

Statistical Correlation between Logging-While-Drilling Measurements and Wireline Caliper Logs

Authors : Rima T. Alfaraj, Murtadha J. Al Tammar, Khaqan Khan, Khalid M. Alruwaili

Abstract : OBJECTIVE/SCOPE (25-75): Caliper logging data provides critical information about wellbore shape and deformations, such as stress-induced borehole breakouts or washouts. Multiarm mechanical caliper logs are often run using wireline, which can be time-consuming, costly, and/or challenging to run in certain formations. To minimize rig time and improve operational safety, it is valuable to develop analytical solutions that can estimate caliper logs using available Logging-While-Drilling (LWD) data without the need to run wireline caliper logs. As a first step, the objective of this paper is to perform statistical analysis using an extensive dataset to identify important physical parameters that should be considered in developing such analytical solutions. METHODS, PROCEDURES, PROCESS (75-100): Caliper logs and LWD data of eleven wells, with a total of more than 80,000 data points, were obtained and imported into a data analytics software for analysis. Several parameters were selected to test the relationship of the parameters with the measured maximum and minimum caliper logs. These parameters include gamma ray, porosity, shear, and compressional sonic velocities, bulk densities, and azimuthal density. The data of the eleven wells were first visualized and cleaned. Using the analytics software, several analyses were then performed, including the computation of Pearson's correlation coefficients to show the statistical relationship between the selected parameters and the caliper logs. RESULTS, OBSERVATIONS, CONCLUSIONS (100-200): The results of this statistical analysis showed that some parameters show good correlation to the caliper log data. For instance, the bulk density and azimuthal directional densities showed Pearson's correlation coefficients in the range of 0.39 and 0.57, which were relatively high when compared to the correlation coefficients of caliper data with other parameters. Other parameters such as porosity exhibited extremely low correlation coefficients to the caliper data. Various crossplots and visualizations of the data were also demonstrated to gain further insights from the field data. NOVEL/ADDITIVE INFORMATION (25-75): This study offers a unique and novel look into the relative importance and correlation between different LWD measurements and wireline caliper logs via an extensive dataset. The results pave the way for a more informed development of new analytical solutions for estimating the size and shape of the wellbore in real-time while drilling using LWD data.

Keywords : LWD measurements, caliper log, correlations, analysis

Conference Title : ICOGPE 2022 : International Conference on Oil, Gas and Petrochemical Engineering

Conference Location : Dubai, United Arab Emirates

Conference Dates : October 13-14, 2022