EGU24-4644, updated on 05 Oct 2024
https://doi.org/10.5194/egusphere-egu24-4644
EGU General Assembly 2024

Probing the SAA Depth Range using ML-measured short-period dispersion

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In this study, we aim to explore the depth range of stress-aligned anisotropy (SAA) in Taiwan. Our recent works have shown that the near-surface SAA is consistent with shear-wave splitting studies employing local earthquakes. However, it contrasts with SWS studies using deep phase (SKS) and the shallow crustal Vs anisotropy model derived from noise-derived broad-band (4-20 s) Rayleigh waves. This suggests that SAA is likely confined to the uppermost crust. Despite micro-cracks assumed to be fully closed with increasing ambient stress at depths, the depth range of the SAA mechanism remains unclear.

Our approach involves noise tomography using short-period (1-10 s) Rayleigh waves enhanced by the multicomponent stacking technique. To measure the dispersion of the isolated fundamental mode Rayleigh waves accurately and effectively, we employ a modified machine learning algorithm based on the algorithm proposed by Yang et al.(2022) We employ the Recurrent-Residual U-Net (R2U-Net) developed by Liao et al. (2021) for training. The model training data consists of dispersion diagrams from CCFs derived in various regions, including Taiwan, Japan, and the South Island of New Zealand. Approximately six thousand data are included in the training stage.

With the obtained dispersion data, we apply the wavelet-based multi-scale inversion technique to derive 3D models of Vs and Vs anisotropy. In this inversion process, the results from prior studies by Lee et al. (2023) serve as a priori constraint for the uppermost section of the model.