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TOMOSTATICS SOLUTION IN THE REGION WITH COMPLEX SURFACE AND GEOLOGICAL ENVIRONMENTS

The statics problem is a vital sense of our work in seismic data processing. Why is this important? Because their function is a major to minimize artifacts in the definition of geological structures. The ability to accurately near-surface velocity modeling and statics solution is a necessity in seismic processing for future petroleum exploration.

Several examples, including models of generalized linear inversion (GLI) and tomography methods of statics corrections calculation, are discussed. Tomostatics solution was analyzed in this research (example of 3D seismic survey, North Africa), whose territory has difficult surface environments, topography (elevation varies from 190 m to 305 m) and geology as 65% sand-dunes and 35% gravel plain, also with varying velocity in the near-surface.

The geology of the near-surface consists of sand, clay, sandstone (weathered rocks), and limestone (bedding hard rock). Near-surface statics are always a significant concern, primarily since the existing surface conditions during acquisition influence the accuracy of the resulting time structure. In this case, the first arrivals produced from the vibroseis source were of reasonable quality and provided reliable first arrival pick times. First breaks were picked and then used for first-arrival traveltime tomography.

The statics calculation problem, whether short wavelength, long wavelength, or residual has always been one of the more time-consuming and problematic steps in seismic data processing. Although the sand dunes produced a severe statics issue, this was relatively easy to remove through simple refraction statics methods on the first arrivals of the field shot records, which solved the short (< 500 m) and medium (200 m - 3000 m) wavelength statics. The longer period statics (> 3000 m) were harder to quantify and quality control.

Refraction tomography methods and generalized linear inversion GLI (based on a 2-layer velocity model) are not always the control of the long-wave anomaly. This article will demonstrate the techniques of accurate control (Figure 1, c) of the long wavelength refraction statics with up-hole (UH) locations on the 3D survey. A detailed build of the near-surface velocity model is the basis of this.

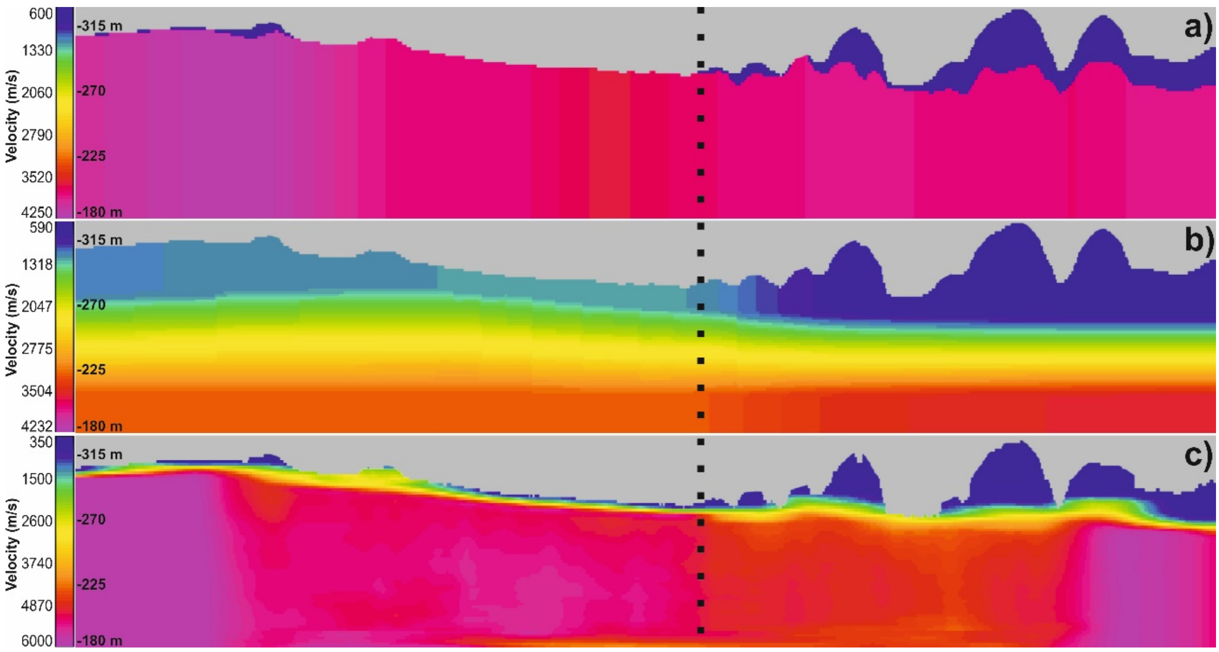

Fig. 1. Presents the results of velocity modeling using GLI a), tomography b) and tomography with accurate up-hole control c). Left - gravel plain, right - sand-dunes

This study was based on practical experiences and applies to well-established modeling techniques from up-hole and refraction statics [1]. The advantage of the tomography method with up-hole control is the construction of grids with fewer artifacts compared with classical tomography or GLI.

Synthetic modeling is fundamental for a plethora of tasks in seismic processing, most notably for comparing to observed seismic data and thus testing hypotheses [2]. It also proposed to check the practical experience of using synthetic modeling of near-surface velocity for statics corrections. In addition, it may be necessary to adapt this methodology to minimize the risks associated with exploration drilling without long-wave artifacts on the southern edge of the Dnieper-Donetsk depression. It is worth noting that this area is a perspective zone for hydrocarbon accumulation in non-anticlinal traps.

It can be concluded that a good technique for statics calculation requires accurate velocity models to be presented. Based on the 3D velocity-depth tomography model with up-hole control we have an excellent result for minimizing the near-surface confusion related to the long-wave. The best statics solution is the most important in the subsurface imaging and truth configuration of target horizons.

References

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