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Scientific Technical Report STR17/08 - Data
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Abstract
Raw-, SEG-Y and other supplementary data of the landside deployment from the amphibious wide-angle seismic experiment ALPHA are presented. The aim of this project was to reveal the crustal and lithospheric structure of the subducting Adriatic plate and the external accretionary wedge in the southern Dinarides. Airgun shots from the RV Meteor were recorded along two profiles across Montenegro and northern Albania.

Coordinates: 42°12'N/19°18' E
Keywords: Seismology, Adriatic Plate, Montenegro, Albania

1. Introduction

The orogen of the western Balkan Peninsula results from the collision between the Adriatic and European plates. The plate boundary has been consuming continental lithosphere for at least 50 million years and the orogenic wedge largely consists of units detached from the downgoing Adriatic Plate. An active convergent plate boundary is located at the Adriatic coast and indicated for example by earthquakes up to magnitude 7. The amphibious Adria LithosPHere investigAtion (ALPHA) was intended to study the lithospheric structure of the Adriatic plate and the Adria-Dinarides collision zone.
The R/V METEOR cruise M86/3 acquired deep penetrating seismic data across the Adriatic Sea from the Italian to the Balkan Peninsula in January and February 2012 (Kopp et al., 2013). In addition to OBS/OBH deployments, land stations in Italy, Montenegro and Albania were deployed to record the offshore airgun shots. This data report describes and provides the land-side data set from the Balkan peninsula recorded on two profiles across Montenegro (P02) and northern Albania (P03), respectively.

2. Data Acquisition

2.1 Experiment design and schedule

The data described here are from on-shore stations of two amphibious transects in continuation of profiles P02 and P03 of the Meteor cruise M86/3. Three-component 4.5 Hz natural frequency geophones together with omnirecs data-cube3 digitizers were deployed on land in Albania and Montenegro (Fig. 1). On the Albanian side profile P03 was extended by 14 land stations with a spacing of ~6 km, reaching 83 km into the land and providing offsets up to 316 km. Profile P02 was extended by 20 land stations deployed in Montenegro reaching 126 km into the land, thus recording to an offset of up to 300 km.

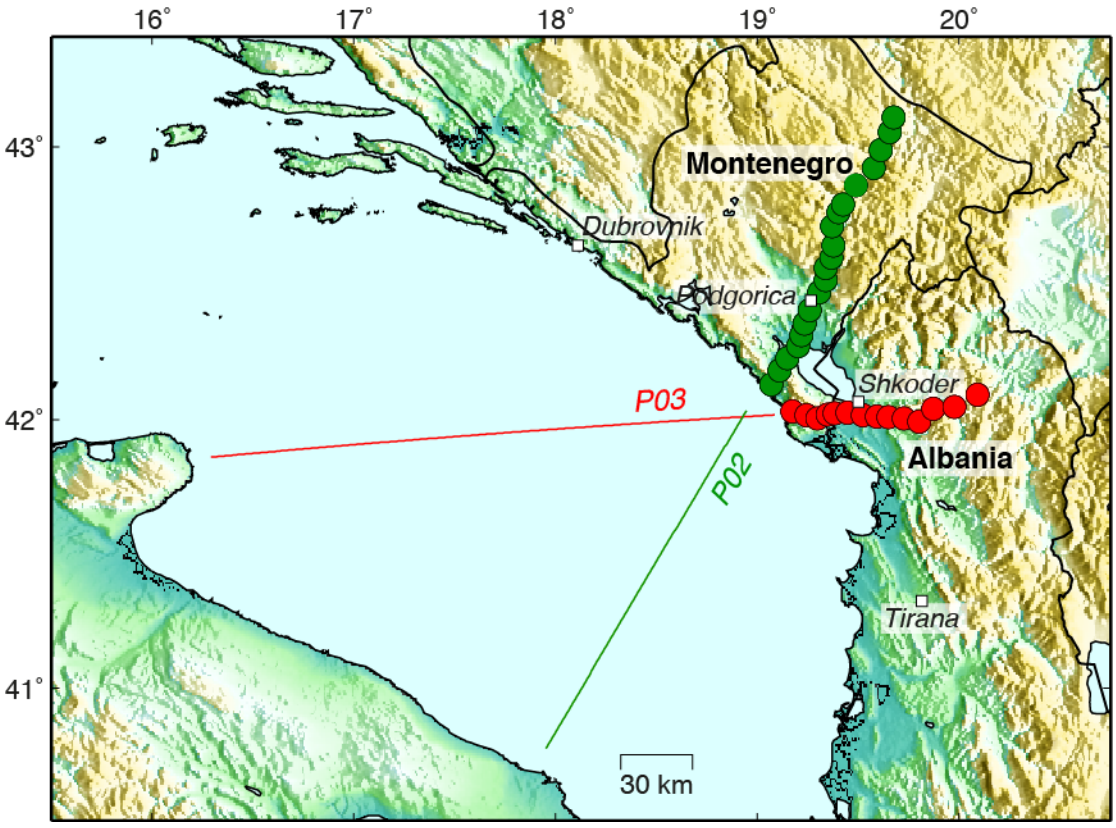

Figure 1: Topographic map of the ALPHA amphibious experiment. Lines P02 and P03 are the ship tracks, circles are the onshore seismic station locations.

2.2 *Geometry/Location*

Geometry of the experiment is shown in Figure 1. Shot and receiver coordinates are listed in files *INFO/p02.shots, INFO/p02.receivers, INFO/p03.shots,* and *INFO/p03.receivers.*

2.3 Instrumentation

Seismic stations consisted of three-component 4.5 Hz natural frequency geophones with Omnirecs data-cube3 digitizers. Internal clocks were synchronized with GPS time.

2.4 Acquisition parameters

The experiment consisted of two lines of approximately 126 km and 83 km length respectively. Station spacing was approximately 6 km. Data were recorded continuously at 200 samples per second for up to one week. For P02 shot spacing was ~120 m (trigger interval of 60 s at a ship's speed of 4.0 kn). For P03 a shot interval of 60 s at the ship's speed of 4.5 kn resulted in an approximate shot spacing of ~140 m (Kopp et al., 2013).

3. Data Processing

Raw cube data were not processed. Continuous MSEED data (FDSN 2012) were converted from raw cube data using the GIPPtool utility software[1]. By means of cube2segy (GIPPtool utility software), the continuous data were cut into 60 s long traces based on the shot tables for P02 and P03, respectively. The resulting data are in standard SEG-Y format. The data are unreduced and no additional processing was applied.

4. Data Description

Raw cube data come as continuous daily files per receiver containing all three components. MSEED data come as continuous daily files per component. SEG-Y data come as shot gathers for the vertical component per receiver (Figure 2).

1 www.gfz-potsdam.de/gipp → Software → GIPPtools

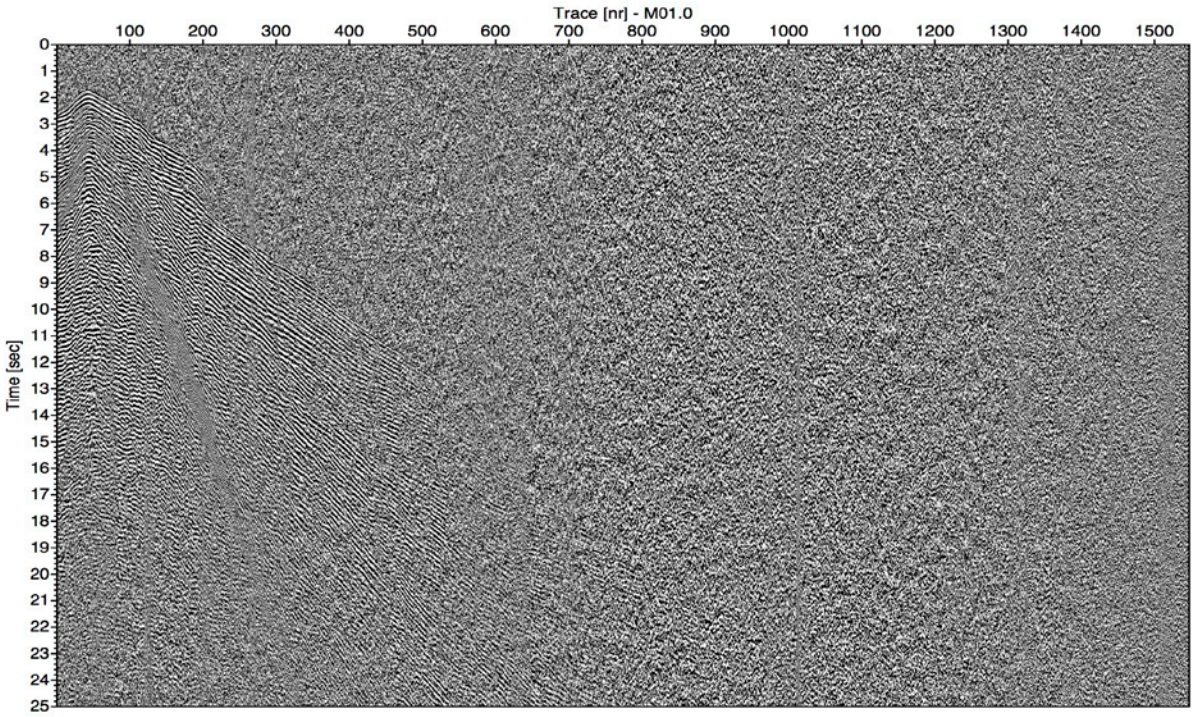

Figure 2: Example of a shot gather for the vertical component of receiver M01 on profile P02. The first 25 s of unreduced data are shown.

4.1 File formats

Raw data come in MSEED format (FDSN 2012).

Shot gathers are stored in SEG-Y format (e.g., Barry et al., 1975). Header word settings are as follows (coordinate reference is ±DDMMSS.ss, degree minutes seconds.decimal UTM zone 34, ellipsoid = WGS-84):

Seismic Unix Header[2]	*SEG-Y header byte no.*	*Length (bytes)*	*ALPHA header settings*	*Values for P02, if constant for all stations*
tracl	1	4	trace number within this file	1-1547
tracr	5	4	trace number within this file	1-1547
fldr	9	4	field record number = shot point number	1-1547
tracf	13	4	receiver channel number	1
trid	29	2	trace identification code	1
offset	37	4	distance between source and receiver	
gelev	41	4	receiver elevation	
selev	45	4	surface elevation at source	-10
scalel	69	2	scalar applied to all elevations and depths	1
scalco	71	2	scalar applied to all coordinates	-100
sx	73	4	source coordinate - X	17470851-18590059
sy	77	4	source coordinate - Y	40462315-42072963
gx	81	4	receiver coordinate - X	
gy	85	4	receiver coordinate - Y	
counit	89	2	coordinate units	4
delrt	109	2	delay recording time	0
ns	115	2	number of samples in this trace	12000
dt	117	2	sample interval in microseconds in this trace	5000
year	157	2	year data recorded	2012
day	159	2	day of year	22-23
timbas	167	2	time basis code	4

Seismic Unix Header	*SEG-Y header byte no.*	*Length (bytes)*	*ALPHA header settings*	*Values for P03, if constant for all stations*
tracl	1	4	trace number within this file	1-1675

2 Cohen & Stockwell, 2017

tracr	5	4	trace number within this file	1-1675
fldr	9	4	field record number = shot point number	1-1675
tracf	13	4	receiver channel number	1
trid	29	2	trace identification code	1
offset	37	4	distance between source and receiver	
gelev	41	4	receiver elevation	
selev	45	4	surface elevation at source	-10
scalel	69	2	scalar applied to all elevations and depths	1
scalco	71	2	scalar applied to all coordinates	-100
sx	73	4	source coordinate - X	16172327-19050636
sy	77	4	source coordinate - Y	41514139-42010408
gx	81	4	receiver coordinate - X	
gy	85	4	receiver coordinate - Y	
counit	89	2	coordinate units	4
delrt	109	2	delay recording time	0
ns	115	2	number of samples in this trace	12000
dt	117	2	sample interval in microseconds in this trace	5000
year	157	2	year data recorded	2012
day	159	2	day of year	27-28
timbas	167	2	time basis code	4

4.2 Data content and structure

directories/files	*size*	*content*	*naming convention*
SEG-Y/ P02	1.4 Gb	20 SEG-Y formatted shot gather files	crp_*stationcode*.0.segy
SEG-Y/ P03	1.1 Gb	14 SEG-Y formatted shot gather files	crp_*stationcode*.0.segy
RAW/P02	34 Gb	20 subdirectories (i.e. for each receiver) containing subdirectories for raw Cube data.	C*cubeserial_stationcode*/ *yymmdd*/*startdate*.*cubeserial*
RAW/P03	19 Gb	14 subdirectories (i.e. for each receiver) containing one subdirectories for raw Cube data.	C*cubeserial_stationcode*/ *yymmdd*/*startdate*.*cubeserial*
MSEED/P02	11 Gb	20 subdirectories (i.e. for each receiver) containing converted MSEED data.	C*cubeserial_stationcode*/ c0*cubeserialstartdatetime*.pri*chan*
MSEED/P03	5.7 Gb	14 subdirectories (i.e. for each receiver) containing converted MSEED data.	C*cubeserial_stationcode*/ c0*cubeserialstartdatetime*.pri*chan*
INFO/p02.receiver	5 Kb	receiver coordinates, cube serial, station code and start time	for profile P02
INFO/p03.receiver	3 Kb	receiver coordinates, cube serial, station code and start time	for profile P03
INFO/p02.shots	82Kb	shot coordinates and timing	for profile P02
INFO/p03.shots	87Kb	shot coordinates and timing	for profile P03

5. Data Quality/Accuracy

During shooting of P02 a commercial seismic survey was conducted in Croatian waters offshore Montenegro. Their airgun signal caused a decreased signal-to-noise ratio (SNR) on the seismic sections described here, manifested in alternating ‘stripes’ (Kopp et al. 2013). In general the signal to noise ratio of P02 land stations is lower compared to P03. Stations M04, M06, M07, and M17, have a very low SNR, making it difficult to detect the shots. For the other stations further processing might improve SNR, however shots can be observed up to 200 km offset to the stations

by applying a simple bandpass filter (f=1,3,15,20). The data of the land stations in Albania, in the extension of P03, show a good SNR. Stations A07 and A08, however, have a lower SNR. By applying a simple bandpass filter (f=1,3,15,20), shots can only be clearly seen between traces 1150 and 1300. All other stations have a very high SNR and some stations show shots along the entire profile length.

6. Data Availability/Access

Data is archived at the *GIPP Experiment and Data Archive* where it is freely available for further use under a "Creative Commons Attribution-ShareAlike 4.0 International License" (CC BY-SA 4.0).

When using the data, please cite the ALPHA dataset as well as Kopp et al. (2013), and acknowledge the use of GIPP instruments. You can additionally cite this Scientific Technical Report STR, especially if referring to details explained therein.

Recommended citation for data described in this publication:

> Schurr, B., Dannowski, A., Glavatovic, B., Duni, L., Kopp, H. and Nagel, T. (2017), Land seismic data of the ALPHA amphibious controlled source experiment – Datasets. GFZ Data Services. DOI: http://doi.org/10.5880/GIPP.201219.1

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> DOI: http://doi.org/10.2312/GFZ.b103-17081

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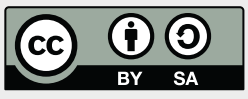

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