

# Description of data set “Wide-angle seismic data (“fixed spread”) from the Oct. 2020 3D survey across the Ivrea Zone, Italy (project SEIZE)”

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Central Coordinate: 8.14148°E, 45.81823°N

## Abstract

**Seismic Data, including raw, mini-seed and SEG-Y files, of a part of a controlled-source 3D survey in Northern Italy, Ivrea Zone, based on 432 Vibroseis sources recorded by a fixed spread of 110 receivers.**

**Keywords:** Geophysics, controlled-source seismic survey, Alps, Vibroseis

## 1. Introduction

This data publication contains part of a seismic survey collected across the Ivrea Zone, Italy, in October 2020. Within the research project SEIZE (SEismic Imaging of the Ivrea Zone), this high-resolution seismic campaign investigates the upper 5 km of the subsurface under and around the commune of Balmuccia (Val Sesia, Piedmont region). The aim is to provide the best in situ geophysical image and physical properties of the subsurface as well as to calibrate future observations made during the planned ICDP drilling (<https://www.icdp-online.org/projects/by-continent/europe/dive-italy>, <http://www.dive2ivrea.org/>).

## 2. Data Acquisition

### 2.1 Experiment design and schedule

The seismic campaign consisted of two intersecting reflection seismic lines (extent 16.3 km WE, and 10.4 km NS). The seismic field work was executed with the use of three vibrators as energy source (see Table 1) and a cable-free acquisition system (440 recorders in total). In the main experiment (“roll-along”), 330 seismic sensors have been deployed along these lines and moved in a roll-along style to record (inline) signals of the vibrators (sources). This data is not part of this data publication and will be published separately. In addition to the moving/roll-along spread, 110 seismic sensors had been deployed along both lines at fixed locations, recording the seismic sources from both lines (“fixed spread”). Two data loggers recorded the timing of the Vibroseis sweep and the pilot sweep. Field work was a joint activity of German, Italian, Austrian and Swiss colleagues and supplements shallow seismic (Liu et al., 2021) and seismological investigations (Hetényi et al., 2017; Scarponi et al., 2021).

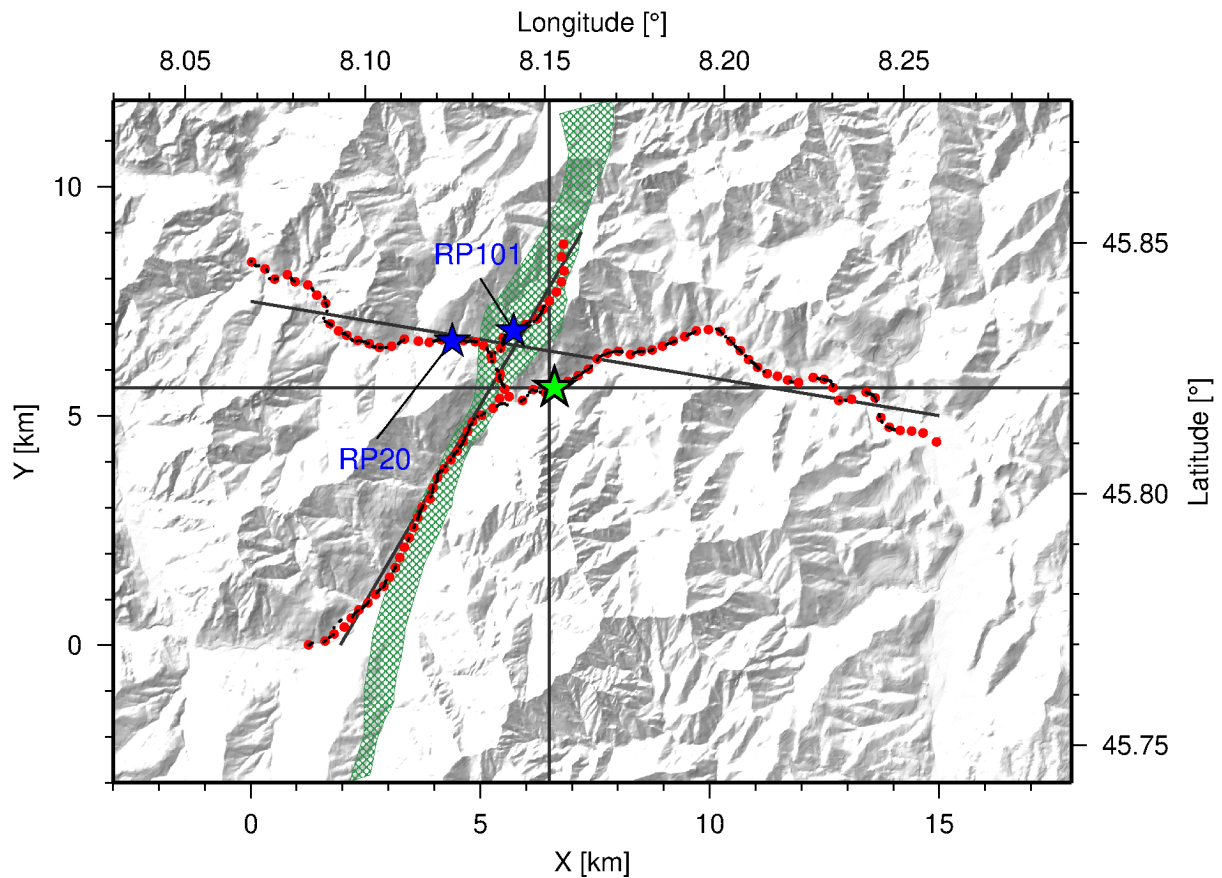


Figure 1: Topographic map showing the distribution of 110 receivers (red circles) and 432 seismic sources (black dots) used in the fixed-spread experiment. The receivers recorded all sources from both seismic lines (fixed stations). For logistic reasons the two lines followed mainly roads in the valleys. The green hatched area maps the Insubric Line Zone and the green star marks the tentatively planned drilling location. The origin of the relative X-Y coordinate system is at 8.06796°E, 45.76976°N.

## 2.2 Geometry/Location

Figure 1 shows the location of the study area, files in sub-directory info/ provide locations and supporting information for the receivers and shot locations.

## 2.3 Instrumentation

We used 110 seismic data loggers (CUBEs, see <https://www.gfz-potsdam.de/en/section/geophysical-imaging/infrastructure/geophysical-instrument-pool-potsdam-gipp/pool-components/seismic-pool/recorder/-/dss-cube> or <https://www.digos.eu/>) equipped with three-component component geophones having an eigenfrequency of 4.5 Hz. The data loggers recorded continuously at 400 samples per second.

## 2.4 Acquisition parameters

Parameter	Value
<b>Vibrators</b>	3 (+1)
<b>Manufacturer</b>	Prakla Geomechanik
<b>Model</b>	VVCA/E with SILENT PACK
<b>Peak Force</b>	28000 lbs (nominal)
<b>Sweep parameters</b>	Linear between 10 – 110 Hz, 14 s
<b>Vibrator point spacing</b>	irregular, ~60 m
<b>Sweep repetition at vibrator point</b>	~8 fold
<b>Sensor spacing</b>	along profiles, ~240 m
<b>Recording system</b>	DIGOS Cube (cable-free nodes)
<b>Sampling rate</b>	400 Hz
<b>Sensors</b>	3C, 4.5 Hz eigenfrequency
<b>Acquisition length</b>	Continuous recordings

**Table 1:** Acquisition parameters

### 3. Data Pre-Processing

The data set was pre-processed at the GFZ in Potsdam. The CUBE data (all 3 components) had been converted to mini-seed (FDSN, 2012) using the *GIPPTools* (Lendl, 2020). Time series for all shots were cut out from the continuously recorded data stream of the data loggers, and consequently converted to the commonly used data format SEG-Y (vertical component only!) again using the *GIPPTools*. The data had then been stacked vertically (all sources from a vibrator point) and correlated with the pilot sweep using SeisSpace/ProMAX® software. The pilot sweep had been recorded with two extra data loggers at the vibrators (sweep and time).

### 4. Data Description

The SEG-Y file (SEG Technical Standards Committee 2002, Barry et al., 1975) contains the vertically stacked and correlated recordings at all receivers and from all sources along the lines. The data set contains also the raw data (all 3 components) of the autonomously running recorders (which ran continuously for about 14 days).

#### 4.1 File formats

We provide two file formats: raw (Cube-formatted) data (level 0) and SEG-Y data (vertically stacked & correlated). Only minimal information is set in the SEG-Y headers (see Table 2). The SEG-Y file has a length of 20 s, starting at -1 s, i.e. 1 second before the start of the vibrator source. The geographical coordinates in the headers are converted from lat/long to UTM (zone 32)

<b>Byte-#</b>	<b>SEG-Y description</b>	<b>SU header word<sup>1</sup></b>	<b>(Min) val</b>	<b>Max val</b>	<b>Comment</b>
1-4	Trace sequence number within line	tracl	1	46970	Set but not defined
5-8	Trace sequence number within reel	tracr	1	46380	Set but not defined
9-12	Original field record number	fldr	4001	5450	FFID
13-16	Trace sequence number within original field record	trafc	1	110	CHAN
17-20	Energy source point number	ep	4001	5450	
21-24	CDP ensemble number	cdp	2	214	Set but not defined
29-30	Trace identification code	trid	1		1 = seismic data
33-34	Number of horizontally stacked traces yielding this trace	nhs	1	24	
37-40	Distance from source point to receiver group	offset	-14471	15441	meters
41-44	Receiver group elevation	gelev	4370000	14540000	meters
45-48	Surface elevation at source	selev	4420000	11230000	meters
69-70	Scalar for elevations and depths	scalel	-10000		negative means divisor
71-72	Scalar for coordinates	scalco	-100		negative means divisor
73-76	X/Y source and receiver coordinates	sx, sy, gx, gy	42753106	44155413	meters
77-80			506888900	507725600	
81-84			42755178	44246403	
85-88			506889200	507763900	
89-90	Coordinate units	counit	1		Coordinate units; 3 = meters; <i>UTM (zone 32)</i>
115-116	Number of samples in this trace	ns	8000		
117-118	Sample interval of this trace in microseconds	dt	2500		
157-158	Year data recorded	year	2020		

**Table 2:** SEG-Y header words (see also SEG Technical Standards Committee, 2002)

#### 4.2 Data content and structure:

<b>File name</b>	<b>Size</b>	<b>Comment</b>
segy/wa_all.segy	1512 MB	stacked, correlated data
raw/cube-xxx	452 GB	raw CUBE data
mseed/	194 GB	mini-seed data
info/rp.dat	3.5 kB	station geometry
info/sp.dat	214 kB	shot information

**Table 3:** Directory and file structure of the data set

<sup>1</sup> Seismic Unix; Cohen & Stockwell (2010)

File info/sp.dat contains source information and has the following structure (times in UTC):

```
45.845055 8.066700 821 2020-10-23T14:34:10.8914931 4001 1
longitude latitude elevation shot_time FFID sweep # @location
```

File info/rp.dat contains receiver information and has the following structure:

```
45.844929 8.066969 820 1 491
longitude latitude elevation channel/receiver point CUBE number
```

## 5. Data Quality/Accuracy

Generally, the data quality (Signal-to-Noise ratio) and the GPS timing/positioning of the data is good. All Vibroseis operations went smoothly.

## 6. Data Availability/Access

Data is archived at the *GIPP Experiment and Data Archive* where it will be freely available for further use after the end of the embargo period (31.12.2024). Data is published under a CC BY 4.0 license. When using the data, please give reference to this data publication as:

**Ryberg, T. et al. (2022)** Wide-angle seismic data (“fixed spread”) from the Oct. 2020 3D survey across the Ivrea Zone, Italy (project SEIZE). GFZ Data Services. DOI: 10.5880/GIPP.202016.2

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