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Tying Different Near Surface Models Using Geostatistics

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ABSTRACT

The objective in the study area is to determine a long wavelength solution for rapid changes in the elevation of the base of model. The challenge of modeling is due to the geology of the outcrops and the gradually dipping strata. An anhydrite layer suffers a water table related dissolution collapse. Regional 2D seismic lines have insufficient control to model the near surface anomaly. The multiple layer model produces a long wave length solution. A 3D tomogram focuses the data at the anomaly but does not produce a consistent long wavelength solution compared to the 2D regional multiple layer model.

The 2D multiple layer model is built from uphole data, that is a direct measurement of the thickness and interval velocity. Interval velocities are interpolated linearly between uphole locations. The tomography method gives greater detail than the multiple layer model. The base of model is subjective and non-unique. The regional 2D multiple layer model is built only from uphole data which is under sampled between uphole locations. The statics can be updated using tomography statics, but this solution does not provide a depth/velocity model to tie other seismic data.

Due to the miss-ties between the multiple layer models and tomography model, different static models are consolidated into a single model. These consolidated statics are inverted to update the 2D multiple layer model. The updated 2D statics model is then input into a variogram, which is then analyzed to fit the best mathematical model and kriging parameters. The input in the cokriging stage will be the 3D static model and the kriged primary 2D multiple layer statics. The tie of the 2D revised multiple layer and 3D models is achieved with Bayesian Collocated Cokriging. A two stage approach has been developed for the cokriging process. The first stage will update the long wavelength of the tomography model, while the second stage will reintroduce the high frequency component over the anomaly area. The result is a revised 3D statics model which will tie adjacent models.

Tying seismic data without losing the high frequency is a difficult task. Different near-surface modeling methods generate time images, but they are not guaranteed to tie. Geostatistic methods grant the tying of 3D static corrections without losing the high frequency component. This detail leads to increased confidence in the seismic solutions for improvements in the exploration and development programs.