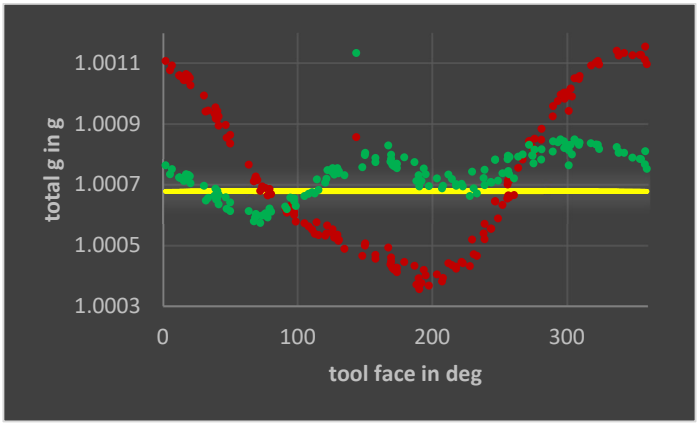
Case Study

Impact of Toolface Error on Well Trajectory

Introduction

In today's directional drilling applications, the position of the wellbore is determined based on calculated stationary surveys. Measurement While Drilling (MWD) tools obtain the required data to calculate the stationary survey that ultimately defines the Inclination and Azimuth of the tool orientation. Azimuth utilizes three axis of accelerometers and three axis of fluxgate magnetometers that are positioned in the MWD tool orthogonal to each other. Any systematic errors around the MWD sensors will influence azimuth accuracy.

Challenges

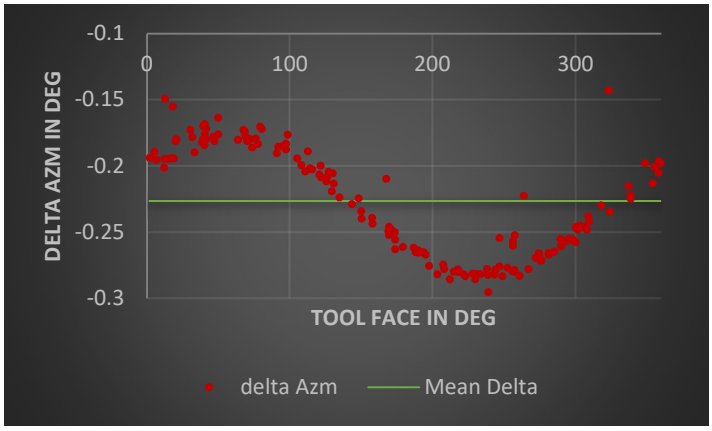


Plotted in RED is the sum of the accelerometer's vector magnitude and defined as Total G. It contains systematic errors such as scale factor, bias and misalignment.
In GREEN is the sum of accelerometers vector magnitude after corrections are applied to ***minimize the influence of the systematic errors.***

When the data is plotted based on tool face, it clearly indicates a toolface dependant error caused by systemic influences. This case shows a large swing in total G that will artificially influence the azimuth as seen at 10 degrees and 190 degrees tool face.

On location, this phenomenon will manifest as an azimuth swing as each survey is taken. Key is knowing this swing is based on survey error 's and not on how the BHA is ACTUALLY reacting. This will mislead the directional driller to compensate by counter steering. Often termed as "chasing azimuth" or "formation appears to be pushing on azimuth" this phantom azimuth swing causes several issues such as:

- **Unnecessary sliding causing slower ROP.**
- **Increasing Tortuosity of wellbore.**
- **Uncorrected wellbore position error can cause increased AC risk and or hard boundary breaches.**



roundLAB Solution

In this case roundLAB quickly identified the systematic error using our 3-Dimensional Multi-Station Analysis (MSA) algorithm. roundLAB contacted the field to let them know that a systematic bias in the x and y accelerometer had been detected and was creating a toolface dependent azimuth swing in the MWD surveys.

The corrected survey data allowed the Directional Driller to make decisions and avoid unnecessary sliding or counter steering actions to keep the well on plan, saving the rig from lost or Non-Productive Time (NPT).