Evaluation of harmonized datasets

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	4.2.1. Evaluation of the harmonized data sets

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Introduction

Evaluation of actual status of existing datasets stored in Transenergy (TE) online database is a very important part of transnational data management. It is necessary to know which types of data are available for further investigations, what type of additional data are needed. It is extremely important to cover all cross-border pilot areas selected for geological, hydrogeological and geothermal modeling with sufficient data. It is also important to know which kind of data are related to particular objects (boreholes). Special care is devoted to recognize incorrect data and their proper transcription.

As of March 31, 2011 the TE online database contains data altogether from 2759 boreholes (Slovakia: 284, Slovenia: 455, Hungary: 1797, Austria: 223). Altogether 1778 boreholes have various types of geological data (Slovakia: 237, Slovenia: 134, Hungary: 1324, Austria: 214), 166 boreholes have hydraulic data (Slovakia: 76, Slovenia: 79, Austria: 11), and 379 boreholes have different sorts of geothermal data (Slovakia: 30, Slovenia: 101, Hungary: 207, Austria: 41). The presented numbers and maps don't include all Austrian data due to confidentiality reasons, as a lot of data deriving from the hydrocarbon industry are not allowed to be included in the common database. Report on confidential reservoir data for the Austrian part of the investigation area is included in the Annex of this document. However these data will be used by GBA experts during modeling.

Overall concept

Transnational online database contains 438 different parameters. To review the actual situation a multicriterial evaluation with spatial distribution of dataset was produced. According to the project aims and further activities, 6 key attributes were selected:

1. Character of data – provides a spatial overview of all boreholes showing the purpose of the drillings (geothermal, hydrogeological, geological - structural),
2. Depth of boreholes - various depths intervals were selected (< 500 m, 500 – 1000 m, 1000 – 2000 m, 2000 – 3000 m, 4000 m >), it allows to see spatial distribution of boreholes with particular depths,
3. Geological information – "lithology", or "age", or "facies",or "formations" were chosen like relevant parameters that represent objects (boreholes) with available geological information, important for geological modeling,
4. Hydraulic characteristics – "hydraulic conductivity" (k), or "transmisivity" (T) were considered to be most representative parameters to review available datasets needed for hydrogeological modelling,
5. Geothermal characteristics – consist of representative parameters: "geothermal gradient", or "heat conductivity", or "specific heat capacity", or "temperature at final borehole depth", or „surface heat flow density".
6. Utilization characteristics: "annual production", or "produced yield" or "thermal power" were selected like the most appropriate parameters to see if objects in TE database contain available information about utilization.

To evaluate actual datasets in TE online database specific queries in Microsoft Access software were created. Results were represented in a form of maps in Map Info software and MS Excel spread sheets for further statistical analyses, as shown in the next chapters.

Results of evaluated datasets

Presentation of results is object orientated. Through the GIS applications using borehole coordinates it is possible to see spatial distribution of data according to selected attributes.

1. Character of data

The datasets included in the database were obtained mainly from boreholes drilled for hydrocarbon, geothermal, or hydrogeological, or geological – structural purposes. According to the purpose of objects, it is possible to expect which kind of dataset are available to work with. The first map shows a spatial distribution of boreholes according to their purpose of drill (Fig.1).

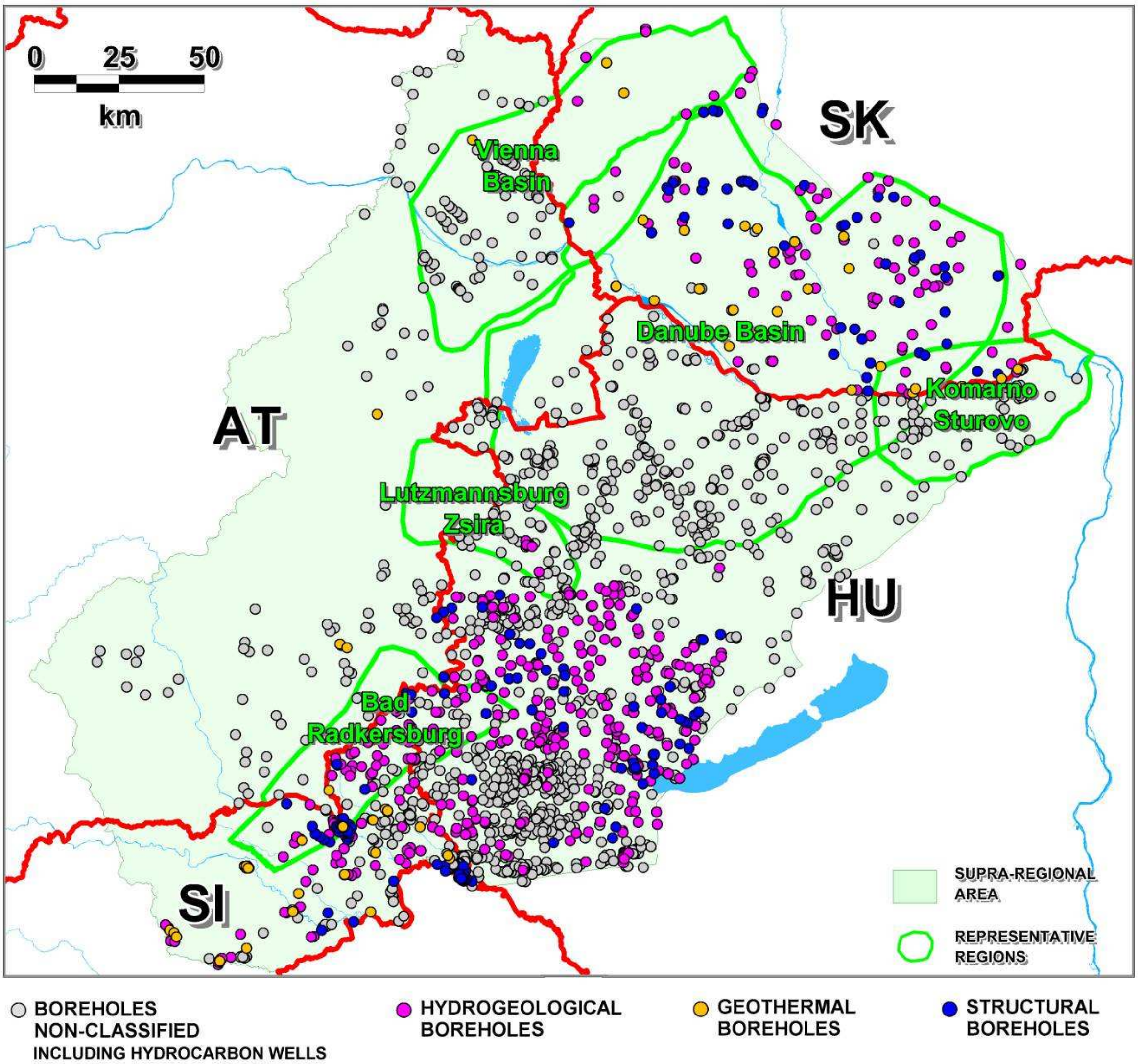


Fig. 1: Character of data according to the purpose of the borehole within the model areas (Austrian boreholes with confidential data are not displayed on the map)

Many of objects are confidential or the purpose of the drilling itself was not identified, therefore a specific group was created: boreholes non-classified, including hydrocarbon wells. The supra-regional area is in general sufficiently covered with data, some spatial inhomogenity can be seen between northern and southern part of region. Concerning the pilot areas, there is a special need for data at the Lutzmannsburg, and Radkersburg area, partly also at the Vienna basin. However, confidential Austrian data are also available for modeling on these areas, furthermore additional data are continuously added to the TE online databases. Summary of actually available data according their purpose is shown in Tab 1.

Tab. 1.: Number of boreholes according to their purpose

	Borehole purpose				**SUM All objects (boreholes)**
	Geothermal	**Hydrogeological**	**Structural**	**Borehole non-classified, including hydrocarbon wells**	
ŠGÚDŠ	**34**	**113**	**69**	**68**	**284**
Geo-ZS	**35**	**170**	**59**	**191**	**455**
MÁFI	**	**313**	**62**	**1422**	**1797**
GBA	**5***	**0***	**0***	**218***	**223***
All	**74**	**596**	**190**	**1899**	**2759**

* numbers without confidential data

**Only hydrogeological and structural boreholes are distinguished in Hungary. Hydrogeological boreholes include geothermal boreholes

The evaluated attributes show that TE database contain mainly boreholes, which were drilled for hydrogeological and hydrocarbon investigation. Considering also Austrian confidential data, the final number of available boreholes is much higher (see Annex).

2. Depth of boreholes

Different depths of boreholes can limit the use of datasets related to modeling purposes. From selected depth intervals of boreholes, the TE database contains boreholes mostly from 100 to 500 m depths, but for geothermal modeling activities boreholes which have the depths from 1000 to 3000 m are more interesting (Fig. 2).

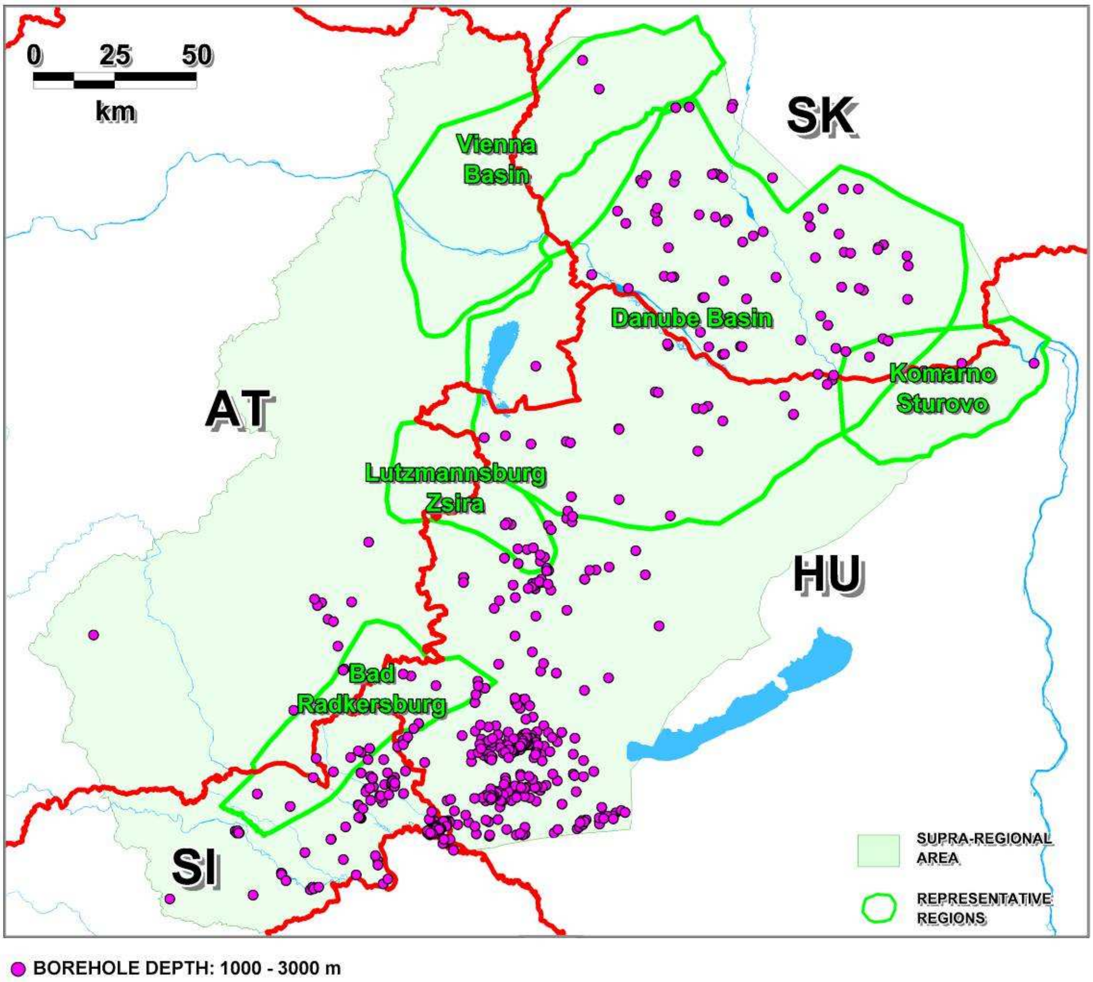


Fig. 2: Spatial distribution of boreholes between 1000 – 3000 m depth intervals (Austrian boreholes with confidential data are not displayed on the map)

Inhomogenity of boreholes distribution within the supra-regional area can be explained by different geological conditions and focus of investors' interests. For example the Komarno-Sturovo pilot area represents an elevated block of a karstic geothermal aquifer, while the SW-ern part of the supra-regional area (Mura-Zala basin) is a classical hydrocarbon exploration area with many deep boreholes. Boreholes in the northwestern part of Vienna basin will be added by further database updating.
Exact numbers of selected boreholes within different depth intervals are presented in Tab. 2.

Tab. 2.: Number of boreholes according to selected depth intervals

	Boreholes depth intervals (m)						
	< 100	100 - 500	500 - 1000	1000 - 2000	2000 - 3000	3000 - 4000	> 4000
ŠGÚDŠ	**4**	**111**	**27**	**50**	**44**	**5**	**0**
Geo-ZS	**38**	**133**	**27**	**173**	**38**	**14**	**2**
MÁFI	**180**	**591**	**82**	**133**	**255**	**75**	**22**
GBA	**4***	**5***	**7***	**14***	**1***	**2***	**?***
All	**226**	**840**	**143**	**370**	**338**	**96**	**24**

* without confidential data

From all objects (boreholes) which are currently stored in the database, 26 % have no information about the depth (Tab. 3). Without considering GBA data (data confidentiality) it will be only 19 % of objects where no accurate information about the depth is available. Sometimes where the final depth of the borehole is missing, there still can be sufficient and useful information about certain depth intervals.

Tab. 3.: Number of boreholes according to data availability on depth

	SUM data available	SUM data not available	SUM All objects (boreholes)
ŠGÚDŠ	*241*	43 (*15 %*)	284
Geo-ZS	*425*	30 (*7 %*)	455
MÁFI	*1338*	459 (*26 %*)	1797
GBA	*33**	190 (*85 %*)*	223*
All	2037	722 (*26 %*)	2759

* without confidential data

3. Geological information

Evaluation of geological datasets was focused on the availability of geological information for geological modeling. Selected parameters are: lithology, age, facies and formations, describing a character of subsurface environment related to particular objects (boreholes) at the specific depth intervals. Geological information originated mostly from core samples and also from interpretations of geophysical measurements. Spatial distribution of boreholes with selected geological data is presented on Fig 3.

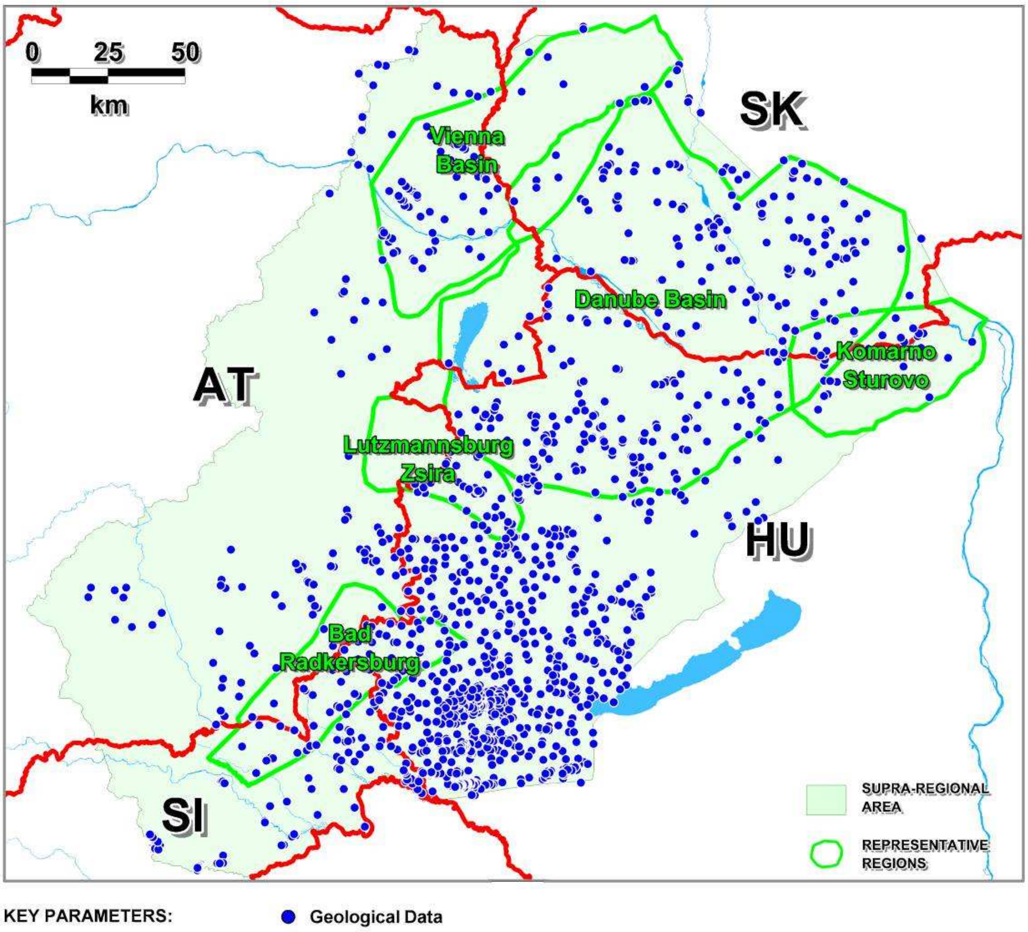


Fig.3: Spatial distribution of available geological data (Austrian boreholes with confidential data are not displayed on the map)

The supra-region contains relatively dense pattern of boreholes with geological data (Fig. 3). Regarding the pilot areas, there is some lack of information in the northern part of the Vienna basin and western part of Danube basin. Some of data related to these areas will be added for existing geological wells.

Numbers of geological data related to particular objects according selected attributes are shown in Tab. 4.

Tab. 4.: Numbers of boreholes with available data according to selected key attributes

	Geological Data	Hydraulic Data	Geothermal Data	Utilization Data
ŠGÚDŠ	**237**	**76**	**30**	**107**
Geo-ZS	**134**	**79**	**101**	**450**
MÁFI	**1324**	**	**207**	**790**
GBA	**214***	**11***	**41***	**48***
All	**1778**	**166**	**379**	**1395**

* without confidential data

**There are no direct hydraulic measurements data in the database from Hungary

Real number of geological data in the database is much higher because different types of geological information are related to the same borehole. An example is be given by the MÁFI geological datasets (Tab. 5).

Tab. 5.: Real amount of available geological Hungarian data according to the number of boreholes

Parameter	**Number of data**	**Number of boreholes**
Age HU	3538	578
Facies	7871	1193
Formation	7872	1193
Lithology description	3537	578
Lithology HU	7873	1193
Lithology HU detailed	6911	578

4. Hydraulic characteristics

Hydraulic datasets represent one of the key parameters necessary to characterize the subsurface environment for hydrogeological modeling.

The parameters hydraulic conductivity (k) and transmissivity (T) were considered to be the most representative parameters to characterize if a particular object has relevant hydraulic information.

Hydraulic Conductivity

Definition: Hydraulic conductivity at reservoir conditions (dynamic viscosity of formation fluid)

Unit: m/s

Data-source(s): Interpretation of hydraulic tests (modeling) at particular borehole

Documentation: All data are aligned to tested horizons

Transmissivity

Definition:	The rate which groundwater flows horizontally through an aquifer
Unit:	m^2/s
Data-source(s):	Interpretation of hydraulic tests (modeling) at particular borehole
Documentation:	All data are aligned to tested horizons

The spatial distribution of hydraulic parameters is presented on Fig. 4.

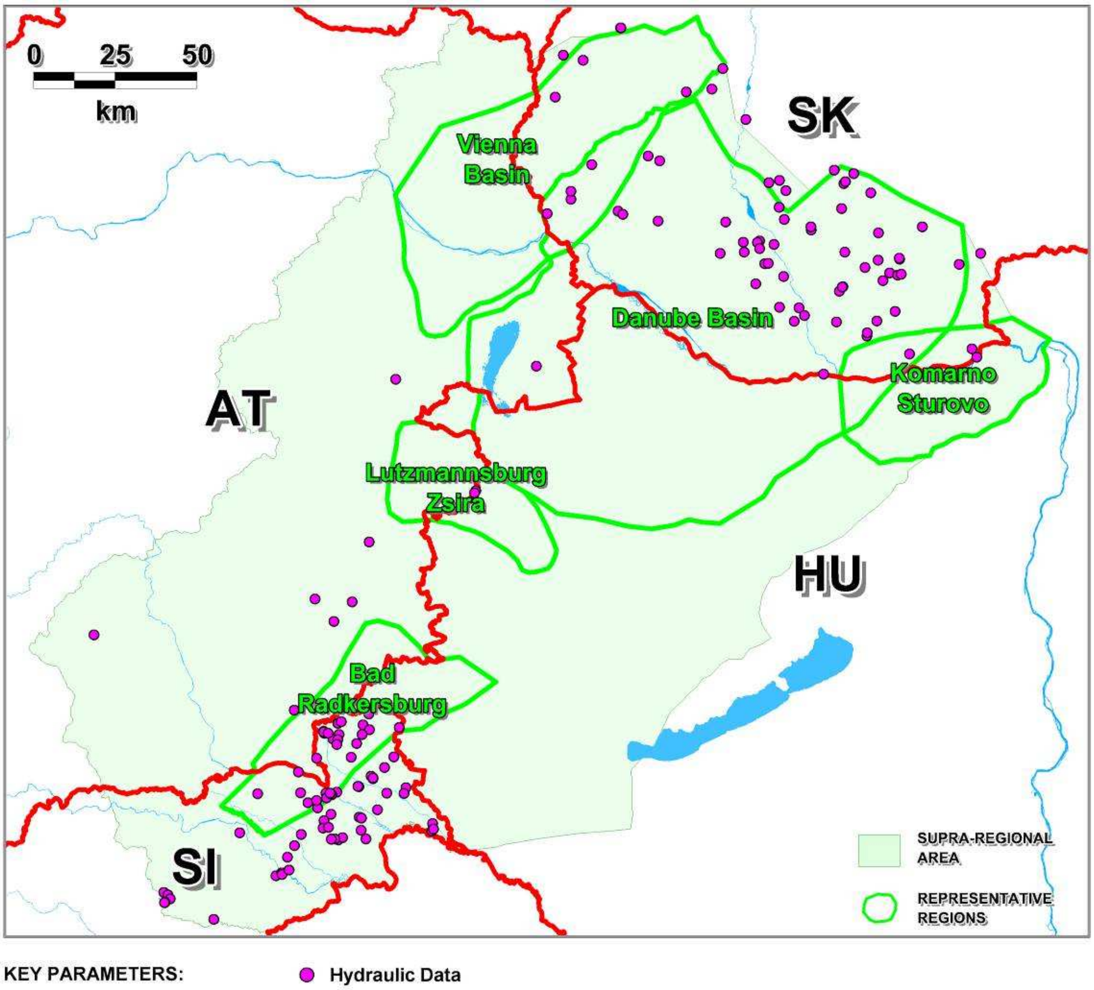


Fig.4: Spatial distribution of hydraulic data (Austrian boreholes with confidential data are not displayed on the map)

Fig. 4 clearly shows relatively big gaps of available hydraulic data. Especially the southern part of Danube basin, the northern part of Vienna basin and Komarno-Sturovo block are problematic. Available Hungarian databases did not contain directly measured hydraulic data from boreholes, these parameters for the most important hydrostratigraphic units are determined from modeling, or estimated from other hydrogeological data and will be incorporated to the database later.

Number of boreholes which contain selected hydraulic parameters is shown in Tab.4.

5. Geothermal characteristics

Geothermal characteristics consist of group of parameters which determine the availability of datasets needed for geothermal modeling. To visualize the number and spatial distribution of this datasets 5 parameters were selected:

- Temperature - at final borehole depth (BHT)
- Geothermal gradient - at final borehole depth
- Heat conductivity
- Specific heat capacity
- Surface heat flow density

Temperature - at final borehole depth (BHT)

Definition: Temperature of geological environment at final borehole depth

Units: deg C

Data-source(s): Geophysical measurements, Hydraulic reservoir tests (Open Hole Tests, Casing Tests) from the hydrocarbon industry

Descriptions: Data have been gained during hydraulic tests and in most cases represent the true formation temperature and therefore don't have to be corrected for the influence of drilling and mud circulation (BHT correction); the main sources of error are represented by inflow of drilling mud (instead of formation fluids) at the testing probe and degassing (adiabatic cooling) during hydraulic tests; BHT data have been corrected for the influence of mud circulation based on graphical and numerical methods

Documentation: All data are aligned to depth intervals

Geothermal gradient - at final borehole depth

Definition: The geothermal gradient is the rate at which the Earth's temperature increases with depth, indicating heat flowing from the Earth's warm interior to its cooler surface.

Units: K/m

Data-source(s): Calculated from different temperature intervals along the borehole depth which are specified by geophysical logs.

Descriptions: Value is expressed for stationary conditions, where temperature distribution between two points of the borehole is linear

Documentation:All data are aligned to depth intervals

Heat conductivity

<u>Definition</u>: A material property that describes the rate at which heat flows within a body for a given temperature difference.

<u>Units</u>: W/m/K

<u>Data-source(s)</u>: Physical and mechanical laboratory tests on geological material. Occasionally values can be expressed from results of geothermal models.

<u>Descriptions</u>: Value is expressed like inversion function of energy loss through a piece of material.

<u>Documentation</u>: All data are aligned to geological units at specific depth intervals.

Specific heat capacity

<u>Definition</u>: A material property that indicates the amount of energy a body stores for each degree increase in temperature, on a per unit mass basis. Characterizes the ability of rocks to accumulate thermal energy.

<u>Units</u>: J/kg.K

<u>Data-source(s)</u>: Physical and mechanical laboratory tests on geological material. Occasionally values can be expressed from results of geothermal models.

<u>Descriptions</u>: Specific heat capacity is a quantity, that doesn't depend on the quantity of material used, but it simply identifies the type of material and the physical conditions of heating.

<u>Documentation</u>: All data are aligned to geological units at specific depth intervals.

Surface heat flow density

<u>Definition</u>: The rate of heat flowing past a reference datum.

<u>Units</u>: W/m^2

<u>Data-source(s)</u>: Interpolation from more boreholes of a selected area. It is calculated from geothermal gradient and thermal conductivity of rocks at specific borehole depth interval.

<u>Descriptions</u>: Characterizes the geothermal activity and thermal field of investigated areas, which is originated due to energy release inside the Earth. The surface heat flow density allows quantity assessing of thermal balance in a studied area, even although it does not specify the origin of heat and the heat source distribution.

<u>Documentation</u>: All data are aligned to geological units at specific depth intervals.

Spatial distribution of all available selected geothermal parameters within the supra-regional area is displayed on Fig. 5.

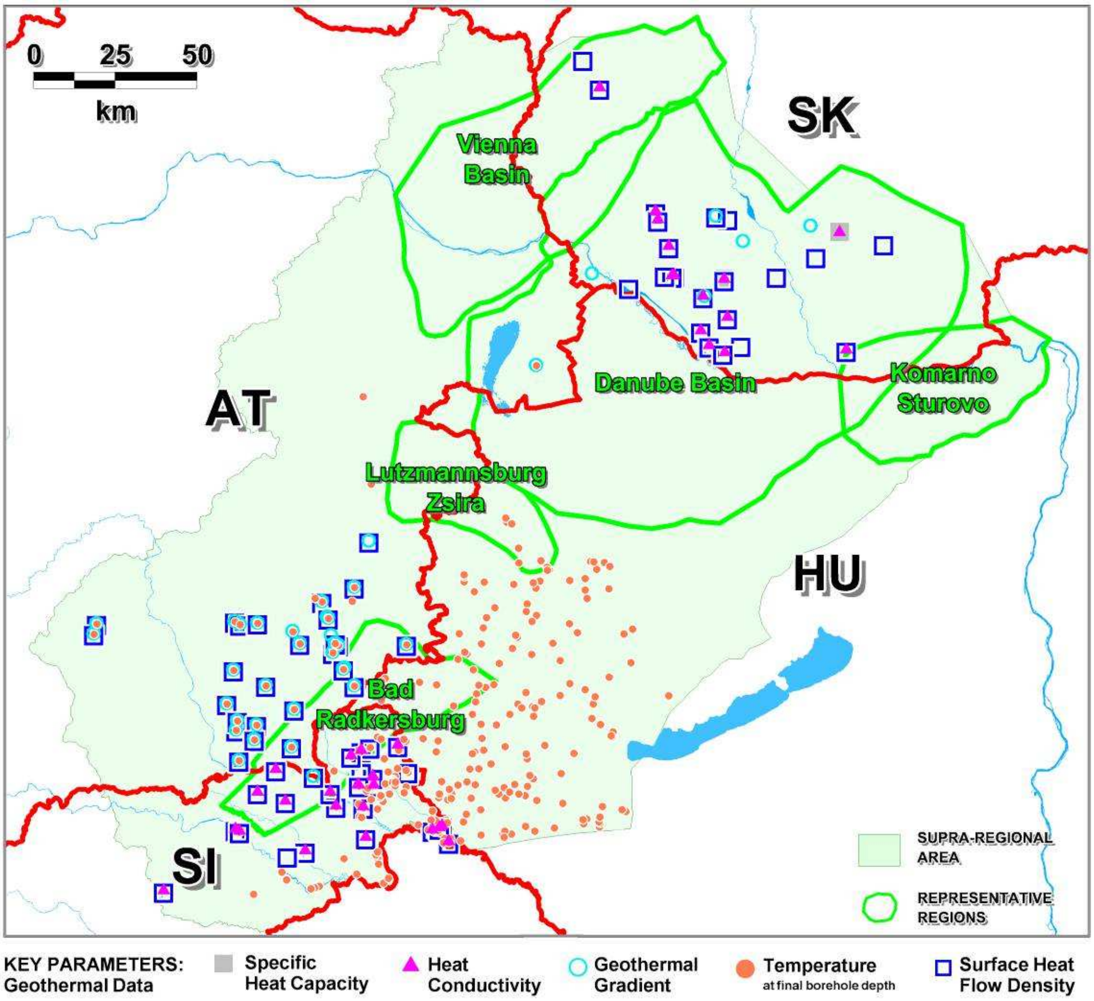


Fig.5: Spatial distribution of available geothermal data according selected parameters (Austrian boreholes with confidential data are not displayed on the map)

Geothermal parameters don't have an even distribution. Gap of information is obvious in the southern part of Danube basin, in Vienna basin and Komarno-Sturovo pilot area. Actual numbers of available boreholes which contain analyzed parameters are in Tab. 6.

Tab. 6.: Numbers of boreholes with available geothermal datasets

	Specific Heat Capacity	Heat Conductivity	Geothermal Gradient	Temperature at final borehole depth	Surface heat flow density
ŠGÚDŠ	**2**	**15**	**6**	**?**	**23**
Geo-ZS	**?**	**23**	**?**	**87**	**27**
MÁFI	**0**	**0**	**0**	**207**	**0**
GBA	**0***	**0***	**36***	**33***	**32***
All	**2**	**38**	**42**	**327**	**82**

*without confidential data

Each of project partners has different kinds of parameters for geothermal characterization (e.g. SGUDS-surface heat flow density and heat conductivity, MAFI – borehole temperature). The question marks represent parameters which should yet be added into the database. In the database one borehole can contain higher number of data related to the same parameter, because different depth intervals were tested. The TE online database actually contains 110 boreholes with temperature data related to particular depth intervals (Tab. 7).

Tab. 7.: Total amount of temperature data related to numbers of boreholes

temperature at final borehole depth		
TE partner	**Number of data**	**Number of boreholes**
Geo-ZS	156	87
MÁFI	402	207
GBA	56	33

6. Utilization characteristics

To see the actual status on the utilization of the objects three key parameters was selected:

- annual production
- produced yield
- thermal power

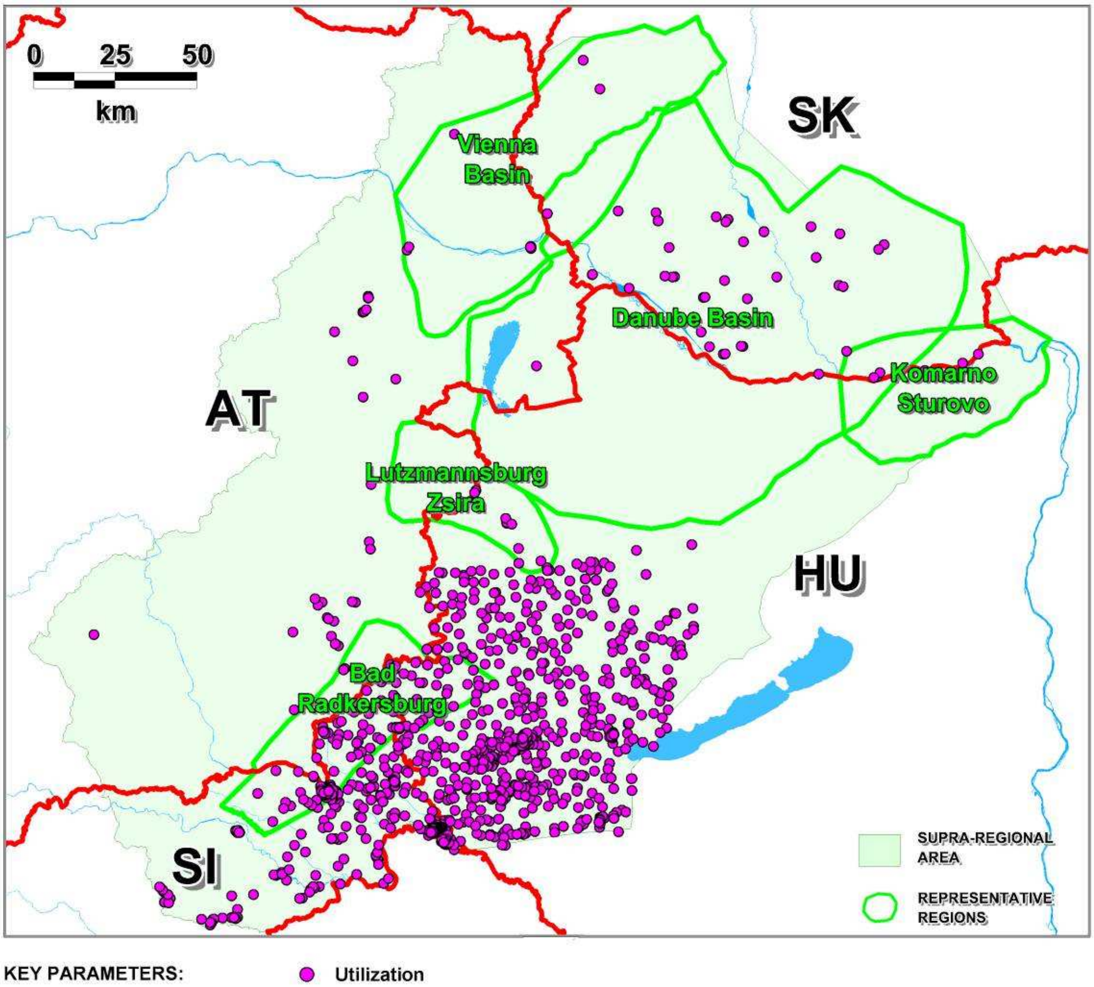


Fig.6: Spatial distribution of boreholes containing datasets regarding to utilization aspects (Austrian boreholes with confidential data are not displayed on the map)

Fig. 6 shows areas where there is actually a lack of data: southern part of Danube basin, Komarno-Sturovo block, northern part of Vienna basin. Most of available data are concentrated in the southwestermn part of the supra-regional area.

Number of boreholes which contain selected utilization attributes is shown in Tab.4.

Additional datasets

The above overview of actually available data visualized on maps clearly shows that additional data are needed (especially hydraulic measurements, geothermal data, petrophysical measurements on core samples and analysis of new water samples). New data from additional investigation will be added and uploaded into the database during and after additional investigation period (until the end of August 2011, PM17). Tab.8 shows data according to the parameters groups which were proclaimed to be updated after 31.03. 2011**.** Database contains much more parameters (total = 438) and some of them can in some cases supply missing evaluated data sets.

Tab. 8.: Existing datasets which will be updated into the TE database in the period April - August 2011

	Parameters goup	No. of objects (cca)	Date	Pilot area
GBA	geothermal, basic chemistry, trace elements, isotops and noble gases, organic compound, gas analysis, thermal rock properties	30	april - august	Vienna basin
	geothermal, basic chemistry, trace elements, isotops and noble gases, organic compound, gas analysis, thermal rock properties	25	april - august	Danube Basin
	geothermal, basic chemistry, trace elements, isotops and noble gases, organic compound, gas analysis, thermal rock properties	5	april - august	Lutzmansburg-Zsira area
	geothermal, basic chemistry, trace elements, isotops and noble gases, organic compound, gas analysis, thermal rock properties	15	april - august	Bad Radkensburg-Hodos area
Geo-ZS	geology, basic chemistry, trace elements, isotops and noble gas, organic compound,hydrogeology, gas analysis	only added data to existing wells 50	april-august	Bad-Radkersburg-Hodoš
MÁFI	basic chemistry, trace elements, isotops and noble gases, organic compound, technical, geology, hydrogeology, geothermal, general, geophysics, utilization, gas analysis	200	april - august	Danube basin, Komarno, Lutzmannsburg,
ŠGÚDŠ	geothermic character, basic chemistry, trace elements, isotops and noble gases, geophysica	25	april - august	Vienna basin, Danube basin

Summary on evaluation of data sets

Actual status of datasets in TE online database was investigated by use of multcriterial data evaluation. From the spatial distribution of chosen attributes it is possible to identify recent gap of datasets within the selected areas for geoscientific modeling. The main conclusions from evaluation of data sets can be summarized as follows:

- As of March 31, 2011 the TE online database contains data altogether from 2759 boreholes (Slovakia: 284, Slovenia: 455, Hungary: 1797, Austria: 223). Altogether 1778 boreholes have various types of geological data (Slovakia: 237, Slovenia: 134, Hungary: 1324, Austria: 214), 166 boreholes have hydraulic data (Slovakia: 76, Slovenia: 79, Austria: 11), and 379 boreholes have different sorts of geothermal data (Slovakia: 30, Slovenia: 101, Hungary: 207, Austria: 41).
- The low density of data in the database regarding Austria (GBA partner) has no effect on the project results because due to data confidentiality there are much more data used separately (see Annex).
- It will be necessary to add general data related to pilot areas, especially in the region of the Danube basin and Vienna basin.
- More existing data will be uploaded into the database during and after additional investigation period (until the end of August 2011, PM17).

Annex

The Annex shows metadata from the Austrian confidential boreholes. In Austria it is not allowed to deliver the individual measurements, but they will be used during modeling. GBA will deliver the different parameters of the individual aquifers as Grids. The shown statistics and maps don't include the Austrian data from the common database.

Overview of presented parameters

- Total Porosity
- Effective Porosity
- Hydraulic Conductivity
- Hydraulic Permeability
- Bulk Density
- Hydro-chemical and hydro-physical Parameters:
  - TDS (Total Dissolved Solids), Evaporation Residue
  - Density at 20 degC
  - pH
  - Main Ions: K, Na, Ca, Cl, Mg, NH4, SO4, Fe
  - Acetate
  - CO3 (calculated), HCO3
  - SiO2
- Formation Pressure
- Shut-in Pressure observed at Hydraulic Tests
- Measured Temperatures

All shown boreholes feature geological stages.

Total Porosity

Definition: Fraction of total pore volume (hydraulic conductive and non-conductive)

Unit: %

Data-source(s): Measurements on drilling cores; interpretation of geophysical logs

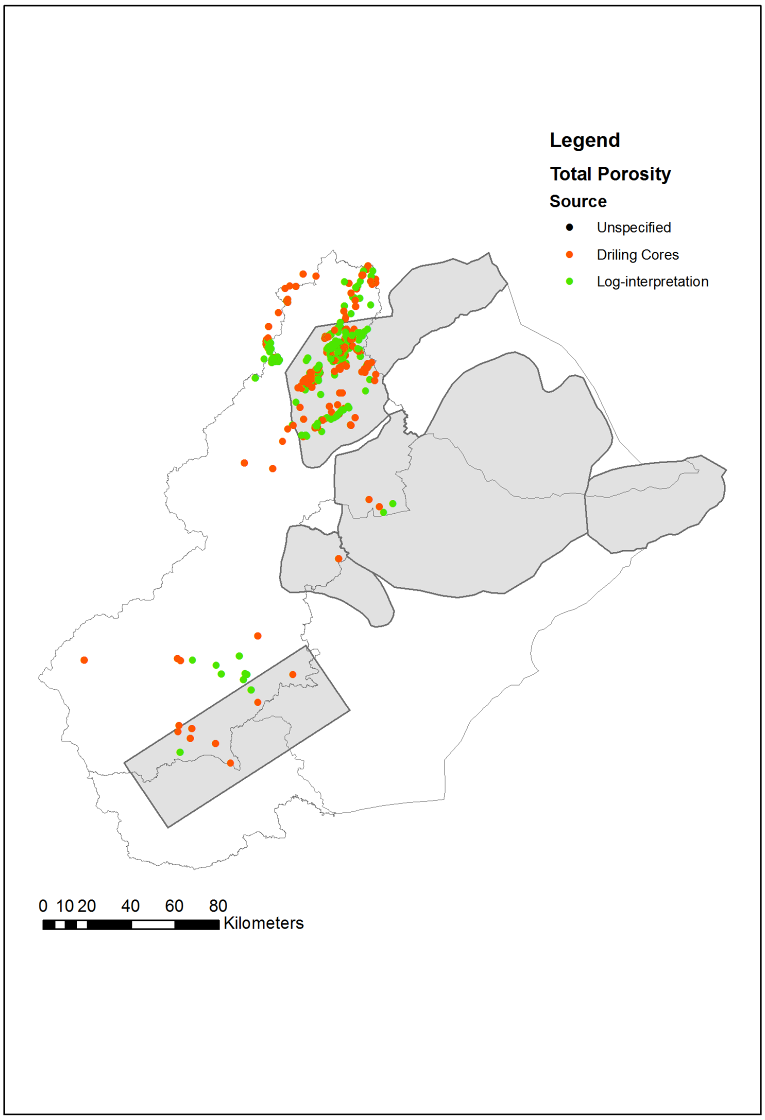
Descriptions: The total porosity according to drilling core measurements is primarily representing the attributes of the solid rock matrix; data from logging give a more comprehensive overview on reservoir conditions, but the available logging interpretation focuses predominately on potential hydrocarbon reservoirs at Neogene basin fillings

Data-processing: The available data are summarized for individual cores, geological units at specific wells and logging intervals (mean value)

Documentation: All data are aligned to depth intervals and geological units

Statistics:

- Number of boreholes with porosity data: 512
- Data from drilling cores: 749
- Data from log-interpretation: 1176
- Total sum at the supra-regional area: 1925



Effective Porosity

Definition: Fraction of hydraulic conductive pore volume

Unit: %

Data-source(s): Measurements on drilling cores; interpretation of hydraulic tests (modeling by hydrocarbon industry based on test results)

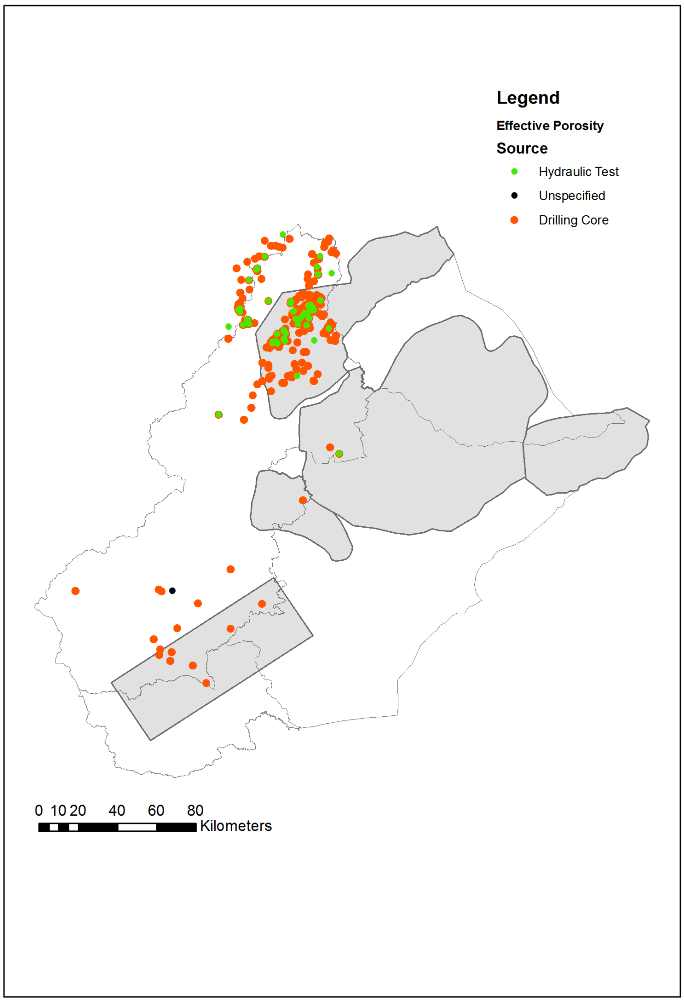
Descriptions: The porosity according to drilling core measurements is primarily representing the attributes of the solid rock matrix; data from hydraulic tests give a more comprehensive overview on reservoir conditions, but the available logging interpretation focuses predominately on potential hydrocarbon reservoirs, which don't necessarily have to coincide with geothermal reservoirs

Data-processing: The available data are summarized for individual cores, geological units at specific wells and test intervals (mean value)

Documentation: All data are aligned to depth intervals and geological units

Statistics:

- Number of boreholes with effective porosity data: 374
- Data from drilling cores: 1020
- Data from hydraulic tests: 76
- Unspecified: 2
- Total sum at the supra-regional area: 1098



Hydraulic Conductivity

Definition: Hydraulic conductivity at reservoir conditions (dynamic viscosity of formation fluid)

Unit: m/s

Data-source(s): interpretation of hydraulic tests (modeling) at geothermal wells

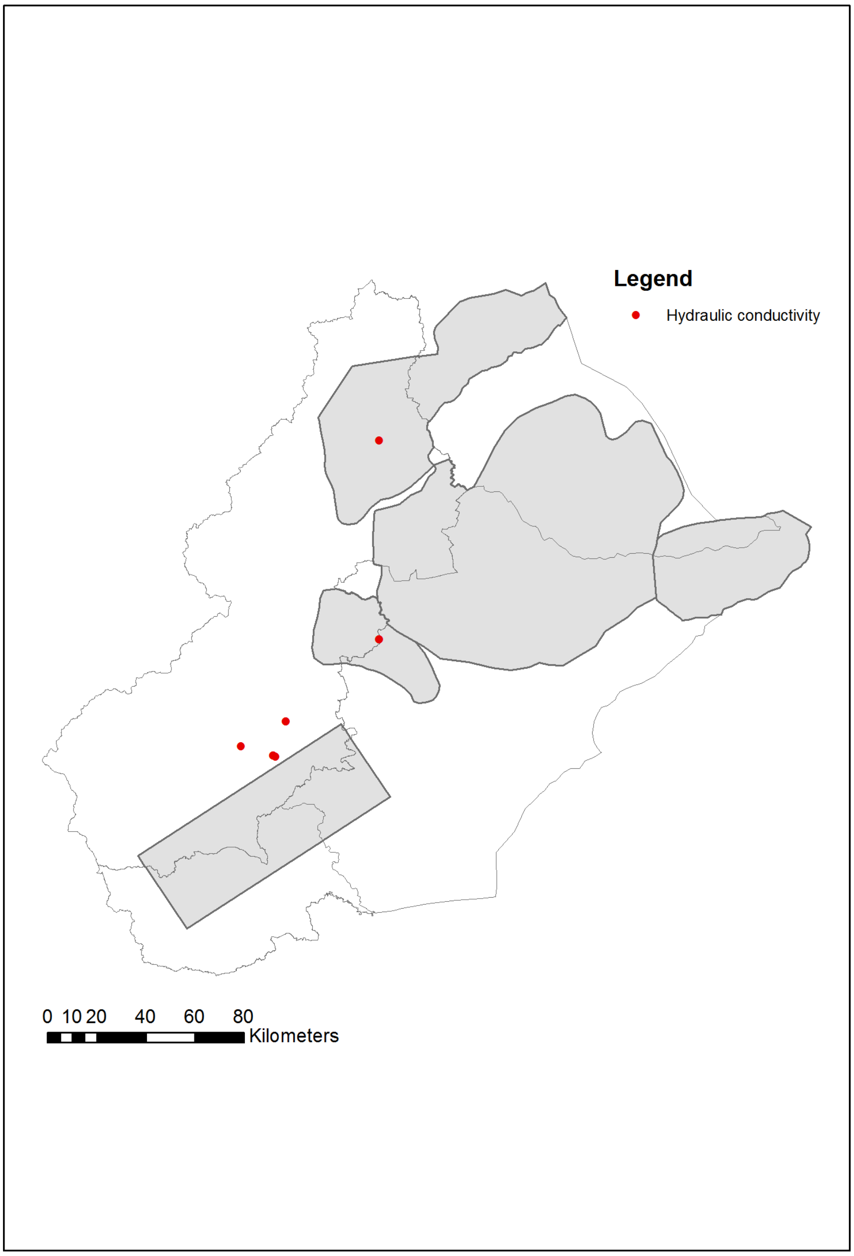
Descriptions:

Data-processing: Individual datum-points

Documentation: All data are aligned to depth intervals and geological units

Statistics:

- Number of boreholes with hydraulic tests for hydraulic conductivity: 7
- Total sum at the supra-regional area: 10



Hydraulic Permeability

Definition: Hydraulic Permeability of subsurface rocks regarding apparent anisotropy rate (value parallel and normal to rock foliation) gained from measurements of drilling cores

Unit: mD (Milli-Darcy)

Data-source(s): Measurements on drilling cores; interpretation of hydraulic tests (modeling by hydrocarbon industry based on test results)

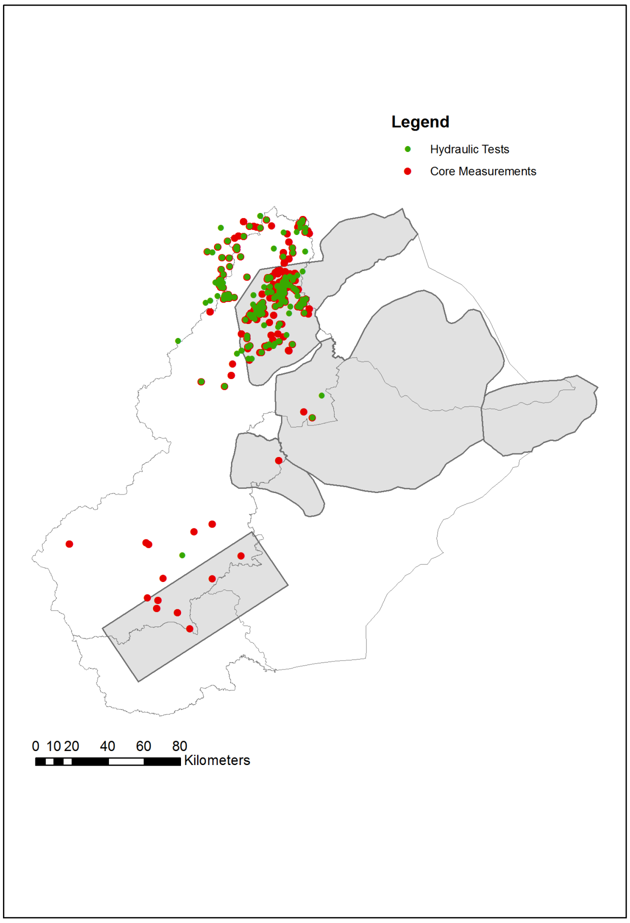
Descriptions: The permeability according to drilling core measurements is primarily representing the attributes of the solid rock matrix; data from hydraulic tests give a more comprehensive overview on reservoir conditions, but the available tests predominately focus on possible hydrocarbon reservoirs, which don't necessarily have to coincide with geothermal reservoirs

Data-processing: The available data are summarized for individual cores, geological units at specific wells and test intervals (mean value); data from drilling core investigations also contain horizontal (horizontal plane of drilling core) as well as vertical permeability (vertical plane of drilling core);

Documentation: All data are aligned to depth intervals and geological units

Statistics:

- Number of boreholes with hydraulic permeability data from hydraulic test: 208
- Number of boreholes with hydraulic permeability data from cores: 345
- Data from drilling cores: 12251
- Data from hydraulic tests: 349
- Total sum at the supra-regional area: 12600



Bulk Density

Definition: Rock Density including pore space

Unit: kg/m³

Data-source(s): Measurements on drilling cores; no data from log interpretation available

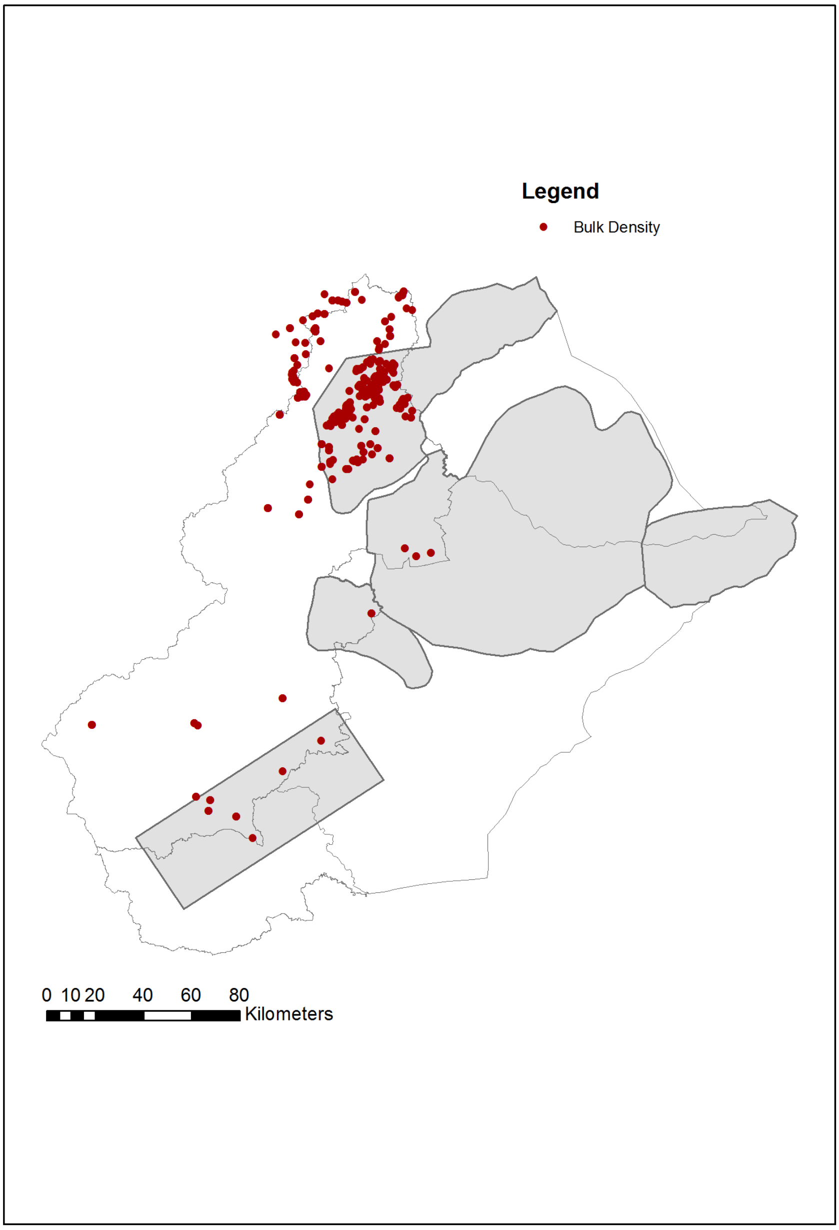
Descriptions: The permeability according to drilling core measurements is primarily representing the attributes of the solid rock matrix;

Data-processing: The available data are summarized for individual cores and geological units at specific wells (mean value);

Documentation: All data are aligned to depth intervals and geological units

Statistics:

- Number of boreholes with bulk density data: 325
- Total sum at the supra-regional area: 1040



Hydrochemical Parameters:

Definition:

(1) Total Dissolved Solid (TDS): Sum-up of measured main ions; Evaporation Residue at 105degC

(2) Density at 20 degC

(3) pH

(4) Main Ions: K, Na, Ca, Cl, Mg, NH4, SO4, Fe

(5) Acetate

(6) CO3 (calculated), HCO3

(7) SiO2

Units:

(1), (4)-(7) mg/l

(2) g/cm³

Data-source(s): Measurements on fluid samples primarily gained during hydraulic tests from hydrocarbon wells; measurements made by hydrocarbon industry

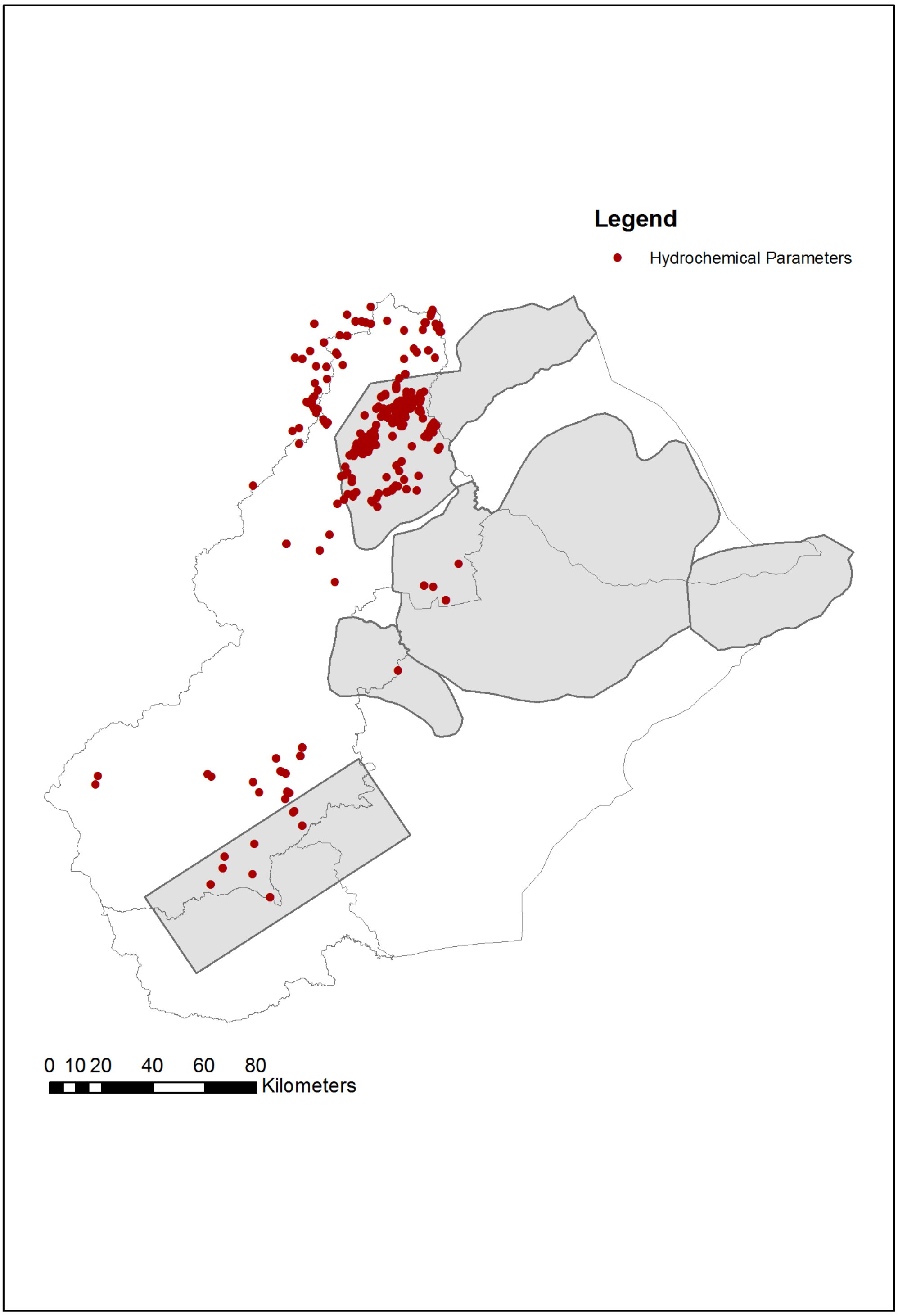
Descriptions:

Data-processing: Single values (no statistical treatment)

Documentation: All data are aligned to depth intervals and geological units

Statistics:

- Number of boreholes with hydrochemical and hydrophysical parameters: 351
- TDS: 3
- Evaporation Residue: 713
- Density: 553
- pH: 522
- K: 440
- Na: 756
- Ca: 761
- Mg: 761
- NH4: 778
- Cl: 796
- SO4: 767
- Fe: 704
- SiO2: 708
- CO3 (calculated): 634
- Acetate: 656
- HCO3: 71


Legend
Hydrochemical Parameters
0 10 20 40 60 80
Kilometers

Formation Pressure

Definition: (1) Final shut-in pressure observed at hydraulic tests; (2) calculated formation pressure based on hydraulic tests; data predominately result from hydrocarbon exploration wells; it has to be kept in mind, that the available test intervals focus on potential hydrocarbon reservoirs and therefore make no claim to represent conditions at potential geothermal reservoirs in a comprehensive manner – especially at reservoirs with known lack of hydrocarbons;

Units: [atm]

Data-source(s): Hydraulic reservoir tests (Open Hole Tests, Casing Tests) from the hydrocarbon industry

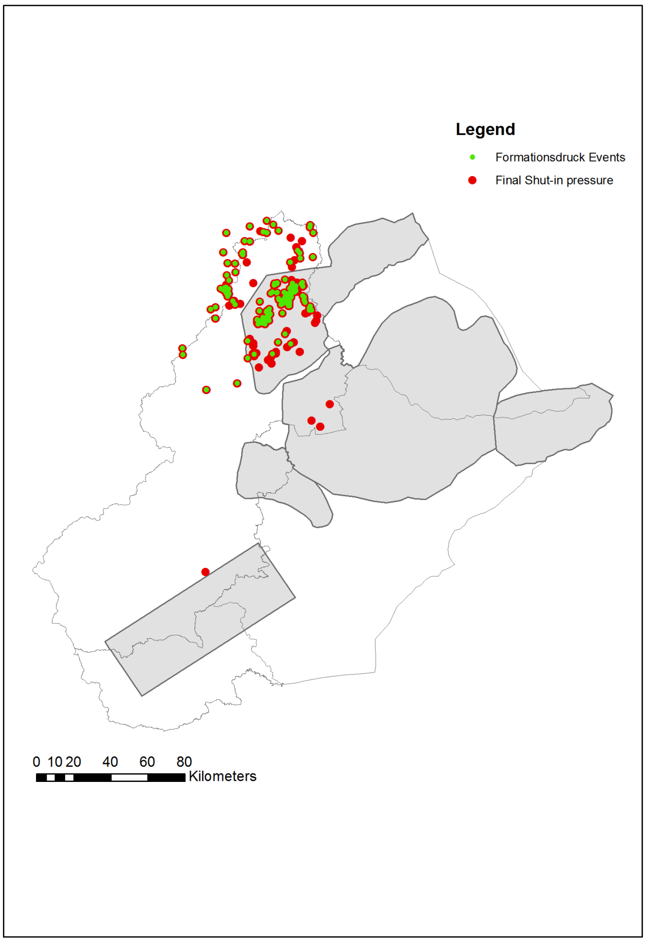
Descriptions: The final shut-in pressure represents the measured pressure at the end of the hydraulic test (pumping test) after a period of 2 hrs. to 4 hrs.; in general the final shut-in pressure is below the true formation pressure and can be seen as a minimum pressure at the reservoir; the true formation pressure has been calculated by modeling from shut-in pressure time series; the available data have already been processed by the hydrocarbon industry; the specific time series are not available;

Data-processing: Single values (no statistical treatment)

Documentation: All data are aligned to depth intervals and geological units

Statistics:

- Number of boreholes with calculated formation pressure based on hydraulic test: 201
- Number of boreholes with shut-in-pressure: 242
- Final shut-in pressure: 637
- Calculated formation pressure: 415



Formation Temperature

Definition: (1) Temperature measurement at hydraulic tests from the hydrocarbon industry (DST-data); (2) Corrected BHT measurements

Units: degC

Data-source(s): Hydraulic reservoir tests (Open Hole Tests, Casing Tests) from the hydrocarbon industry

Descriptions: DST-data have been gained during hydraulic tests and in most cases represent the true formation temperature and therefore don't have to be corrected for the influence of drilling and mud circulation (BHT correction); the main sources of error are represented by inflow of drilling mud (instead of formation fluids) at the testing probe and degasing (adiabatic cooling) during hydraulic tests; BHT data have been corrected for the influence of mud circulation based on graphical and numerical methods;

Data-processing: Single values (no statistical treatment)

Documentation: All data are aligned to depth intervals

Statistics:

- Number of boreholes with temperature data: 411
- Total Sum: 1658
- DST-data: 1142
- Corrected BHT-data: 516