

Basel Demo Dataset

This example dataset consists of seismic data recorded during the Enhanced Geothermal System (EGS) stimulation within the Deep Heat Mining project in Basel, Switzerland in December 2006 (Kraft et al. 2011). The project aimed the exploitation of geothermal heat from a depth of about 4,630 m. During the stimulation thousands of earthquakes have been induced within a few days reaching M_L 3.4 on December 8th 2006. This earthquake effectively stopped the stimulation, and finally terminated the whole project. Basel is situated in the Upper Rhine Graben, and has experienced larger earthquakes before. Therefore a rigid seismic monitoring was imposed by mining authorities consisting of several borehole stations. This gave excellent Ground Truth for any comparison studies on seismic monitoring concepts down to M_L -2.

So the potential and limits of surface-based mini arrays to monitor induced seismicity could be evaluated. Personnel of the Institute for Geophysics from the University of Stuttgart performed the measurements, processed the data, and compiled several reports (e.g. Häge et al. 2013).

The compiled data set contains records of two tripartite small arrays (SNS – Seismic Navigating System) in some two to five km distance to mimic an OSI (On-Site Inspection) SAMS (Seismic Aftershock Monitoring System) layout where just the two nearest stations resolved a weak event in the environmental noise. Just for comparison, we added one additional 3c BRB surface station of the Swiss Seismological Service (SED), and one 3c borehole station made available by the operator. These extra stations should give some impressions on SNS performance but are not necessary for event location.

We focus on a time segment two days before the main shock when hundreds of induced earthquakes M_L -2 to 2 occurred.

Start time of the dataset:	12/08/2006 00:00 UTC
End time of the dataset:	12/08/2006 03:00 UTC
Global sampling rate:	250.0 Hz

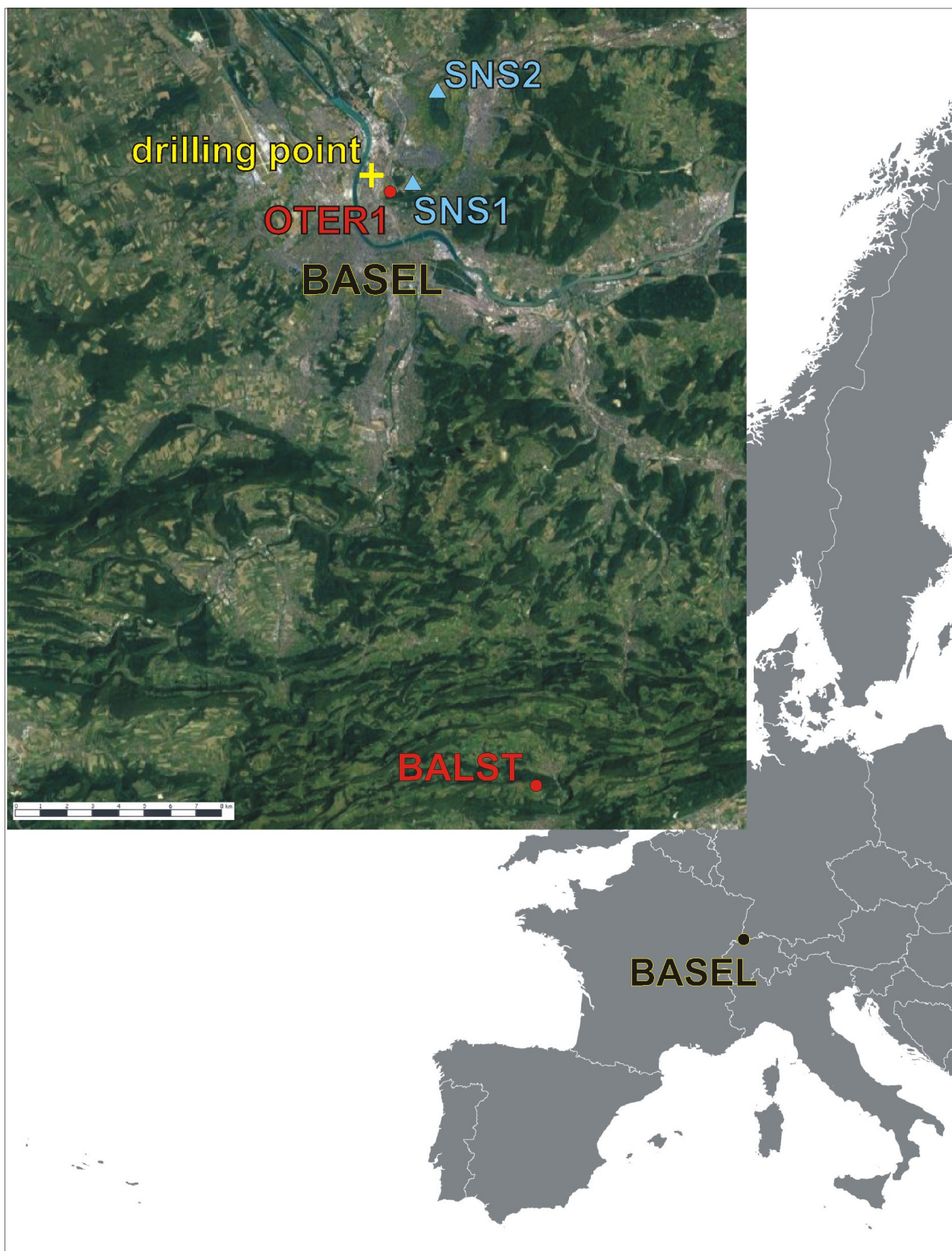
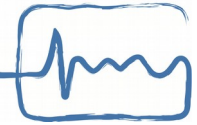


Figure 1. Location of the SNS1, SNS2 and the permanent stations OTER1 and BALST in relation to the drilling point during the EGS-stimulation in 2006 in Basel, Switzerland.



Station	Latitude	Longitude	Altitude (m a.s.l.)	Sensor type	Installation
SNC (SNS1)	47.57980	7.61822	256	LE-3D/Vlite	surface
SNN (SNS1)	47.580538	7.618274	255	LE-1D/Vlite	surface
SNE (SNS1)	47.57935	7.619204	257	LE-1D/Vlite	surface
SNW (SNS1)	47.579413	7.61703	257	LE-1D/Vlite	surface
S2C (SNS2)	47.617593	7.633754	432	LE-3D/Vlite	surface
S2N (SNS2)	47.617856	7.634813	440	LE-1D/Vlite	surface
S2E (SNS2)	47.616744	7.63394	438	LE-1D/Vlite	surface
S2W (SNS2)	47.618017	7.32858	432	LE-1D/Vlite	surface
OTER1	47.57775	7.603898	253	CMG-3TB	borehole sensor in 500m depth
BALST	47.33599	7.694849	860	STS2	in 4.5m depth

Table 1. Location and instrumentation of the SNS and permanent stations used in this dataset.

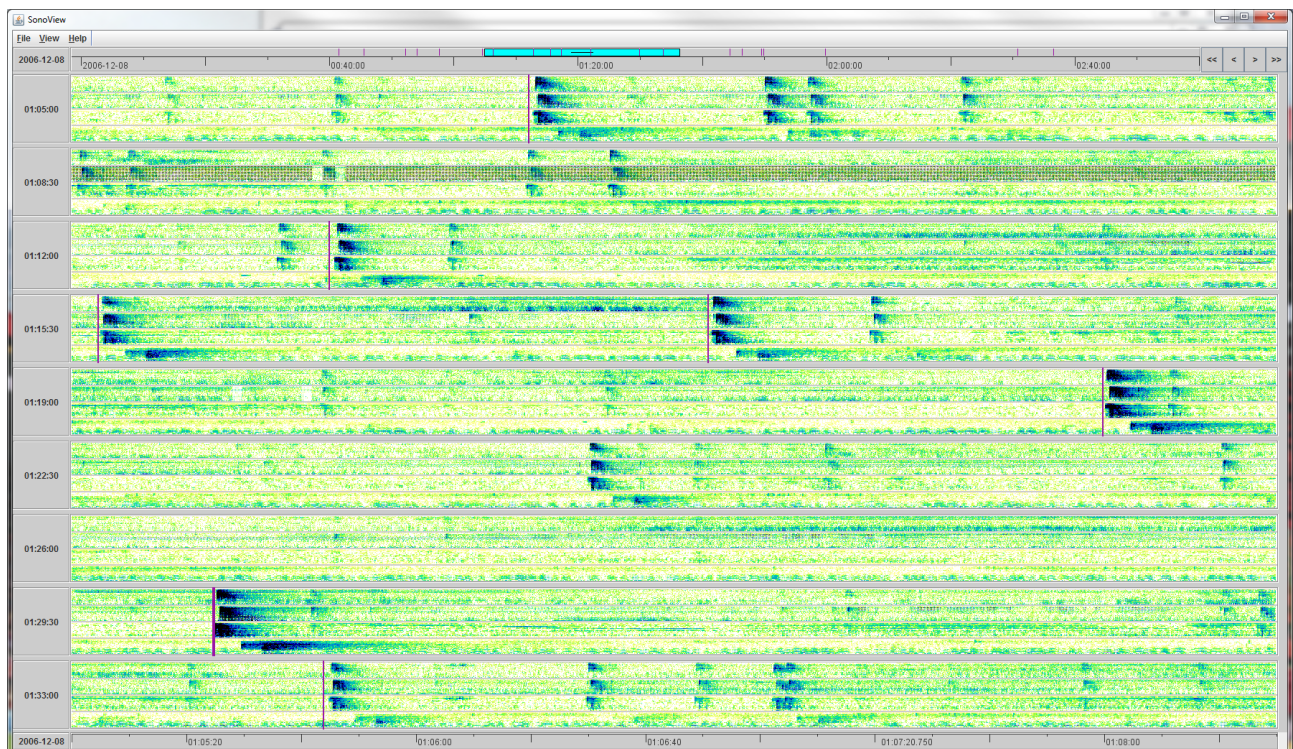


Figure 2. Screenshot of SonoView showing approx. 40 minutes of continuous seismic data with dozens of earthquakes. The stronger events with $1.5 < M_l < 2.0$ are marked.



References

Häge, M., Blascheck, P. & Joswig, M. 2013. EGS hydraulic stimulation monitoring by surface arrays - location accuracy and completeness magnitude: the Basel Deep Heat Mining Project case study. *J Seismol* **17**, 51–61 (2013). <https://doi.org/10.1007/s10950-012-9312-9>

Joswig, M. 2008. Nanoseismic monitoring fills the gap between microseismic networks and passive seismic. *First Break* 26:121–128.

Kraft, T., Mai, P.M., Wiemer, S., Deichmann, N., Ripperger, J., Kästli, P., Bachmann, C., Fäh, D., Wössner, J. & Giardini, D. 2011. Enhanced Geothermal Systems: Mitigating Risk in Urban Areas. *EOS* 90, Issue 32: 273-274.

Contact:

If you need any assistance or if you have any questions regarding the software and or dataset please contact us:

