Generation of the water saturation curve of a carbonatic reservoir using artificial neural network with Monte Carlo simulation and well logs in real time

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Abstract

In this article, a water saturation curve from an oil reservoir was generated, using artificial neural network that trained reservoir well logs and water saturation values calculated using the Monte Carlo simulation for acarbonate reservoir in the Campos Basin, Rio de Janeiro Brazil. For this purpose, the IP petrophysics software was used. Water saturation (Sw) is the petrophysical parameter that determines the amount of water in a reservoir and consequently determines whether there are hydrocarbons in the reservoir with sufficient commercial value to be produced, or if the well is plugged and is not continued to the next phase. First, water saturation values were found, for which the reservoir under study was divided into three areas (southwest, central and northeast) according to its similar geological and petrophysical characterization. A scenario was created with eleven wells, three for the northeast area, three for the central area and finally five for the southwest area, with 100, 500 and 1000 simulations, to obtain clouds of optimum, pessimistic and average water saturation values (Sw) of the reservoir, using a probabilistic approach with Monte Carlo simulation, in Excel applied to the Archie equation. One hundred water saturation values of the calculated results were chosen and were transformed into LAS extensions to be used, together with the resistivity, neutron, gamma, density and sonic logs, as input of an artificial neural network in the IP software, which trained the input layer data and generated the water saturation curve of the reservoir and the computer with this software simulated receiving the data from the logging tools in real time, using the logging data source saved with the LAS extension.