Strong variations of near-surface seismic anisotropy of Taiwan revealed by coda interferometry

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We report the near-surface (<500 m) seismic structure, Vs, Vp and Vs anisotropy, of Taiwan using the empirical Green’ s function of body waves extracted by applying coda interferometry to the vertical station pairs at 56 borehole sites. We find clear characteristic cos2θ dependence of Vs in all the determinations of Vs azimuthal anisotropy. Because the borehole sites are located at very diverse geological structures of Taiwan, we are able to notice the following interesting features about the near-surface Vs anisotropy: (1) The patterns of the observed anisotropy fall into two categories, OPA (Orogeny-Parallel Anisotropy) and SAA (Stress-Aligned Anisotropy), and both types of anisotropy fit well the local geological fabrics and/or the ambient stress. (2) About half of the amplitudes of anisotropy are larger than 10 %. The site with the largest amplitude of anisotropy (34%) is located in the slate belt of the Central Ranges, while the sites with weak anisotropy (~1%) are associated with low Vs and/or small strain rate. (3) The amplitudes of OPA are generally stronger than SAA, and the types of anisotropy are closely related to the Poisson’ s ratios at the borehole sites. (4) The strong variations of the OPA amplitudes can be explained by the rock types in the well body with the metamorphic rocks carrying stronger anisotropy than the sedimentary rocks. (5) The strong near-surface anisotropy also implies that delay times contributed by the shallow crust might have been underestimated in studies of shear-wave splitting measurements using the direct arrivals of earthquakes waves.

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