Activity report about field measurements in the pilot area Kraków

Deliverable D.T3.2.2 Updated database of existing and additionally measured data at the pilot areas

Template 01 2019

MAREK HAJTO[1], GABRIEL ZĄBEK[1], BARTŁOMIEJ CIAPAŁA[1] & THE GEOPLASMA-CE TEAM.

[1] AGH University of Science and Technology

Contact details of author: mhajto@agh.edu.pl

The involved GeoPLASMA-CE team

PP 09	Marek Hajto, Gabriel Ząbek, Bartłomiej Ciapała

Content

1. Executive summary in English language

This report presents basic information about field measurements conducted in Kraków Pilot Area in the GeoPLASMA-CE project. The aim of performed activities was to gather data useful for literature information calibration and fill few gaps in knowledge.

Measurements divided in two parts: geological sampling for thermal conductivity measurements and hydrogeological measurements of groundwater temperature, electric conductivity and water table level.

Places of geological sampling were affected by accessibility of outcrops of rocks interesting from project point of view and borehole cores. Points of hydrogeological measurements were narrowed to anthropologically affected aquifers and chosen available wells and observation wells.

2. Podsumowanie

Raport przestawia podstawowe informacja o pomiarach terenowych przeprowadzonych dla obszaru pilotażowego Kraków w ramach projektu GeoPLASMA-CE. Celem przeprowadzonych działań było zebranie danych użytecznych w kalibracji danych literaturowych i dla wypełnienia występujących luk w wiedzy.
Pomiary podzielono na dwie części: pobieranie próbek geologicznych do pomiarów przewodności cieplnej i badania hydrogeologiczne wody gruntowej obejmujące pomiar temperatury, przewodności elektrycznej i poziomu zwierciadła wody.
Miejsca poboru próbek geologicznym podyktowane były dostępnością odsłonięć skał interesujących z punktu widzenia projektu oraz rdzeni wiertniczych. Punkty badań hydrogeologicznych zawężono do obszaru o silnym wpływie człowieka na wody gruntowe, a zostały wykonane w dostępnych studniach i piezometrach.

3. Introduction

3.1. Aim and scope of this report

This report describes the field measurements performed in the pilot area Kraków, which have been performed within the frame of Activity A.T2.3.2. It aims at a full documentation of the assessed field data, which will be published at the GeoPLASMA-CE web portal (www.geoplasma-ce.eu).

This report contains:

- An overview of parameters measured in the pilot areas for creating the aimed project outputs
- A brief description of the methods applied for measurement and data processing
- A documentation of the field measurements performed in the PA area.
- A short description of the results achieved and how these results contribute to the generation of thematic outputs.

3.2. Overview of the chosen strategy for field measurements

The general purpose of performed measurements was to fill in gaps in knowledge and provide data for literature values calibration. Thus, field measurements has been performed in places and intervals representative for the crucial parts of geological and hydrogeological models.

Purchased device allowed for simultaneous measurement of groundwater temperature, electric conductivity and groundwater head level. As most of water-bearing levels in Kraków area is confined, main effort was targeted to provide modern information about most variable and surface-dependant quaternary basin. Results of these measurements were compiled into comprehensive database containing relevant values for wide area covering vicinity of the Wisła River and Kraków Old Town, where significant anthropogenic changes may be observed. All the information is supposed to be used as input in hydrogeological model calibration and in numerical modelling validation.

Thermal conductivity of rock samples measurements were performed for hard rocks and soil samples of rocks. Intervals and places of sampling were selected so that relevant and representative rocks were examined. Obtained results are going to be used in 3D geological model parametrisation, in calculation of temperature within model layers and in map of BHE potential heat transfer rate. The compiled database consists of lithology description, sampled rock's GPS coordinates, position within the geological profile and measured thermal conductivity parameters.

4. Documentation of field measurements

4.1. Hydrogeological measurements

4.1.1. Points for measurement selection

Points for hydrogeological measurements were chosen among wells and observation wells that belong to reliable owners providing its accessibility and satisfying technical condition as well as documentation. Only observation wells were measured to the bottom, as they are devoid of infrastructure which might be potentially dangerous for equipment. Measured points allow for variability analyses and assessment of anthropologic influence on groundwater conditions.

Locations of measurement points are presented in Fig. 1. Structure of the compiled database is visible in Fig. 2.

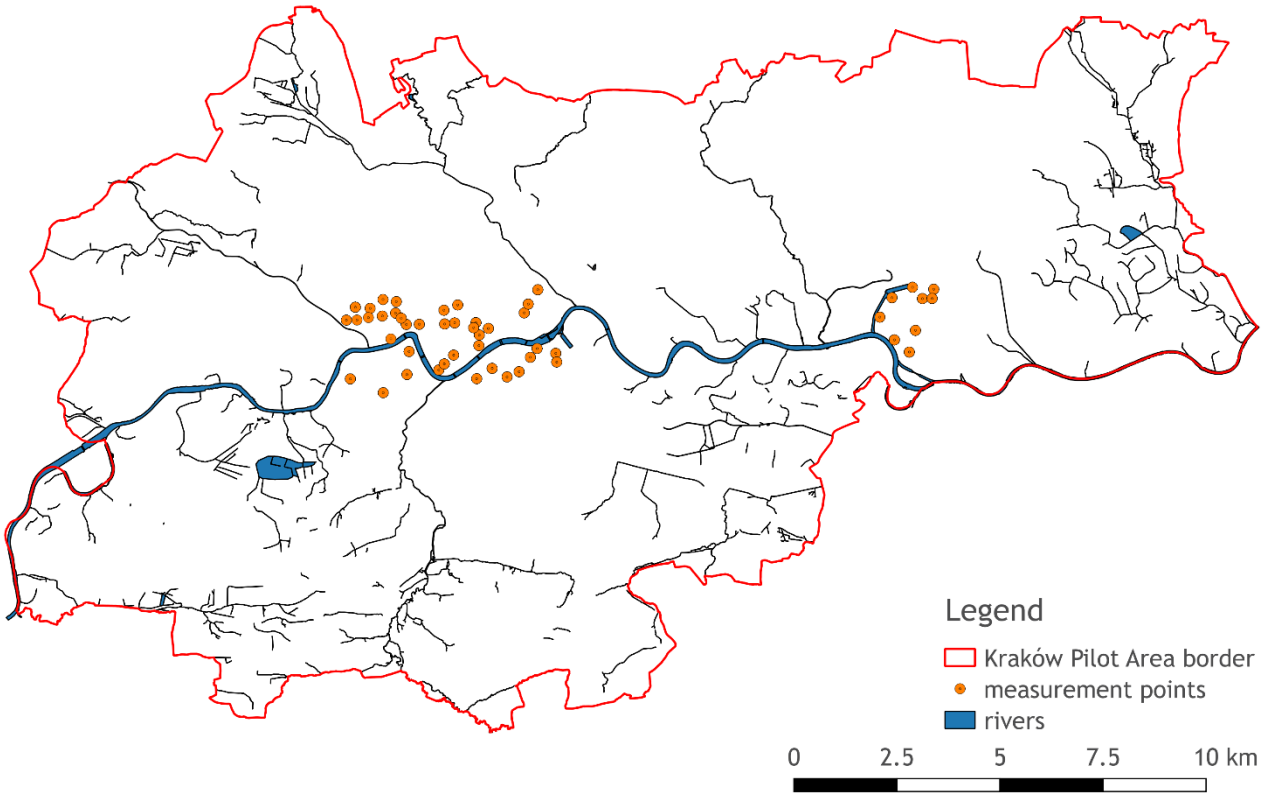

Figure 1 Location of measurement points. Objects are mainly located in places where intensive anthropogenic pression occur.

date	object name	lat	lon	meter beneath watertable	meter beneath terrain	pipe height	temperature (degC)	electric conductivity (µS)	deg N	min N	sec N	deg E	min E	sec E
UZUPEŁNIĆ		wypełniane automatycznie		UZUPEŁNIĆ										
Data pomiaru	**nazwa obiektu**	Szerokość N	Długość E	**metr poniżej zwierciadła**	**m ppt**	**wsokość obudow**	**temperatura**	**przewodność**	**stopnie N**	**minuty N**	**sekundy N**	**stopnie E**	**minuty E**	**sekundy E**
11.06.2018	P-1	50.0606	19.9117	0	2.65	0.5	13.5	1670	50	3.00	38	19	54	42
11.06.2018	P-1	50.0606	19.9117	1	3.65	0.5	11.5	1896	50	3.00	38	19	54	42
11.06.2018	P-1	50.0606	19.9117	2	4.65	0.5	10.8	1921	50	3.00	38	19	54	42
11.06.2018	P-1	50.0606	19.9117	3	5.65	0.5	10.5	1939	50	3.00	38	19	54	42
11.06.2018	P-1	50.0606	19.9117	4	6.65	0.5	10.5	1953	50	3.00	38	19	54	42
11.06.2018	P-1	50.0606	19.9117	5	7.65	0.5	10.5	1958	50	3.00	38	19	54	42
11.06.2018	P-1	50.0606	19.9117	6	8.65	0.5	10.6	2320	50	3.00	38	19	54	42
11.06.2018	P-1	50.0606	19.9117	7	9.65	0.5	10.7	2323	50	3.00	38	19	54	42
11.06.2018	P-1	50.0606	19.9117	8	10.65	0.5	10.7	2353	50	3.00	38	19	54	42
11.06.2018	P-1	50.0606	19.9117	9	11.65	0.5	10.8	2045	50	3.00	38	19	54	42
11.06.2018	P-4/R	50.0603	19.9167	0	2.8	0.2	11.3	950	50	3.00	37	19	55	0
11.06.2018	P-4/R	50.0603	19.9167	1	3.8	0.2	10.7	956	50	3.00	37	19	55	0
11.06.2018	P-4/R	50.0603	19.9167	2	4.8	0.2	10.2	980	50	3.00	37	19	55	0
11.06.2018	P-4/R	50.0603	19.9167	3	5.8	0.2	10	990	50	3.00	37	19	55	0
11.06.2018	P-4/R	50.0603	19.9167	4	6.8	0.2	9.9	987	50	3.00	37	19	55	0

Figure 2 Structure of compiled hydrogeological database.

4.1.2. Measurements performed

In common, more than 400 measurements of temperature, electric conductivity for a given depth were performed. Each and every measurement was noted on the site along with object's name with GPS coordinates of the point, date of measurement and additional notes. An example field card is visible in Fig. 3.

Obiekt

P-1

Współrzędne geograficzne

50° 3' 38" N
19° 54' 42" E

	głębokość	temp [°C]	przewodność
ZWIERCIADŁO	3,15	13,5	1670
+1m	11,5	1896	
+2m	10,8	1921	
+3m	10,5	1939	
+4m	10,5	1953	
+5m	10,5	1958	
+6m	10,6	2320	
+7m	10,7	2323	
+8m	10,7	2353	
+9m	10,8	2045	
+10m			
+11m			
+12m			
+13m			
+14m			
+15m			
+16m			
+17m			
+18m			
+19m			
+20m			

-0,5 na metr

KOMENTARZ

17:30 - zakończenie
Inna grupa elektrycznego na tych WC przy Błoniach

Obiekt

P-4/R

Współrzędne geograficzne

50° 3' 37" N
19° 55' 0" E

	głębokość	temp [°C]	przewodność
ZWIERCIADŁO	3m	11,3	950
+1m	10,7	956	
+2m	10,2	980	
+3m	10,0	990	
+4m	9,9	987	
+5m	10,0	988	
+6m	10,2	986	
+7m	10,3	795	
+8m			
+9m			
+10m			
+11m			
+12m			
+13m			
+14m			
+15m			
+16m			
+17m			
+18m			
+19m			
+20m			

-0,2 na metr

KOMENTARZ

Niedokładna lokalizacja (ok. 10m)
17:47 - zakończenie

Pomiary wykonane w dniu 11.06.18 Wykonawcy: M. Hajto, B. Ciapała

Pomiary wykonane w ramach projektu GeoPLASMA-CE sprzętem TLC meter

4.1.3. Measurement device

All obtained values are The Model 107 TLC Meter, which consists of 3/4" (19 mm) diameter probe where temperature along with water electric conductivity is determined and tape indicating depth at which the probe is submerged. The device was calibrated with manufacturer's calibration liquids delivered together with the equipment.

4.2. Thermal conductivity of rock samples

4.2.1. Points for measurement selection

Thermal conductivity of rock samples measurements were performed for hard rocks and soil samples of rocks. Intervals and places of sampling were selected so that relevant and representative rocks were examined. Locations of measurement points are presented in Fig. 3. Structure of the compiled database is visible in Fig. 4. Fig. 5 show field work (sample capture).

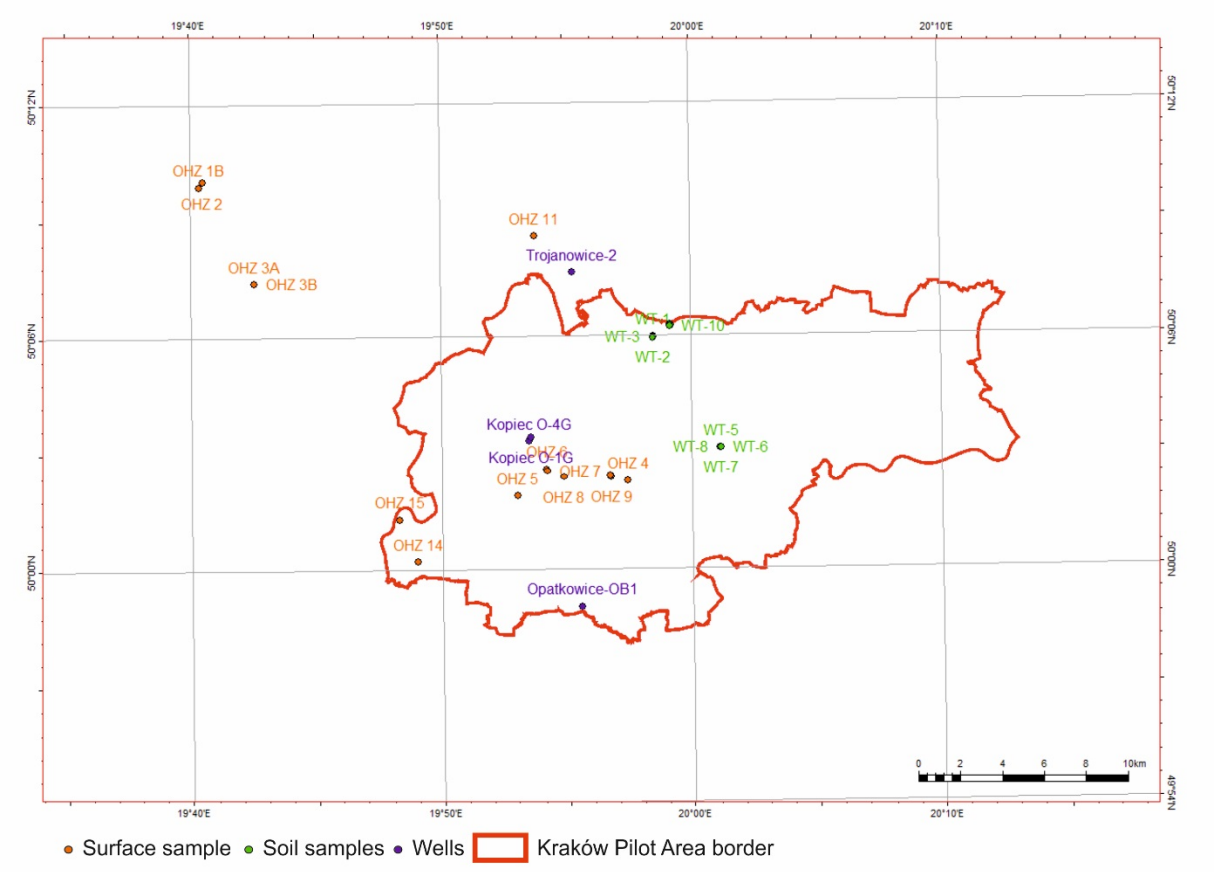

Figure 3 Location of measurement points.

WGS (84 - Deg.Min.Sec)				Układ 92						GPS (WGS84) (deg)		UTM 34N			
X (N)	Y (East)	Czas	Data	X	Y	Z (rzędna wysokości n.p.m.)	KOD PRÓBY	Lp	Stan	Lat	Lng	Name	POINT_X (Easting)	POINT_Y (Northing)	POINT_Z
50.09.53.376	19.40.21.413	11:14:00	08-08-2018	548024.710	255505.858	415.00	OHZ 1A	1	wstrzymano	50.1648266705704	19.6726147216853	OHZ 1A	405197.325110	5557800.48189	415.00
50.09.53.376	19.40.21.413	11:14:00	08-08-2018	548024.710	255505.858	415.00	OHZ 1B	2	otrzymane wyniki	50.1648266705704	19.6726147216853	OHZ 1B	405197.325110	5557800.48189	415.00
50.10.01.184	19.40.29.852	11:47:00	08-08-2018	548189.901	255748.448	406.00	OHZ 2	3	otrzymane wyniki	50.1669955591544	19.6749588845757	OHZ 2	405369.024499	5558038.64805	406.00
50.07.23.075	19.42.32.353	12:03:00	08-08-2018	550665.749	250889.256	250.00	OHZ 3A	4	otrzymane wyniki	50.1230763910859	19.7089869449336	OHZ 3A	407714.666923	5553113.00174	250.00
50.07.23.075	19.42.32.353	12:03:00	08-08-2018	550665.749	250889.256	250.00	OHZ 3B	5	otrzymane wyniki	50.1230763910859	19.7089869449336	OHZ 3B	407714.666923	5553113.00174	250.00
50.02.15.477	19.57.25.970	11:01:00	10-08-2018	568526.030	241590.117	232.00	OHZ 4	6	otrzymane wyniki	50.0376325009169	19.9572138911823	OHZ 4	425325.638045	5543335.74022	232.00
50.01.54.017	19.53.00.553	12:29:00	10-08-2018	563255.895	240862.555	245.00	OHZ 5	7	otrzymane wyniki	50.0316713913601	19.8834869443513	OHZ 5	420036.232150	5542749.23495	245.00
50.02.33.994	19.54.11.233	12:47:00	10-08-2018	564646.669	242113.637	206.00	OHZ 6	8	otrzymane wyniki	50.0427761093345	19.9031202729473	OHZ 6	421460.443717	5543963.05935	206.00
50.02.31.158	19.54.12.137	12:59:00	10-08-2018	564665.702	242026.293	217.00	OHZ 7	9	otrzymane wyniki	50.0419883313209	19.9033713846714	OHZ 7	421477.138471	5543875.20889	217.00
50.02.22.326	19.54.52.787	13:29:00	10-08-2018	565477.315	241763.437	227.00	OHZ 8	10	otrzymane wyniki	50.0395350028306	19.9146630608569	OHZ 8	422281.688427	5543590.64123	227.00
50.03.96.281	19.94.61.903	13:04:00	22-08-2018	567784.072	241801.885	237.00	OHZ 9	11	otrzymane wyniki	50.0396281570524	19.9461903806735	OHZ 9	424539.383414	5543568.69247	237.00
50.03.97.521	19.945.66.466	13:08:00	22-08-2018	567696.264	241815.194	234.00	OHZ 10	12	otrzymane wyniki	50.0397521818466	19.9456646614782	OHZ 10	424501.933259	5543583.01270	234.00
50.08.34.747	19.53.47.496	18:35:00	23-08-2018	564040.993	253246.264	264.00	OHZ 11	13	otrzymane wyniki	50.1429852772020	19.8965266612569	OHZ 11	421152.953032	5555111.63848	264.00
50.08.41.147	19.53.43.999	18:49:00	23-08-2018	563969.235	253443.034	258.00	OHZ 12	14	wstrzymano	50.1447630575522	19.8955552829980	OHZ 12	421066.471406	5555310.22534	258.00
50.00.16.59	19.48.55.98	11:49:00	12-09-2018	558424.616	237799.231	249.00	OHZ 13	15	nie pobrano	50.0046083374978	19.8155500038593	OHZ 13	415123.091449	5539815.22799	249.00
50.00.13.03	19.48.59.84	11:56:00	12-09-2018	558502.627	237690.154	233.00	OHZ 14	16	otrzymane wyniki	50.0036194408682	19.8166222189101	OHZ 14	415198.185894	5539704.06549	233.00
50.01.18.05	19.48.16.49	12:25:00	12-09-2018	557618.374	239688.288	217.00	OHZ 15	17	otrzymane wyniki	50.0216805513050	19.8045805489906	OHZ 15	414367.394259	5541725.83577	217.00
50.03.17.6579	19.53.30.4517	-999	-999	563819.710	243452.020	288.25	-999	18	otrzymane wyniki	50.0549049621018	19.8917921486005	Kopiec O-4G	420669.334168	5545323.53361	288.25
50.03.25.0394	19.53.33.9985	-999	-999	563887.860	243649.890	223.30	-999	19	otrzymane wyniki	50.0566775962926	19.8927773573045	Kopiec O-1G	420742.778759	5545519.57322	223.30
50.03.25.0394	19.53.33.9985	-999	-999	563887.860	243649.890	185.00	-999	20	otrzymane wyniki	50.0566775962926	19.8927773573045	Kopiec O-1G	420742.778759	5545519.57322	185.00
50.03.17.6579	19.53.30.4517	-999	-999	563819.710	243452.020	214.05	-999	21	otrzymane wyniki	50.0549049621018	19.8917921486005	Kopiec O-4G	420669.334168	5545323.53361	214.05
50.03.25.0394	19.53.33.9985	-999	-999	563887.860	243649.890	155.70	-999	22	otrzymane wyniki	50.0566775962926	19.8927773573045	Kopiec O-1G	420742.778759	5545519.57322	155.70
50.07.38.23	19.55.17.49	-999	-999	565848.258	251522.993	128.76	-999	23	otrzymane wyniki	50.1272857581364	19.9215258097162	Trojanowice-2	422913.970256	5553339.89582	128.76
50.07.38.23	19.55.17.49	-999	-999	565848.258	251522.993	84.16	-999	24	otrzymane wyniki	50.1272857581364	19.9215258097162	Trojanowice-2	422913.970256	5553339.89582	84.16
50.07.38.23	19.55.17.49	-999	-999	565848.258	251522.993	-23.69	-999	25	otrzymane wyniki	50.1272857581364	19.9215258097162	Trojanowice-2	422913.970256	5553339.89582	-23.69
49.59.01.73	19.55.33.97	-999	-999	566372.935	235580.178	83.80	-999	26	otrzymane wyniki	49.9838138763288	19.9261027771549	Opatkowice-OB1	423011.865928	5537383.65503	83.80
49.59.01.73	19.55.33.97	-999	-999	566372.935	235580.178	27.55	-999	27	otrzymane wyniki	49.9838138763288	19.9261027771549	Opatkowice-OB1	423011.865928	5537383.65503	27.55
49.59.01.73	19.55.33.97	-999	-999	566372.935	235580.178	-17.30	-999	28	otrzymane wyniki	49.9838138763288	19.9261027771549	Opatkowice-OB1	423011.865928	5537383.65503	-17.30

Figure 4 Structure of compiled database.

Fig. 5 Sample catching from surface and well

4.2.2. Measurements performed

37 samples were delivered to PP08. The measurements has been done and sent (Fig. 6) to AGH-Team. The results were connected with GPS coordinates and depth for preparation of the location in D.T3.2.1_Database

SAMPLE	CROSS SECTION	RUN	TC [W/mK]				G (standard deviation)	Inhomogenity	Starting point	Ending point
			mean LONG	mean	min	max				
ohz1b	LONG	1	2.442	2.456	2.287	2.741	3.358	0.185	237.9	386.7
ohz1b	LONG	2		2.407	2.241	2.54	2.299	0.124	237.9	386.7
ohz1b	LONG	3		2.462	2.332	2.583	2.238	0.102	237.9	386.7
ohz2	LONG	1	2.460	2.461	2.256	2.794	4.641	0.219	89.900	167.5
ohz2	LONG	2		2.456	2.268	2.778	4.101	0.208	89.900	184.4
ohz2	LONG	3		2.464	2.293	2.688	3.852	0.160	89.900	184.4
ohz3a	LONG	1	1.743	1.744	1.508	1.976	6.177	0.268	285.100	442.9
ohz3a	LONG	2		1.733	1.509	2.016	6.651	0.293	285.100	442.9
ohz3a	LONG	3		1.753	1.508	1.949	5.992	0.251	285.100	434.8
ohz3b	LONG	1	1.564	1.552	1.375	1.757	6.333	0.246	243.200	352.9
ohz3b	LONG	2		1.568	1.393	1.767	6.662	0.239	243.200	348.4
ohz3b	LONG	3		1.572	1.376	1.743	6.044	0.233	243.200	348.4

Figure 6 Structure of results table.

5. Data processing

5.1. Data processing

5.1.1. Hydrogeological data processing

Raw measurements (temperature, electric conductivity and distance from well's edge) was inserted into spreadsheet, where distance was recalculated into depth below ground and level below water table. GPS coordinates were recalculated into decimal.

5.1.2. Thermal conductivity data processing

For joint database all the TC results were recalculated into average values, as required.

5.2. Transfer of field data to the joint databases

In a last step, the processed field data have been summarized and documented for a transferring them to the following databases:

- Metadata database of relevant input data (D.T3.1.2) for a full documentation of the achieved datasets.
- Key value database for publishing the achieved results (D.T3.2.1).

The metadata description of the produced datasets follows the joint concept on geodata management, which is described in Deliverable D.T2.3.1.

The summarized of datasets, shown in the key value database are characterized by:

- Number of individual measurements (≥1)
- Presentation of either alpha-numeric (e.g. <0,01 mg/l) or numeric values
- The dataset is characterized by a single or mean-, minimum- and maximum value as well as by the standard deviation (in case of at least 3 single datum points).
- All presented values are allocated to a measurements period, a surface location and a depth interval of the measurements.

6. Results

The compiled database consists of lithology description, sampled rock's GPS coordinates, position within the geological profile and measured thermal conductivity parameters. The results were imported to Petrel database project for further works eg.3D model parametrization.

7. Summary and conlusions

Obtained results from trt measurements are going to be used in 3D geological model parametrisation, in calculation of temperature within model layers and in map of BHE potential heat transfer rate.