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Defining the Base of Sand from 2D Seismic Data Using Geostatistics:Rub Al-Khali, Saudi Arabia

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ABSTRACT

The low velocity of sand dunes has a significant effect on seismic data. This low velocity, introduces large travel times that cause a time shift in the seismic data. The sand dunes of the Rub Al-Khali rest on a flat smooth surface (Sabkha base). The single way time is determinate for the sand curve, which is a relationship between sand thickness and time. Sand thickness is determined by defining the base of sand assuming it is flat. The main objective of this project is to define the elevation of the base of the sand and the transition from the high dunes to the insignificant ones using a polygon. The base of sand was obtained by surveying the Sabkha surface elevations, inter-dunes and the velocity interface seen in the uphole surveys drilled in the sand dunes. In the south-west of this area the dunes converge and no Sabkha is exposed. The defined base of sand was extrapolated between uphole locations on elevation profiles of 2D lines. These elevations of base of sand on a grid of 2D lines were contoured and the final surface was created. The examination of the sand thickness in Rub Al-Khali was essential to define the boundary of the sand. At the same time we used geostatistics that created grids with less artifacts than the ones produced by contouring. Both contouring and geostatistics results were combined to give an estimate of the base of sand and its edge, where thickness is zero. Geostatistics also preserves the high frequency component along the input regional 2D lines, which cannot be preserved by gridding with sparse cells. The kriging parameter settings of range 2.2 km and sill 130 km were obtained from the analysis of the variogram, using the Gaussian mathematical model.

The geostatistics results show a reliable base of sand for the whole Rub Al-Khali area. The result is a single base of sand and a sand boundary for the whole area that can be used for 2D and 3D surveys. The static correction has long and short spatial wavelengths that improve the time structure and focusing of the seismic events, compared to earlier base of sand models. The result is greater confidence in the initial model and seismic section, which is significant for the exploration of low relief structures.