

Time Lapse Inversion of MWD and Wireline Measurements

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Time lapse measurements provide information at different times on varying subsurface geological conditions. In recent years, time lapse measurements have become an integral part of geophysical data acquisition programs, from surface seismic to borehole geophysics. The wealth of information provided by time lapse measurements facilitates better understanding of reservoir properties and poses a great challenge in interpretation. In this study we propose a methodology to integrate time lapse measurements, e.g., measurement while drilling (MWD) and wireline data, by introducing the concept of “multi model”, that takes into account the various invasion conditions encountered at different logging times. MWD and wireline data obtain responses from similar subsurface formations at different times, reflecting different borehole and invasion conditions. Each of these data offers distinct advantages when compared to the other. In general, MWD data are not affected by invasion, allowing better interpretation of formation resistivities. On the other hand, wireline data allow us to characterize the invasion profile, resulting in identification of permeable and impermeable zones, and thereby facilitating the evaluation of movable and residual hydrocarbons.

An inversion process that handles the multi model was implemented and demonstrated using Multiple Propagation Resistivity (MPRSM) and High-Definition Induction Log (HDILSM) measurements. The value of time lapse inversion process is demonstrated by the estimation of reliable and consistent formation parameters for both synthetic and Gulf of Mexico data examples.