Real-Time Focal Mechanisms at Axial Seamount via Deep Learning

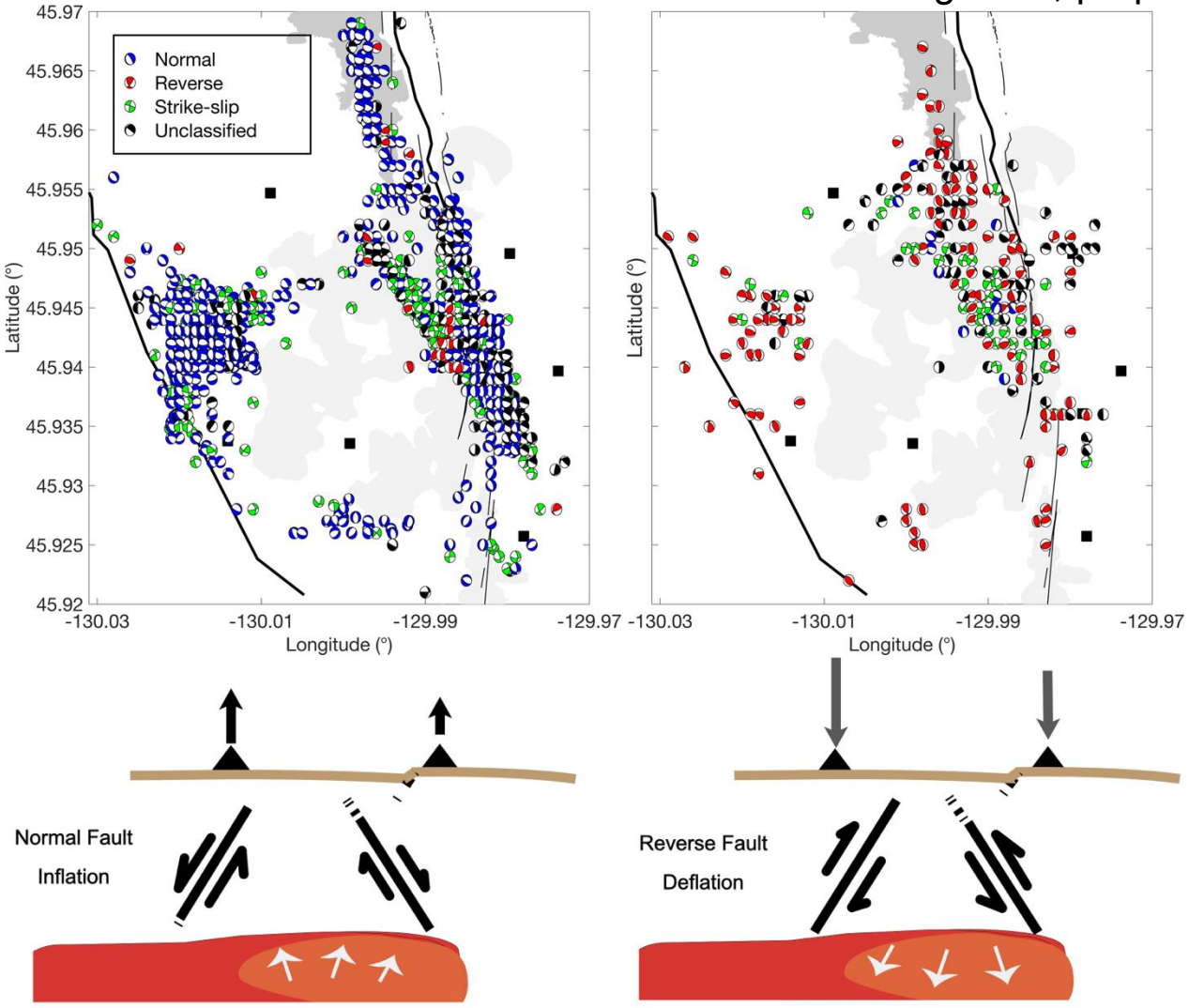
Maochuan Zhang (mczhang8@uw.edu)**,** William Wilcock, Marine Denolle, Felix Waldhauser, Kaiwen Wang, Maya Tolstoy, Yen Joe Tan

Dec 15th 2025

OOIFB

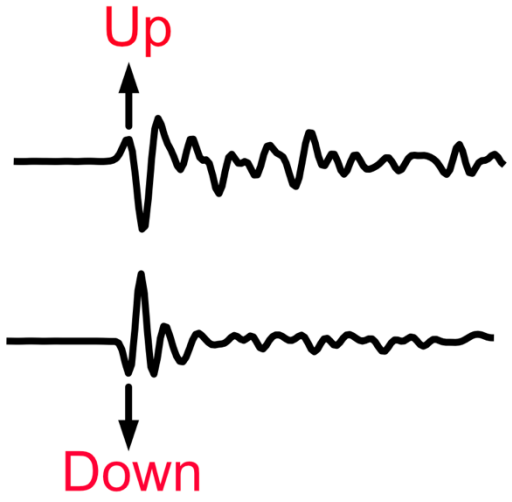
Microearthquake focal mechanisms provide crucial information about subsurface fault geometry and stress orientations

Zhang et al., prep

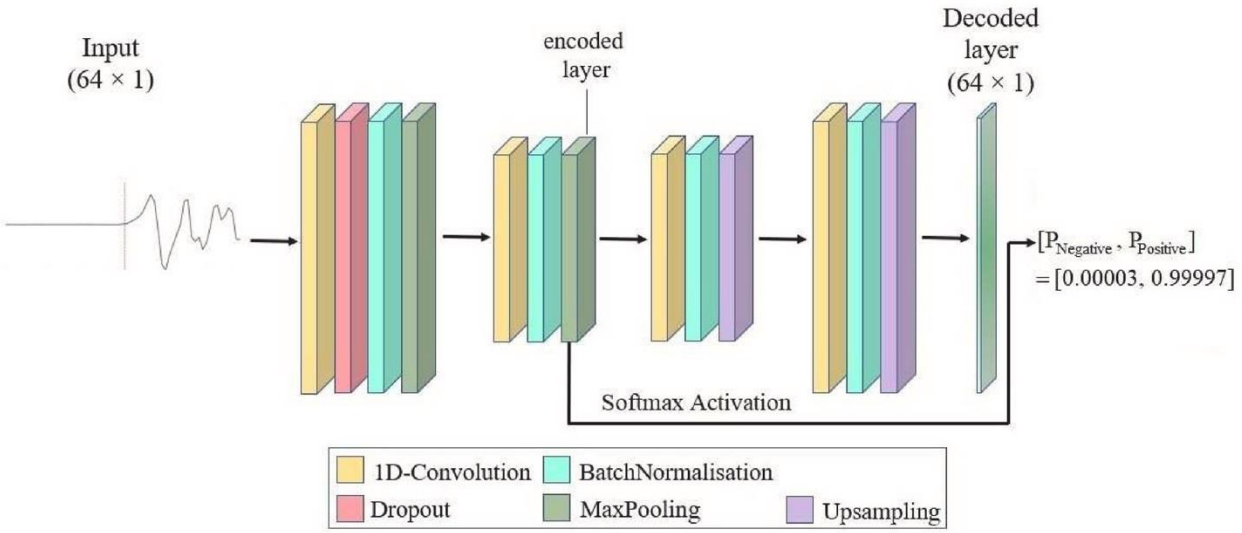


Levy et al (2018)

- Microearthquakes reflect magma movement, tectonic deformation, and hydrothermal activity.
- Determining focal mechanisms offshore is challenging due to sparse networks, small event sizes, and uncertain polarities.
- Accurate focal mechanisms require reliable P-wave first-motion polarities.

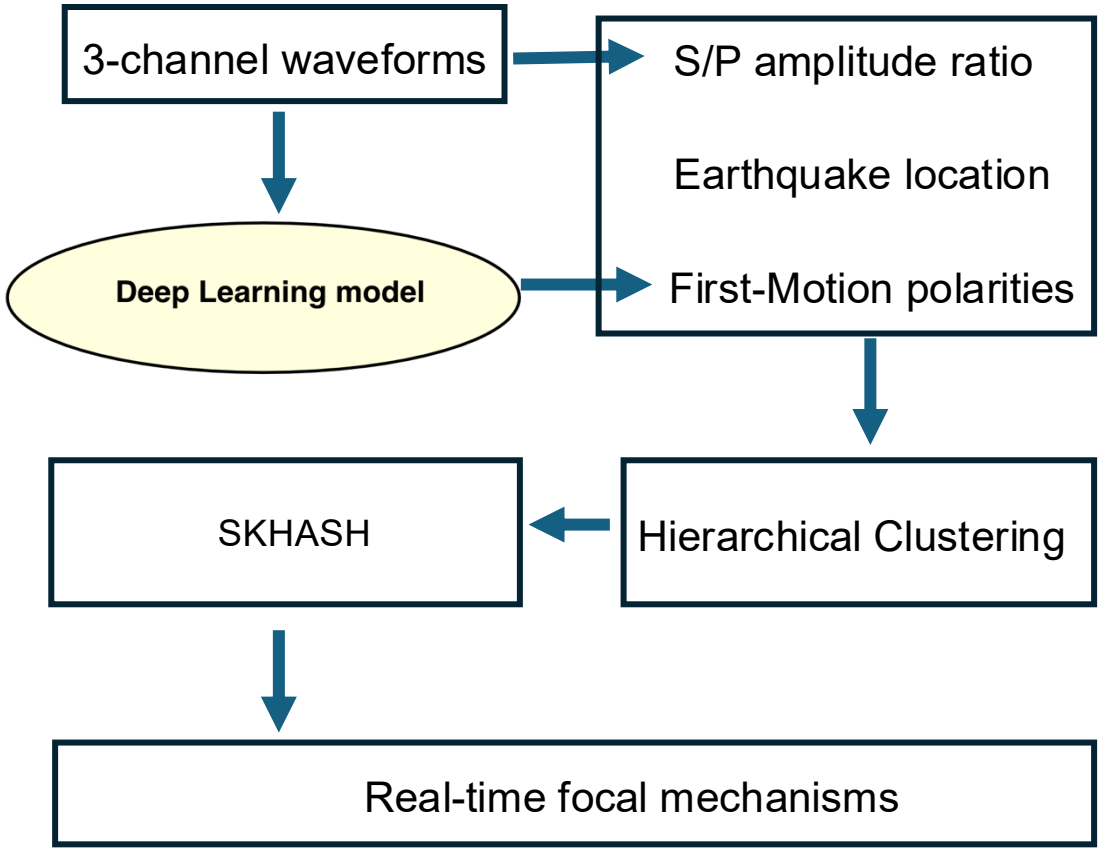


Deep learning delivers fast, robust first-motion polarities for challenging marine microearthquakes.



PolarCAP, Chakraborty et al., 2022

Please check out my poster DI43A-0017
On Thursday, 18 December 2025; 14:15 - 17:45 CST



- Trained and transfer learning based on synthetic Axial OBS data
- **>95% accuracy with pick time errors and varying SNR waveforms**
- Deep learning polarities is well-suited to support real-time focal mechanism pipelines