S014-08 - Anisotropic Elastic Tensor Estimation from Joint Analysis of Translation and Rotation

Tuesday, 8 December 2020

15:00 - 15:04

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Abstract

We investigate the resolving power of 6C observations (translations and rotations) for the anisotropic elastic tensor. A hypothetic receiver is placed in a borehole within a homogeneous anisotropic medium. In this study, numerous simplifications are taken, including plane waves, uniform propagation directions between all phases and no specified radiation patterns for events. The presented inversion scheme requires the estimation of several wave parameters. Backazimuth and inclination are either determined by evaluating the polarization of the rotational signal of S-waves or the polarization of P-waves. Existing methods to estimate shear-wave velocities are extended towards P-waves. The inversion for the elastic tensor relies on measuring rotation of qP-waves and therefore cannot be applied to isotropic media. It's demonstrated that direction-dependent information about wave velocities for at least six distinct events lead to an unambiguous determination of the elastic tensor. Assuming hexagonal symmetry, we show to what extent the direction of the symmetry axis is retrievable. Further, we study the improvement of the inversion when a strainmeter recording is added to the observations. The strain measurement allows the determination of the propagation direction of an isolated wavefield whereas the rotation scheme relies on capturing at least two distinct phases. The precision of P-wave velocity estimations can be greatly improved and therefore raises the accuracy of elastic parameter determinations. The medium is not required to be anisotropic for the seven-component inversion scheme. We discuss, which questions need to be answered before the method can be applied to real data.

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