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Data of the seismic reflection experiment in the Baza Basin (BASE project, October 2013)

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Abstract

SEGY and supplementary data of the seismic reflection experiment in the Baza Basin (Southern Spain). Presented are unstacked and unmigrated data of three 2D vibroseis profiles which were carried out in October 2013 and all corresponding raw data.

Supplementary data:
DOI: 10.5880/GIPP.201312.1

Coordinates: 37°29' N, 2°42' W

1. Introduction

The Baza Basin is an intra-mountain evaporitic basin in the Betic Cordillera (Southern Spain). The basin is formed by Pliocene to Pleistocene sediments. It can be distinguished into three lithological zones corresponding to different paleo-environments (Gibert et al., 2007). The inner zone, interpreted as a central saline lake, is dominated by an alternation of gypsum and carbonate laminae. The intermediate zone is characterized by cyclic carbonate beds. This zone is interpreted as a mosaic of shallow lakes surrounding the inner zone. The marginal zone consists of lacustrine deposits which are surrounded by an alluvial belt. In the marginal zone, distal fan deposits and shallow lake sediments alternate as a result of fluctuations in the lake water level which are related to changes in climate (Gibert et al., 2007). Therefore, up to 2.5 km thick lacustrine and ancillary continental deposits are found in this part of the basin which provide an unique archive of climatic changes and paleo-climatic events. The basin is bounded to the West by the Baza fault zone (e.g., Alfaro et al., 2010).There are plans to analyze the sedimentary record of the central zone with regard to the paleo-climaste in the Mediterranean as well as on a global scale within a scientific drilling project.

In preparation for future drilling activities, the project BASE (BAza Seismic Experiment) started in the middle of the year 2013 with a duration of 12 month. In the framework of this project, controlled-source seismic measurements were used to investigate the structure of the Baza Basin and to find local zones of neo-tectonic deformation bounding the basin to the west (Baza fault). The aim of the seismic work was to provide structural information for the planned scientific drilling project.

2. Data Acquisition

2.1 Experiment design and schedule

The vibroseismic experiments were carried out in the vicinity of Baza during 21st and 29th October 2013. A net of three individual seismic profiles was conducted, each 18 km in length (Figure 1). Two simultaneously operating vibrators were used as source at 301 positions at each profile. The nominal source point spacing was 60 m. The receivers were spread along the active profile in a roll-along configuration with a nominal receiver spacing of 20 m. Depending on the proceeding of the vibrators, groups of receivers were picked up at the end of the spread and were moved to the front. With a total amount of ~340 receivers, an offset range of at least 3 km around the source point was covered during the entire registration of each profile. Additionally to the roll-along receivers at Line 2, 31 fixed recorders were spread with a spacing of 600 m over the full distance of this profile (far-field recordings).

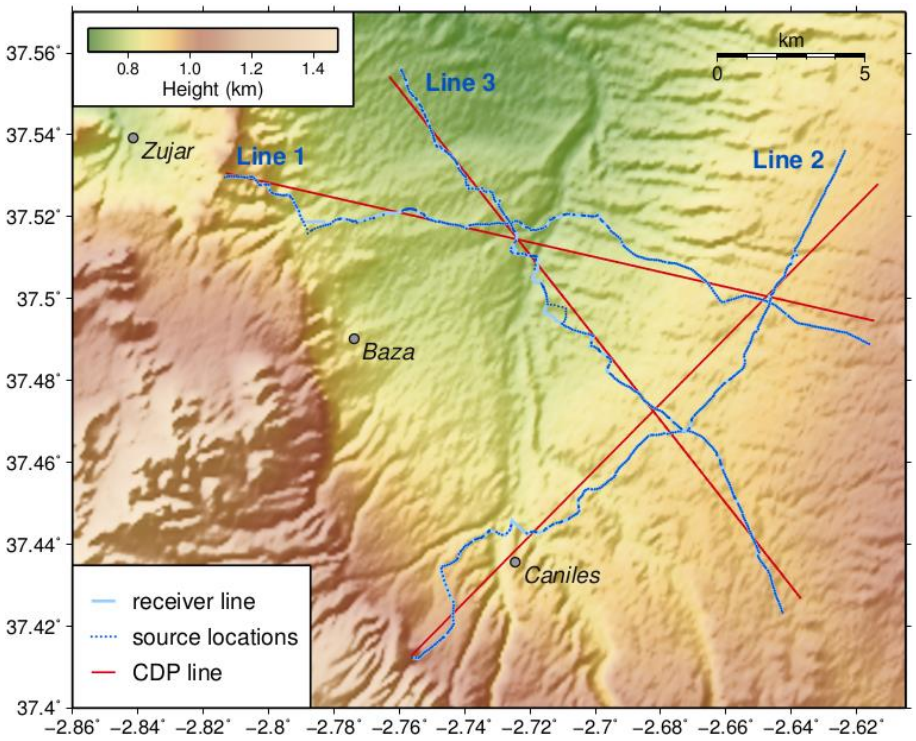

Figure 1: Location map of the three seismic profiles of the BASE project. The receiver lines are plotted in light blue and the source locations are plotted as dark blue dots. The CDP lines (red lines) were calculated by an orthogonal regression of the original (crooked) receiver locations. Underlying the profiles, the topography of the investigation area is inserted showing the Baza Basin in green and yellow colors.

2.2 Geometry/Location

The shot and receiver coordinates of all profiles are listed in the folder *info/geometry*. Given are files with the coordinates of the original crooked profiles and the corresponding linearized CDP lines (see Figure 1). Additionally, lists containing the source locations and all associated active receivers can be found in the folder. The UTM coordinates were subtracted by a constant value to match the format requirements of the processing software. These values are noted in all the geometry files.

2.3 Instrumentation

Two simultaneously operating vibrators, each with 200 kN peak force, were used as the source. A sweep of 13 s sweep length was initiated 8 times at each source point with linearly increasing frequency from 8 to 100 Hz.
The recording of the seismic data was done with autonomous digital data recorders (Omnirecs DSS Data-Cubes, Geophysical Instrument Pool Potsdam GIPP) using 4.5 Hz geophones. The recorders were operating with a sample rate of 2.5 ms.
The topographic surveying was realized with the Trimble differential GPS system.

2.4 Acquisition parameters

The following table gives the acquisition parameters of the straight CDP lines of all seismic profiles.

Parameter	***Value***
total profile length (m)	18 000
number of source points	301
total number of receivers points	901
nominal source spacing (m)	60
nominal receiver spacing (m)	20

Due to the roll-along configuration, not all receiver locations were active for each source, except the far-field recorders for Line 2. Figure 2 shows the active receivers for each source in the roll-along configuration and gives an overview of the movement of the receivers around the source points. The location numbers are set from 1000 – 1900 for Line 1, from 2000 – 2900 for Line 2 and from 3000 – 3900 for Line 3. Tables of the active receivers are also given in the folder *info/geometry*. Missing locations for all sources are due to inaccessibility of the terrain or theft/breakdown of instruments.

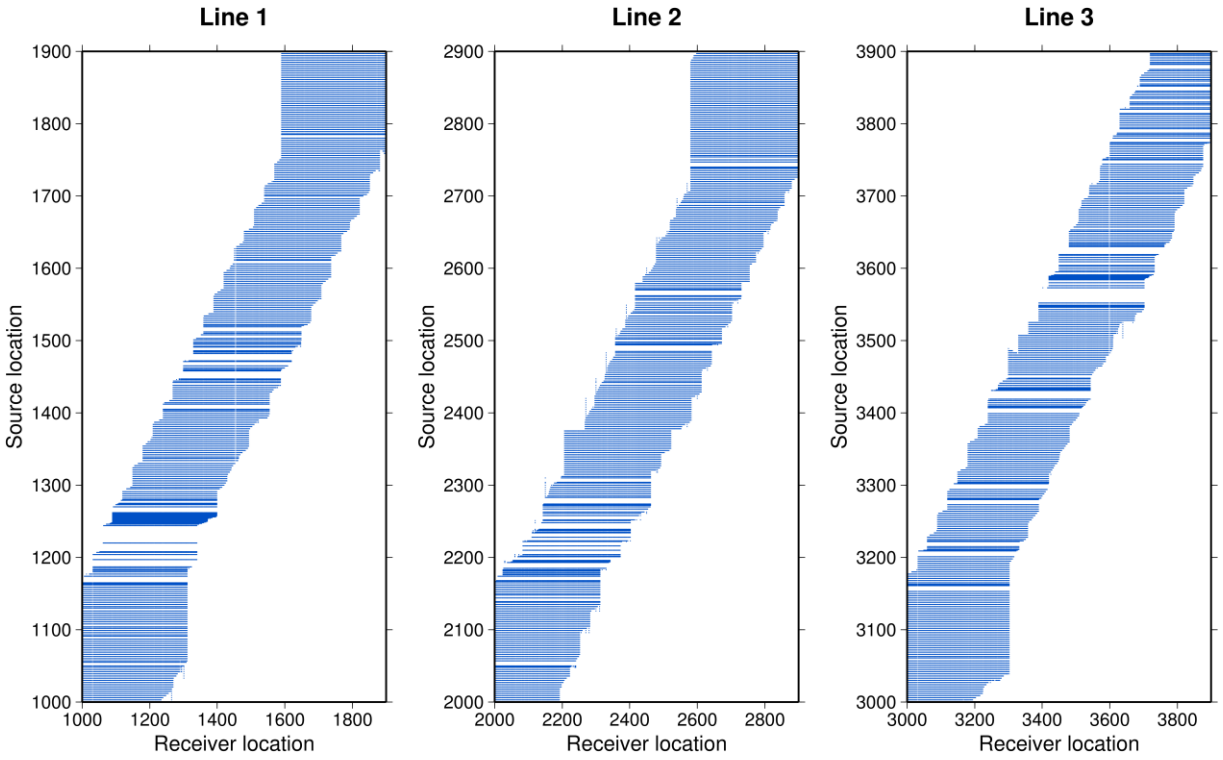

Figure 2: Plot of the active source and receiver locations for all three roll-along profiles. The single active receivers some distance away from the main spread (e.g., source locations around 2500, middle panel) are due to the progress of the rearrangement of the recorders: Whereas some recorders were already removed from the end of a spread, some others were still recording and contribute to the full record of a particular source point.

3. Data Processing

The archived SEG-Y data were basically processed, including

- vertical stacking (diversity stack based on power, operator length of 250 ms),
- vibroseis correlation and
- geometry installation.

The raw data were converted from the recorder-specific format to SEG-Y using the conversion software *cube2segy* and the files contained in the folder *raw/conversion*.

4. Data Description

For all seismic lines one SEG-Y file contains the roll-along recordings of all active receivers and all sources along the lines. Additionally, one SEG-Y file contains the far-field recordings of all sources of Line 2.

The raw (unprocessed) data, which are stored in the folder *raw/data*, contain the continuous recordings of all deployed instruments. This data have to be converted into the SEG-Y format using the files contained in the folder *raw/conversion*.

4.1 File format

The data are stored in SEG-Y format (e.g., Barry et al., 1975). The header words are set as listed in the following table.

Seismic Unix header	***SEG-Y header bytes***	***description***
tracl	1 – 4	trace number within line
tracr	5 – 8	trace number within this file
fldr	9 – 12	field record number = shot point number
tracf	13 – 16	receiver channel number
ep	17 – 20	shot point number (= fldr)
cdp	21 – 24	CDP ensemble number
trid	29 – 30	trace identification code
nhs	33 – 34	number of horizontally stacked traces
offset	37 – 40	distance from source to receiver (in m)
gelev	41 – 44	elevation at receiver location
selev	45 – 48	elevation at source location
gdel	53 – 56	datum elevation at receiver group (final datum)
sdel	57 – 60	datum elevation at source
scalel	69 – 70	scale factor of gelev and selev
scalco	71 – 72	scale factor of sx, sy, gx and gy
sx	73 – 76	source coordinate (utm x)
sy	77 – 80	source coordinate (utm y)
gx	81 – 84	receiver coordinate (utm x)
gy	85 – 88	receiver coordinate (utm y)
counit	89 – 90	coordinates unit code
ns	115 – 116	number of samples per trace
dt	117 – 118	sampling interval in microseconds
year	157 – 158	year data recorded
day	159 – 160	day of year
hour	161 – 162	hour of day (24-hour clock)
min	163 – 164	minute of hour
sec	165 – 166	second of minute
d1	181 – 184	X CDP coordinate
f1	185 – 188	Y CDP coordinate
ungpow	197 – 200	negative of power used for dynamic range compression
nmo_datm	203 – 204	floating datum
cdp_elev	205 – 208	average elevation above CDP
cdp_stat	209 – 212	CDP block static
profil_m	213 – 216	profile distance along line
msec_sec	217 – 220	milisecond of second of record
azimuth	221 – 224	source-receiver azimuth
sou_stat	225 – 228	source static correction
rec_stat	229 – 232	receiver static correction
sou_sloc	233 – 236	source location number
srf_sloc	237 – 240	receiver location number

4.2 Data content and structure

file name	*sources*	*traces*	*samples/trace*	*sample rate*	*size (bytes)*	*acquisition date*	*comment*
segy/BASE_Line1.sgy	301	87278	2001	2.5	719523432	26.-29.10.14	roll-along
segy/BASE_Line2.sgy	301	85165	2001	2.5	702103860	21.-23.10.14	roll-along
segy/BASE_Line2_fixed.sgy	301	8426	2001	2.5	69467544	21.-23.10.14	far-field recordings
segy/BASE_Line3.sgy	301	79232	2001	2.5	653192208	23.-25.10.14	roll-along
raw/data/*							raw data
raw/conversion/*							conversion files
info/geometry/*							geometry files
info/README							readme file
info/BASE_seismics.pdf							project report
* content described in readme file (/info/README)							

5. Data Quality/Accuracy

The triggering of the sweep signal was done with a trigger switch with an accuracy of 34.7 µs. The coordinates were measured with a differential GPS system with a location accuracy of about 0.5 m.

6. Data Availability/Access

The dataset is archived at the *GIPP Experiment and Data Archive* where it will be made available under a “Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License”.(CC BY-NC-SA) on January 1, 2018. The DOI number of the supplementary data is 10.5880/GIPP.201312.1. When using the data, please give reference to this data publication:

> Baumann-Wilke, M., Haberland, Ch., Stiller, M., Gibert, L., Jurado, M.J. and G. Scott (2014) Data of the seismic reflection experiment in the Baza Basin (BASE project, October 2013). Scientific Technical Report STR Data 15/01; DOI: 10.2312/GFZ.b103-15011 Potsdam.

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