Investigation of the presence of transverse anisotropy in the 3D baseline seismic data at Ketzin, Germany

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A 3D seismic baseline survey was acquired within the EU funded CO_2SINK project at Ketzin, Germany in 2005. CO_2 was injected at about 630-650 meters depth into the Stuttgart Formation. The formation is heterogeneous with lithological facies of channel sandstones interbedded with floodplain mudstones. It underlies an approximately 210 meters thick sequence of claystone, silty claystone and anhydrite of the Weser and Arnstadt Formations. Claystone is considered to be an intrinsic-type anisotropic medium due to the platy shape of clay minerals. A thick interval of claystone caprock may show seismic velocity variation with propagation angle or seismic anisotropy.

In this study, the degree of anisotropy was assumed to be weak. The processing steps followed conventional seismic data processing, except for the velocity estimation used for the moveout correction. The velocity approximation used nonhyperbolic or 4th order moveout for transverse anisotropic (TI) media which was proposed by Alkhalifah (1997). The 4th order moveout velocity approximation used the zero-dip normal moveout velocity (V_{nmo}) and eta (?) anisotropic parameter for the velocity correction as defined by the following equations.

$$t_x = \sqrt{t_o^2 + \frac{X^2}{V_{nmo}^2} - \frac{2?\frac{X^4}{V_{nmo}^4}}{t_o^2\left[(1+2?)\frac{X^2}{V_{nmo}^2}\right]}}$$ where $? = \frac{1}{2}\left[\frac{V_h^2}{V_{nmo}^2} - 1\right]$ and t_x is the traveltime, t_o is traveltime at zero

offset, X is the offset and V_h is horizontal velocity. Preliminary results indicate the presence of anisotropy in the study area with an eta parameter ranging from -0.185 to +0.180. Moveout velocity corrected stacked sections show an improvement in the continuity of reflections in the shallow part of the survey (above 500 ms), whereas there is no significant difference in the deeper region.