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SPani, a whole-mantle V_P and V_S model: Implications on thermo-chemical structure.

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We have derived a joint model of radially anisotropic P- and S-wave velocity (V_P, V_S) heterogeneity in the whole mantle, partly based on the S-velocity model SAVANI of Auer et al., 2014. Sensitivity to P velocity is provided by a large set of global teleseismic P-wave travel time data, as well as observations of Rayleigh-wave fundamental-mode and overtone dispersion curves. P- and S-sensitive data are inverted jointly, and the P- and S-inversions are "coupled" by (i) Rayleigh-wave data, which are sensitive to both S and P, and (ii) a-priori mineralogical constraints on the relationship between P and S-velocity. We conduct extensive testing of the effects of such mineralogical constraints, and assess in detail potential trade-offs between P- and S-wave speeds and radial anisotropy. Importantly, our model exhibits interesting anomalies in the ratio between V_P and V_S in the upper mantle (at around 150 km depth) within the Asian plate, at continental regions and along mid-ocean ridges. In light of the well known limitations inherent to any tomographic method we perform a qualitative interpretation of these features, based on the joint analysis of radial anisotropy and V_P/V_S ratio, and infer the anomalous zones to be likely caused by (i) a high concentration of water in the western pacific subduction system and (ii) chemical depletion of continental lithosphere below the American and the East European cratons.