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Prestack reverse time migration for tilted transversely isotropic media

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According to having interest in unconventional resource plays, anisotropy problem is naturally considered as an important step for improving the seismic image quality. Although it is well known prestack depth migration for the seismic reflection data is currently one of the powerful tools for imaging complex geological structures, it may lead to migration error without considering anisotropy. Asymptotic analysis of wave propagation in transversely isotropic (TI) media yields a dispersion relation of couple P- and SV wave modes that can be converted to a fourth order scalar partial differential equation (PDE). By setting the shear wave velocity equal zero, the fourth order PDE, called an acoustic wave equation for TI media, can be reduced to couple of second order PDE systems and we try to solve the second order PDE by the finite difference method (FDM). The result of this P wavefield simulation is kinematically similar to elastic and anisotropic wavefield simulation. We develop prestack depth migration algorithm for tilted transversely isotropic media using reverse time migration method (RTM). RTM is a method for imaging the subsurface using inner product of source wavefield extrapolation in forward and receiver wavefield extrapolation in backward. We show the subsurface image in TTI media using the inner product of partial derivative wavefield with respect to physical parameters and observation data. Since the partial derivative wavefields with respect to the physical parameters require extremely huge computing time, so we implemented the imaging condition by zero lag crosscorrelation of virtual source and back propagating wavefield instead of partial derivative wavefields. The virtual source is calculated directly by solving anisotropic acoustic wave equation, the back propagating wavefield on the other hand is calculated by the shot gather used as the source function in the anisotropic acoustic wave equation. According to the numerical model test for a simple geological model including syncline and anticline, the prestack depth migration using TTI-RTM in weak anisotropic media shows the subsurface image is similar to the true geological model used to generate the shot gathers.