Modification of Gaussian elimination to identify hydrocarbon reservoir (the thin- bed model reconstruction)

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Passive seismic tomography can be not expensive and effective tool for hydrocarbon exploration as well for challenging task of environment protection. In this paper we focus our attention on the thin-bed model (20 m thick) that has been defined by Haitao Ren and Gennady Golobushin (2007). Their 2-D model includes both water- and gas-saturated reservoirs cases. We supplemented this model by synthetic sources assuming that they imitate possible micro seismicity. Positions of sources were selected in order to resolve the dipping thin model from point of view ray's theory. Stations of the surface network were located to be able register seismic waves that transmitted via thin-bed. The medium parameters were found so that to approximate the layer by means of blocks. Two large zones with significant velocity contrast between them correspond to the water-saturated and the gas-saturated reservoirs. Properties of rocks define anomalies in zones that surround reservoirs. It is known that such kind of tomographic structures are normally poorly resolved because of over- or under- determined systems of arising linear equations. Therefore synthetic data were processed applying new differentiated approach, which is stable at least with respect to parameterization errors. The base of the approach is the modification of Gaussian elimination that has been developed by Tatyana A. Smaglichenko (2011) with purpose to decrease level of any error by means of division of initial system into sub-systems. In this study we demonstrate stages of the thin-bed model reconstruction and ability of inversion technique to adequately detect the complicated parts of this model. With help of this example, we conclude that under defined physical conditions passive tomography identifies details of hydrocarbon reservoir.