main characteristics of the questionnaire

Information on the institution system and data management was gained by distributing a questionnaire among the participants. It was received and completed by each participating country (All the filled questionnaires can be found in Annex 4.).

The primary aspects of designing the questionnaire were its ability to reflect data flow from data providers to end-users and the institution system as clearly as possible and to encompass all the related data types. Another important issue was to provide an opportunity for addressing the specific features in each country.

It was also considered that there were some countries where the common national database has not yet been established and different data sets are thus stored in several independent databases. Consequently, data types were divided into 5 main thematic groups. They were further subdivided into subgroups if for some professional or administrative reasons the related data could be processed separately. It may mean different data providers or data collecting institutions or data management in separate databases.

The question-groups for the first four, professional thematic units were determined upon common principles and they were tailored then to the specific unit with the least possible change compared with the others. The question-groups follow the complete data flow starting from the data service of the measuring institution through various levels of data storage and management up to publication and dissemination. A separate question concerns the user community.

Corresponding to the format of the majority of questionnaires of the eWater project, the first introductory question-group requests for the data of the organisation responsible for and the contact person giving the answers. A separate set of questions concerns the sales agency of the organisation.

The first question-group of the questionnaire (questions 1 and 2) concerns the data providers performing the measurements and the types of the primary data collecting institutions.

The second question-group (questions 3-6) inquires for the different levels of data collection including local, regional and national levels. Local authorities, municipalities, etc. represent the local level, whereas data collection organised in regions by the corresponding administrative institution system in different countries is regarded as the regional level. Data collecting activities in national data banks are considered as the highest level of data acquisition. The latter are invariably in the responsibility of national institutions. Validation of the data itself and its reliability is the inseparable part of data collection. The institution responsible for data validation should thus be indicated in each country as well as the level at which validation occurs. As part of validation a separate



question deals with the back sending of the verified data to data providers and data collecting organisations of lower levels. We have also inquired for the nature of obligatory data supply between various levels of data collection. Database construction is the inseparable part and consequence of data collection. It is not supposed, however, that a single database was set up at each data collection level but accessibility to the database of the higher-level organisation is presumed to be provided instead. A separate question concerns the link to the databases accessible on the web.

The third question group (questions 7-8) is devoted to the dissemination, publicity and accessibility of data. Open databases with free access are distinguished of the data sets with restricted access that can be entered by password or special right. The cost of data and data service was also concerned. Description of the accessibility of all publications printed or put on the web was also requested in the questionnaire.

Finally, the fourth question group (questions 9-10) concerns the end-user organisations.

It is evident that the questions asked in the metadatabase theme are essentially different from that of the professional themes. They concern basically the organisations managing and updating the metadatabase as well as the characteristics of the link between the metadatabase and the data sets proper in the background. The link of the metadatabase was also requested if it is available on the Internet.

5 Existing data types

Data types were subdivided in the following five thematic groups:

- well data,
- water exploitation data,
- monitoring - time series - data,
- maps,
- related metadatabases.

Within the thematic groups the following subgroups have been distinguished:

- Well data
They include administrative data including identifying information (co-ordinates, depth, well name, other identifiers, etc.) and some other complementary data (well type, owner, operating organisation, etc.).
Related technical data concern basically the nature of well construction (type of casing, its depth and diameters, type, depth and size of filters, etc.).
The geological description, geological sequence, description of samples and the curves of well logs pertain also to basic well data.
Parameters measured during well construction (groundwater heads, test pumping and recharge data) reflect the intact state before exploitation providing the basis for comparison with the same parameters measured later. Consequently the first parameters are commonly stored among the basic well parameters separately of the database of the results of later measurements.
The results of analyses of water samples taken at construction are also stored separately of the data of further hydrochemical tests.
- Exploitation data
Water exploitation data have not been divided into subgroups, since foreign and our national experience shows that they are treated in a common way.
- Monitoring data



- Monitoring data were subdivided in two subgroups:
 - time series of groundwater heads,
 - time series of groundwater quality.
- Hydrogeological Maps
Hydrogeological maps were assigned to three categories:
 - maps of groundwater heads,
 - maps of groundwater quality,
 - other hydrogeological maps.
- Metadatabases
Metadatabases were not classified in separate categories.

The organisation of quantitative and qualitative characteristics of subsurface waters into a common national database is underway or has been completed in all participant countries of the eWater project.

Except for Austria the national well database is available in each country, though the Swedish database does not contain technical, neither well test data. Well data management proceeds in each country in a common way, usually in one database. In Lithuania all data are stored in one database, nevertheless they have different publicity.

On the contrary, quantitative data of exploited water are not collected in each country, neither are they structured in a database. There is a lack of summarising information on exploitation data available in Austria and the Czech Republic. There is only one country (Denmark) where information on the amount of exploited water is free accessible. In Emilia-Romagna Region (Italy) data on the amount of exploited water are available upon special request without however the personal data of the owner. Exploitation data are also available upon special request in Lithuania and Holland, while in Holland they will soon be available via web.

Each country has a monitoring network of subsurface waters including the measurement of quantitative and qualitative changes. There are some countries where both data types are subjected to common treatment (Emilia-Romagna Region (Italy), Lithuania, Sweden, Holland, Denmark, Slovenia, and France). Data management of the time series of measured groundwater heads and hydrochemical parameters can however be different. Data concerning the amount and composition of the water are stored in separate databases in some countries, while they are in the responsibility of different institutions in some others (Spain, Hungary, Czech Republic and Austria). In Hungary and in Austria time series of the changes in the quality and amount of water are managed by different organisations.

The most variable picture is provided by the management of hydrogeological maps. Each country launched and proceeds with the digital acquisition and/or scanning of “old” (maybe archive) hydrogeological maps. Nevertheless, systematic map databases have been set up only occasionally. Digital maps on groundwater level and quality are still missing in Emilia-Romagna Region (Italy), Austria, Sweden and Slovenia. In Denmark not only digital versions of the aforementioned maps are missing but related paper maps are not available either. Publicity of available maps varies in each country. Some items of digital maps are available via web in Spain, France, Austria, Czech Republic, Holland, Slovenia and Sweden.

Data types existing in the participating countries are summarised in Annex 1 Fig.1 and Annex 2, Table 1.



6 Well data

Well data in the databases are provided by drilling companies, waterworks commissioning constructed wells, consultancy agencies and research institutes. Data collection is conducted in different ways and on various levels in participating countries (Annex1, Fig.2 and Annex2, Table 2.).

6.1 Well data management on local level

Local municipalities and authorities as well as the local offices of national institutions are the most important data collectors on local level, like in Emilia-Romagna Region (Italy), France, Denmark, Holland and Hungary. In Hungary local authorities collect data of wells shallower than 50 metres. In Emilia-Romagna Region (Italy) local authorities collect data and then supply them to the Region in order to manage the regional database. On the contrary, locally collected data are loaded directly in the national database in Denmark and France. If data collected on local level is not loaded in the national database (Italy, Hungary) local institutions have obligatory data supply toward regional data collecting organisations.

6.2 Well data management on regional level

Data collection on regional level is conducted by provincial and regional authorities, regional water management organisations, water management agencies of river basin authorities and regional offices of research institutes.

Data collection is performed by regional organisations in Italy and Hungary without direct loading of locally collected data in the national database. In Emilia-Romagna (Italy) regional databases have been set up. In compliance with obligatory data supply data are delivered to the institution responsible for the national database (National Department of the Environment through National Agency for Environment). The related data are published in printed format in technical reports with free access.

In Hungary data are collected by regional water authorities on national level. Instead of constructing regional databases data are delivered to the Water Directorate responsible for the national database that can be accessed by regional authorities. Users can request data in writing of regional authorities. Data are free but the service is charged according to delivery method.

In Spain data collection is performed by two institution systems. Between 1970 and 2001 IGME (Instituto Geológico y Minero de España) was responsible for regional hydrogeological data collection and it is still collecting and systematising data associated to its different research projects. The collected data are directly loaded in the national database of the institute. From 2002 the Direction General of Water and the River Basin Authorities, the latter belonging to the Ministry of Environment have been charged with regional data collection. These institutions set up their own regional databases that can mostly be accessed in the Internet.

Like data acquired on local level regionally collected data are loaded also in the national database in Holland.

In the rest of participating countries data are not collected on regional level (Slovenia, France, the Slovak Republic, the Czech Republic, Denmark, and Sweden).



6.3 Well data management on national level

Except for Austria data collection and database building concerning construction- and core data of wells proceeds on national level in each country. Data collection is mostly the responsibility of geological surveys like in Lithuania, the Slovak Republic, the Czech Republic, Denmark, Sweden, France and Holland. In Slovenia the Environmental Agency of the Republic of Slovenia is responsible for this task but the national database itself is managed by the Geological Survey of Slovenia. In Italy the related data are collected and the database is managed by the National Department of the Environment through the National Agency for Environment (Sistema152). Like the regional level, data collection and database management on national level are in the hands of two institutes. Similarly, national well data collection is conducted by two institutions in Hungary (Water Directorate and Geological Institute of Hungary). They set up two actually independent national databases. Their harmonisation and the provision of bilateral free access are currently underway.

Except for Italy national organisations are responsible for making the data available for the public or its publication. In Denmark and France the data are completely free and accessible via web (www.geus.dk/jupiter; www.infoterre.brgm.fr;). The same applies in Italy but the user has to be registered before accessing the database (www.arpa.emr.it/acquarer). In Sweden some data sets are available free of charge via web (www.sgu.se) but some other data sets cannot be accessed by external users. In Lithuania and the Czech Republic data are free and public but the user is charged for the service. In the Czech Republic data can be procured upon a query and the result is delivered subsequently. The query can be initiated through a special interface (www.geofond.cz). In Lithuania the data can be accessed free but the publicity of well data varies according to the specific subgroups. Administrative data are free and available via web. Technical data are available via web but only for registered users. Technical data can not be downloaded. Groundwater quality data are available only for internal users (www.lgt.lt). Data service is charged according to a contract usually once a year. Data service in Holland is quite similar to that in Lithuania. Data are accessible via web (www.dinoloket.nl) the database itself can be accessed only by special right. Access is provided also for a yearly flat rate covering only the maintenance of the database. Data are free. In Spain some segments of the national databases of both institutes are free accessible and they can be accessed in the Internet.

(http://www.mma.es/portal/secciones/acm/aguas_continent_zonas_asoc/aguas_subterraneas/situacion_recursos/consultas.htm;

http://www.igme.es/internet/ServiciosMapas/siasweb/sias_general.htm).

The other part of the data is provided upon special request for payment. In the Slovak Republic and in Hungary well data are delivered upon request and the service must be paid. In Slovenia the related data sets are not free accessible.

7 Exploitation data

Data concerning the amount of exploited water are provided by water supplying companies (mostly waterworks) or by local authorities. In Lithuania data must be provided on production of more than 10m³/day.

Like for wells, collection of exploitation data is conducted by different methods and on various levels in each country (Annex 1. Fig.3. and Annex 2. Tab. 3.). In Holland, Denmark and France production data are gathered on local level at local authorities and municipalities. In Emilia-Romagna (Italy) data are collected by different offices of the same organisation on both local and regional levels (Emilia-Romagna Region). In the



frame of obligatory data service local authorities submit the gathered data to regional data collectors, as well as to regional- and water authorities. Regional organisations load the related data directly in the national database (DINO). In Spain similarly to well data, collection of exploitation data on regional level was conducted between 1970 and 2001 by regional offices of IGME. From 2002 this task was overtaken by River Basin Authorities. Both institutes manage their own databases. Data of IGME are directly loaded in the national database, whereas those of the River Basin Authorities are stored in local ones. In Hungary exploitation data are collected on regional level by Regional Water Authorities and Environmental Protection and Water Inspectorates, the so-called “Green Authorities”. Upon obligatory data supply the collected data are transferred to the Water Directorate.

Data collected on local level are integrated on national level in Denmark and France. In Spain, Holland and Hungary regional data are collected on national level and they are stored in a national database. On the contrary, exploitation data are collected only on national level in Lithuania, Sweden and Slovenia. In Emilia-Romagna (Italy) exploitation data are stored in database of regional organisation.

Publicity of data varies country by country. Exploitation data are not accessible in several countries, like in Hungary, Lithuania, Spain, Sweden and Slovenia. They are public and accessible in France and Holland but the related national databases are under development. Digital data are thus not available at the moment, they will be accessible in the near future. The data are managed in Excel tables and delivered upon special request. During data service the personal data of water producing companies are not public. In the Slovak Republic data are provided upon special request for payment. It is only in Denmark that exploitation data are available via web.

8 Monitoring data

Monitoring of subsurface waters is conducted in each participating country of the eWater project including the monitoring of the changes in their amount and composition. Quantitative and qualitative changes are characterised by groundwater head time series and groundwater quality time series, respectively. Content and frequency of execution of the recordings as well as the type and number of tested parameters vary for these two groups of measurements, the related data are thus managed separately in different databases and tables. Measurement, data collection and occasionally the management of the related databases can therefore be executed by different organisations or organisation systems within a specific country.

8.1 Groundwater level

The measurement of groundwater heads in the frame of monitoring is performed by a number of institutions encompassing waterworks, local or regional water and environment protection authorities, geological surveys and their regional offices, as well as other research institutes like hydrological or hydrometeorological ones. Monitoring within a specific country can be conducted simultaneously by several institutions (Annex 1. Fig.4. and Annex 2 Tab.4.)

Monitoring data can be gathered on local, regional and national levels. Local monitoring serves for the protection of some smaller regions and water bases executed essentially in the frame of the monitoring activities of waterworks and local municipalities. Monitoring of groundwater heads proceeds on local level in Italy, Holland, Denmark and France. The related data are managed in local databases in Emilia-Romagna Region (Italy). The data



are transferred in the frame of obligatory data supply to regional data collecting organisations. In France local monitoring proceeds in several institutions without specific obligations. Like in Emilia-Romagna Region (Italy), the gathered data are managed in local databases for internal use. In Holland data on local level are transferred to the national database (DINO) in the frame of obligatory data supply. Locally collected data are directly loaded in the national database in Denmark.

Monitoring on regional level is devoted to tracking the changes in the state of subsurface waters in the regions of a specific country. Regional monitoring activities are conducted by state institutions and authorities (water boards, river basin authorities and regional offices of environmental authorities) or state-budget research institutes (geological surveys, hydrological institutes and hydrometeorological institutes). In Emilia-Romagna Region (Italy), data collected on regional level are organised in regional database, whereas the collected raw data are transferred to national data collecting organisations upon obligatory data supply. The same applies in Holland, i. e. regional data must be submitted to the institution responsible for the management of the national database. In Hungary there is also a compulsory transfer of regionally gathered data to the unit managing the national database which sends regularly back verified data to the regional databases. The regional database forms thus a separated part of the national database. By applying this rule of data transfer duplicated items of the same database as well as accidental deviations between the two databases can be prevented. In line with the aforementioned hydrogeological data management the Geological Survey (IGME) was responsible for monitoring data collection and database management in Spain between 1970 and 2001. Starting from 2002 it extends the database with monitoring measurement data collected in the frame of its own research projects. On regional level data collection is executed by the regional offices of IGME. The related data are directly loaded in the national database of IGME. Starting from 2002 the Direction General of Water and the River Basin Authorities of the Ministry of Environment are responsible for monitoring data collection. The Ministry of Environment and the River Basin Authorities are developing six new projects of monitoring networks in compliance with the requirements of the WFD. Regionally collected data are stored in regional databases.

Monitoring data collection is underway on national level in each participant country. All of them possess a national groundwater head monitoring database as well. The database constitutes part of the harmonised hydrogeological database including the well database in Italy (Sistema152), Denmark (JUPITER), Spain (SIAS), Holland (DINO), and Lithuania (GEOLIS). Out of them Sistema152 is managed by the National Department of the Environment through National Agency for Environment. In the other related countries this role is played by the geological surveys. In France, Slovenia and Sweden national monitoring data are gathered and the associated database is managed by the geological surveys, whereas in the Slovak Republic the Slovakian Hydrometeorological Institute is responsible for national monitoring data collection and database management. In Austria the Hydrographisches Zentralbüro is charged with the same task. There are two institutes gathering groundwater head monitoring data in the Czech Republic (Geofond and the Czech Hydrometeorological Institute), in Hungary (Water Directorate and the Geological Institute of Hungary) and in Spain (IGME and Direction General of Water and River Basin Authorities).

Monitoring data are public in the majority of the countries and there is also a free access via web. In Emilia-Romagna Region (Italy) regional organisations ensure the publicity of monitoring data that can be accessed free on the Internet. In other countries the



organisations responsible for the management of national databases are charged with data dissemination. Measurement data are published in print in annuals in several countries, like in Austria, Hungary, Lithuania and Emilia-Romagna Region (Italy). Instead of raw data the interpreted tendencies of changes are published in Lithuania that can be accessed via web in pdf format. A similar publication appears in Emilia-Romagna Region (Italy) released by regional organisations. Hungary, Denmark and France provide free access to groundwater heads monitoring data. Data are free but data supply is charged in Holland and in the Czech Republic. Some of the data can be accessed free in Spain and Austria as well. The database is available only for internal use in Lithuania, Sweden, Slovenia and the Slovak Republic. In the latter two countries monitoring data are supplied upon special request for payment. In Lithuania the applications for connecting external users to the database is under construction.

8.2 Groundwater quality

In several participant countries, like in Denmark, Holland, Lithuania, the Czech Republic, the Slovak Republic, Italy and France the character of the management of hydrochemical data is common with the groundwater heads data described above in detail and the related data supplying organisations are also the same. In the following only deviating characteristics will be addressed concerning this subject (Annex 1. Fig.5. and Annex 2 Tab.5).

In Austria, like groundwater heads data, hydrochemical records are collected only on national level but they are gathered by another organisation, namely by the Umweltbundesamt being also responsible for data management and publicity. In Spain regional data collecting organisations (River Basin Authorities) provide free access to hydrochemical monitoring data on the Internet. In contrast to groundwater heads data national hydrochemical recordings are free in Sweden and they can be accessed via web. In Hungary the Environmental Nature and Water Inspectorate collects hydrochemical monitoring data. The related national database is under construction; therefore the available data are currently stored in Excel format that can be accessed for internal use only. In Slovenia hydrochemical monitoring data can be accessed only in the form of summarising reports in the web-page
http://www.arso.gov.si/podro~cja/vode/poro~cila_in_publikacije/podzemne_letna.html.

9 Hydrogeological maps

Hydrogeological maps are assigned to three thematic groups as follows: maps of groundwater heads, maps of groundwater quality, and other hydrogeological maps. Not all of them are available in each of the participating countries (see chapter 6.5). Most of them are compiled and supplied by research institutes and some less by proper water and environmental authorities, the latter aimed essentially for decision making support in water management projects on different – local, regional, national or European – scale (Annex 1. Fig.6.).

Extensive digital map databases existing in Holland (DINO) and Spain (SIAS) are not quite common in other participating countries but related database construction, its extension and the digital acquisition of printed paper maps is underway in each of them. In some countries hydrogeological maps are collected by geological Surveys, like in Austria, Sweden, Lithuania, Holland and Spain. They are stored and published in several institutions in others including Emilia-Romagna Region (Italy), Hungary, the Czech Republic, the Slovak Republic and Slovenia.



In most cases there is no difference in the management of the three thematic groups provided that they are compiled and published by the same institution. In Hungary, the Slovak Republic and Slovenia the maps are possessed by different organisations. In Hungary an agreement will shortly be signed by the Geological Institute of Hungary and the Water directorate on bilateral free access to geological and hydrogeological maps available in the two institutions. There is not any appointed institute responsible for the compilation and publication of hydrogeological maps in Holland. Several institutions possess different, mostly geological maps accessible in the Internet with much less share of hydrogeological maps.

There are a considerably high number of printed paper maps available in each participating country that can be supplied upon request for payment. In some countries, like Hungary, Sweden, the Czech Republic and Lithuania some hydrogeological maps can be obtained digitally notwithstanding that they are not available on the web. Moreover, in Lithuania it is necessary to pay for the service i. e. for the processing of digital data sets even if the maps are free. In the Slovak Republic though hydrogeological maps cannot be accessed in the Internet but they can be ordered of a pricelist on the web. In France the web-based application of hydrogeological maps is under development, the related maps will be available via web in the near future. The hydrological Atlas of Austria is available in printed format including a CD. Every user have to buy the entire hydrological atlas.

Some of the maps can be accessed free in Italy, Spain and Austria. The same applies in the Czech Republic but in raster format. A rather small segment of digitally available hydrogeological maps can be accessed in the Internet in Hungary. The other ones can be delivered upon special order for payment.

In Holland in line with the above described manner the use of the Internet database is charged, whereas the proper maps are free.

10 Metadatabases

According to our inquiry, of the 12 interviewed countries some 8 (Spain, Sweden, Holland, Denmark, the Czech Republic, the Slovak Republic, France and Slovenia) process a metadatabase of hydrogeological databases managed by the geological survey in each country. All types of hydrogeological data reviewed in this report are included in the metadatabases of each country except for the Slovak Republic where it is restricted to well data. Except for Sweden the metadatabases can mostly be accessed on the web though in Holland it will be realised only in the near future. Of the reported metadatabases direct link to the proper databases exists only in Spain and the Czech Republic (Annex 1. Fig.7.).

11 Relationship between the organizations and data flow in the different countries

In this point that can be regarded as the focal part of the report a summarising description is given of the institutions responsible for the collection, storage and publication of hydrogeological data and their relationships concerning data flow and service in each participating country. This summary is followed by a conclusion, short bibliography and



references and, finally, with some tables and figures in the end throwing some more light on the relationships in the data management procedures.

Table 1 represents the availability of the specified data types in the different participating countries on national level. The dark-blue colour presents that the related data type is available on national level, the notes in the cells refer to some inhomogeneities in data collection and/or storage. Light shades indicate that the related data type is not registered on national level.

Figures 1-4 illustrate the distribution of the responsibilities between different organisations in the participating countries concerning the management of different types of hydrogeological data. Emphasis was put on differentiating between geological organisations represented by the participating parties in this eWater project and other non-geological authorities. Countries displayed by light-brown colour in the well and exploitation management maps could not be assigned to any of those two categories upon the data that were put at our disposal.

Finally, figure 5 is actually a set of charts representing the relationships between the organisations responsible for or engaged in hydrogeological data management in each participating country.

Data service

There are quite a number of institutions in each participating country which conduct activities bringing about hydrogeological data. These activities include field survey, drilling of boreholes, monitoring work, compilation of maps, etc.). Consequently, the related data can be provided by drilling companies, waterworks, local and regional authorities, municipalities, private companies and research institutes.

Data collection, -storage and -publication

According to the review we made in the previous chapters collection, storage and publication of the data varies country by country. In the following passage we characterise data flow within each country.

11.1 The Netherlands

The institutions possessing hydrogeological data are provincial water boards, the regional authorities and the Geological Survey of Holland (TNO).

Each data type is collected on local, regional and national levels. Regional data collecting organisations (water boards in provinces) deliver data in the frame of obligatory data supply to the institution (TNO) managing the national database (DINO). There is free access to the national database via web.

TNO disseminates the data it manages - insofar as these are not deemed, temporarily, confidential by their suppliers - to any interested parties, public, semi-public and private individuals. TNO charges only for the cost of disseminating these data without any profit mark-up. A distinction is made between private individual users and commercial users in regard to the data made available by TNO over the Internet. TNO does not charge private



individual users for the provision of data over the Internet; this also applies to university researchers who use the data in conjunction with fundamental geoscientific research and for instructors who use the data for the purpose of knowledge transfer. TNO charges commercial users a dissemination fee for providing them with data over the Internet. In the pricing policy two size categories have been established, each of which has a maximum annual limit in regard to the number of data to be provided. There is also a maximum placed on the number of data that can be provided in a single request. However there is no limitation for the number of times, one can access the system. Theoretically there are several kinds of data to which any requesting party can gain immediate access free of charge. These free data are Metadata (data about data, such as summaries, tables, catalogues, etc.), where the level of detail determines the degree to which these data are immediately and openly accessible, Demodata (intended to give the requesting party an idea of what the data consist of) that can vary according to the application / type of data, and Maps (maps and 3D models) of the deep Dutch subsurface and the natural resources found there, up to a scale of 1:100.000, in a standard atlas layout. In certain situations, arrangements can be made with customers who are also major suppliers of information. The costs for these arrangements are considered costs for collecting data. The arrangements concern the 'domain' in which the supply of data takes place and are established by the management at the Institute level.

Hydrogeological maps are compiled by various organisations. There is no appointed organisation responsible for the publication of maps; they are published by several institutions e.g. DINO / TNO. The list of available geological maps (no hydrogeological maps) is published at DINO portal (at free of charge zone). The maps can be ordered by e-mail in print or digital form, depending on their availability. (www.dinoloket.nl and several other web portals).

A metadatabase has been set up of the databases including all hydrogeological data types (wells, monitoring, water heads and administrative data). For the time being it is not accessible for external users but it will be in the near future. It does not have a direct link to the databases proper.

11.2 Austria

The institutions possessing hydrogeological data include the Federal State – Water Management Department, Hydrographisches Zentralbüro, Umweltbundesamt, Geologische Bundesanstalt (GBA), Österreichischer Kunst- und Kulturverlag, Vienna, Federal Ministry of Agriculture, Forestry, Environment and Water Management and University of Natural Resources and Applied Life Sciences, Vienna.

In Austria national database of well and exploitation data is missing, whereas monitoring data are directly put in a national database. The institutions responsible for the monitoring data of groundwater heads and groundwater quality are the Hydrographisches Zentralbüro and the Umweltbundesamt, respectively. There is free access to the related data over the Internet. On the pages of the water heads data (<http://geoinfo.lfrz.at/website/egisroot/services/ehyd/viewer.htm>) and hydrochemical recordings (<http://gis.umweltbundesamt.at/austria/wasser/Default.faces>) some images of clipped maps and attribute tables to the selected objects are also available. Data can also be delivered on special request.



Hydrogeological maps are compiled and disseminated by various organisations. The Österreichischer Kunst- und Kulturverlag of Vienna, the Federal Ministry of Agriculture, Forestry, Environment and Water Management as well as the University of Natural Resources and Applied Life Sciences of Vienna take part in collecting and disseminating both hydrochemical and groundwater heads maps. Both printed and digital versions of the maps exist as part of the Hydrogeological Atlas of Austria (Hydrologischer Atlas Österreichs) including a CD. It is published by the Österreichischer Kunst- und Kulturverlag of Vienna. The Atlas is in German and English languages. It is not allowed to publish the maps in the Internet.

Other hydrogeological maps are prepared and published by the Geologische Bundesanstalt. They are available in both printed and digital formats and can be found on the Internet as well (<http://www.geologie.ac.at/>). Data can also be delivered on special demand.

There is no metadatabase of the databases.

11.3 Italy

The organisations possessing hydrogeological data encompass regional agencies like the Regional Agency of Emilia-Romagna Region, regional agencies for the environment and national institutions and companies like the National Agency for Environment, and ENI&AGIP SPA – an oil company.

We have information about the management of hydrogeological data in Italy only from the region of Emilia-Romagna. In the Emilia-Romagna region with the exception of exploitation data all data types are collected on local, regional and national levels. The most important organisations responsible for data gathering are regional agencies of environment. Local data are collected by their local agencies, whereas the National Agency for Environment is charged with the management of the national database (SISTEMA 152). Data collecting organisations of various levels transmit the data in the frame of obligatory data supply. Their availability is ensured by the regional offices. Quite a number of technical reports are accessible in printed format that can be supplied on special written order. There is free access to the data via web following simple registration (www.arpa.emr.it/acquarer).

Water exploitation data are collected by regional offices. They are managed in a separate database. Exploitation data are supplied on special written order free of charge in print or in Excel tables without personal data (owner, address, etc.).

Hydrogeological maps are managed also by regional organisations. The maps are available chiefly in printed version for payment. Some of them are accessible however in the Internet (www.regione.emilia-romagna/geologia).

There is no metadatabase of the databases.

11.4 Slovenia

The institutions possessing hydrogeological data involve the Geological Survey of Slovenia, the Environmental Agency of the Republic of Slovenia, the Ministry of



Environment and Spatial Planning and the Surveying and Mapping Authority of the Republic of Slovenia.

Collecting of all data types is restricted to national level structured in a national database. Well- and exploitation data are gathered and managed by the Geological Survey of Slovenia. The data are not public.

The Environmental Agency of the Republic of Slovenia is responsible for the monitoring data. Groundwater heads data are provided on special written request on CD. Payment is required only for the service. Hydrochemical data are available in both printed version and on the Internet but the user can access only reports of summarised data (http://www.arso.gov.si/podro~cja/vode/poro~cila_in_publicacije/podzemne_letna.html).

Both of the aforementioned institutions deal with the compilation and dissemination of hydrogeological maps. They are in the responsibility of the Environmental Agency of the Republic of Slovenia. The maps can be accessed in the Internet (http://www.arso.gov.si/podro~cja/vode/poro~cila_in_publicacije). The maps of groundwater heads and other hydrogeological maps are in charge of the Geological Survey of Slovenia. They are available in both printed and digital versions and they can be accessed in the Internet. Digital maps can be procured on CD against a fee for data service.

A metadatabase has been set up of the database managed by the Ministry of Environment and Spatial Planning and the Surveying and Mapping Authority of the Republic of Slovenia. Information are provided over all data types (well data, exploitation data, monitoring data of groundwater heads, monitoring data of groundwater quality, hydrogeological map, vulnerability map, infiltration rate map) but there is not direct link to the databases proper. The metadatabase is displayed on the Internet (<http://www.geodetska-uprava.si/gu/aplik/CEPP/index.jsp>, http://www.geodetska-uprava.si/Gu_eng/applic/cepp/cepp.asp, http://www.geo-zs.si/slo-text/digitalne_karte.htm).

11.5 Denmark

The institution possessing hydrogeological data is the Geological Survey of Denmark. (in Denmark).

The collection of all data types (well- exploitation- and monitoring data) proceeds on local level which are then delivered to the Geological Survey of Denmark in the frame of obligatory data supply. It is also the geological survey that is responsible for both national data collection and the national database. The latter is free (JUPITER) and available for everybody via web.

Hydrogeological maps are prepared by the Geological Survey of Denmark commonly on special commission. They are available in limited number in printed and in digital raster format.

It is also the Geological Survey of Denmark which is responsible for the national metadatabase of the hydrogeological databases. It incorporates all data types and is available in the Internet.



11.6 Spain

The institutions possessing hydrogeological data embrace the River Basin Authorities, the Direction General of Water, and the Instituto Geologico Y Minero De Espana (IGME).

Well data are managed in harmonised manner in Spain as well. Data are gathered on regional level by the River Basin Authorities and Regional Offices of IGME, where the data are directly imported in the national database. Between 1970 and 2001 IGME was the organisation responsible for well data collection in Spain (SIAS database). Nowadays, since 2002 the Direction General of Water and the River Basin Authorities (from the Ministry of Environment) are responsible for well data collection. At present the two databases exist simultaneously and separately in charge of the Ministry of Environment and IGME. The data can be accessed free on the Internet (www.igme.es, and www.mma.es). Data in the database of the Ministry of Environment can only be viewed but not downloaded, whereas IGME puts a limit on the amount of data that can be downloaded free. A fee is charged for large data volumes or data for commercial use.

Similarly to well data, exploitation data were collected on regional level by IGME until 2001 overtaken by the Direction General of Water and the River Basin Authorities (of the Ministry of Environment) since then. Data are directly loaded in the national database. Exploitation data are not free they are accessible only for internal users.

Monitoring data are collected also simultaneously by the two institutions chiefly on regional level. IGME maintains its own monitoring networks associated to R&D projects and provides scientific and technical support to the Direction General of Water in the design and construction of the boreholes belonging to the monitoring network of the Ministry of Environment. The Ministry of Environment and the River Basin Authorities are developing six new projects of monitoring networks in compliance with the requirements of the WFD. Data are loaded directly in the national databases. Concerning groundwater heads only a part of the data of the IGME database is available free, access to the restricted segment can be obtained on special request for payment. Data in the database of the Ministry of Environment can only be viewed on the Internet but they cannot be downloaded. Groundwater quality data are supplied by the River Basin Authorities. They are available via web (e. g. Ebro River Basin Authority: http://oph.chebro.es/DOCUMENTACION/Calidad/pa3_4.htm, Duero River Basin Authority: <http://www.chduero.es/Webcorp/Calidad/subterra.htm>). The format of the data accessible on the Internet varies according to the specific River Basin Authority. The Ebro River Basin Authority allows for downloading chemical data in PDF format and print screen. The Duero River Basin Authority allows for downloading chemical data in XLS format and print screen. IGME allows for free access to some of its data in the Internet, whereas access to the restricted segment can be obtained on special request for payment.

Compilation and publication of hydrogeological maps are performed by IGME. Part of the hydrogeological and thematic cartography realized by IGME is in printed format. The printed copies (offset) of all kinds of hydrogeological maps can be ordered at the IGME's publications service. Many of these maps belong to cartographic series; other maps are included in research reports. It is possible to consult all of them in IGME's library. A part of the hydrogeological and thematic cartography realised by IGME is in digital format (vector and raster). These map data are available in the web portal (INGEOES, IGME):



<http://www.igme.es/internet/cartografia/portada/sig.htm>.

Finally, SIAS makes it possible to obtain, via on-line, different hydrogeological and thematic maps. Depending on their needs, the user may decide and design the content and the scale of its own “ad-hoc” maps realised with the layers and information included in SIAS via:

http://www.igme.es/internet/ServiciosMapas/siasweb/sias_general.htm.

IGME manages a metadatabase encompassing its national hydrogeological databases. The metadatabase contains well data and other related characteristics (exploitation data, monitoring data of groundwater levels, monitoring data of groundwater quality, etc.), as well as specific, temporary measurements, and maps. The metadatabase can be accessed on the Internet with special link to some of the databases proper.

11.7 Czech Republic

The organisations possessing hydrogeological data include Geofond, Czech Geological Survey, Czech Hydrometeorological Institute, Water Research Institute and the River basin administration.

In the Czech Republic hydrogeological data derived of different types of activities or projects are managed by different institutions (Geofond, Czech Geological Survey, Czech Hydrometeorological Institute, Water Research Institute). The specific organisations have their proper databases but they closely co-operate. All hydrogeological data are gathered by Geofond in the frame of obligatory data supply according to the Geological Law where they are structured in a national database accessible on the Internet. Data are free but payment is charged as a function of the supplied data volume according to a price list. At the same time water exploitation data are missing.

The Czech Hydrometeorological Institute is responsible for monitoring data concerning the National Monitoring Network including very detailed measurements, interpretation and prognostic processing. Only some of the data are available for the public that can also be found in the database of Geofond. Data of restricted access can be procured on special request to Geofond with the permission of the data owner organisation.

Hydrogeological maps are produced and published by quite a number of organisations including the Czech Geological Survey, Water Research Institute and the Czech Hydrometeorological Institute. The maps are mainly printed. They can be accessed in the related institutions or on their web pages in raster format in compliance with the specific data supply regulation of the organisation. Raster maps can be accessed on the web pages listed below:

<http://heis.vuv.cz/>;

http://nts2.cgu.cz/servlet/page?_pageid=677,687,683&_dad=portal30&_schema=PORTAL30.

The metadatabase set up for the administration of the databases is based on the co-operation of several institutions (Geofond, Czech Geological Survey, Water Research Institute, Czech Hydrometeorological Institute, Ministry of the Environment, CENIA). It contains well and borehole data as well as map series.



11.8 Slovak Republic

The organisations possessing hydrogeological data include the Slovak Agency of Environment, Slovak Geological Survey Division of Geofond, Slovak Geological Survey and the Slovak Hydrometeorological Institute.

Various types of hydrogeological data are managed by different institutions working independently and establishing separate, independent databases, though collection and registration of well- and exploitation data are harmonised on national level with the Slovak Geological Survey Division of Geofond in charge. Data are supplied on special request according to a price list.

Monitoring data are managed by the Slovak Hydrometeorological Institute. The data are not accessible for external users.

Hydrogeological maps are processed by a number of institutions (e.g. Slovak Geological Survey, Slovak Hydrometeorological Institute). Most of them are printed maps that can be procured on special request against a fee.

The metadatabase of hydrogeological databases is processed by the Slovak Geological Survey Division of Geofond. It includes only well data. It can be accessed on the Internet free but lacks a direct link to the databases proper.

11.9 Sweden

The institution possessing hydrogeological data is the Geological Survey of Sweden.

In Sweden all hydrogeologically related data are managed by the Geological Survey of Sweden. Well data are gathered on national level in uniform manner but technical data and well test data are missing. Well data can be regarded on the Internet but the database proper can only be accessed for internal users.

Water exploitation data are not public.

The management of monitoring data varies. Though groundwater heads data are not public but they can be purchased. Hydrochemical data can be accessed and downloaded free via web.

Hydrogeological maps can be purchased in printed format; some of them are available in the Internet (www.sgu.se).

The metadatabase of hydrogeological databases is available only for internal users; it cannot be accessed on the Internet.

11.10 Lithuania

The institute possessing hydrogeological data is the Geological Survey of Lithuania (LGT).

In Lithuania all hydrogeological data and maps are invariably in the possession of the Geological Survey of Lithuania. The data including well-, exploitation- and monitoring



recordings are gathered on national level and managed in a harmonised database (GEOLIS). Simultaneously, their accessibility varies according to the data types.

Well data can be accessed in the Internet but the service is provided for registered users only. There is a special fee – generally a yearly flat rate – for the registration according to a contract related to the use of the service. The data are free. Simultaneously, everybody has free access to the administrative data of wells. Application for Internet access to the wells' hydrochemical data has not yet been developed. They can be procured on written request.

Concerning water exploitation and monitoring information summarized data are published in annual groundwater monitoring bulletins, which is available in PDF format on the Internet (www.lgt.lt). Groundwater exploitation data can be accessed only by internal users for Internet application for external users has not yet been developed. Data can be procured on written request.

Most hydrogeological maps are available in printed format, whereas some of them can be accessed digitally as well. The fee of data service covers material and service costs.

Metadatabase of hydrogeological databases has not yet been developed.

11.11 France

The institutions possessing hydrogeological data incorporate the French Geological Survey (BRGM), regional water agencies and the French Ministry of Environment.

In France no matter of which type, data collection proceeds on local level. Well data are gathered by regional geological surveys. Data are directly loaded in the national database (Banque du Sous-Sol (BSS)). The data are available directly in regional surveys. Each site (well, spring, etc.) has a paper file gathering all information (layers description, pumping tests, chemical analysis, etc.). When visiting directly the regional geological surveys, copies of the file containing the data can be made. Data are available on free web portal (<http://infoterre.brgm.fr/>).

Water exploitation data are gathered by six regional water agencies (Adour-Garonne, Seine-Normandie, Loire-Bretagne, Rhône-Méditerranée et Corse, Rhin-Meuse, Artois-Picardie). They are collected and processed in a national database by the French Ministry for Environment. The data can be obtained in regional offices. Though the format of available data varies, they can be procured free of charge. Sometimes the data are available on the Internet but a written request would always be sufficient.

Monitoring data are collected on local level also by several institutions including public organisations in charge of groundwater monitoring (e.g. regional geological surveys, local authorities of the Ministry for Environment), local authorities (regions or departments interested in groundwater data without any obligations) and local health authorities. The related data are gathered and structured in a database on national level invariably by the French Geological Survey (ADES database). The data can be found and downloaded free from the page <http://www.ades.eaufrance.fr/>. There is only one restricted site (open and free for every water professional after filing a form) <http://bdes.brgm.fr/>. Data from this site can also be freely downloaded. The only difference between the two sites is that on the latter the exact coordinates of chemical



monitoring sites are also available, whereas on the public website, only approximate coordinates (city's church) are reported.

Hydrogeological maps are produced by the French Geological Survey in the frame of projects, if needed or upon commission. The documentation center of BRGM is also gathering existing hydrogeological maps that are registered in the relevant database. Currently, most of the related maps are printed but some of them are available digitally as well. For the time being they cannot be accessed on the Internet but this situation will change soon.

A metadatabase has been developed over the hydrogeological databases (SANDRE) which is also available in the Internet (<http://sandre.eaufrance.fr/>).

11.12 Hungary

The following is a list of organisations possessing hydrogeological data: regional water authorities, regional nature, environment protection and water inspectorates, Water Directorate, Ministry of Environment and Water, Geological Institute of Hungary, Environmental Protection and Water Management Research Institute.

In Hungary different types of well data are managed in uniform manner. On local level they are collected by local communes and municipalities, regionally by regional water directorates as well as nature, environment protection and water inspectorates, whereas on national level this task is performed by the Water Directorate, Water Management Research Institute and Geological Institute of Hungary. Data transfer between different collection levels proceeds according to obligatory data supply. Well data on national level are gathered simultaneously by several organisations resulting in several parallel databases. There is a continuous, systematic co-operation and data exchange between the institutions. National databases are available for internal users only. External users can request data directly of regional authorities. Data are free but a fee is charged according to the mode of the service.

Water exploitation data are collected on regional level by regional water directorates and regional nature, environment protection and water inspectorates. Data storage conditions can vary according to the regions. As a result of obligatory data supply the related data are processed in a national database by the Water Directorate. The database is not public.

Monitoring data of groundwater heads are collected by regional water directorates and the Geological Institute of Hungary. Regional water directorates transmit the data to the Water Directorate, the latter harmonising and structuring them into the national database. Recordings in the monitoring network of the Geological Institute of Hungary are processed directly in the Institute's national database. All monitoring data are published in print in the Hydrogeological Annual with a CD annex. The annual can be procured for a fee set yearly by the Water Management Research Institute. The database of the Water Directorate can be accessed via web (www.vizadat.hu), but the volume of downloadable data is restricted. Upon special request the data can directly be delivered by regional water directorates against a fee charged for the service. The Geological Institute of Hungary supplies its data directly on special request under individually specified conditions.



Hydrogeological maps are compiled by several institutions including research institutes, regional and national authorities and private companies. The maps are mostly commissioned in the frame of specific projects. Their publicity is regulated by the contracting party. A number of commissions are financed by the Water Directorate and the Ministry for Environment. Maps commissioned or financed by them are gathered in a specific map server that can be accessed however for internal users only. The maps of some projects can also be accessed on the Internet, mostly on the project's web page. Hydrogeological maps are compiled and published also by the Geological Institute of Hungary. Most of them are available only in print. Up until now only a small fragment of them has been made available on the web (www.mafi.hu). Printed maps can be purchased according to a price list, digital maps are provided under individually specified conditions.

A metadatabase of the hydrogeological databases has not yet been developed.

End users

Hydrogeological data are applied by a very large user community of the whole population as well as professionals and institutions of similar profile including research institutes, waterworks, drilling companies, private companies, local governments in provinces and municipalities, ministries, local and regional authorities, universities, etc.

12 Conclusion

Making use of the evaluation and analysis of questionnaires sent for and then returned after filling by the partners representing participating countries in the project an attempt has been made to classify data management methods of different countries according to data types. Though certain similarities do occur it has to be stressed that each country follows specific data management practices. Nevertheless, national databases existing in each participant country provide a strong foundation for the eWater project. Apart from it partner geological institutes should take charge of insuring direct or indirect access to free hydrogeological data, databases and metadatabases for the purposes of the project in each country. The scope and mode of availability of data vary however country by country, a fact that should be considered at the design phase (WP7). The mode of access following registration also varies according to the respective country. Harmonisation of different national price policies concerning well data dissemination or harmonisation of the data themselves are beyond the target of the project. However these aspects should be considered while designing data service. These problems become even more emphasised in the case of hydrogeological maps. To mention only some of them, it occurs quite frequently that there is not any designated institution charged with their publication; map databases, or map servers are still missing or they are implemented in several institutions; the maps have to be searched for on the web pages of several different institutions, etc.

It is thus suggested to specify the designation of the databases providing the foundation for setting up the eWater portal as a special task in the frame of WP7 of the project. It is therefore also suggested to set up a metadatabase considering the diversity of data management practices in the participant countries in order to optimise search and delivery of data to an end user.



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Databases:

Banque du Sous-Sol (BSS) : <http://infoterre.brgm.fr/>

ADES : <http://www.ades.eaufrance.fr/>

Maps in Czech Republic:

<http://nts2.cgu.cz/servlet/page?pageid=677,687,683&dad=portal30&schema=PORTAL30>

JUPITER: www.geus.dk/jupiter

GEOLIS: www.lgt.lt

DINO: www.dinoloket.nl

Maps in Austria: <http://www.geologie.ac.at/>

SIAS: <http://www.igme.es/internet/ServiciosMapas/siasweb>

Maps in Italy: www.regione.emilia-romagna/geologia

<http://archiviocartografico.regione.emilia-romagna.it/>

Database of groundwater heads in Hungary: www.vizadat.hu

Maps in Slovenia: <http://kalcedon.geo-zs.si/website/PTGK/viwer.htm>

Metadatabases:

Well description in France:

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Piezometer in France:

http://sandre.eaufrance.fr/dictionnaire.php?id_mot=62&lang=fr

Quality measurements in France:

http://sandre.eaufrance.fr/dictionnaire.php?id_mot=63&lang=fr

Metadatabase of Czech republic - CENIA:

<http://mis.env.cz>

Metadatabase of Denmark:

www.geus.dk/jupiter;

Metadatabase of Netherland:

www.dinoloket.nl

Metadatabase of Spain:

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Annex I

Figures



Table of content

Fig. 1. Organizations responsible for groundwater data.....	28
Fig. 2. Well data management on national level.....	29
Fig. 3. Exploitation data management on national level.....	30
Fig. 4. Monitoring data management - groundwater head data	31
Fig. 5. Monitoring data management - groundwater quality data	32
Fig. 6. Data managenemt of hydrogeological maps	33
Fig. 7. Metadatabase management	34

Organisation of ground water data management in the participating countries

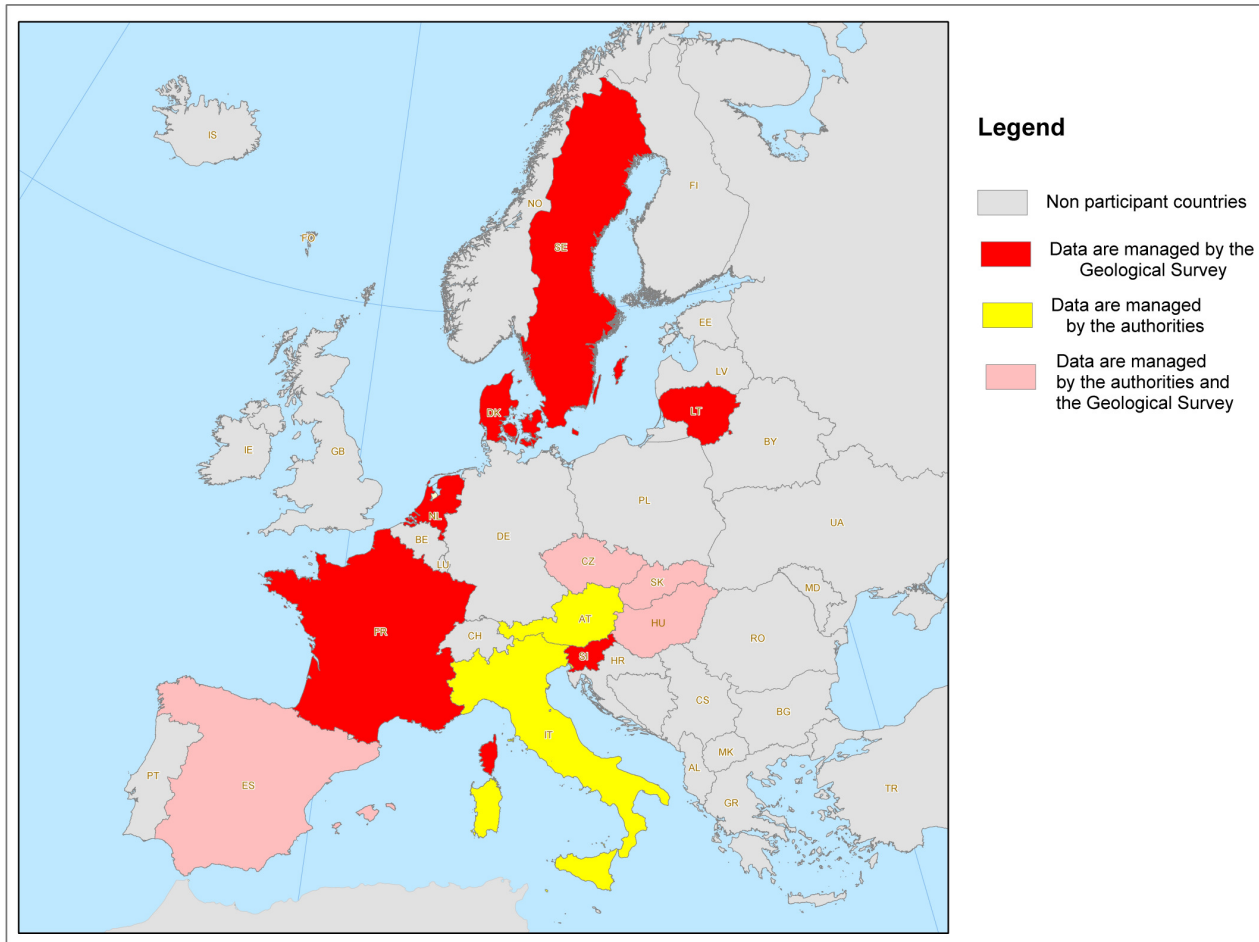


Fig. 1. Organizations responsible for groundwater data
In Italy data refers only for the Emilia-Romagna Region

Organisation of ground water data management in the participating countries

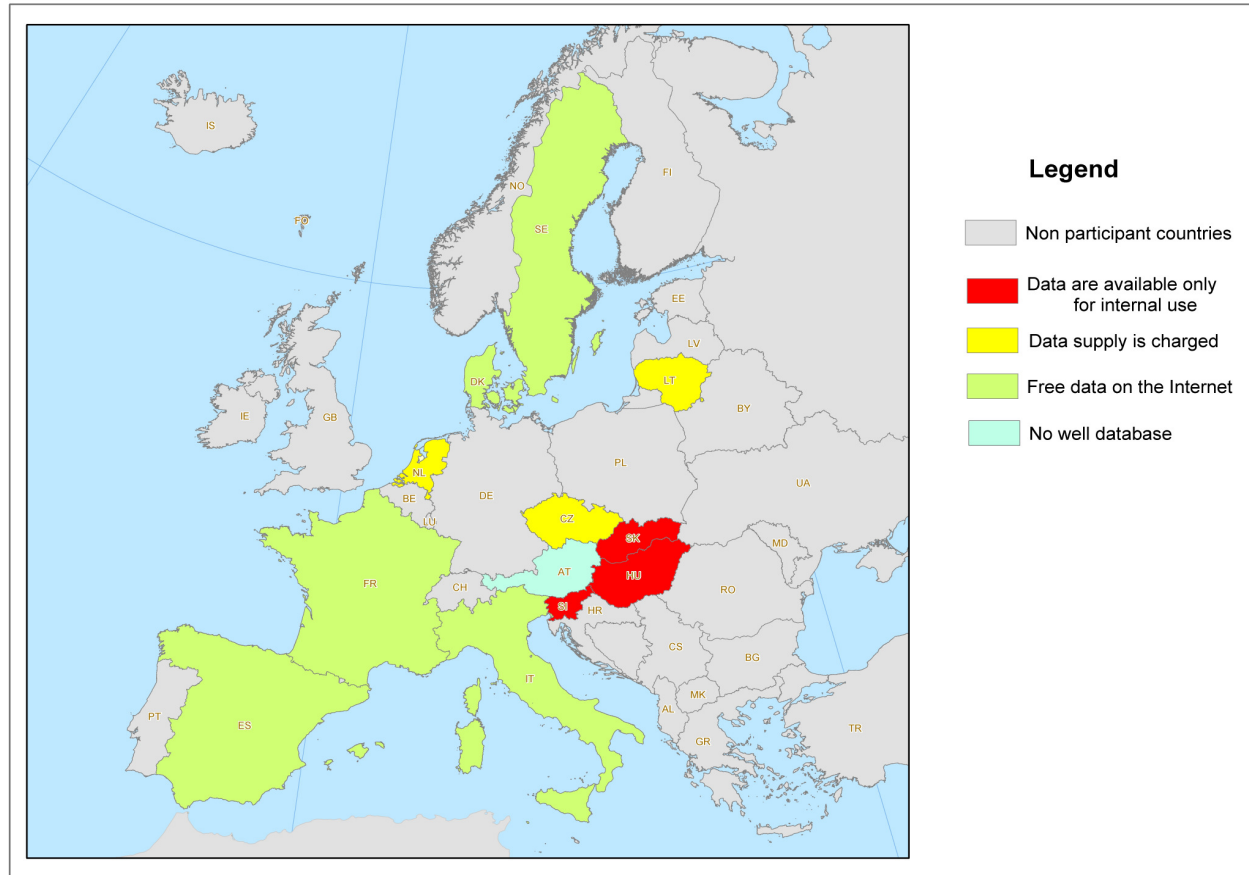


Fig. 2. Well data management on national level
In Italy data refers only for the Emilia-Romagna Region

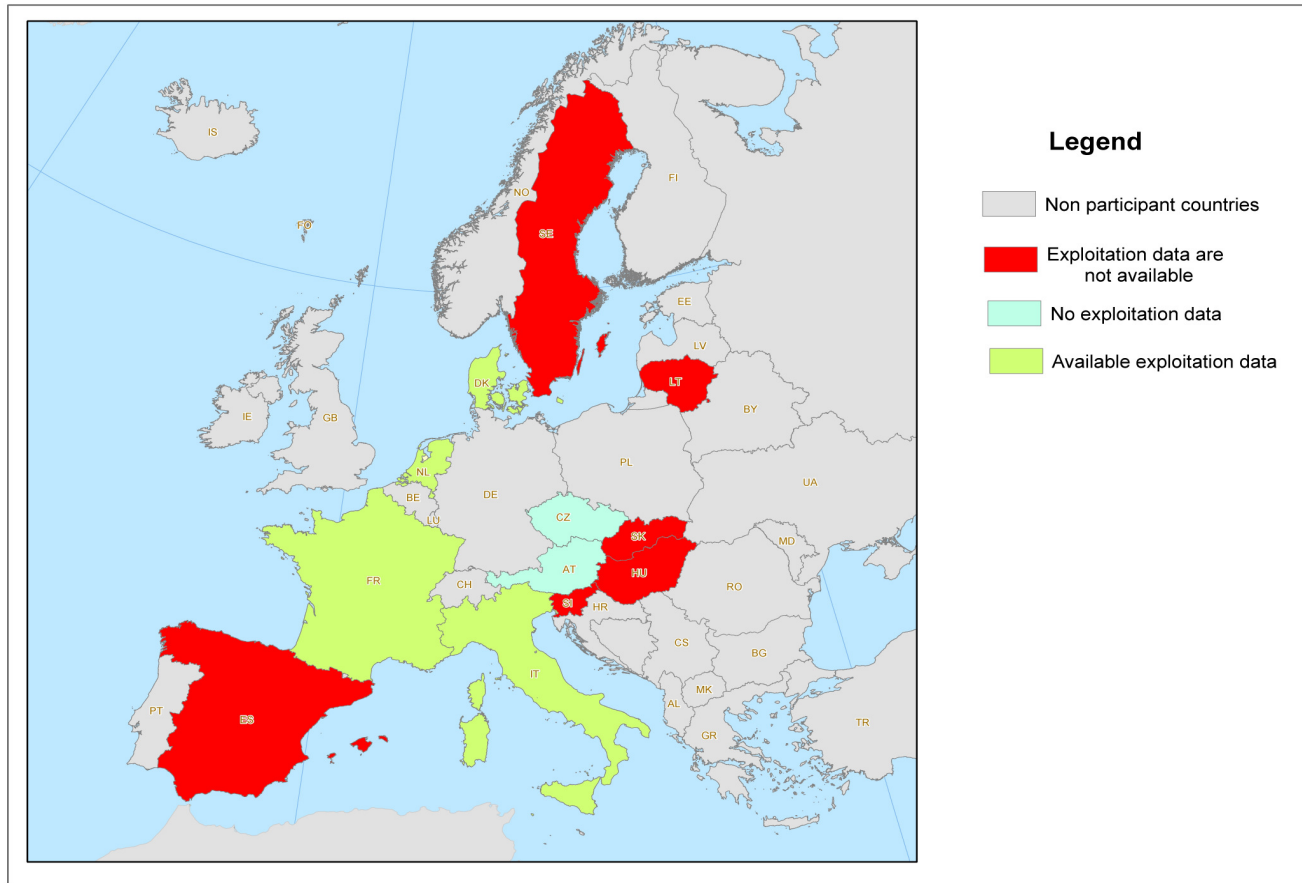


Fig. 3. Exploitation data management on national level
In Italy data refers only for the Emilia-Romagna Region

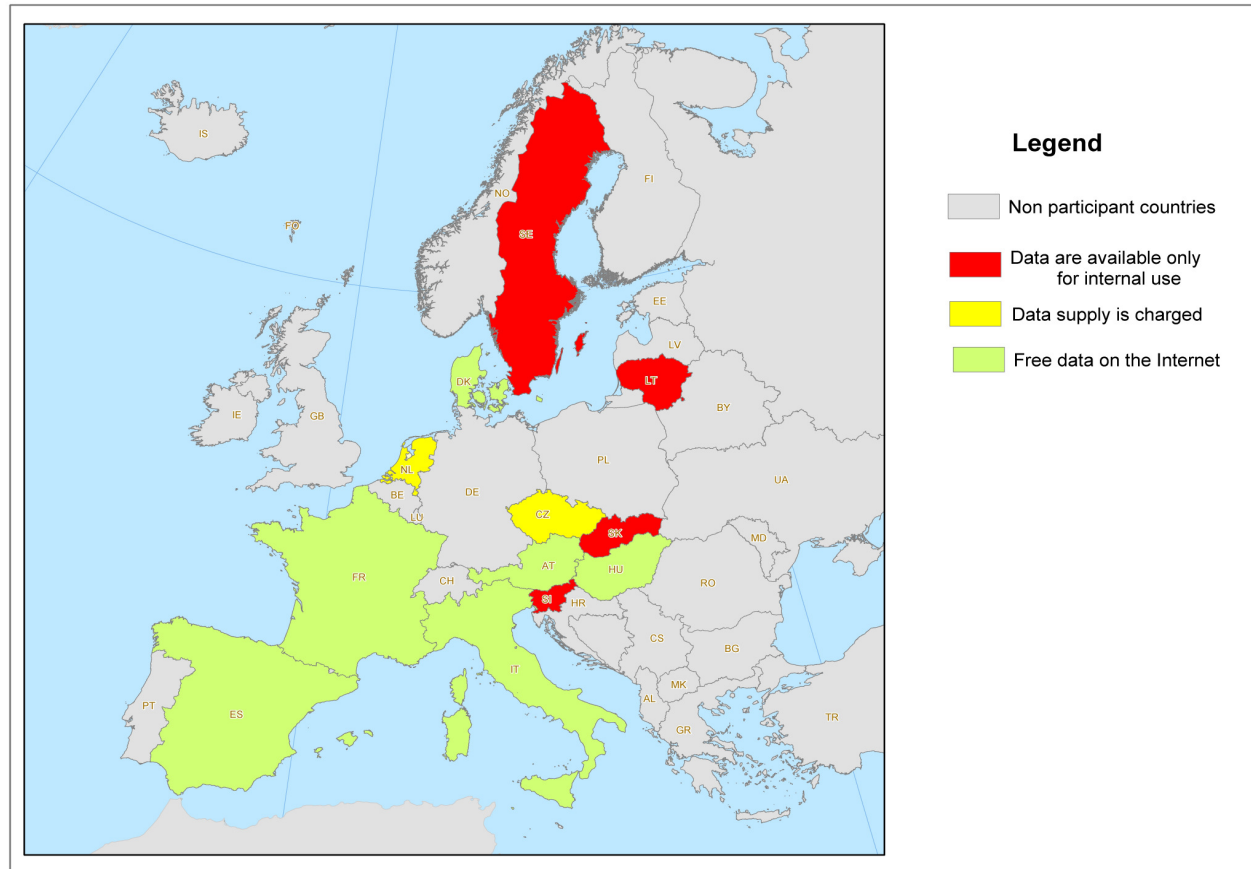


Fig. 4. Monitoring data management - groundwater head data
In Italy data refers only for the Emilia-Romagna Region

Organisation of ground water data management in the participating countries

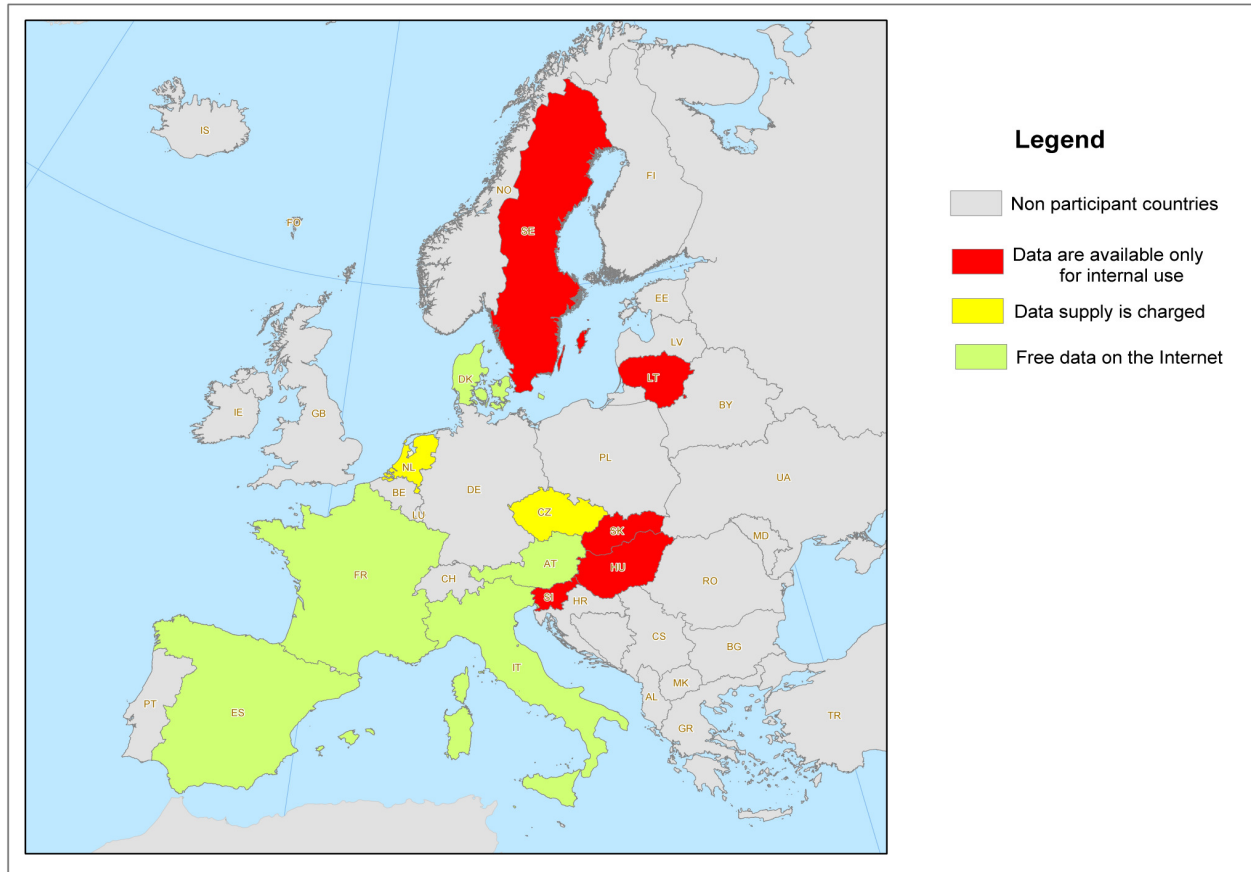


Fig. 5. Monitoring data management - groundwater quality data
In Italy data refers only for the Emilia-Romagna Region

Organisation of ground water data management in the participating countries

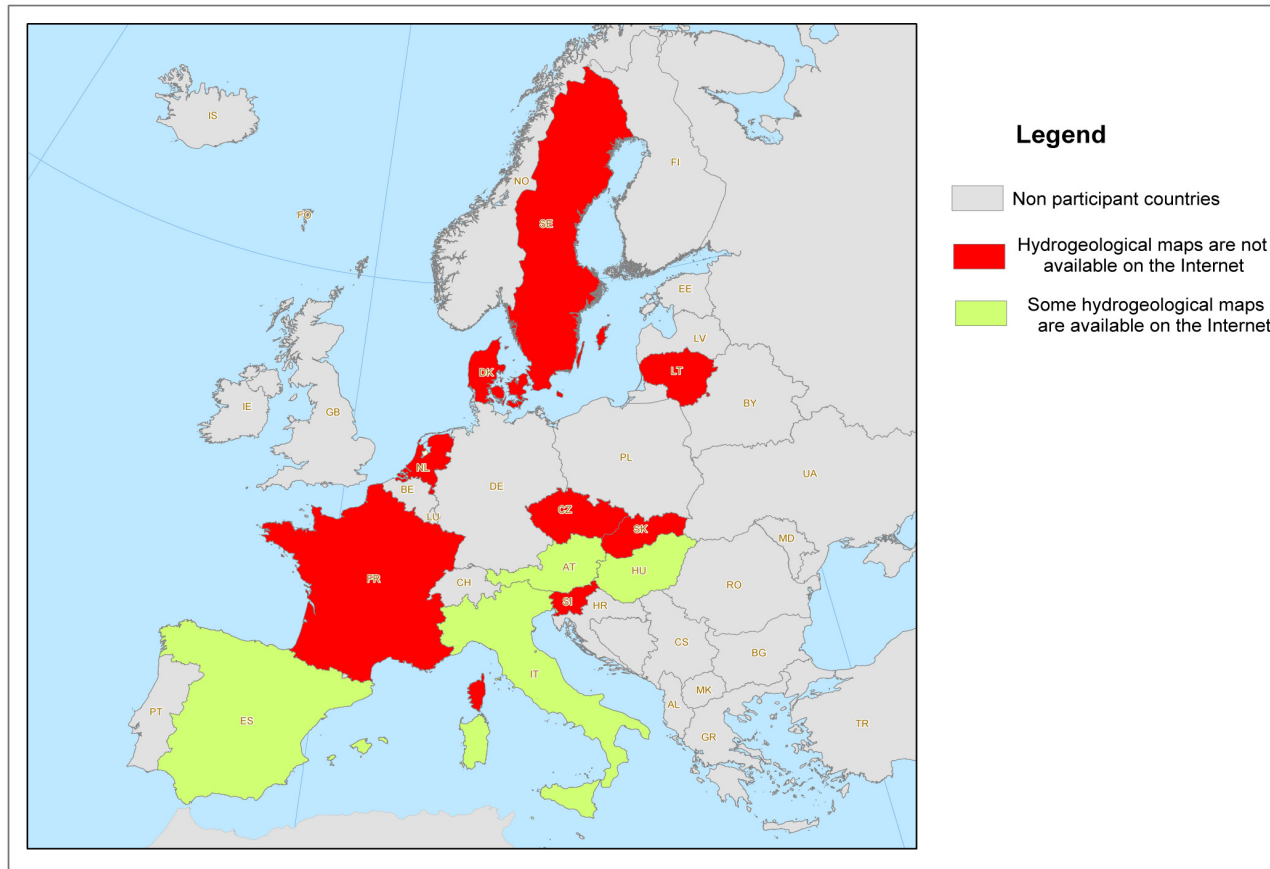


Fig. 6. Data management of hydrogeological maps
In Italy data refers only for the Emilia-Romagna Region

Organisation of ground water data management in the participating countries

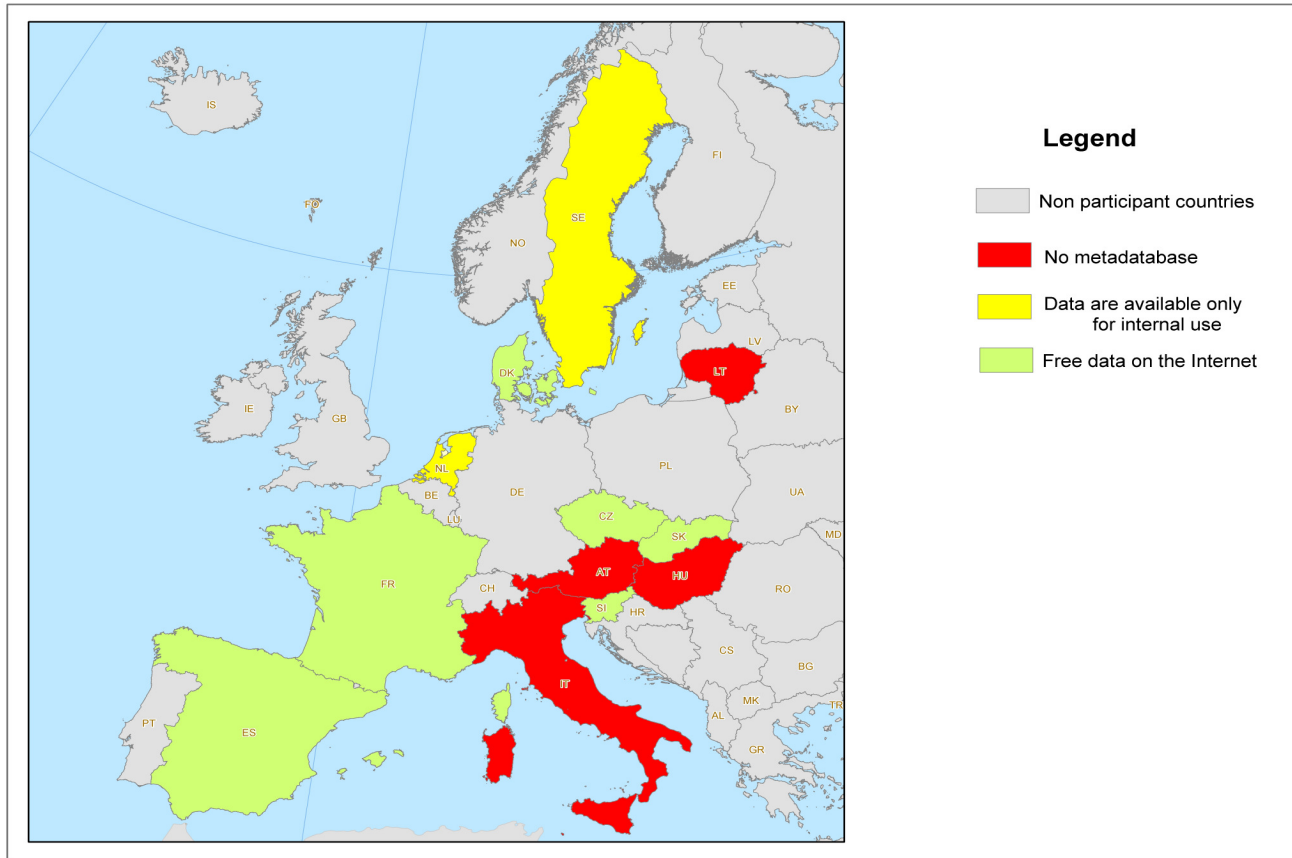


Fig. 7. Metadatabase management
In Italy data refers only for the Emilia-Romagna Region



Annex II.

Tables



Table of content

Table 1. Existing datatypes.....	37
Table 2. Well data management in different levels	38
Table 3. Exploitation data management in different levels.....	38
Table 4. Monitoring data (groundwater head) management in different levels	39
Table 5. Monitoring data (groundwater quality) management in different levels.....	39



Table 1. Existing datatypes

Datatypes	Subgroup of datatypes	Emilia-Romagna Region (Italy)	Lithuania	Spain	Austria	Sweden	Netherlands	Denmark	Czech Republik	Slovak Republic	Hungary	France	Slovenia
Well data	Administrative data												
	Technical data												
	Geologic and geophysical data												
	Well tests												
	Groundwater quality												
Exploitation data													
Monitoring data	groundwater level												
	groundwater quality												
Hydro-geological maps	Maps of groundwater level and potentials												
	Maps of groundwater quality												
	Other hydrogeological maps												



Table 2. Well data management in different levels

		Emilia-Romagna Region (Italy)	Lithuania	Spain	Austria	Sweden	Netherland	Denmark	Czech Republik	Slovak Republic	Hungary	France	Slovenia
well data	local												
	regional												
	national												

Table 3. Exploitation data management in different levels

		Emilia-Romagna Region (Italy)	Lithuania	Spain	Austria	Sweden	Netherland	Denmark	Czech Republik	Slovak Republic	Hungary	France	Slovenia
Exploitation data	local												
	regional												
	national												



Table 4. Monitoring data (groundwater head) management in different levels

			<i>Emilia-Romagna Region (Italy)</i>	<i>Lithuania</i>	<i>Spain</i>	<i>Austria</i>	<i>Sweden</i>	<i>Netherland</i>	<i>Denmark</i>	<i>Czech Republik</i>	<i>Slovak Republic</i>	<i>Hungary</i>	<i>France</i>	<i>Slovenia</i>
Monitoring data	groundwater heads	local												
		regional												
		national												

Table 5. Monitoring data (groundwater quality) management in different levels

			<i>Emilia-Romagna Region (Italy)</i>	<i>Lithuania</i>	<i>Spain</i>	<i>Austria</i>	<i>Sweden</i>	<i>Netherland</i>	<i>Denmark</i>	<i>Czech Republik</i>	<i>Slovak Republic</i>	<i>Hungary</i>	<i>France</i>	<i>Slovenia</i>
Monitoring data	groundwater quality	local												
		regional												
		national												



Annex III.

Flowcharts



Table of content

Fig. 1. Structure of relationships between the most important organizations responsible for hydrogeological data management in the Slovak Republic	42
Fig. 2. Structure of relationships between the most important organizations responsible for hydrogeological data management in Austria	43
Fig. 3. Structure of relationships between the most important organizations responsible for hydrogeological data management in Sweden	44
Fig. 4. Structure of relationships between the most important organizations responsible for hydrogeological data management in The Netherlands	45
Fig. 5. Structure of relationships between the most important organizations responsible for hydrogeological data management in Slovenia	46
Fig. 6. Structure of relationships between the most important organizations responsible for hydrogeological data management in Hungary	47
Fig. 7. Structure of relationships between the most important organizations responsible for hydrogeological data management in the Czech Republic.....	48
Fig. 8. Structure of relationships between the most important organizations responsible for hydrogeological data management in Spain.....	49
Fig. 9. Structure of relationships between the most important organizations responsible for hydrogeological data management in Italy.....	50
Fig. 10. Structure of hydrogeological data flow in the Slovak Republic.....	51
Fig. 11. Structure of hydrogeological data flow in France.....	52
Fig. 12. Structure of hydrogeological data flow in Austria.....	53
Fig. 13. Structure of hydrogeological data flow in Denmark.....	54
Fig. 14. Structure of hydrogeological data flow in The Netherlands	55
Fig. 15. Structure of hydrogeological data flow in Slovenia.....	56
Fig. 16. Structure of hydrogeological data flow in Hungary.....	57
Fig. 17. Structure of hydrogeological data flow in the Czech Republic.....	58
Fig. 18. Structure of hydrogeological data flow in Spain at the IGME	59
Fig. 19. Structure of hydrogeological data flow in Spain at the Ministry of Environment	60
Fig. 20. Structure of hydrogeological data flow in Lithuania	61

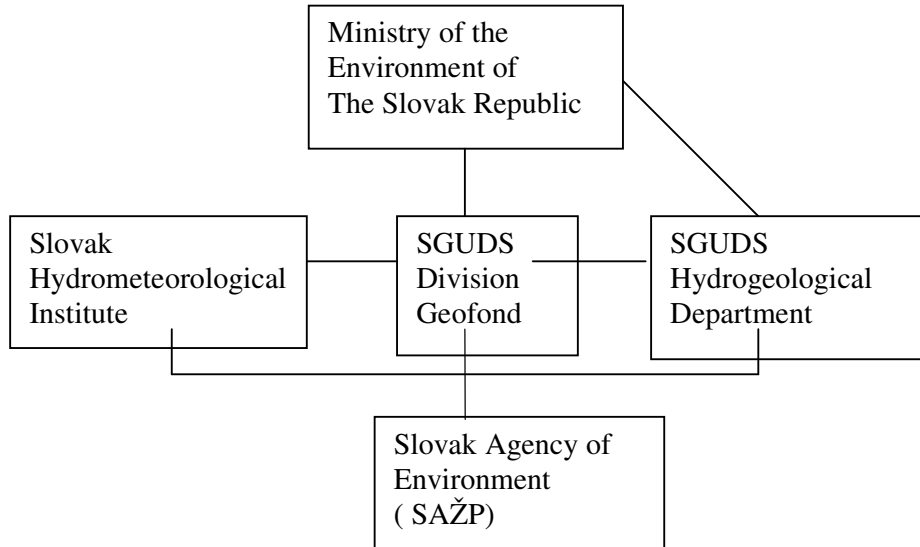


Fig. 1
Structure of relationships between the most important organizations responsible for hydrogeological data management in the Slovak Republic

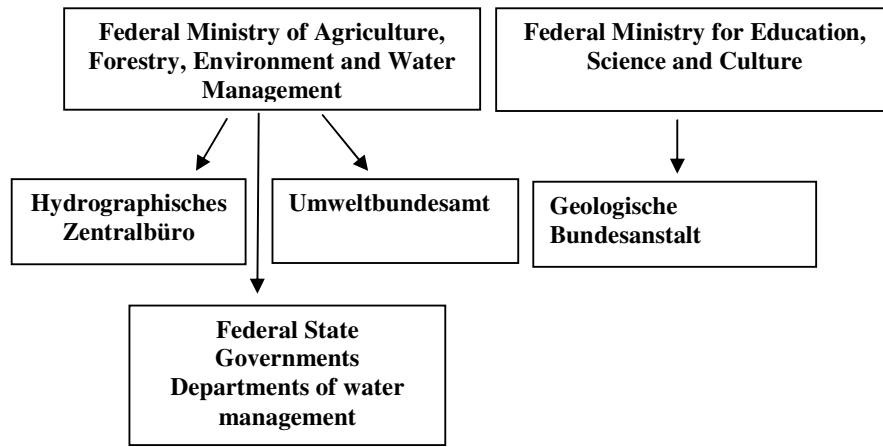


Fig. 2
Structure of relationships between the most important organizations responsible for hydrogeological data management in Austria

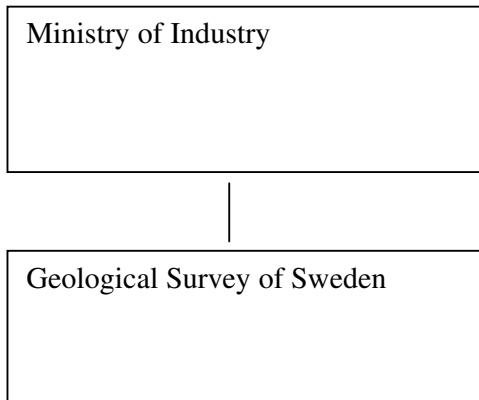


Fig. 3
Structure of relationships between the most important organizations responsible for hydrogeological data management in Sweden

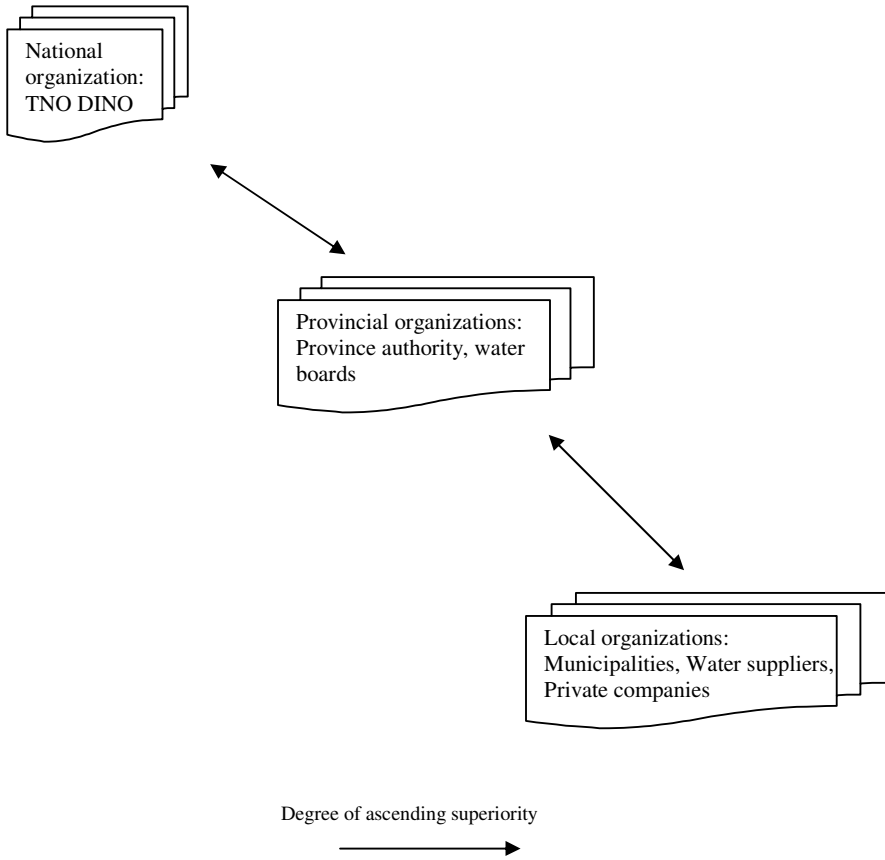


Fig. 4
Structure of relationships between the most important organizations responsible for hydrogeological data management in The Netherlands

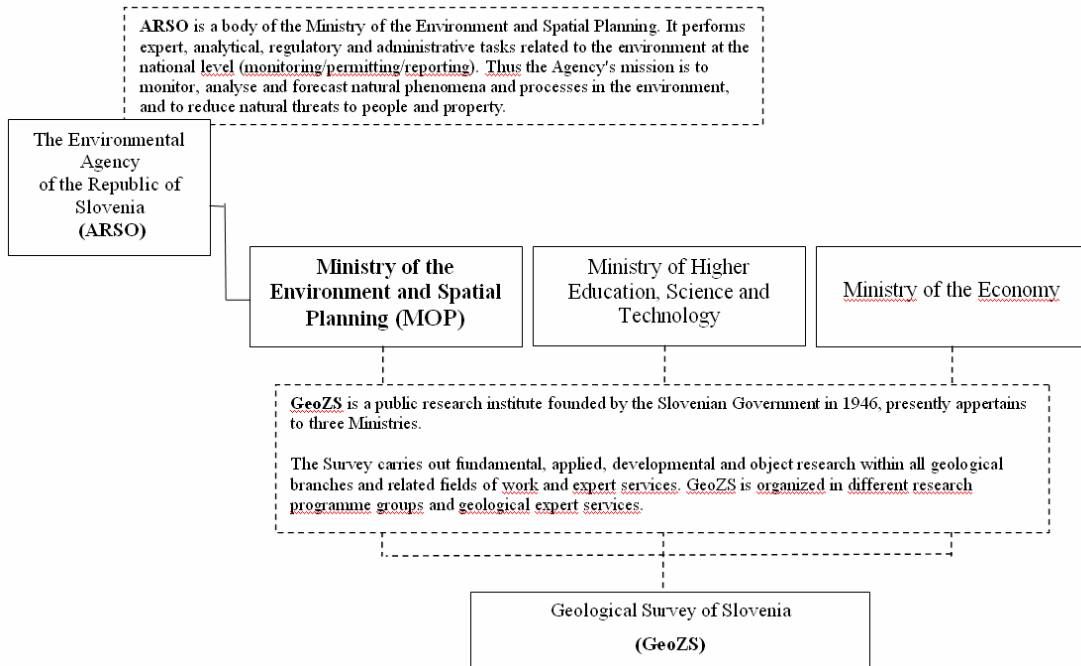


Fig. 5
Structure of relationships between the most important organizations responsible for hydrogeological data management in Slovenia

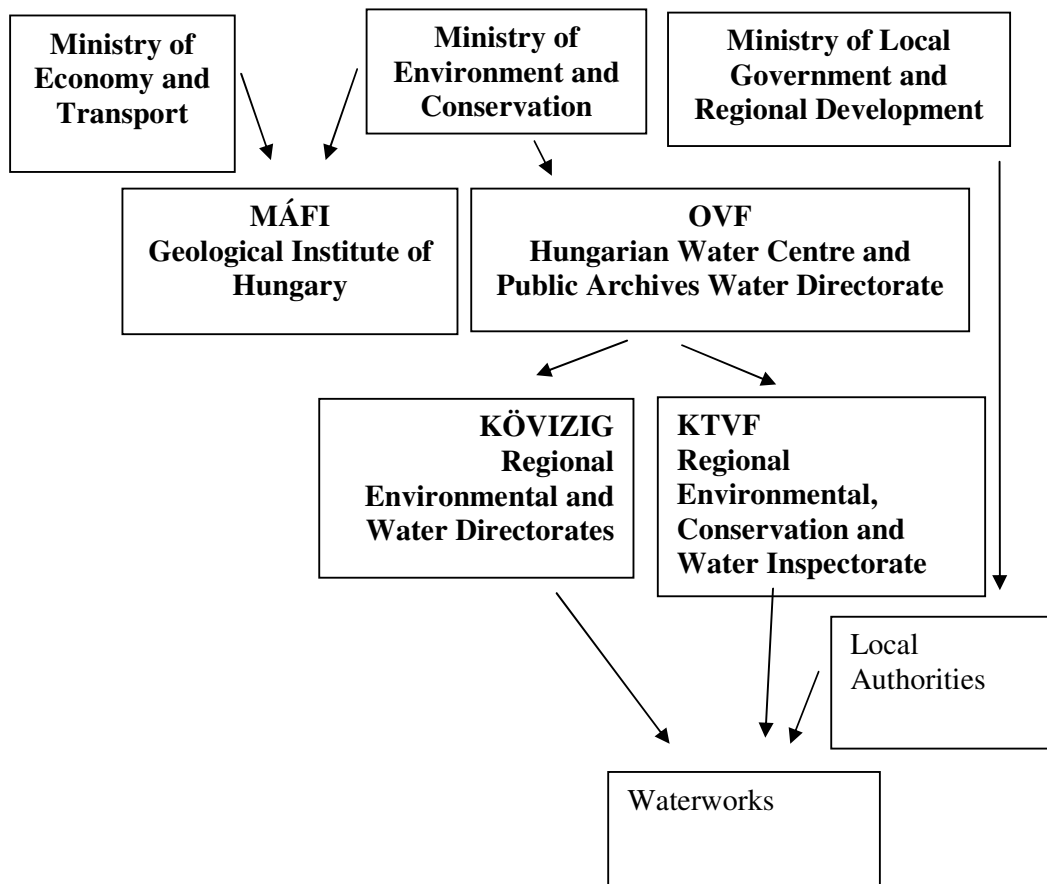


Fig. 6
Structure of relationships between the most important organizations responsible for hydrogeological data management in Hungary

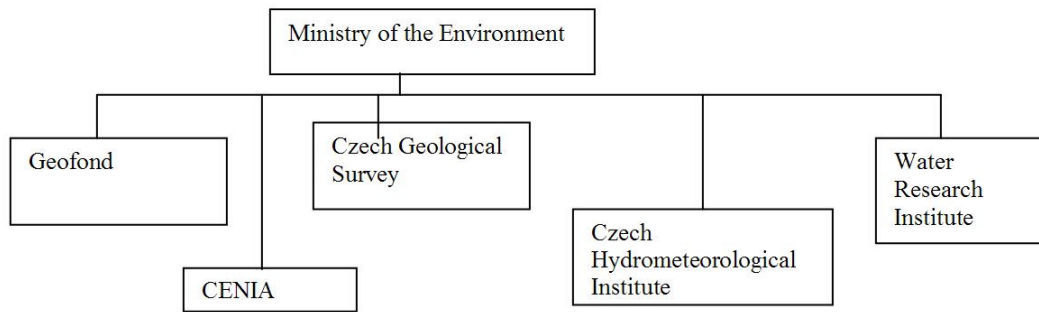


Fig. 7
Structure of relationships between the most important organizations responsible for hydrogeological data management in the Czech Republic

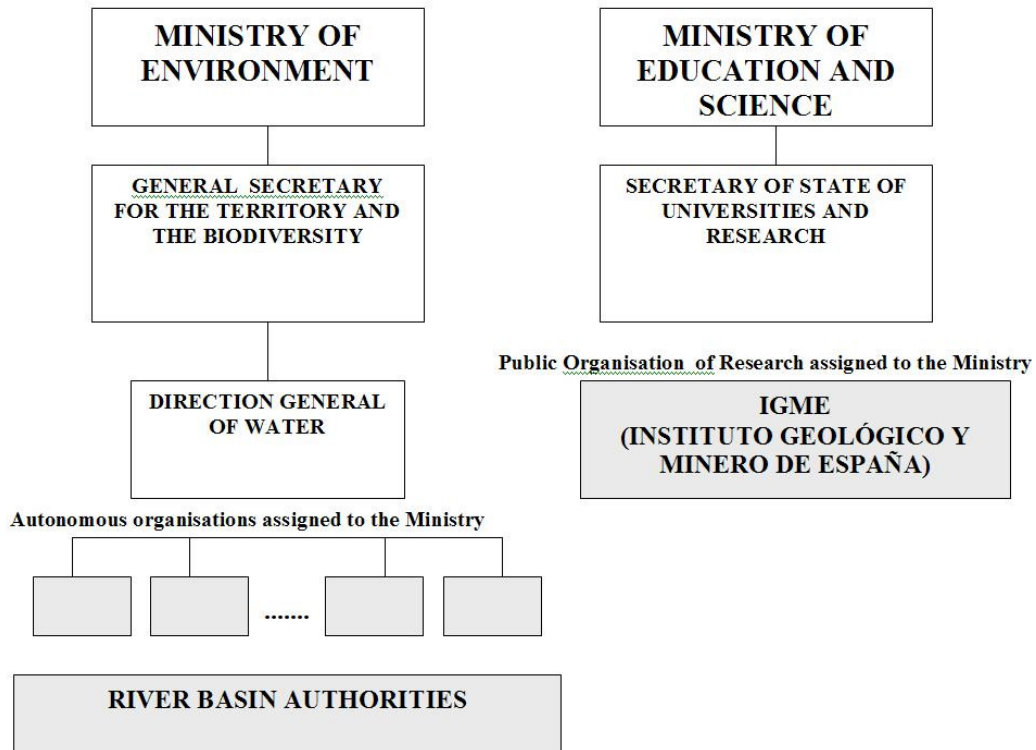


Fig. 8
Structure of relationships between the most important organizations responsible for hydrogeological data management in Spain

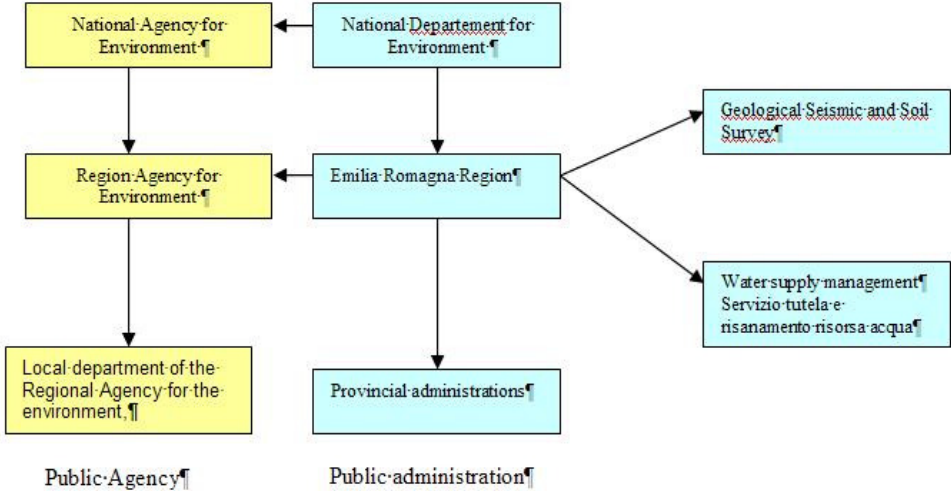


Fig. 9
Structure of relationships between the most important organizations responsible for hydrogeological data management in Italy

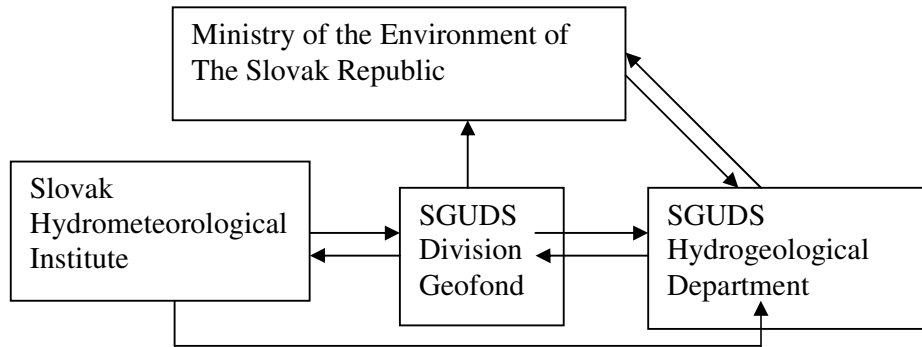


Fig. 10
Structure of hydrogeological data flow in the Slovak Republic



Partners organizations : more than 80 producers

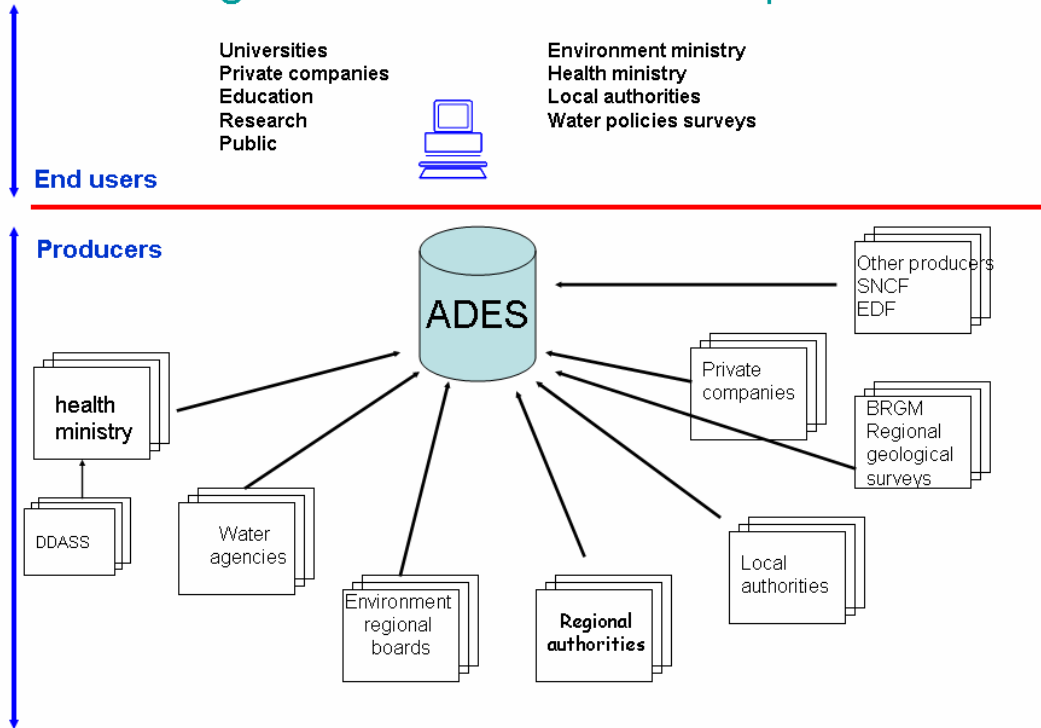


Fig. 11
Structure of hydrogeological data flow in France

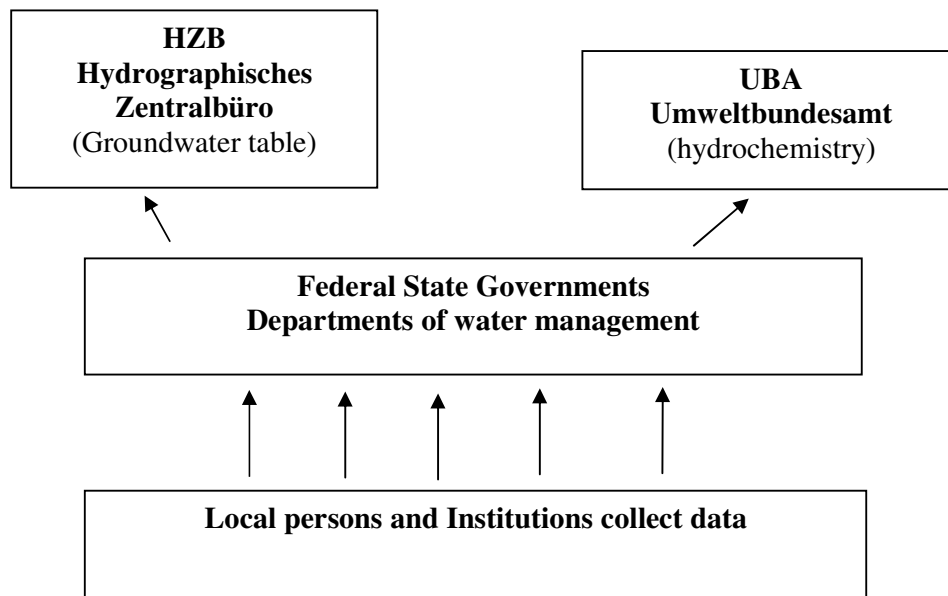


Fig. 12
Structure of hydrogeological data flow in Austria

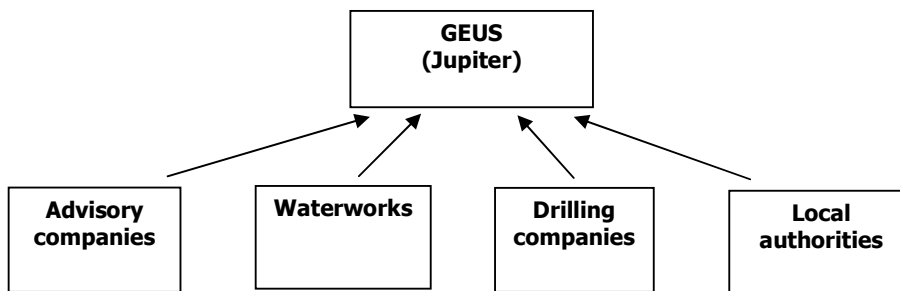


Fig. 13
Structure of hydrogeological data flow in Denmark

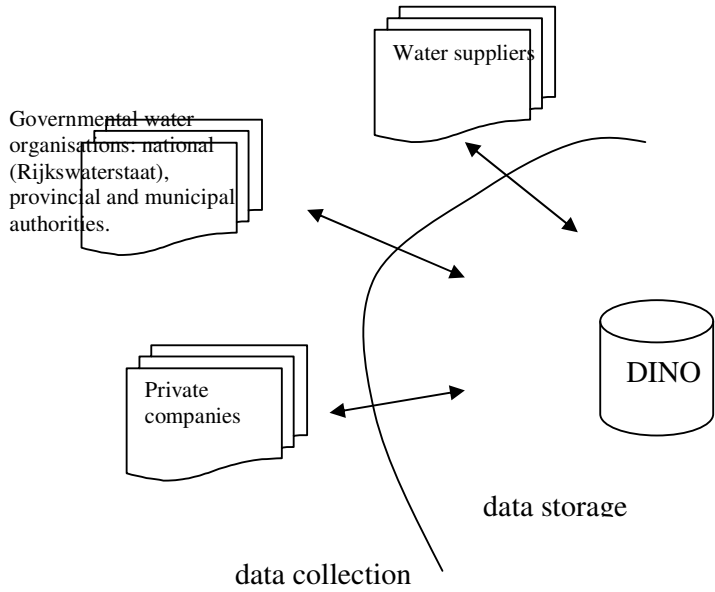


Fig. 14
Structure of hydrogeological data flow in The Netherlands

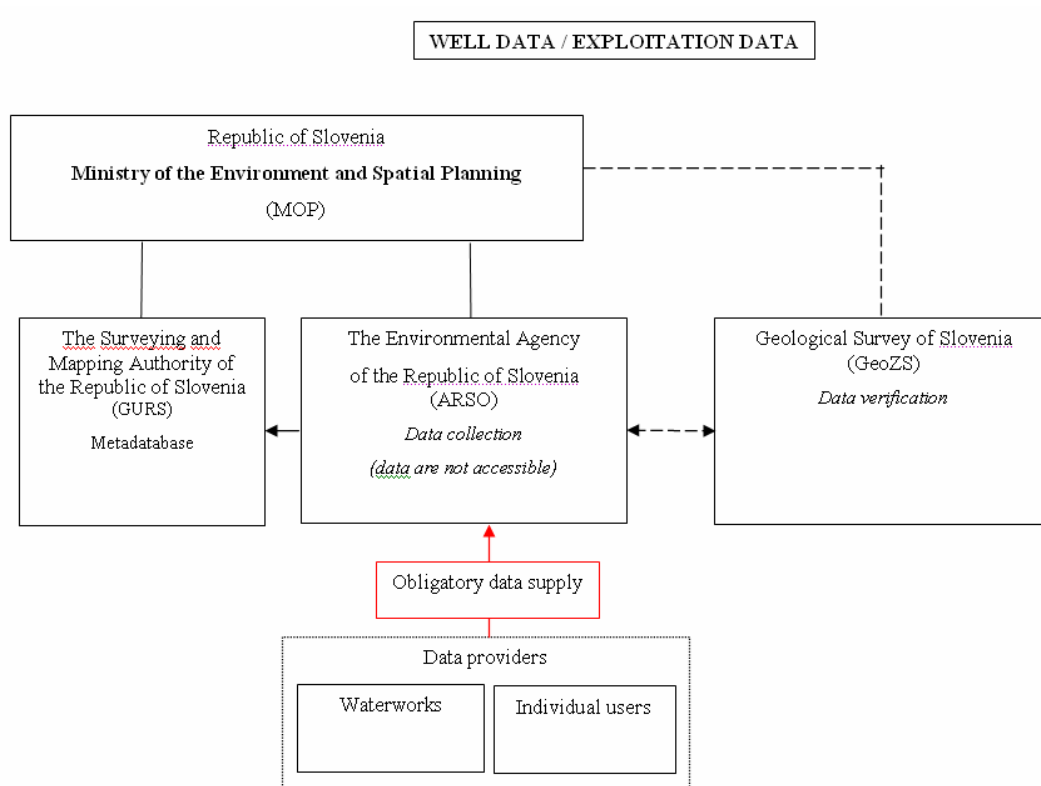


Fig. 15
Structure of hydrogeological data flow in Slovenia

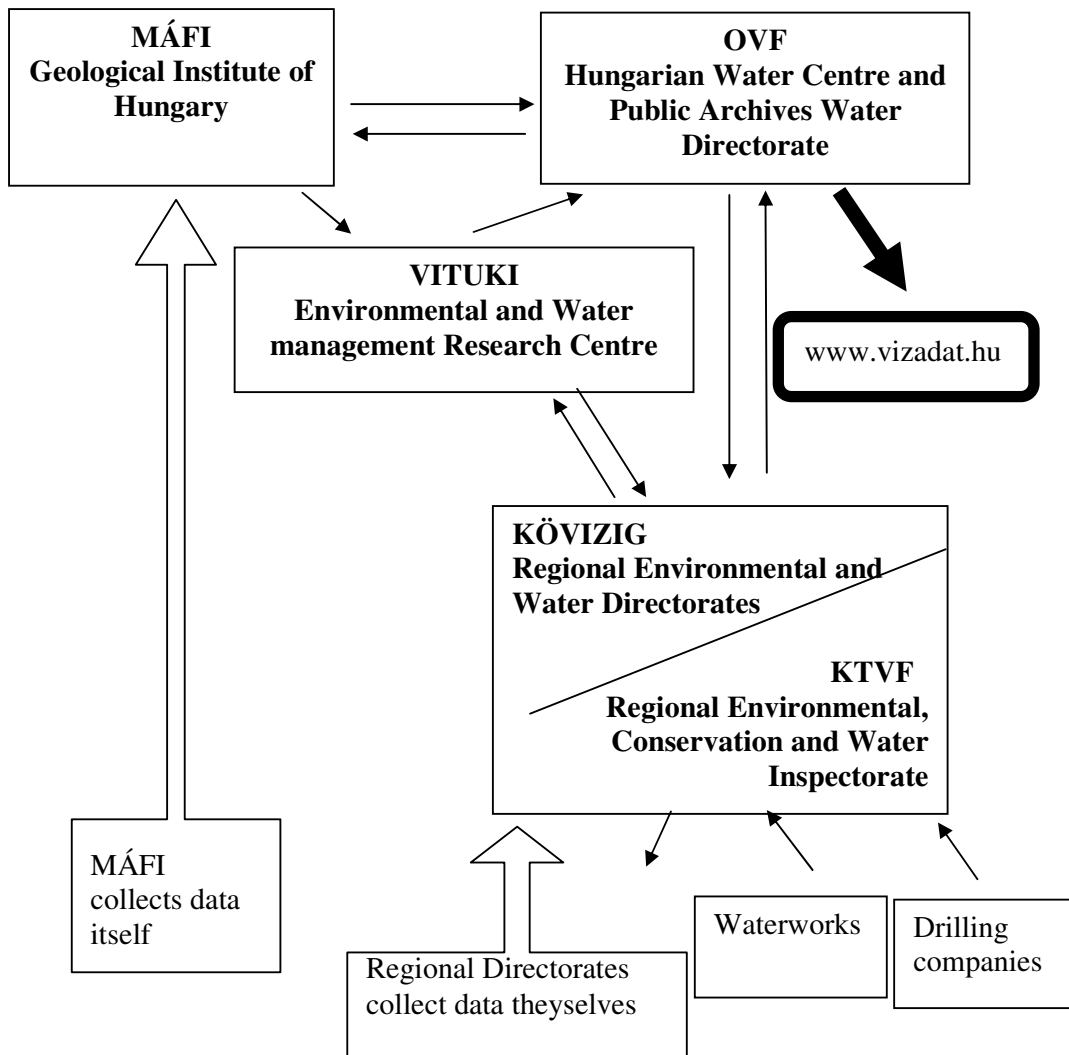


Fig. 16
Structure of hydrogeological data flow in Hungary

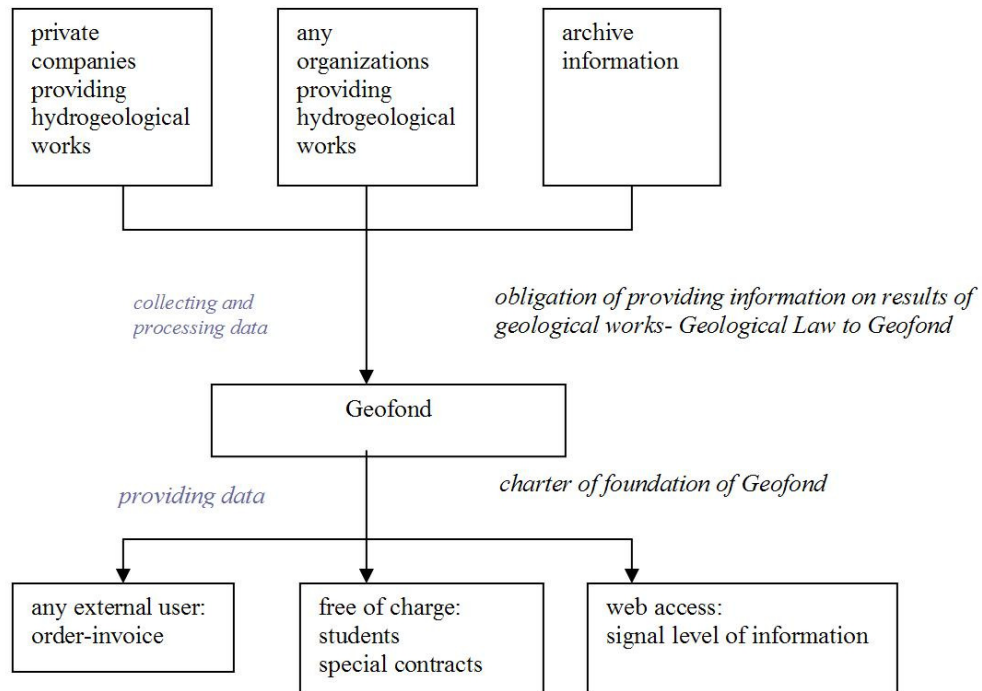


Fig. 17
Structure of hydrogeological data flow in the Czech Republic

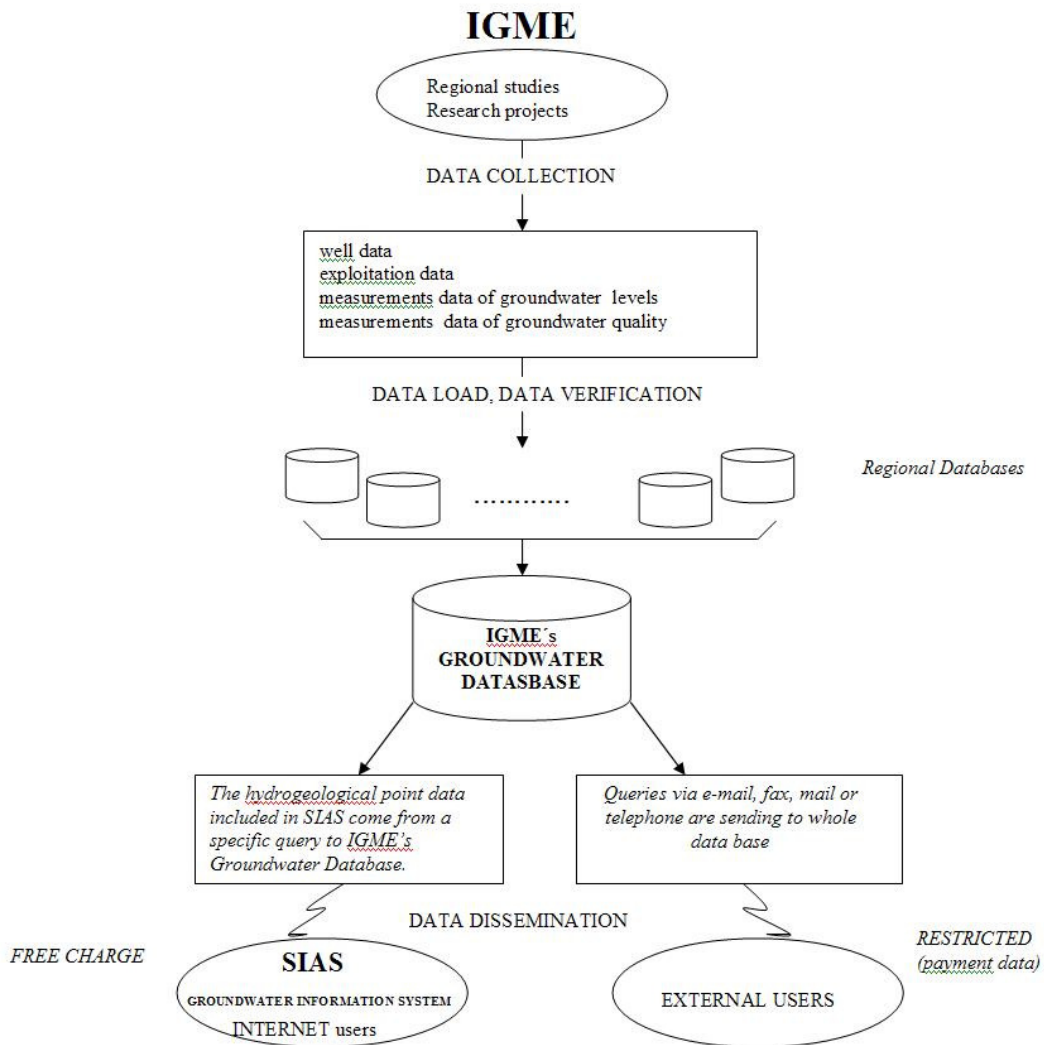


Fig. 18
Structure of hydrogeological data flow in Spain at the IGME

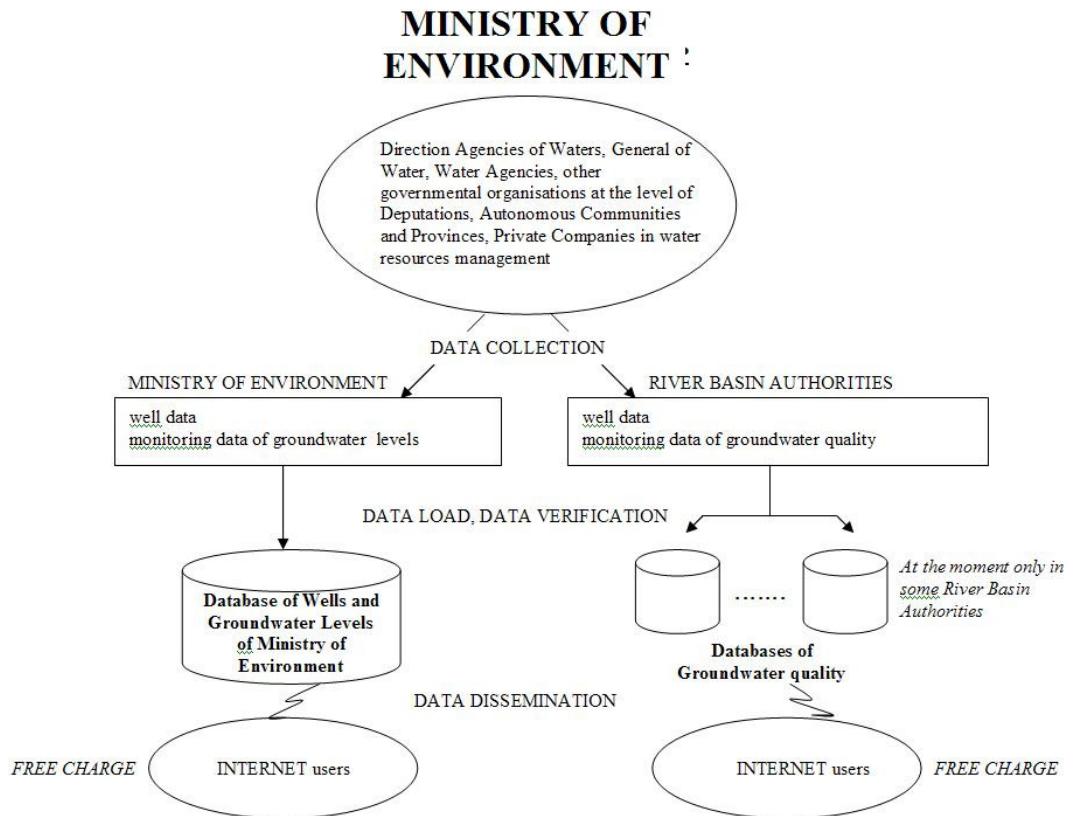


Fig. 19
Structure of hydrogeological data flow in Spain at the Ministry of Environment

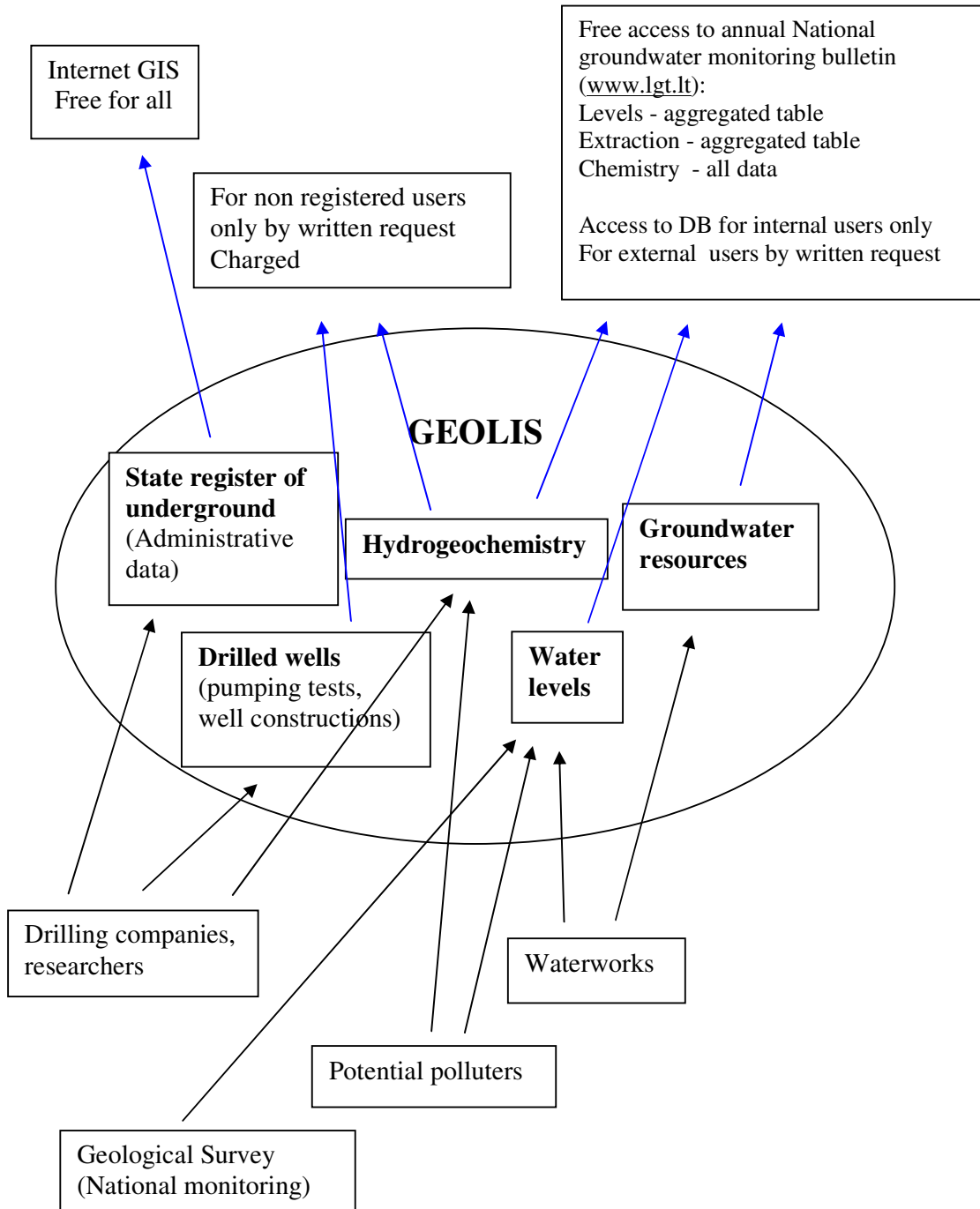


Fig. 20
Structure of hydrogeological data flow in Lithuania