Description of dataset “Seismic data from the 2016-02-22 flood event and from an active seismic survey conducted around the Eshtemoa River, Israel”

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Abstract

Bedload transport is a key process in fluvial morphodynamics and hydraulic engineering, but is notoriously difficult to measure. The recent advent of stream-side seismic monitoring techniques provides an alternative to in-stream monitoring techniques, which are often costly, staff-intensive, and cannot be deployed during large floods. Seismic monitoring is a surrogate method requiring several steps to convert seismic data into bedload data. State-of-the-art approaches of conversion exploit physical models predicting the seismic signal generated by bedload transport. Here, we did an active seismic survey (2017-11) and used seismic data from a flood event (2016-02-22) on the Nahal Ehstemoa to constrain a seismic bedload model. We conducted the active seismic survey to determine the local seismic ground properties, i.e., the Green’s function. We also used water depth and bedload grain size distribution to constrain the seismic bedload model and were able to compare the bedload flux obtained from the seismic data using the model with high-quality independent bedload measurements from slot samplers on the site. The complementary non-seismic data is published in a separate data publication (Lagarde et al., 2020).

Coordinates: Latitude: 31.316255°N, Longitude: 34.969866°E

Keywords: Ground properties, Green’s function, Environmental seismology

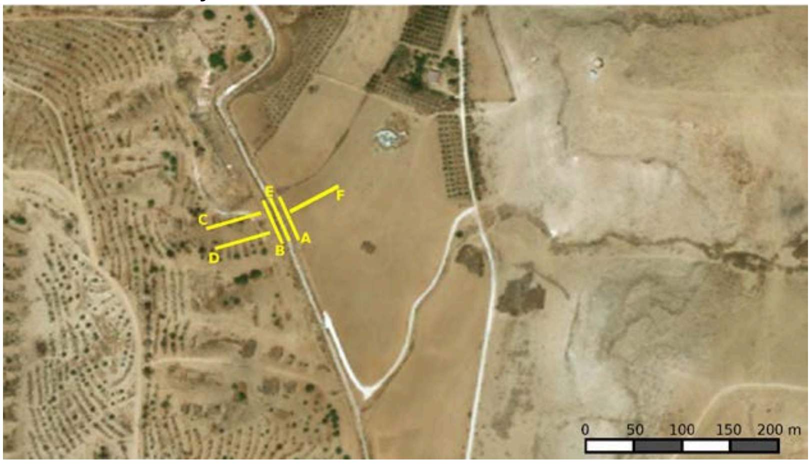
1. Data Acquisition – Experiment, schedule, acquisition parameters

Part 1: Passive Seismic Monitoring

The site is equipped with a broadband seismometer (Nanometrics Trillium Compact 120s) since 2016 (31.305598° N, 34.969971° E). The seismometer is installed 5.75 m from the river centerline, and is sampled by a Nanometrics Centaur data logger at 200 Hz.

Part 2: Active Seismic Experiment:

The active seismic survey was done in November 2017. The sensors used were 1-component and



3-component 4.5Hz geophones and the loggers were DataCube³int (provided by the Geophysical Instrument Pool Potsdam GIPP). The ID of 3-component geophones were: 822, 823, 824, 826, 827, 857. All the others were 1-component geophones. 3-component geophones were logged at 400 Hz, whereas the 1-component devices were recorded at 800 Hz. We deployed different sensor lines parallel and perpendicular to the channel, on both sides (Figure 1). We imposed hammer blows on a 5 cm by 40 by 30 cm steel plate. Two different lines perpendicular to the river were deployed on the right bank (Line CX and DX). Below there is a description of each line, and a time frame of the blows conducted apart from the vertical blows when the plate is at its initial position. For these blows, a detailed time frame for each blow is given in text files.

1.1 Line A1

Line A1 was 20m long, parallel to the river and was deployed on the left bank when looking downstream. The plate was moved at -1 m compared to its initial position and 6 vertical blows were done between 2017/11/21 9:32:48 and 2017/11/21 9:33:17 (all time are UTC). The plate was moved at -2 m compared to its initial position and 10 vertical blows were done between 2017/11/21 9:37:47 and 2017/11/21 9:38:40. The plate was moved at -3 m compared to its initial position and 9 vertical blows were done between 2017/11/21 9:41:13 and 2017/11/21 9:42:23.

1.2 Line A2

Line A2 was 40m long, parallel to the river and was deployed on the left bank when looking downstream. The plate was moved at -2 m compared to its initial position and10 vertical blows were done between 2017/11/21 11:05:08 and 2017/11/21 11:05:42. The plate was moved at -4 m compared to its initial position and 13 vertical blows were done between 2017/11/21 11:08:44 and 2017/11/21 11:09:49.

1.3 Line A3

Line A3, was 100m long, parallel to the river and was deployed on the left bank when looking downstream. 10 horizontal blows were done between 2017/11/23 11:44:24.500 and 2017/11/23 11:44:51.

1.4 Line A3bis

Line A3bis was 100m long, parallel to the river and was deployed on the left bank when looking downstream.Only the position of the 3-component geophones differs with A3 line. 15 horizontal blows were done between 2017/11/23 11:58:36 and 2017/11/23 11:59:14. The plate was move at -1.67 m compared to its initial position and 10 vertical blows were done between 2017/11/23 12:09:34.500 and 2017/11/23 12:10:04

1.5 Line B1

Line B1 was 20m long, parallel to the river and was deployed on the right bank when looking downstream. The plate was move at -1 m compared to its initial position and 10 vertical blows were done between 2017/11/21 14:28:40 and 2017/11/21 14:29:15. The plate was moved at -2 m compared to its initial position and 10 vertical blows were done between 2017/11/21 14:32:22 and 2017/11/21 14:32:59. The plate was moved at -3 m compared to its initial position and 10 vertical blows were done between 2017/11/21 14:38:40 and 2017/11/21 14:39:16.

1.6 Line B2

Line B2 was 40m long, parallel to the river and was deployed on the right bank when looking downstream. 5 horizontal blows were done between 2017/11/22 13:10:39 and 2017/11/22 13:10:48.800. The plate was move at -2.45 m compared to its initial position and 10 vertical blows were done between 2017/11/22 13:17:53 and 2017/11/21 13:18:14

1.7 Line C1

Line C1 was 100m long, perpendicular to the river and was deployed on the right bank when looking downstream. 11 horizontal blows were done between 2017/11/22 09:51:14 and 2017/11/22 09:51:38. The plate was move at -2.04 m compared to its initial position and 8 vertical blows were done between 2017/11/22 10:00:03 and 2017/11/22 10:00:24.

1.8 Line C2

Line C2 was 40m long, perpendicular to the river and was deployed on the right bank when looking downstream. 7 horizontal blows were done between 2017/11/22 10:27:35.500 and 2017/11/22 10:27:49; The plate was move at -2.04 m compared to its initial position and 10 vertical blows were done between 2017/11/22 10:21:59 and 2017/11/22 10:22:28.

1.9 Line C3

Line C3 was 20m long, perpendicular to the river and was deployed on the right bank when looking downstream. 10 horizontal blows were done between 2017/11/22 10:40:47.000 and 2017/11/22 10:41:08.400. The plate was move at -2.04 m compared to its initial position and 10 vertical blows were done between 2017/11/22 10:45:27 and 2017/11/22 10:45:51.

1.10 Line D1

Line D1 was 20m long, perpendicular to the river and was deployed on the right bank when looking downstream. 10 horizontal blows were done between 2017/11/22 11:14:29 and 2017/11/22 11:14:55; The plate was moved at -1.6 m compared to its initial position and 9 vertical blows were done between 2017/11/22 11:19:10.500 and 2017/11/22 11:19:39.

1.11 Line D2

Line D2 was 100m long, perpendicular to the river and was deployed on the right bank when looking downstream. 10 horizontal blows were done between 2017/11/22 12:34:03 and 2017/11/22 12:34:27.500. The plate was moved at -1.6 m compared to its initial position and 10 vertical blows were done between 2017/11/22 12:27:32 and 2017/11/22 12:27:56.500.

1.12 Line E

On day 2017/11/22, line E was deployed in the river with 10 vertical blows between 14:03:37.500 and 14:04:01. No details are given in text files because the geophones were not well fixed in the ground (armored bed), and thus the recording was not of good quality.

1.13 Line F1

F1 was 100m long, perpendicular to the river and deployed on the left bank when looking downstream. 11 horizontal blows were done between 2017/11/23 09:15:06 and 2017/11/23

09:15:29.500. The plate was moved at -1.8 m compared to its initial position and 10 vertical blows were done between 2017/11/23 09:18:25.500 and 2017/11/23 09:18:47.500.

1.14 Line F2

The line F2 was 40m long, perpendicular to the river and was deployed on the left bank when looking downstream. 8 horizontal blows were done between 2017/11/23 10:07:18.500 and 2017/11/23 10:07:43.400. The plate was moved at -1.8 m compared to its initial position and 9 vertical blows were done between 2017/11/23 09:53:56.700 and 2017/11/23 09:54:38.

1.15 Line F3

Line F3 was 30m long, perpendicular to the river and was deployed on the left bank when looking downstream. 6 horizontal blows were done between 2017/11/23 10:16:35 and 2017/11/23 10:16:47.500. The plate was moved at -1.8 m compared to its initial position and 10 vertical blows were done between 2017/11/23 10:20:38 and 2017/11/23 10:21:04.

3. Data Processing

The datacube files were converted to SAC files (https://ds.iris.edu/files/sac-manual/manual/file_format.html) in the statistic programming language R v. 3.6 (R Core Team, 2020), using the function *aux_organisecubefiles* in the package eseis v. 0.5.0 (Dietze, 2018, 2018a). The data used for our active seismic survey comes from the line B2 (see section 1.6). The signals were processed with the “COMPUTER PROGRAMS IN SEISMOLOGY” software (Hermann, 2013). Processing consisted of two stages. In stage one, the hammer blows were exploited to obtain the surface waves velocity as a function of depth, defining a ground model. In stage two, the ground model was used to obtain the Green’s function parameters as a function of frequency.

4. Data Description

- **Folder */flood_seismic***

  Subfolder /MSEED

The folder contains the raw seismic file (MSEED format, FDSN, 2012) of the 2016-02-22 flood event.

- **Folder */active_seismic_survey***

  Subfolder /RAW

The folder contains the raw cube data (in proprietary cube format) of the active seismic experiment.

Subfolder /SAC

The folder contains the converted seismic file (in SAC format) of the active seismic experiment.

Subfolder /INFO contains...

...*XX_position.txt*

For each line, information on the geophone position is given in the text file XX_position.txt. Distance 0 m corresponds to the position of the metallic plate where the hammer blows took place.

...XX_shot.txt

One file is provided for each line. The first column corresponds to the vertical hammer blow number, in the format X_Y where X is the line reference and Y is the hammer blow reference. The second column corresponds to the start time of the hammer blow, the third column to the end time of the hammer blow. Time format is XXXX/YY/ZZ_AA:BB:CC, with XXXX the year, YY the month, ZZ the day, AA the hours, BB the minutes and CC the seconds.

...*data_green.txt.*

The file contains results from the processing of the line B2 using “COMPUTER PROGRAMS IN SEISMOLOGY” software (Hermann, 2013). vc is the Rayleigh wave phase velocity (m/s), vu is the Rayleigh wave group velocity (m/s), N11 is the amplitude coefficient of the displacement Green’s function for a force applied along a given direction and a displacement evaluated along this same direction (no unit) and N12 is the amplitude coefficient of the displacement Green’s function for a force applied along a given direction and a displacement evaluated along the perpendicular direction (no unit).

6. Data Availability/Access

Data is archived at the *GIPP Experiment and Data Archive* where it is freely available for further use. When using the data, please give reference to this data publication. Recommended citation is:

> S. Lagarde, M. Dietze, F. Gimbert, J.B. Laronne, J.M. Turowski, E. Halfi (2020) Seismic data from the 2016-02-22 flood event and from an active seismic survey conducted around the Eshtemoa River, GFZ Data Services. http://doi.org/10.5880/GIPP.201727.1

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