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Seismic anisotropy of the crust in the Central Range of Taiwan from the 2008 TAIGER explosion experiment

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Distinguishing the effect of crustal anisotropy from that of the upper mantle anisotropy has been a critical question for the results of teleseismic shear wave splitting. From previous teleseismic shear splitting studies in Taiwan, it is known that stations on land in general and the mountainous area in particular record large trend parallel delays (up to about 2 seconds) between the fast and slow SKS/SKKS phases. The splitting has been interpreted to come from a highly anisotropic crust and upper mantle ($\sim$4%) due to the collision between the Philippine Sea plate and the Eurasian plate. Laboratory measurements of anisotropy of Central Range metamorphic rocks (Christensen, unpublished) show that the anisotropy can be as high as 15%. This leads to a fundamental question of how the total anisotropy is partitioned between the crust and the mantle. We use the records of the temporary dense seismic arrays ($\sim$200m spacing) from the 2008 TAIGER explosions experiment and the permanent broadband seismic stations to determine the crustal anisotropy in the Central Range. Totally, 8 shots and 1,330 of Pg recordings in the 30–150 km offset range are used in this study. A minimum of 30 km and a maximum of 150 km offset are applied to exclude the local-scale effects (low velocity layer) and Pn arrivals, respectively. From the analysis of different azimuthal refracted arrivals of shots, we are able to see a dependence on azimuth with a trend of $\cos 2\theta$ form. The amplitude of the periodic trend is significantly larger than the travel time variations of velocity inhomogeneities. The travel time minimum is at about 20–30°, which is parallel to the structural trend of the Central Range. Furthermore, we will invert the parameters of an anisotropic model ("1D solution") based on those arrivals to quantify the crustal anisotropy in the Central Range by assuming transverse isotropic model with a horizontal symmetry axis (HTI).