



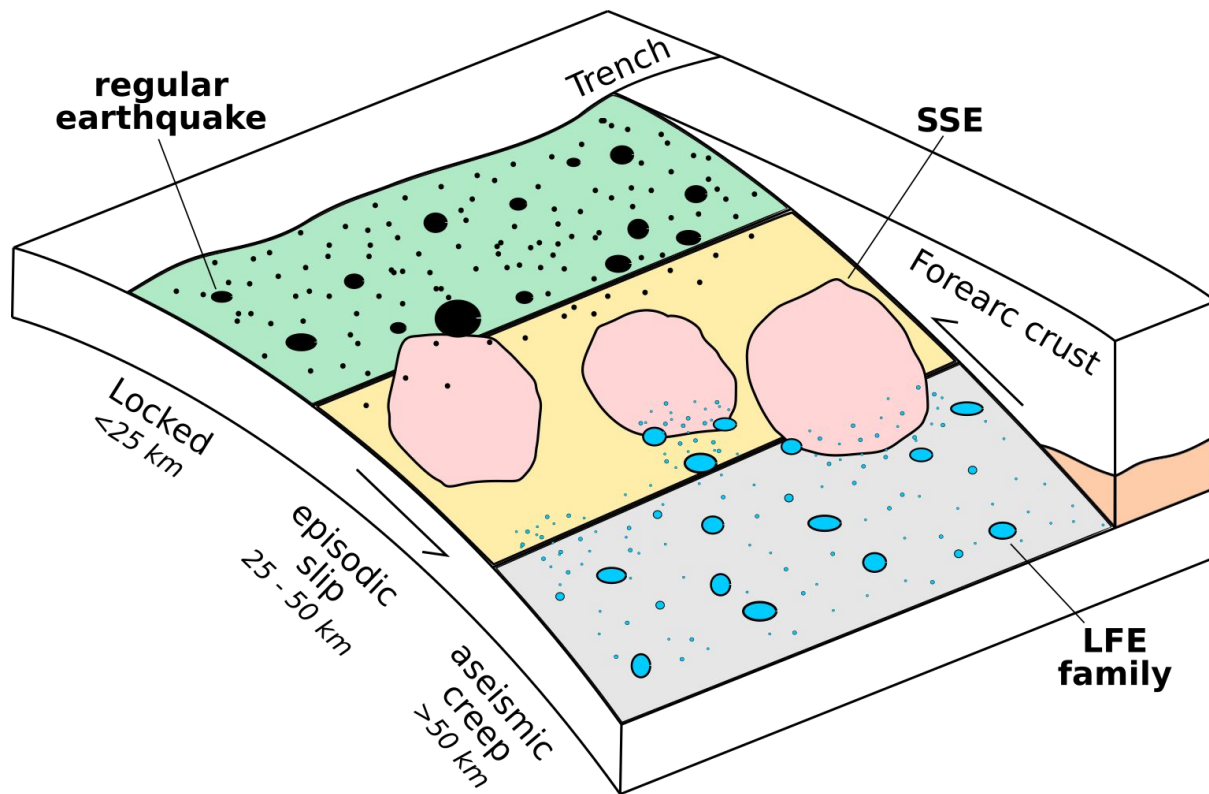
Institut des Sciences de la Terre

# Detecting low-frequency earthquakes with deep learning

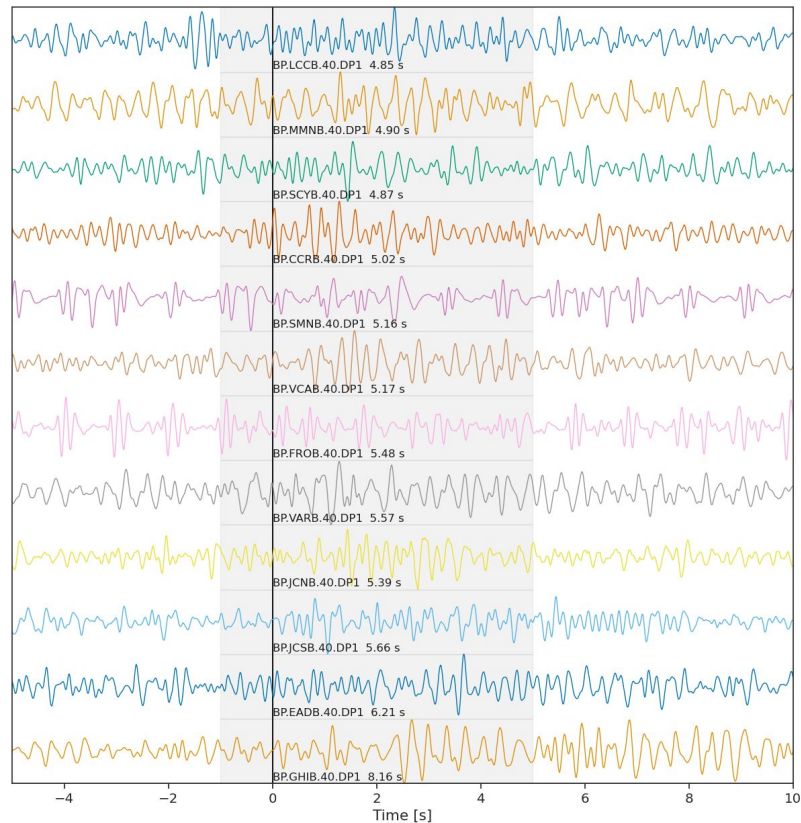
Jannes Münchmeyer



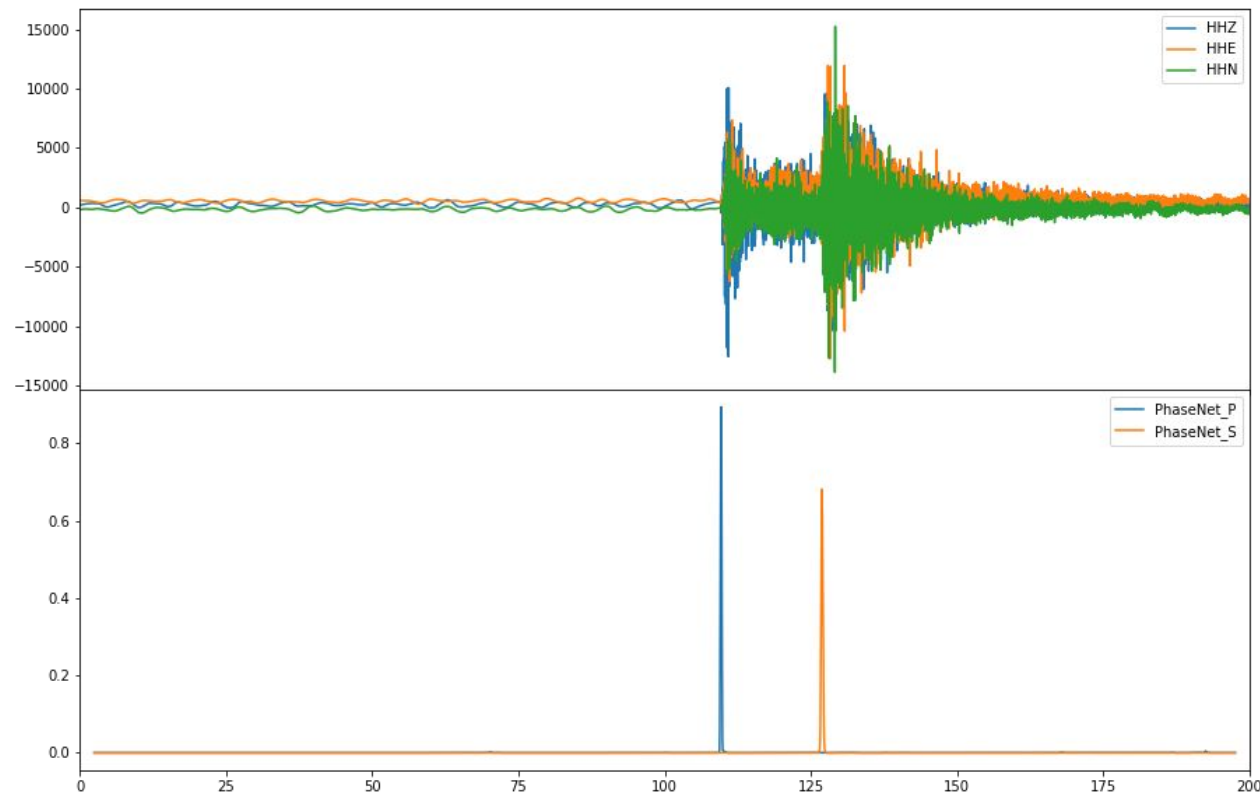
# The (a)seismic spectrum



# Detecting LFEs is difficult



# Earthquake detection with deep learning

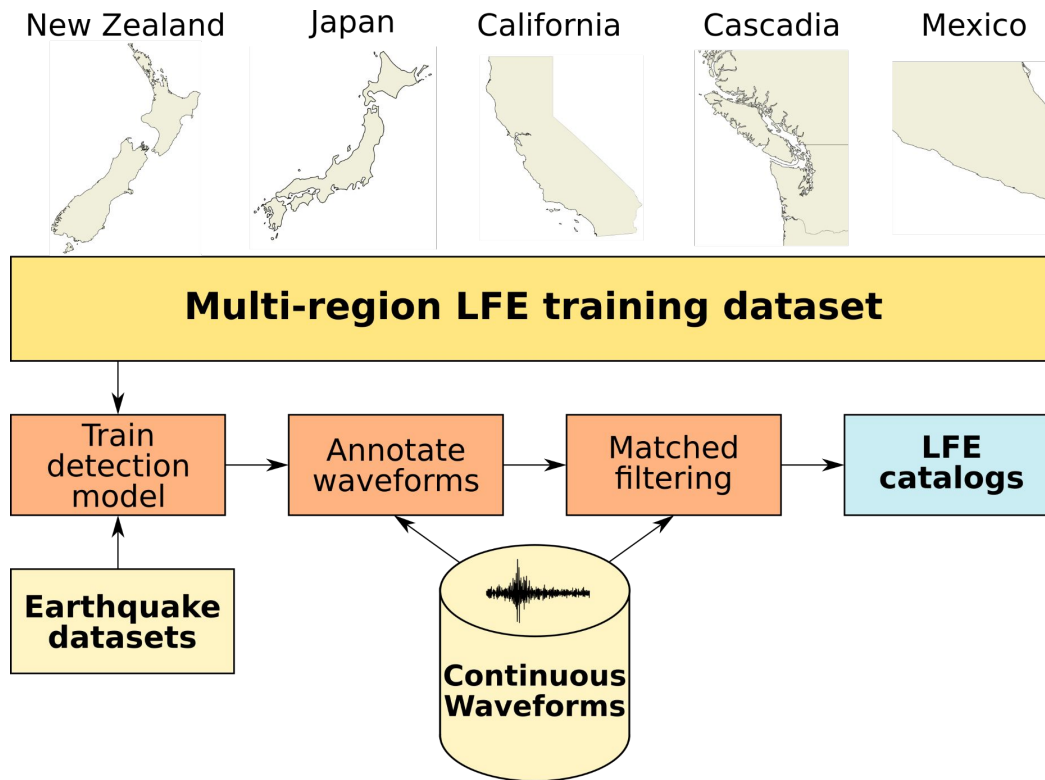


**SeisBench**  
A toolbox for machine learning in seismology

Picks:

CX.PB01.	2007-01-02T05:48:59.648392Z	P
CX.PB02.	2007-01-02T05:49:03.658392Z	P
CX.PB03.	2007-01-02T05:49:05.548392Z	P
CX.PATCX.	2007-01-02T05:49:06.339998Z	P
CX.PB01.	2007-01-02T05:49:16.868392Z	S
CX.PB02.	2007-01-02T05:49:23.088392Z	S
CX.PB03.	2007-01-02T05:49:26.228392Z	S
CX.PATCX.	2007-01-02T05:49:28.269998Z	S
CX.PB04.	2007-01-02T05:49:10.948392Z	P
CX.PB04.	2007-01-02T05:49:35.288392Z	S
CX.PB05.	2007-01-02T05:49:15.378392Z	P
CX.PB05.	2007-01-02T05:49:43.108392Z	S

# Deep learning for LFE detection



# LFE training datasets

Japan



California



Cascadia

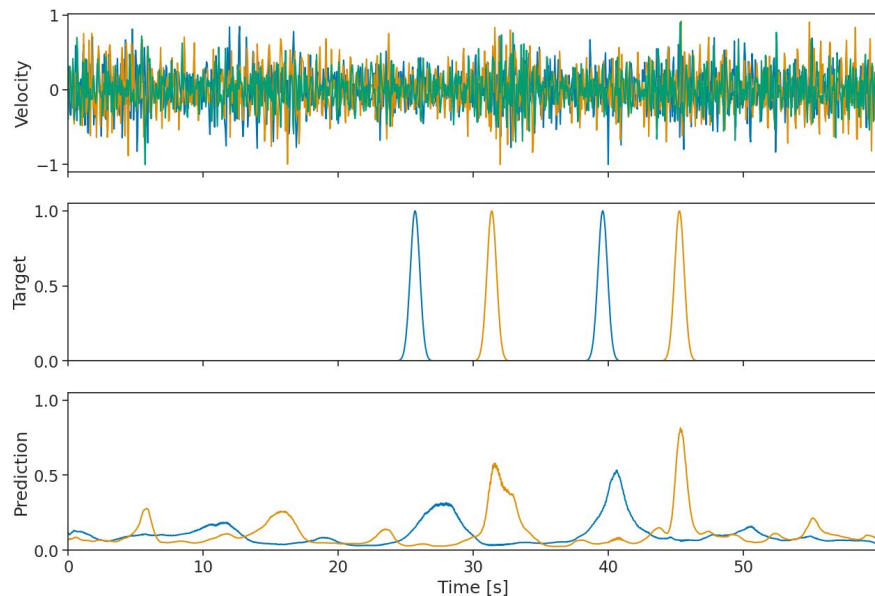


Mexico

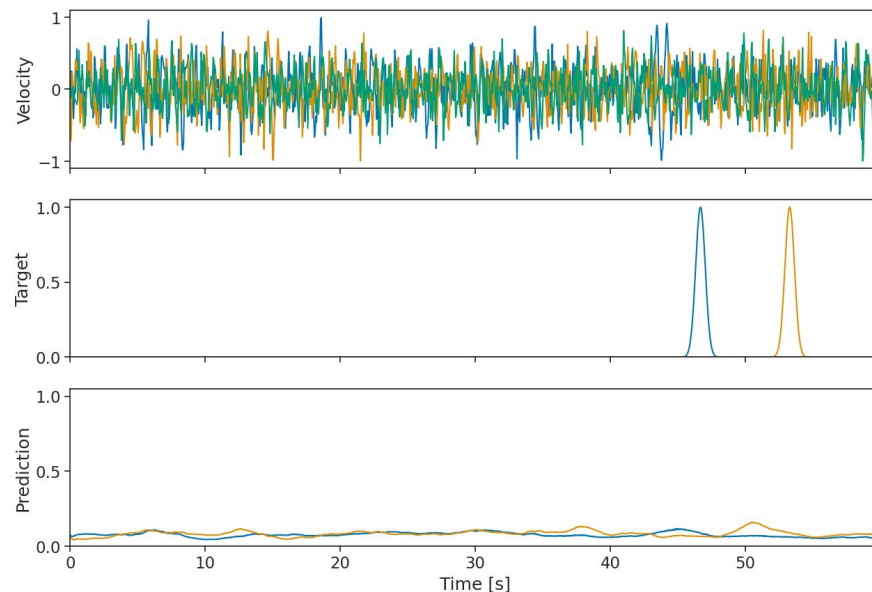


# LFE detection curves ...

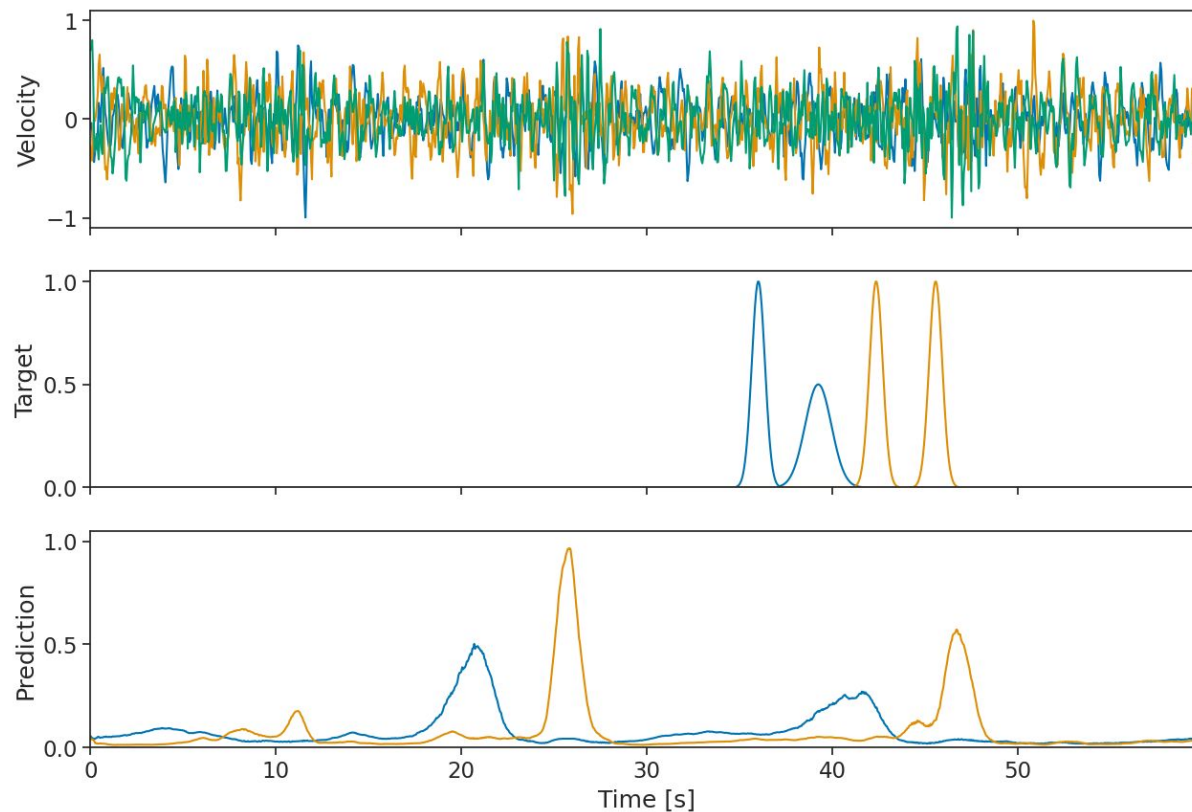
... are sometimes good.



... but usually bad.



# Uncataloged LFEs





# Why is detecting LFE harder than EQs?

- Catalog quality
- Worse signal-to-noise ratio
- Dense spacing of events