CDGP: a data center for deep geothermal data

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Introduction

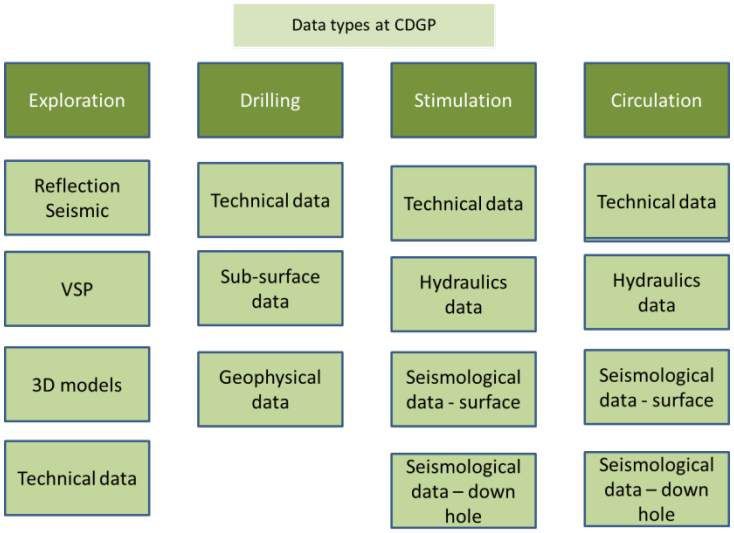
One objective of the LabEx G-EAU-THERMIE PROFONDE is to archive the data collected in the Upper Rhine Graben geothermal sites and to distribute them to the scientific community for R&D activities. The CDGP objectives are to centralize, (long term) archive, and distribute the high quality collected datasets according to IPR (Intellectual Property Rights).

Collected data cover the whole life of geothermal projects, from exploration to drilling, stimulation, circulation and production. They originate from Soultz site as well as from more recent surveys like Rittershoffen, Illkirch, etc.

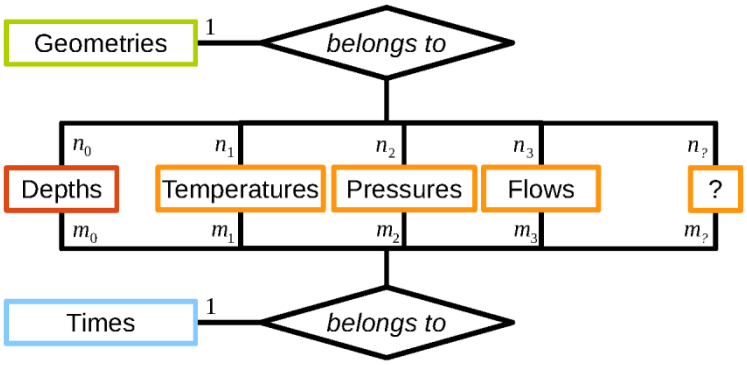
The data

The data handled by the CDGP are from different types and origin depending on the phase of the projects:

- Exploration: reflection seismic (legacy or specifically acquired reflection seismics), vertical seismic profiles VSP, 3D models of fractures, MT and gravimetric data, passive seismic imaging, technical documentation,
- Drilling: well trajectory, logs (T, gamma ray, etc.), borehole imagery (caliper, UBI), well geology, fractures description, technical data,
- Stimulation: technical data, logging, hydraulic data, temperature data, surface seismological data, deep-hole seismological data,
- Circulation: technical data, hydraulic data, surface seismological data, deep-hole seismological data, MT and gravimetric data.



Geophysical data: datasets are mainly from Soultz project, and were stored on office's shelves and old digital media. Some inventories were done (Genter, 1999), and a first step of integration of reservoir data into a posgresql/postgis database (ISO 19107 compatible) was performed (Jahn, 2014). The database links depths, temperatures, pressures, flows, for periods (times) and locations (geometries).



Other geophysical data are stored in structured directories.

Seismological data: datasets handled by the CDGP are of two kinds: the seismological waveform and the seismicity bulletin.

Waveform data originate from permanent or temporary seismic network deployed to monitor geothermal projects such as Soultz, Rittershoffen and Illkirch. The waveforms collected are either "event oriented" or consist in "continuous time series". Since mid 2009, all collected waveforms are stored in a standardized way both in format (miniSEED) and in files and directories structures (SDS) following international standard of the seismological community (FDSN). Regarding waveforms before mid 2009, mainly related to the Soultz project, some efforts have already been deployed, in the Labex framework, to convert the huge amount of "legacy data" to the current standards.

The second kind of data is the seismicity bulletin which consists mainly in gathering parametric dataset of induced events recorded by a seismic network during the different phases of the geothermal project (stimulation, circulation, etc.). Since 2013, these parametric datasets (date, time, localization, magnitude, phase picking information, etc.) are stored in a database following the open

standard QuakeML. However, most of the seismicity bulletins exist before 2013 as text file and need to be converted to QuakeML.

The metadata

Metadata are data that describe the datasets: when, where, what, who, how, where to find the data, etc. Describing the datasets is necessary to organize the discovery of the datasets, and their selection.

CDGP chooses GeoNetwork cataloging application to manage the resources. It provides metadata editing and search functions as well as a web map viewer. The metadata editor supports ISO19115/119/110 standards used for spatial resources. A demonstrator is under deployment to verify that this application fulfills requirements, one of them being the description of proprietary and access rules.

A step forward will be to add specific metadata records as defined by the Open Geospatial Consortium to provide geophysical/geologic/reservoir informations: Observations and Measurements (O&M) to describe the acquisition of information from a primary source, and SensorML to describe the sensors.

Seismological metadata, which describe all the instrumental response, use the dateless SEED standard.

Access to the data

Giving access to date will be handled in an additional step. We'll have to handle with IPR rights, and therefore define several level of access (all, academic, project, etc.) and several groups of users. Access will be granted after registration and validation.

We are thinking at geOrchestra, a free, modular and interoperable spatial data Infrastructure that provides all necessary tools: in addition to the metadata catalog based on GeoNetwork, it provides a map and features server (GeoServer), an advanced web map viewer, a data extractor, a user and group manager.

At present, the project is supported by Labex G-Eau-Thermie Profonde and the consortium COGEOS.

Access to the data will also be granted via EPOS-IP Anthropogenic Hasards project. Access to episodes (time-correlated collections of geophysical, technological and other relevant geo-data over an geothermal area) and application of analysis (time- and technology-dependent probabilistic seismic hazard analysis, multi-hazard and multi-risk assessment) will be services accessible via a portal and will require AAAI (Authentification, Authorization, Accounting and Identification).

Nevertheless, some data are now open. An example is given by the 1993 Soultz microseismic events locations that are a resource linked the the book Elements of Crustal Geomechanics (Cornet, 2015). These events are available as a csv file at http://labex-geothermie.unistra.fr/article420.

	A	B	C	D	E	F	G	H
1	52.2307	-132.0115	-2882.2935	M	25	sep93003	02-sept-93	16:19:11:72
2	54.8949	-133.9915	-2984.4690	M	26	sep93003	02-sept-93	16:23:33:33
3	185.6788	-99.0925	-2883.4912	M	27	sep93003	02-sept-93	18:27:13:58
4	122.1373	-114.6369	-2987.7437	M	28	sep93003	02-sept-93	18:29:34:87
5	118.6575	-153.2012	-2947.1094	M	29	sep93003	02-sept-93	18:29:42:97
6	63.7802	-147.0027	-2901.5874	M	30	sep93003	02-sept-93	18:37:06:82
7	264.4823	-100.9207	-2956.1807	M	31	sep93003	02-sept-93	19:03:31:27
8	70.3564	-103.1797	-2988.6089	M	32	sep93003	02-sept-93	19:13:46:17
9	153.2398	-156.0894	-2920.5388	M	33	sep93003	02-sept-93	19:15:01:01
10	98.2670	-142.2277	-2912.2327	M	34	sep93003	02-sept-93	19:17:55:18
11	83.6266	-143.1648	-2935.7996	M	35	sep93003	02-sept-93	19:18:25:64
12	106.6186	-153.9764	-2957.0894	M	38	sep93003	02-sept-93	22:27:35:04
13	47.0185	-115.9020	-2941.2256	M	39	sep93003	02-sept-93	22:40:17:88
14	83.9763	-143.8768	-2932.2437	M	40	sep93003	02-sept-93	22:42:34:41
15	111.8301	-103.7903	-3007.7327	M	41	sep93003	02-sept-93	22:42:38:01
16	74.2460	-131.0387	-2942.3486	M	42	sep93003	02-sept-93	22:45:27:22

Before giving access to this file restored from a DVD-ROM, we had to investigate PhD thesis and program codes, to find the signification of each column. X (A) and Y (B) are related to injection well (GPK1), Y toward Magnetic North, Z (C) is altitude. We have to define position of GPK1, the value of magnetic declination at acquisition period, and round Z to the meter. We still have to check if Z is related to the top of the well or is real altitude, and if time is given in local or GMT time (including changes related to Daylight saving time).

Conclusion

CDGP (1) collects, centralizes, (long-term) archives, data related to deep geothermal sites in Alsace, (2) is actually populating metadata records and setting a metadata catalog (GeoNetwork), and (3) will set-up a Spatial Data Infrastructure to provide data access that grants IPR. An important forthcoming step will be to include this effort of setting a local data center to the European initiative EOPS-IH AH.

Bibliography

Genter, A., 1999 – Geological and well-logging data collected from 1987 to 1999 at the HDR site Soultz-sous-Forêts. Rapport BRGM R40795, http://infoterre.brgm.fr/rapports/RR-40795-FR.pdf.
Jahn, M., 2014 – Guide to the Soultz PostGIS Database & OpenJUMP-Client(s). Internal report.
GeoNetwork, http://geonetwork-opensource.org/.
geOrchestra, http://www.georchestra.org/.
Cornet, F.H., 2015 – Elements of Crustal Geomechanics, Cambridge University Press.