Layered seismic anisotropic structure of the subducting asthenosphere in the Cocos subduction zone

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Previous studies of the seismic anisotropy in the subslab mantle of the Cocos subduction zone show that the fast directions are in general parallel (~30 degrees) to the absolute plate motion (APM). Such APM-parallel pattern can be interpreted as the a-axis of olivine being aligned by the shear stress associated with the moving plate.To better understand the relationship between anisotropy and mantle flow, we collected S waves from the Cocos slab recorded by the stations located on the Pacific plate. Our results show that fast directions predominantly align at N65E, or 30 degrees clockwise from the direction of the APM, and that the delay time of our source-side anisotropy is much larger than previously reported. We also found that both of the splitting parameters have $\pi/2$ periodicity. We model the periodic distribution using 2 layer anisotropic structure with E-type olivine fabric, for which the fast direction remains the same at all incident angles to satisfy the basic assumption of the 2 layer modeling. The best-fit model shows that the upper and lower layers are characterized by a fast direction of 30 and 65 degrees, respectively, with delay time ratio about 1:2~3. The upper layer immediately entrained by the slab is "normal" descending and the lower layer is oblique in subduction. The mechanism behind this double layer subduction of the asthenosphere is under investigation.

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