Streamlining Core to Log Depth Adjustment Workflow for Accurate Matching

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Abstract

Objective
Core data are often used to calibrate and verify well to log based petrophysical and geomechanical models. However, core and log depths can be mismatched due to their operational conditions. Depth matching, therefore, is needed and crucial for enhancing the speed of well log quality control. Usually core to log depth shifting is done manually by petrophysicists, which can be a time-consuming process that is prone to human error and level of expertise. Here, we developed an automatic, time-effective, workflow that improves core to log depth matching speed and accuracy. The workflow aims to automate core to log depth shifting through imitating expert skills and detecting matching events between the core and log within a few minutes. The results can be used to calibrate different types of laboratory data (e.g., geomechanical) and correctly match them with core log. This approach can improve reservoir characterization and modeling.

Procedure
The workflow aims to improve the matching accuracy in a timely and cost-effective manner. It uses two depth inputs: core depth (target log) and log depth (reference log). Two types of shifting are used in this workflow: bulk shifting, and stretching and squeezing of different events.

First, the automatic workflow applies an optimal bulk shift for the best correlation. After that, if there is any remaining mismatch between the input logs, similar events (peaks, troughs, and bed boundaries) are automatically detected and matched using stretching and squeezing method. Based on events with the same depth matching, a depth shift table is generated. In the following validation stage, the users can check the quality of the automatic depth shift outputs and modify the results if needed. After the depth shift outputs are validated, the final depth shift table is applied to the different types data, which can include wireline logs, geomechanical, and even geochemical laboratory data. The workflow correctly shifts and calibrates core lab measurements with log data.

Results
The self-generated and automatic workflow is executed to enhance the accuracy and efficiency of core to log depth shifting, which can be useful to improve the calibration of various core data with wireline logs. This workflow has been tested on different fields with multiple well data and achieved excellent accuracy in much shorter time than the manual shifting. Results show successful generation of automatic core to log depth shift within a few minutes and up to 90% correlation between core and log data. This approach is expected to generate consistent correlation time-efficiently and improve the overall efficiency of well log quality control task/process.

Conclusion

A workflow is developed and implemented to increase the accuracy and efficiency of core to log depth shifting. It generates an automatic depth shift between core and log data accurately. The workflow contributes to reducing cost, time, and effort required from petrophysicists. Results are reliable and can be used to improve the efficiency of well log quality control, calibrate and correctly shift core laboratory measurements with well log data. After a single-well core to log depth shifting, the model can be used to auto shift other types of data. Such a workflow is necessary for accurate depth shifting, which have direct implications in enhancing reservoir characterization and modeling.