Integrated Workflow for Reservoir Properties Prediction, Using Ultra-Far Seismic Data, Mansoura Area, Onshore Nile Delta, Egypt

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ABSTRACT

The onshore Nile delta middle and late Miocene are dominated by siliclastic sediments of variant reservoir quality, this allows researchers to introduce different techniques to predict reservoir properties which aids in promoting areas with good reservoir quality. In this paper AVO simultaneous inversion using the ultra-far seismic data is used. The selection of ultra-far seismic data was to demonstrate the reliability of ultra-far data (reaching 45o) and to increase the accuracy of fluid delineation, with the additional benefit of the density cube resulted from this type of inversion. The ultra-far data was an output from the gathers conditioning processes, which was applied to the whole CDP gathers for the area of study. A proper rock physics analysis using well logs in the area of study showed good potential to link the elastic properties to the reservoir properties, and suggests that the AVO simultaneous inversion can easily discriminate between different lithological units, and fluid types. By applying the results in the unexplored areas within the area of study this can help in di-risking delineated prospects. The AVO simultaneous inversion was applied for the different angle stacks (near, mid, far and ultra-far) seismic data using the statistically extracted wavelet from each corresponding partial angle stack. The reservoir properties prediction was done using multi attribute analysis which helped in increasing the predictive power between well locations using the inverted ultra-far seismic data, furthermore, to ensure a good correlation with the well logs. The well logs petrophysical analysis helped significantly in building up a representative rock physics model within the area of study. The developed model was later used to differentiate between wet sand, shale and gas sands. The prediction results showed a robust conformity between the structure, amplitude, and the different reservoir properties such as porosity, and water saturation, additionally, the predicted results indicated excellent match with well data in terms of the range of reservoir properties within the reservoir, as well as outside the reservoir. The inverted density volume generated from AVO simultaneous inversion of the ultra-far seismic data used in the discrimination between low gas saturation, and the commercial gas; furthermore, it can be used to delineate new drillable locations that have a possible good reservoir quality.