S13F-0405 Improving Stress Drop Estimation through Point-Wise Spectral Ratio Stacking

Monday, 11 December 2023

14:10 - 18:30

Poster Hall A-C - South (Exhibition Level, South, MC)

Abstract

Stress drop, a crucial source parameter in earthquake studies, significantly influences ground motion prediction and seismic hazard assessment. Despite several existing methods to estimate stress drops, the resulting stress drop estimates often exhibit a wide variation of up to 3-4 orders of magnitude. In this study, we address the robustness of stress drop estimation by introducing a point-wise spectral ratio stacking approach based on empirical Green's functions (eGfs). Conventional trace-wise stacking can lead to data exclusion due to high signal-to-noise ratio requirements across a wide range of frequency. By adopting point-wise stacking, we maximize the utilization of useful recording information, leading to more accurate stress drop estimates.

We applied the point-wise spectral ratio stacking method to a comprehensive dataset comprising global earthquakes from 1990 to 2020 with magnitude larger than Mw5.5 and depth shallower than 50 km. We first verified the moment magnitudes of earthquakes estimated from the resulting seismic moment ratios. We found that the moment magnitude of master events best consistent with catalog magnitudes when the magnitude difference between master and their eGfs differs by about 0.5. Our analysis indicates that stress drop of shallow earthquakes exhibits no depth dependence, while showing a slight increase with magnitude. The results obtained through our optimized stacking process shed new light on stress drop estimate of shallow earthquakes and have the potential to enhance the understanding of earthquake mechanics.

First Author

L

Meichen Liu
University of Michigan Ann Arbor

Authors

H

Yihe Huang
University of Michigan Ann Arbor

R

Jeroen Ritsema
Univ Michigan

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