Anisotropic attenuation analysis of crosshole data generated during hydraulic fracturing

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Measurements of attenuation anisotropy can provide valuable information for reservoir characterization and monitoring. The paper analyzes a crosshole data set generated by perforation shots fired in a horizontal borehole to induce hydraulic fracturing in a tight shale-gas reservoir. The spectral-ratio method is applied to pairs of traces to set up a system of equations for directionally-dependent effective P-wave attenuation. The anisotropic attenuation coefficient is expanded in a quadratic function of the polar and azimuthal angles of the source-receiver line. The coefficients of this polynomial are found separately for each stage of perforation shots. Although the inversion provides clear evidence of attenuation anisotropy, the narrow range of propagation directions impairs the accuracy of anisotropy analysis. The observed variations of the P-wave attenuation coefficient between different perforation stages may be related to changes in the medium due to hydraulic fracturing and stimulation.