



Unexpected consequences of transverse isotropy

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In a series of papers, Kawakatsu et al. (2015) and Kawakatsu (2016a, b, 2017) introduced and discussed a new parameter, η_κ , that characterizes the incidence angle dependence (relative to the symmetry axis) of seismic body wave velocities in a transverse isotropy (TI) system. With the properly defined new set of parameters, Kawakatsu (2016b) further demonstrated that sensitivities of those parameters to Rayleigh wave phase velocity made much more sense and thus they were useful for long-period seismology. More recently, Kawakatsu (2017) showed how the reflection and transmission coefficients behaved in terms of η_κ . During the course of these exercises, several nontrivial consequences of transverse isotropy are realized and summarized as follow: (1) a trade-off exists between η_κ and V_p/V_s -ratio if assumed for isotropy; (2) P-wave velocity (anisotropy) strongly influences the conversion efficiency of P-to-S and S-to-P, as much as S-wave velocity perturbation does; (3) Rayleigh wave phase velocity has substantially sensitivity to P-wave anisotropy near the surface. These findings, especially the last two, might deserve careful attention in interpretation of results of popular seismic analysis methods, such as receiver function analyses and ambient noise Rayleigh wave dispersion measurements. Especially, the strong influence of P-wave anisotropy to P-to-S and S-to-P conversion may be essential to the receiver function analysis, because, for isotropic media, we typically attribute the primary receiver function signals to S-wave velocity changes. Considering that the receiver function analysis has become a popular and powerful tool to investigate the crustal and upper mantle structures, it seems important to fully investigate to what extent and under what circumstances the effect might be significant.

Reference:

Kawakatsu, H., J.-P. Montagner and T.-R. A. Song (2015), On DLA's η , GSA Special Paper 514: The Interdisciplinary Earth, pp. 33-38.

Kawakatsu, H. (2016a), A new fifth parameter for transverse isotropy, GJI, 204, 682-685.

Kawakatsu, H. (2016b), A new fifth parameter for transverse isotropy II: partial derivatives, GJI, 206, 360-367.

Kawakatsu, H. (2017), A new fifth parameter for transverse isotropy III: reflection and transmission coefficients, GJI, in press.