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Improved BHA Sag Correction and Uncertainty Evaluation Brings Value to Wellbore Placement.

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Abstract

Recent well positioning uncertainties evaluation per SPE published ISCWSA model for MWD survey tools suggests that 80% of the inclination measurement error budget is a consequence of BHA sag.

BHA sag is the misalignment of the directional sensor with the borehole direction due to deflection of the MWD drill collar under gravity and borehole curvature. The magnitude of the error depends on BHA type and geometry, sensor spacing, hole size and several other factors.

This paper presents a new methodology based on modern 3D BHA/Hole interacting modeling for BHA sag corrections and residual error evaluation at each MWD survey stations.

11 different typical 17½" and 12¼" rotary and steerable motor BHA's with variable gauge stabilizers were computed in multiple configurations (borehole geometry, BHA settings, friction...) following a Monte Carlo process which involved more then a million simulations. Results of this study show that the residual BHA sag uncertainty as proposed by the ISCWSA model can be further reduced by as much as 50%.

A simplified software automated process was developed in order that Operations Support Centers can easily integrate the proposed methodology as part of near real time Survey Management advanced processing routines.

A sound BHA sag correction method along with a thoroughly analyzed residual sag error, readily fit for use within the ISCWSA MWD well positioning uncertainty model (today's industry standard), appears essential in a wide variety of directional drilling applications including extended reach and horizontal drilling.

The proposed process contributes to improve significantly wellbore placement through the pay zone while drilling. Reduced trajectory positional uncertainties contribute to the construction of sound geological models for rational well target design, positioning and development pattern fine tuning during the drilling campaign. In turn reservoir management including mature fields shall benefit from improved Wellbore Placement as a multidisciplinary task by locating more accurately layer tops and contacts.