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Influence of observed mantle anisotropy on isotropic tomographic models

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We investigate the possible bias in isotropic 3D upper mantle S-velocity models due to observed anisotropy. For a perfectly uniform data coverage, anisotropic effects would be canceled out of tomographic images. Conversely, if anisotropic regions are sampled by unevenly distributed wave paths, some anisotropy may be erroneously mapped into artificial isotropic velocity anomalies. We quantify these effects on two recent tomographic models derived from fundamental and higher-mode Rayleigh waves. These models are EAV03 for the Mediterranean (Marone et al., 2004) and NA04 for North America (Van der Lee and Frederiksen, 2005). For both regions we compile azimuthal anisotropy mainly from observed SKS splitting, and compute the resulting perturbations on Rayleigh waves used for the models (i.e. same wave paths). We use these data twofold: first we invert only the anisotropic perturbations for an isotropic model, to locate regions where bias may occur in the actual models, then we correct the actual data for the inferred contribution from anisotropy, and invert these in order to highlight potential artifacts in EAV03 and NA04. The depth of the anisotropy is not constrained by SKS waves. Therefore, we hypothesize different depth regions where the anisotropy occurs. Our tests show that the effect of observed anisotropy on isotropic tomographic models is generally small, and depends on the depth of the anisotropy. If the anisotropy is concentrated in a shallow layer, the effects are largest, but inversions of anisotropy-corrected Rayleigh wave data do not yield dramatically different tomographic models.