Analytical Velocity Modeling for Offshore East Coast of India: An Approach Using VSP Time-Depth Dataset

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ABSTRACT

Worldwide hydrocarbon exploration is moving towards reducing cost of deep-water drilling due to tumbling oil prices. It became a demand of time to do an effective and efficient analysis of existing database. Therefore it is very essential to utilize the existing well data for further drilling and understanding of the basin. More than 50 exploration wells data is available from offshore region of east coast of India, which spans water depths from 40.8m to 3100m. Out of 13 Wells data of Mahanadi basin, 6 wells showed very high pore pressures. 27 wells data of Krishna-Godavari basin are from different geological setups (shallower targets are from Pleistocene/Pliocene, deeper targets are from Cretaceous) while Cauvery basin has gone through huge erosion during Cretaceous times which is very well reflected on interval velocity plot of 11 wells data. Different geology of each basin is well reflected on their interval velocity plots. V0-K method, which is a most well-known way of depth conversion of seismic reflection travel times, was applied on this dataset. This method had given excellent results in Gulf of Mexico or UK West of Shetlands areas. But large errors were produced while using it for time-to-depth conversion in Indian offshore basins. To constrain and test the accuracy, several other models were analysed (derived from V0-K method). Out of which four models have been tested to understand different geological environments using time-depth data. The results indicate that average velocity model in time is very suitable for Mahanadi basin. For Cauvery basin, linear interval velocity model in time gives the optimum solution while for shallow targets in Krishna-Godavari basin the most well-known “linear interval velocity with depth” (V0-K method) gives the optimal solution. For deeper targets in Krishna-Godavari basins same relationship is applicable after incorporating a correction for upliftment. Solutions have been verified on pre-stack seismic data, by considering the proposed model as equivalent guide function during velocity picking. These analytical velocity models are quite suitable for optimal time to depth conversion in this area, which can be updated further with addition of new datasets.