Geophysical Research Abstracts
Vol. 18, EGU2016-15672-2, 2016
EGU General Assembly 2016

Seismic depth conversion vs. structural validation

Yukitsugu Totake (1,2), Rob Butler (1), and Clare Bond (1)

(1) University of Aberdeen, Geology and Petroleum Geology, United Kingdom (yukitsugu.totake@abdn.ac.uk), (2) INPEX CORPORATION, Technical Resources Unit, Japan

Interpretation based on seismic reflection data is inherently an uncertain product based on imperfect datasets, with limits in data resolution and spatial extent. This has boosted geologists to use structural validation techniques to verify their seismic interpretations for many years. Structural validation of seismic interpretations should be ideally completed on depth sections, which are converted from time domain using velocities derived from well checkshot survey, seismic velocity analysis, or even estimates. Choices of velocity model critically control the final depth image and hence structural geometry of interpretations that are used as initial datasets for structural validations. However, the depth conversion is never perfectly accurate because of absence of depth constraint. Now, how robust are structural validation techniques to depth conversion uncertainty?

Here we explore how structural validation techniques respond to different versions of depth interpretations converted by different velocities. We use a seismic time-based image of a fold-thrust structure in the deepwater Niger Delta to interpret, and convert to depth using three different velocity models: constant velocity (VM1); a single layer having initial velocity v0 at layer top with vertical velocity gradient k (VM2); and three layers having each v0-k set (VM3) below seabed. Forward modelling, automated trishear modelling algorithm called 'inverse trishear modelling' and Groshong's area-depth-strain (ADS) methods are applied to test the structural geometry of the depth-converted interpretations.

We find forward modelling and inverse trishear modelling reasonably 'fit' all versions of interpretation, regardless of the velocity model used for depth conversion, with multiple sets of model parameters. On the other hand, only velocity model VM3 'passes' the ADS validation method, with the detachment level interpreted concordant with the depth estimated from excess area analysis, based on interpreted horizons.

In conclusion, the structural validation of seismic interpretations using kinematic models is practical approach to obtain self-consistent interpretations, but uncertainty arising from depth conversion choice and kinematic model parameter settings still remains. Use of the ADS method may help narrow such uncertainty, although we must note it is only effective if seismic data quality allows the detachment layer to be recognised. Given that the ADS method can be performed quickly, the ADS method is suitable to test preliminary products of depth conversion. Updating seismic interpretations and velocity models in accordance with the ADS method's feedback is expected to be highly effective for building more reliable structural models.