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Office fédéral de l'énergie OFEN

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IMPLEMENTATION OF THE BDFGEOTHERM DATABASE (GEOTHERMAL FLUIDS IN SWITZERLAND) ON GOOGLE EARTH

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Les auteurs sont seuls responsables du contenu et des conclusions de ce rapport.

ABSTRACT

The database BDFGeotherm compiled in 2007 on ACCESS code was modified to improve its availability and attractiveness by using Google Earth free software and the CREGE website. This database allows gathering existing geothermal data, generally widely dispersed and often difficult to reach, towards a user's friendly tool. Downloading the file "BDFGeotherm.kmz" from the CREGE website makes possible to visualize a total of 84 geothermal sites from Switzerland and neighbouring areas. Each one is represented with a pinpoint of different colour, for different temperature ranges.

A large majority of sites is located in the northern part of the Jura Mountain and in the upper Rhone Valley. General information about water use, geology, flow rate, temperature and mineralization are given in a small window by clicking on the desired pinpoint. Moreover, two links to an Internet address are available for each site in each window, allowing returning to the CREGE website and providing more details on each sampling point such as: geographical description, reservoir geology, hydraulics, hydrochemistry, isotopes and geothermal parameters. For a limited number of sites, photos and a geological log can be viewed and exported.

RESUME

La base de données BDFGeotherm, réalisée en 2007 sous ACCESS, a été modifiée dans le but d'améliorer sa diffusion et de faciliter son emploi. Le logiciel Google Earth et le site Internet du CREGE ont été utilisés pour convertir cette base regroupant des données sur les fluides thermaux souvent dispersées et difficiles d'accès. En téléchargeant le fichier "BDFGeotherm.kmz" depuis le site Internet du CREGE et en ouvrant ce fichier dans Google Earth, 84 sites contenant des informations sur les fluides thermaux apparaissent sur un fond de carte géographique. Chaque site est représenté par une épingle dont la couleur représente un intervalle de température mesurée.

Le secteur nord du massif du Jura et la vallée supérieure du Rhône sont les deux zones où se concentrent la majorité des sites. Des données sur l'utilisation de l'eau, la géologie, le débit, la température et la minéralisation de l'eau apparaissent dans une nouvelle fenêtre en cliquant sur l'épingle des sites. Pour chacun d'entre eux, un lien vers le site Internet du CREGE permet d'obtenir des informations supplémentaires: description géographique, géologie du réservoir, propriétés hydrauliques, hydrochimie, isotopes et paramètres géothermaux. Pour un nombre limité de sites, des photos et des logs géologiques peuvent être visualisés et exportés.

1. INTRODUCTION

A database on geothermal fluids in Switzerland, called BDFGeotherm, has been compiled in 2007. It consists of nine related tables with fields describing the geographical, geological, hydrogeological and geothermal conditions of each sampling location. In total, 212 springs and boreholes from 84 geothermal sites in Switzerland and neighbouring regions are listed in this new interactive Microsoft Access database. BDFGeotherm is a functional tool for various phases of a geothermal project such as exploration, production or fluid re-injection. Many types of queries can be run, using any fields from the database, and the results can be put into tables and printed or exported and saved in other files (Sonney and Vuataz 2007 and 2008).

Currently, a CD-Rom of the BDFGeotherm database (version v1) containing the user's manual is available on request from the authors. This database was not accessible via Internet due to its file size (408 Mo) which generates a long time for downloading. Moreover, the use of BDFGeotherm requires knowing the functionalities of the Microsoft ACCESS software.

For all these reasons, it has been proposed to improve the accessibility and the attractivity of this database by using the Google Earth free software (www.earth.google.com) and the CREGE website. Google Earth is used to visualise general information about the 84 sites in Switzerland and neighbouring areas, whereas the CREGE website is used to compile all data in a SQL format.

In this report, the first section will develop the importation of the database, the view of general information about the sites and the links to the CREGE website. The second section will highlight diverse functionalities of the CREGE website such as the selection of sites and sampling points and the exportation of data.

2. USE OF THE GOOGLE EARTH DATABASE

2.1. Importation of the database

Importation of the BDFGeotherm database requires to download and to save the file BDFGeotherm.kmz available in the CREGE website at the following address: www.crege.ch/BDFGeotherm/. It is also possible to download the final report. After opening the database in Google Earth, sites with geothermal fluids in Switzerland and neighbouring areas appear on a geographical map with international boundaries and are alphabetically listed in a window on the left side (Fig. 1).

Five colours were assigned to the pinpoints which correspond to ranges of maximum measured temperature (Table 1).

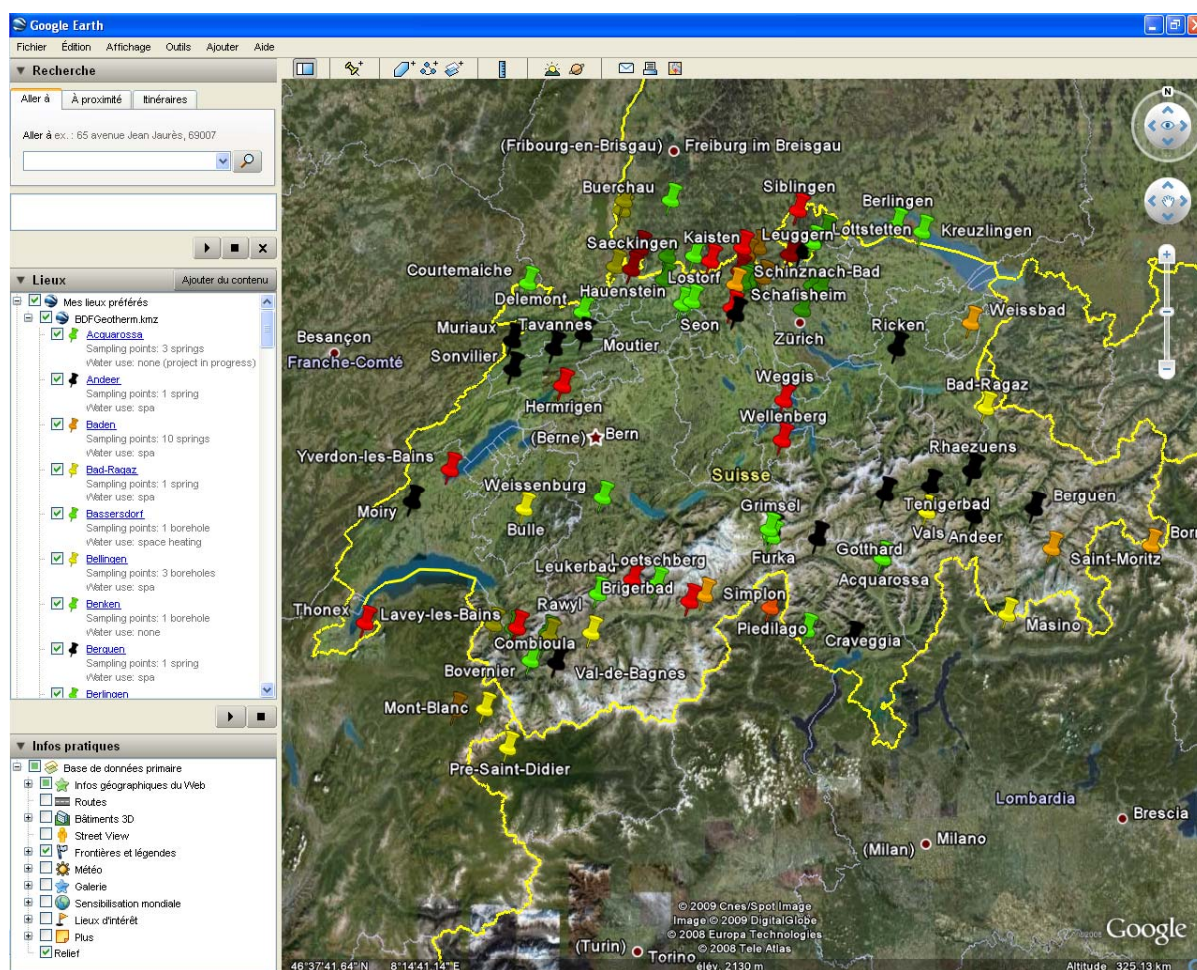


Figure 1: View of geothermal sites implemented in the Google Earth free software.

Table 1: Assigned colours to the pinpoints corresponding to ranges of maximum measured temperatures.

Colour	Temperature range (°C)
Red	> 50
Orange	40 - 50
Yellow	30 - 40
Green	20 – 30
Black	< 20

2.2. View of general information

Visualization of general information about a desired site is possible while clicking only once on a site listed in the window on the left side. A new window will appear in the

map showing general information such as: geographical description, geology, hydraulics, hydrochemistry, isotope and geothermal parameters (Fig. 2).

While clicking twice on a chosen site in the left window, the scale of the map decreases down to a view fixed at 2000 m of elevation. This can be modified in the properties of the pinpoint with a right click of the mouse. A new window appears where the coordinates of the site, the pinpoint style and the description can be changed (Fig. 3).

Finally, two Internet links are available for each site in each window, which allow returning to the homepage of BDFGeotherm or providing more details on each sampling point such as: geographical description, reservoir geology, hydraulics, hydrochemistry, isotopes and geothermal parameters.

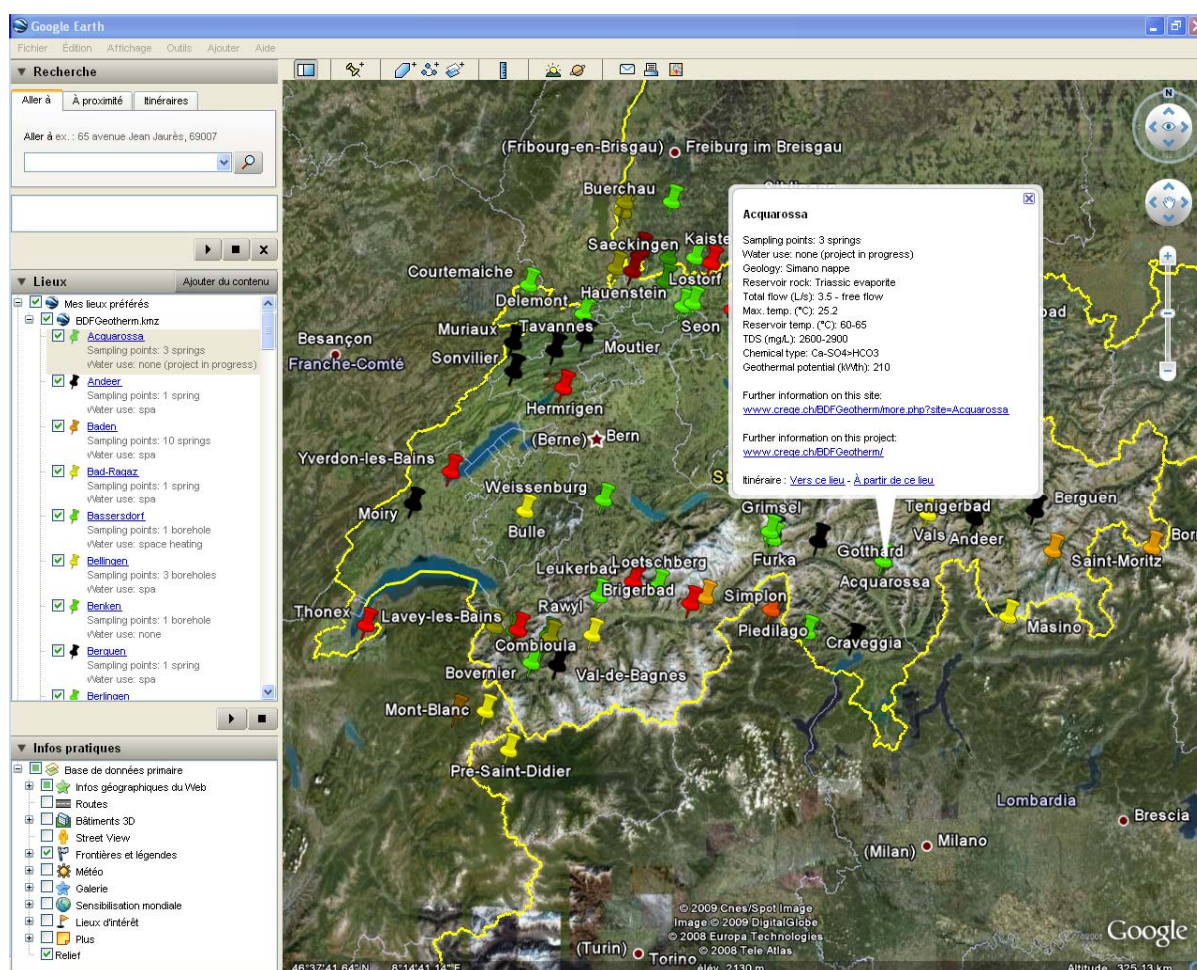


Figure 2: View of the general information in the example of Acquarossa.

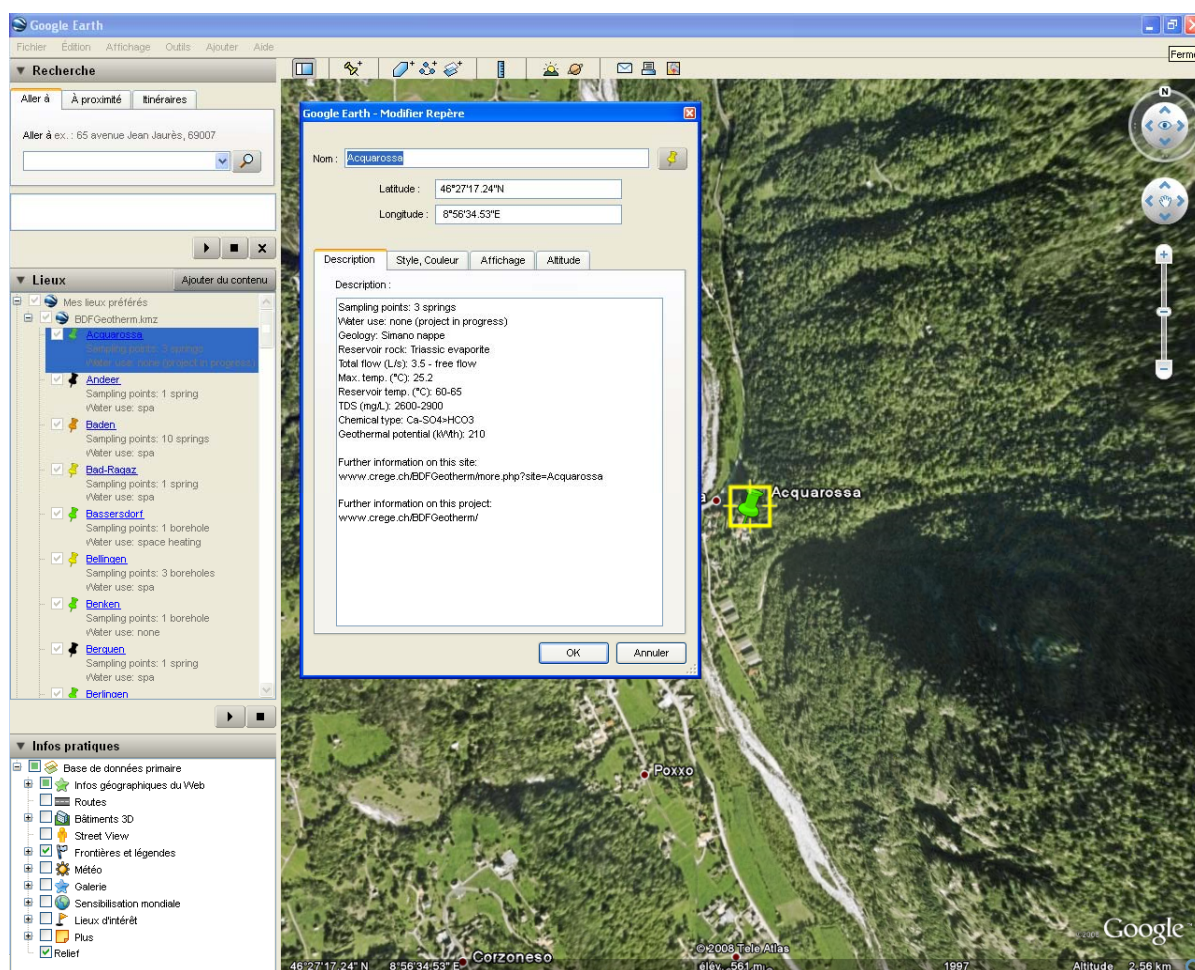


Figure 3: View of the properties of the pinpoint in the example of Acquarossa.

3. USE OF THE WEB DATABASE

The homepage of this project is available on the CREGE website at <www.crege.ch/BDFGeotherm/>. In this homepage, the final report, two publications and the database file can be downloaded. Moreover, a dropdown list allows choosing a site on an alphabetical list (Fig. 4).

While clicking on a desired site, for example Acquarossa, general information about the site description and the geology are given with a photo of the site. At the bottom of this window, a frame indicates the presence of 3 sampling points for Acquarossa (Fig. 5).

While selecting one of the sampling points, a new window opens with detailed information about coordinates of the sampling point, elevation, hydrochemistry, hydraulics, isotopes and geothermal parameters. From this window, it is also possible to change the sampling point or to search for another site in BDFGeotherm web database (Fig. 6).

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BDFGeotherm – Web database of geothermal fluids in Switzerland

212 geothermal groundwater points from 84 sites in Switzerland and neighbouring regions are referenced and documented in this web database.

Abstract

The database BDFGeotherm compiled in 2007 on Access code has been adapted to improve its availability and attractivity by using **Google Earth** free software & make these data directly available on our website.

This web database allows gathering existing geothermal data, generally widely dispersed and often difficult to reach, towards a user's friendly tool. A large majority of sites is located in the northern part of the Jura Mountain and in the upper Rhone Valley. For a limited number of sites, photos and a geological log can be viewed.

You can browse this web database using the **Search function** below to reach any site.

You can also download the [below BDFGeotherm.kmz](#) file to visualize on Google Earth the 84 geothermal sites from Switzerland and neighbouring areas. Each one is represented with a pinpoint of different colour, for different temperature ranges.

Google Earth pinpoint colour	black	green	yellow	orange	red
Fluid temperature (°C)	<20	20-30	30-40	40-50	>50

On Google Earth, general information about water use, geology, flow rate, temperature and mineralization are given in a small window by clicking on the desired pinpoint. Moreover, for each site, a direct link to this web database version allows you to view more detailed information, such as geographical description, geology, hydraulics, hydrochemistry, isotopes and geothermal parameters.

**Search a site
in BDFGeotherm web database**

Please choose a site...

Report

Sonney R. & Vuataz F.-D., 2008. Implementation of BDFGeotherm database (Geothermal fluids in Switzerland) on Google Earth. Final report for the OFEN, Project No 101'842.
[[pdf - 2.73 Mo](#)]

Publications

Sonney R. & Vuataz F.-D., 2008. Properties of geothermal fluids in Switzerland. A new interactive database. *in* *Geothermics*, 37, 5 : 496-509.
[[web DOI link](#)]

Sonney R. & Vuataz F.-D., 2007. BDFGeotherm: the Database of Geothermal Fluids in Switzerland. *in* Proc. European Geothermal Congress 2007, Unterhaching, Germany, 30 May - 1 June 2007.
[[pdf - 0.45 Mb](#)]

BDFGeotherm for Google Earth

[[BDFGeotherm.kmz file - 18 ko](#)]



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[[Contactez-nous](#)] - Mise à jour: 18.12.08
Centre de recherche en géothermie - Neuchâtel - Suisse

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Figure 4: View of the BDFGeotherm project homepage in the CREGE website.



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BDFGeotherm – General information on Acquarossa

Site description

Country	Switzerland
Canton/Province	Tessin
Use	None

Geology

Surface formation	Gneiss
Age of surface formation	Hercynian
Reservoir formation	Evaporite
Age of reservoir formation	Trias
Geological setting	Simano nappe



Acquarossa has 3 sampling points

- Albergo (ACQUA-ALB)
- SatroC (ACQUA-SATROC)
- SatroD (ACQUA-SATROD)

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Figure 5: View of an example : the page of Acquarossa.

BDFGeotherm – General information on Acquarossa

Site description

Country	Switzerland
Canton/Province	Tessin
Use	None

Geology

Surface formation	Gneiss
Age of surface formation	Hercynian
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Acquarossa has 3 sampling points

Albergo (ACQUA-ALB)
SatroC (ACQUA-SATROC)
SatroD (ACQUA-SATROD)

Search another site in BDFGeotherm web database

Acquarossa ▾

Site: Acquarossa

Sampling point: SatroC

Sample name: ACQUA-SATROC

Description

Sampling point type: Spring
X-coord: 715'575
Y-coord: 145'925
Elevation: 520 m amsl
Depth: *no data*

Hydrochemistry

Sampling date: 03.03.1978
Geochemical type: Ca-SO₄>HCO₃
Temperature: 23.8 °C
Electrical conductivity: 2415 µS/cm
pH: 6.5

Cations (mg/L)

Li: 0.11
Na: 18.2
K: 17.1
Mg: 87.7
Ca: 564
Sr: 12.5

Anions (mg/L)

F: *no data*
Cl: 6
SO₄: 1250
HCO₃: 641

Undissociated (mg/L)

SiO₂: 44.3

TDS: 2643 mg/l
Ionic balance: 0.25 %

Hydraulics

Flow rate: 1.00 l/s
Surface temperature: 23.8 °C
Max. measured temp.: 24.5 °C
Hydraul. conduct. (m/s): *no data*
Exploitation mode: Free flow

Isotopes

Sampling date: 03.03.1978
δ¹⁸O: -10.85 ‰
D: -73.90 ‰
³H: 35.0 TU
¹⁴C: *no data*
Resid. time: <1953 years/date
Infiltration area: 1600 m amsl
Remarks: *no data*

Geothermal parameters

Min. reservoir temp.: 60 °C
Max. reservoir temp.: 65 °C
Reservoir depth: -1100 m amsl
Geoth. gradient: 30 °C/km
Geoth. potential: 58 kW_{th}

Geological log not available

Search another site in BDFGeotherm web database

Acquarossa ▾

Figure 6: View of the main information page for an example in Acquarossa site.

ACKNOWLEDGMENTS

The development and the modification of BDFGeotherm database was financed by subsidies of the Swiss Federal Office of Energy, Bern, Project No 101'842.

REFERENCE

Sonney R and Vuataz FD (2008) Properties of geothermal fluids in Switzerland: a new interactive database. *Geothermics* 37: 496-509.

Sonney R and Vuataz FD (2007) BDFGeotherm: the Database of Geothermal Fluids in Switzerland. *Proc. European Geothermal Congress 2007*, Unterhaching, Germany, 30 May – 1 June 2007.

Sonney R and Vuataz FD (2007) BDFGeotherm – Base de données des fluides géothermiques de la Suisse. *Rapport final pour l'OFEN*, No 101'842.