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Separation of intrinsic and artificial anisotropy by using homogenization method

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The effect of anisotropy on seismic waves and on the inversion for 3D tomographic models of velocity and anisotropy is not negligible and is used for different applications in geodynamics at small scale. The exact determination and interpretation of anisotropy (amplitude and attenuation) are quite difficult because the observed or inverted anisotropy is usually a mixture of intrinsic and artificial anisotropies, which may partly hide the true properties of the model. The artificial anisotropy might be due to the fact that seismic waves don't see the real medium but a filtered (and imperfect) version of the model of the earth. The homogenization method developed by Yann Capdeville (Capdeville et al., 2007, 2010) enables adapt the scales of the model to the seismic wavelengths. This method uses a two-scale homogenization expansion to construct a new more continuous model based on filtering technique without loss of accuracy in wave-field computation. Such homogenized model is quite effective to compute full waveform seismograms in heterogeneous anisotropic medium. In addition, it makes it easier to take account of shallow layers on seismograms.

By introducing a spatial low-pass filter, the homogenized model changes the anisotropic properties from the original model (Capdeville et al., 2007), but it is still valid when applying to model wave propagation especially for models contain small heterogeneities with respect to the minimum wavelength of the wave-field and can be used for studying the intrinsic anisotropy.

In this paper, we use the homogenization method to separate the true and artificial anisotropies, and we show some preliminary results. Both 1-D isotropic and anisotropic models are tested by different filters in homogenization method. The synthetic waveforms are computed by normal mode summation method. These seismograms obtained by the original and the homogenized model are compared and show a good match. Actual seismic data is to be investigated in the next step. The homogenization method applied to the 3-D problem for separating the true and artificial anisotropy is also left to the future.