[EE] Evening Poster | S (Solid Earth Sciences) | S-IT Science of the Earth's Interior & Tectonophysics

[S-IT28]The lithosphere and the asthenosphere

convener:Catherine Rychert(University of Southampton), Hitoshi Kawakatsu(Earthquake Research Institute, University of Tokyo), Samer Naif(共同), Jessica M Warren (University of Delaware)

Tue. May 22, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)

The lithosphere-asthenosphere boundary (LAB) separates Earth's rigid tectonic plates from the underlying convecting mantle. The LAB is fundamental to our understanding of plate tectonics and mantle dynamics, although its depth and defining mechanism are highly debated. How it varies among tectonic environments and its relationship to the Moho, MLD, and anisotropy are also poorly understood. Ocean bottom seismic data is particularly important for constraining the young plate with relatively simple history, although this data is difficult to attain and rare. We will focus on the lithosphere, the asthenosphere, and the lithosphere-asthenosphere system in a variety of settings including but not limited to continents, oceans, margins, rifts, ridges, hotspots, plumes, and subduction zones. We welcome research contributions from diverse fields, including but not limited to seismology, magnetotellurics, petrology/mineralogy, dynamical modelling, and mineral physics.

[SIT28-P01]Unexpected consequences of transverse isotropy

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In a series of papers, Kawakatsu et al. (2015) and Kawakatsu (2016a, b, 2018) introduced and discussed a new parameter, ηκ, 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 ηκ. During the course of these exercises, several nontrivial consequences of transverse isotropy are realized and summarized as follow: (1) a trade-off exists between ηκ and Vp/Vs-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. Some of relevant implications for the topics of this session will be presented.

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. (2018), A new fifth parameter for transverse isotropy III: reflection and transmission coefficients, GJI, DOI:10.1093/gji/ggy003.