Time-to-Depth Conversion Using Seismic Inversion Products: A Successful Application on Synthetic and Real Data

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Abstract

Converting seismic data from time to depth plays pivotal role in the success of exploration for oil and gas. Numerous approaches are used for the conversion purpose. The accuracy of the conversion methods and results is essentially influenced by numerous factors including but not limited to the quantity and quality of velocity data available, the number and distribution of control and calibration points, as well as the complexity of the geology. This study introduces a novel approach that uses impedance-derived velocity model from seismic inversion to convert seismic data from time to depth. The approach is tested on synthetic and on real data and demonstrated very good results.

To test the proposed approach, seismic data with well data are created from a well-defined geological model in depth. The created data are inverted to impedances using classical inversion methods. A velocity model is then derived from the products of the inversion. The derived velocity is used to convert the seismic image from time to depth. The depth model is compared with the input geological model. Next, the experiment is applied on real data from offshore field.

The first experiment carried out on the theoretical data showed that the depth converted model matches very well with the input depth model. The two models are found very consistent. Furthermore, calibrating the depth model obtained from real data with depths at the well locations indicated that the depth conversion is successful.

The study demonstrates the usefulness of seismic inversion products in time-to-depth conversion and provides a cheap and reliable alternative to some other conversion methods that underestimate the lateral and vertical changes in geology.