Well Trajectory Uncertainties on Positioning: Impact on Geosciences

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Most known studies involving trajectory uncertainties have been conceived with collision avoidance in mind. The goal of this study is to introduce and highlight the impact that trajectory uncertainties have on reservoir geosciences. The initial step of this sensibility study was to visualize in 3D the trajectory uncertainties on two extended reach departure (ERD) wells. Uncertainty quantification of the wells, with measured depths (MD) of 7600m and 8100m respectively, was provided by a previous study by Drillscan and TOTAL SA. The magnitudes of uncertainty obtained from this previous analysis, in particular the vertical component of the trajectory uncertainty, were then applied to the geologic model of the "Liliane" field containing the two wells. As the depths of most stratigraphic markers of a geologic model are defined by the well data, the vertical uncertainty of the trajectory could then be directly applied to the top reservoir depth. While the vertical displacement of horizons due to trajectory uncertainty was shown to be significant at reservoir top (+/- 35m in this case), repositioning due to bias correction was also important. Using these values of uncertainty and bias correction, an initial quantitative impact on volumetrics was explored using various methods and strategies. It was found that a flat horizon with equal elevations, such as a fluid contact, could exhibit differing depth measurements between wells due to trajectory uncertainties and could possibly lead to over-compartmentalizing of a reservoir. Going beyond the two wells, a full field analysis of the impact that trajectory uncertainties has on volumetrics was carried out. The global 2σ vertical uncertainty at top reservoir for all the trajectories of the field were then incorporated into an earlier structural and volumetric uncertainty analysis that assumed no uncertainty on wellbore position. A comparison of net rock volumes above the oil water contact was made between the two methods to highlight the impact that trajectory uncertainties has on the overall uncertainty analysis. Trajectory uncertainties impact reserves estimates by altering the depths of structures themselves and on the positioning of horizontal drains with respect to the fluid contact. With prior knowledge of trajectory uncertainties, the optimization of geosteering applications is also possible.