

Toward proper characterization of seismic radial anisotropy of the lithosphere-asthenosphere system

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Kawakatsu et al. (2015) recently proposed a new fifth parameter,  $\eta_k$  that properly characterizes the incidence angle dependence (relative to the symmetry axis) of seismic bodywaves in a transverse isotropy (TI) system. When existing models of upper mantle radial anisotropy (TI with a vertical symmetry axis) are compared in terms of this new parameter, PREM shows a distinct property. Within the anisotropic layer of PREM (a depth range of 24.4-220km),  $\eta_k < 1$  in the top half and  $\eta_k > 1$  in the lower half. If  $\eta_k > 1$ , anisotropy cannot be attributed to the layering of homogeneous layers, and thus requires the presence of intrinsic anisotropy (Kawakatsu, 2016, GJI).

Partial derivatives of surface wave phase velocity and normal mode eigen-frequency for the new set of five parameters indicate that the sensitivity of  $\eta_k$  is about twice as large as that of the conventional  $\eta$ , indicating that  $\eta_k$  is more resolved than is usually considered. While sensitivities for (anisotropic) S-velocities are not so changed, those for (anisotropic) P-velocities are greatly reduced. In contrary to Dziewonski and Anderson (1981)'s suggestion, there is not much control on the anisotropic P-velocities; on the other hand the significance of  $\eta_k$  for the long-period seismology is clear.

Considering now that a variety of seismic body waves with different incidence angles (receiver functions, multiple S, SS-precursors, SKS, etc.), as well as surface waves and normal-modes, are available to constrain the property of the lithosphere-asthenosphere system, and that the presence of strong radial anisotropy in the suboceanic asthenosphere is well established, we should properly characterize seismic radial anisotropy of the lithosphere-asthenosphere system using the new fifth parameter.

Reference:

Kawakatsu, H., J.-P. Montagner, and T.-R. A. Song (2015), On DLA's  $\eta$ , in *The Interdisciplinary Earth: A volume in honor of Don L. Anderson*, edited by Foulger et al., PP. 33-38, GSA and AGU.

Kawakatsu, H. (2016), A new fifth parameter for transverse isotropy, *Geophys. J. Int.*, 204, 682-685.

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