

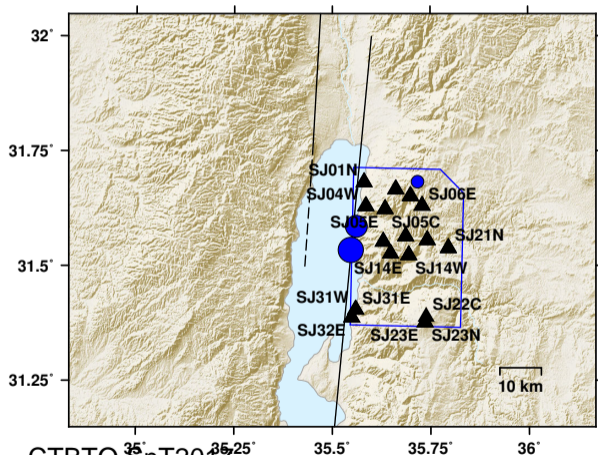
New Insights into the Dead Sea Transform Fault Seismicity Gained from the IFE2014 Seismological Recordings

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CTBT - Science And Technology, 26.6.2017

IFE2014 wrap-up



- 12 Tripartite mini-arrays
- 4 3-Component stations
- Sampling rate 500Hz

Detection Performance

- $M_l > -0.5$ detectable (average)
- Gutenberg-Richter relation based on seismicity 2003-2013:

Predicted number of events: ≈ 2000

Detected events: 3

Questions

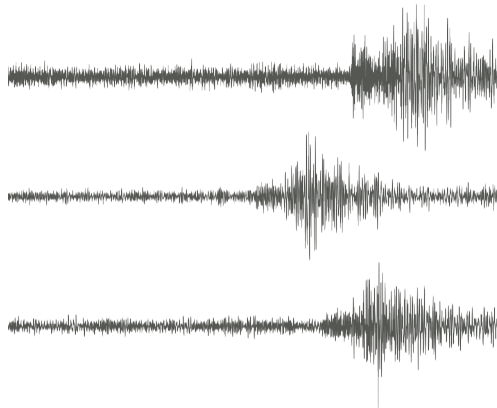
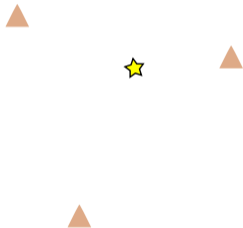
1. Why discrepancy?
2. Performance of automated detector?
3. Seismicity on regional scale?

Lassie - Your Friendly Earthquake Detector

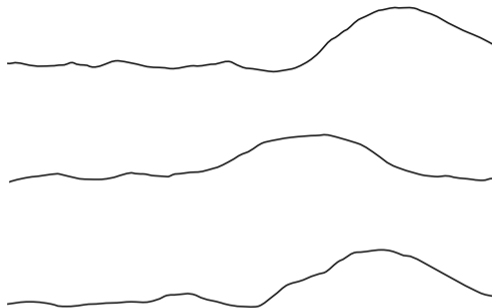
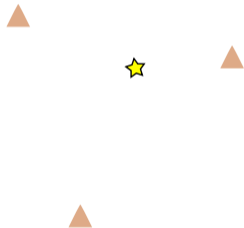


- Works on full waveforms
- Automated detection
- Approximate location

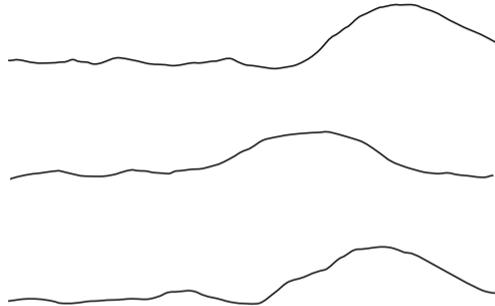
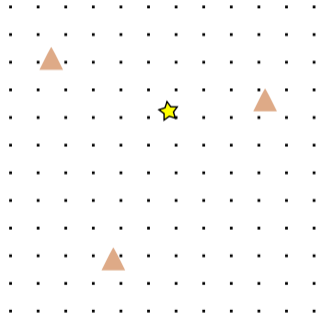
Method



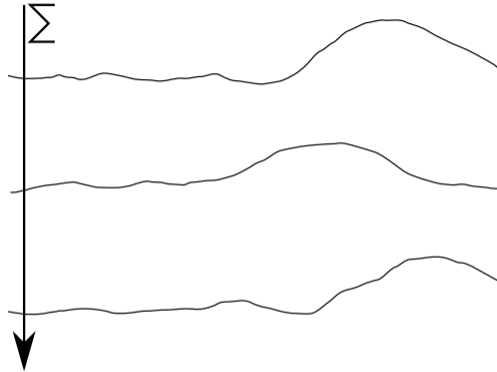
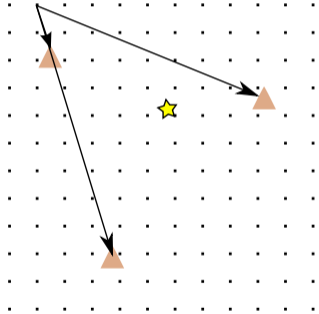
Method



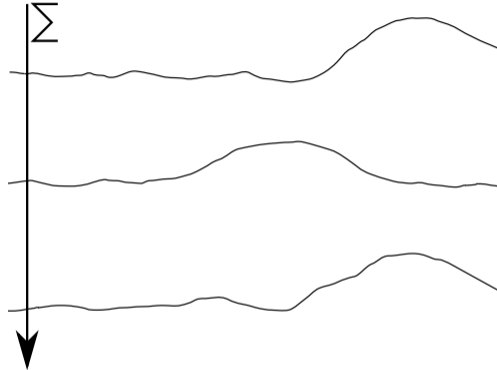
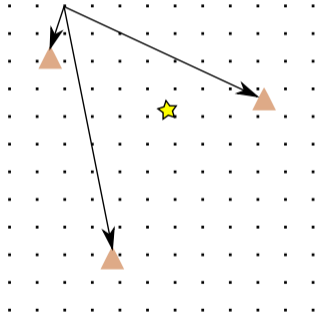
Method



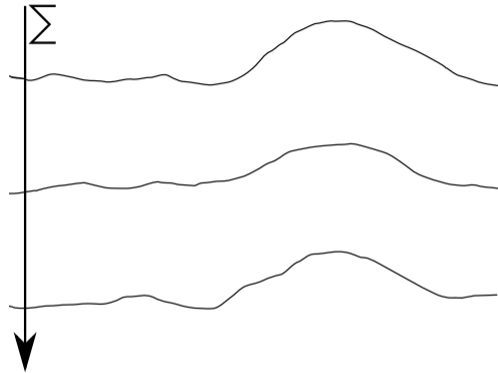
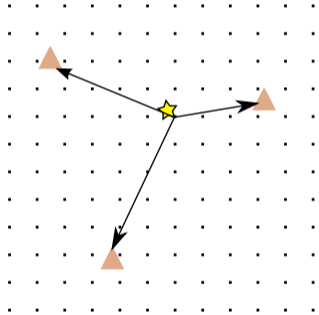
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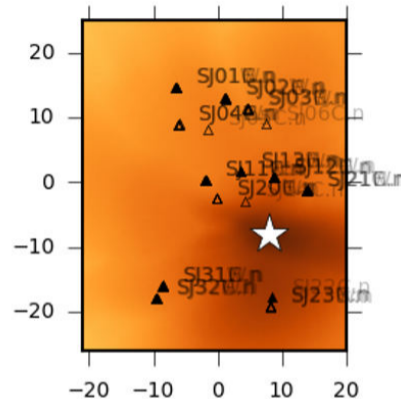
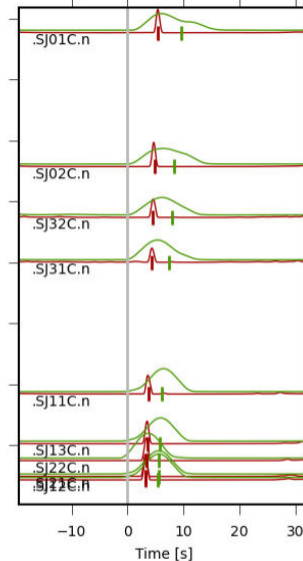
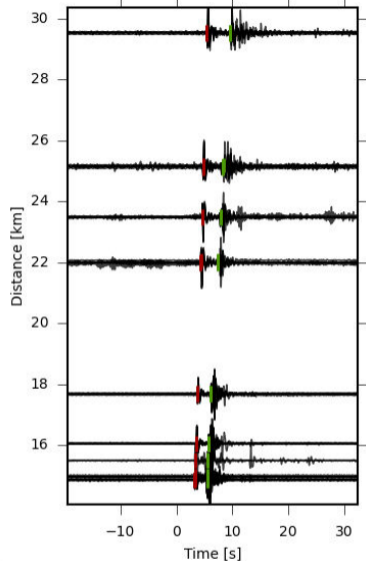


Method



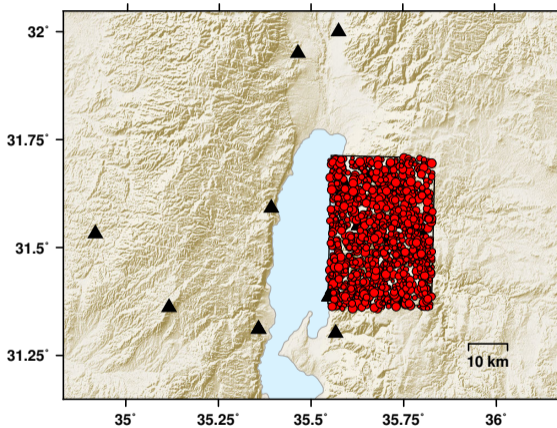
Method





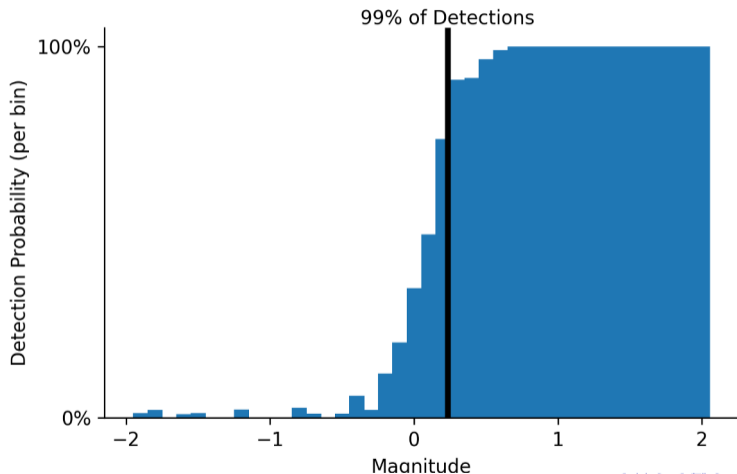
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Synthetic Test



- Re-organised recorded waveforms
 - 30000 synthetic earthquakes tested
- ⇒ Realistic and controlled dataset

Detection Performance (revisited)



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Questions

1. Why discrepancy?

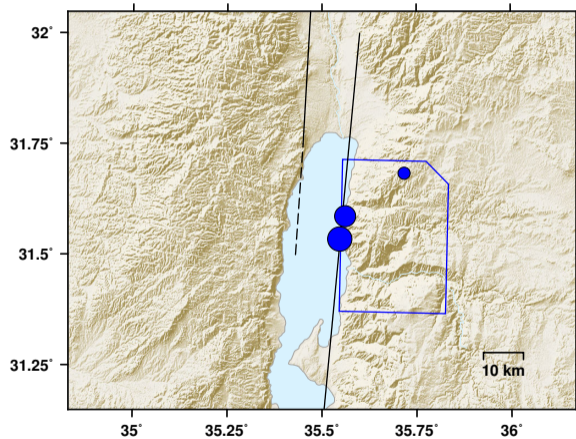
⇒ **Detection threshold underestimated**

⇒ **Inhomogeneous distribution of events in time**

2. Performance of automated detector?

3. Seismicity on regional scale?

Application to IFE2014 Data



Questions

1. Why discrepancy?

⇒ Detection threshold underestimated

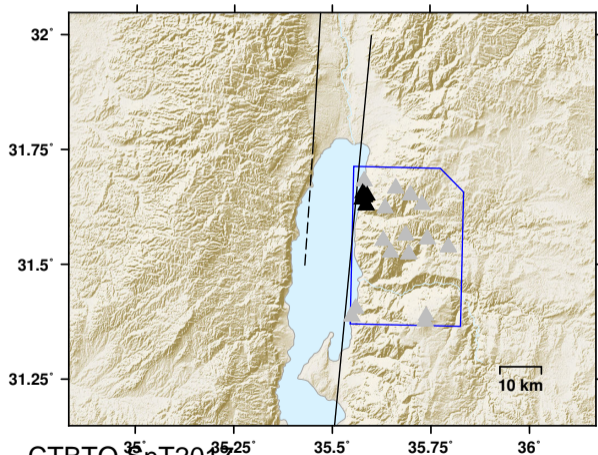
⇒ Inhomogeneous distribution of events in time

2. Performance of automated detector?

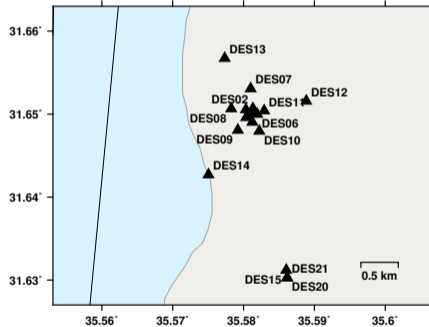
⇒ **Same detections but fully automated**

3. Seismicity on regional scale?

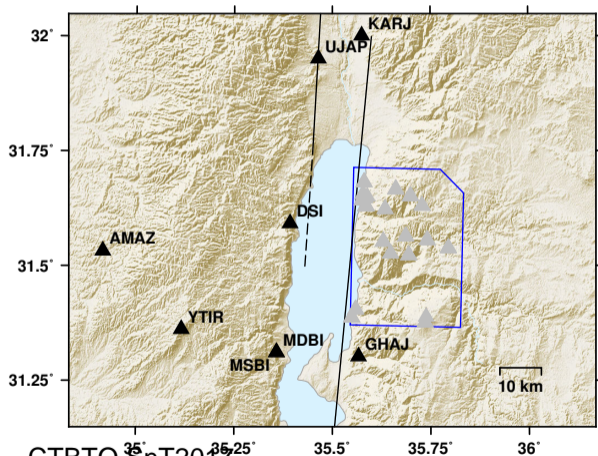
Dataset - *DESERVE*



Magnified

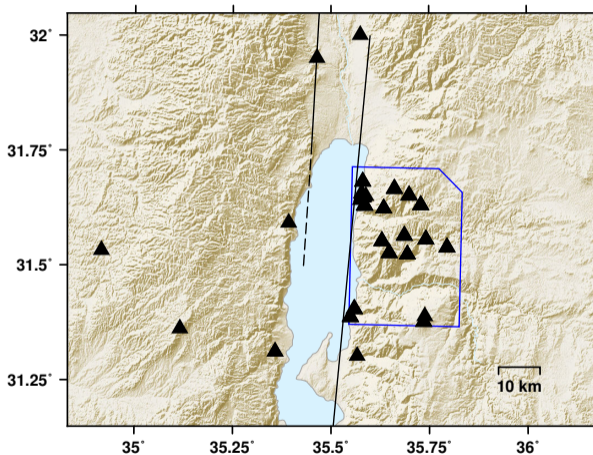


Dataset - Regional Network



- 4 broad band
- 3 short period
- Sampling rates: 20 - 100Hz

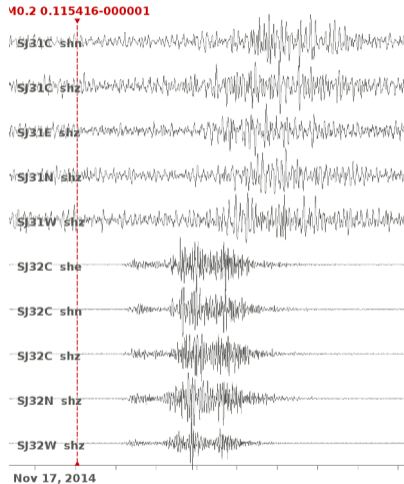
Dataset



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Application to Regional Data

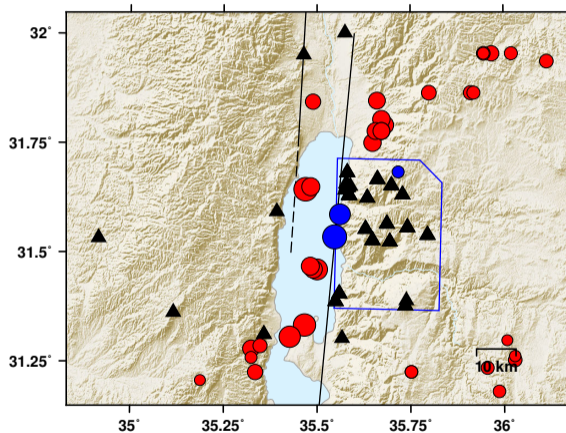
- Lower frequencies
- Larger grid spacing
- ≈ 2000 detections manually checked
- Numerous mining events
- Picking and relocation
- Local magnitudes



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Relocated Detections

Questions



1. Why discrepancy?
2. Performance of automated detector?
3. **Seismicity on regional scale?**
 - ⇒ 10 Natural tectonic events (M_l 0.1 - 2.0) beneath Dead Sea
 - ⇒ 20 $M_l < 2.1$ events in vicinity of Dead Sea (Anthropogenic bias?)

Conclusions

- Automated detection of local and regional earthquakes
- Few events with smallest magnitudes of $M_l > 0.1$ detected
- Thanks to the data of the IFE2014

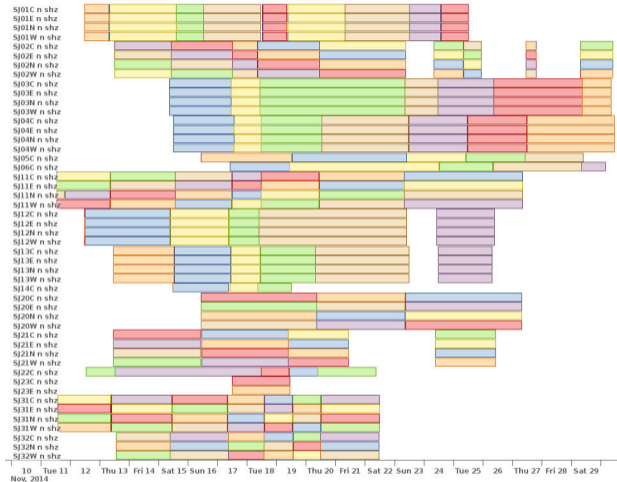
Thank You

Lassie: soon available via www.pyrocko.org

References

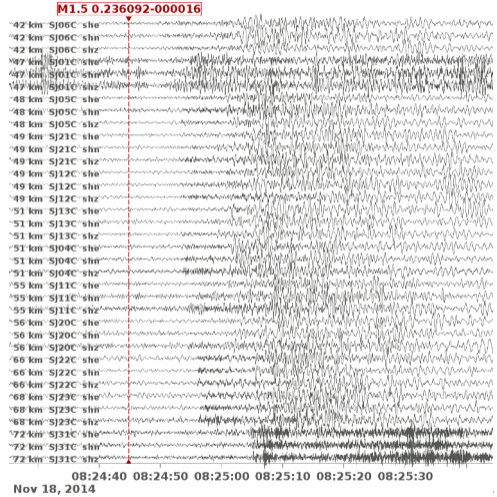
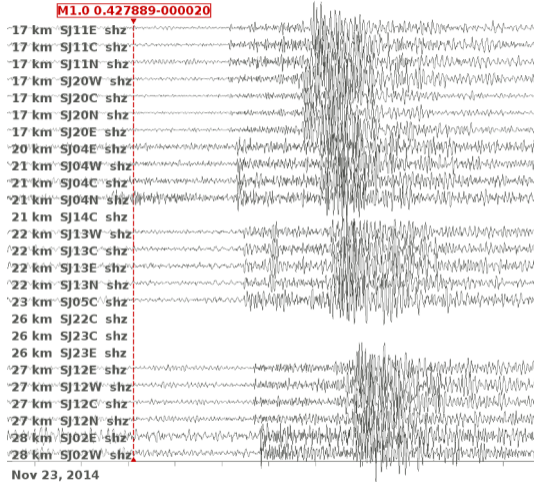
- Pyrocko: Heimann, Sebastian; Kriegerowski, Marius; Isken, Marius; Cesca, Simone; Daout, Simon; Grigoli, Francesco; Juretzek, Carina; Megies, Tobias; Nooshiri, Nima; Steinberg, Andreas; Sudhaus, Henriette; Vasyura-Bathke, Hannes; Willey, Timothy; Dahm, Torsten (2017): Pyrocko - An open-source seismology toolbox and library. V. 0.3. GFZ Data Services.
<http://doi.org/10.5880/GFZ.2.1.2017.001>
- Lassie: Heimann, Sebastian; et al., Lassie, a versatile tool to detect and locate earthquakes, 2017 (in prep.)
- Acknowledgement: *DESERVE Project*

Dataset



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Waveform Examples



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