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Anisotropy in 1D reference Earth models

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The Neighbouhood Algorithm of Sambridge was applied to normal mode and surface wave phase velocity data to determine the likelihood of radial anisotropy in mantle reference models. This full model space search technique provides probability density functions for each model parameter, and therefore reliable estimates of resolution and uncertainty, without having to introduce unnecessary regularization on the model space. Our results show a fast decrease of S-wave anisotropy (described by parameter ξ) and of intermediate parameter η in the top 220 km of the mantle, and they do not seem to deviate significantly from PREM at any depth. The data do not require strong deviations from PREM for P-wave anisotropy except in the lowermost mantle and between 220 and 400 km depth, which indicates deeper P-wave anisotropy than S- or η-anisotropy. The sign change in the anisotropic parameters across the 670-discontinuity found by other authors is not warranted by our data. Density need to be well resolved because we observe a high trade-off between P-wave related parameters and density anomalies, although S-wave anisotropy and η are less affected by density. A well-resolved negative density anomaly was found in the uppermost mantle and a density excess was observed in the transition zone and the lowermost mantle. This deep mantle density excess possibly corresponds to the post-perovskite transition recently discovered by the mineral physics community.