



Fuzzy Logic prediction of petrophysical parameters (porosity and velocity) at La Faja del Orinoco, Venezuela

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We present a methodology to predict petrophysical parameters in wells and in 3D volumes, integrating well data with conventional post-stack seismic attributes (instant amplitude and real amplitude of the seismic trace) using Fuzzy Logic. The studied area corresponds to the Area Mayor de Oficina, at La Faja Petrolífera del Orinoco (Venezuela). We have used 12 wells, a migrated seismic cube and a seismic impedance inversion cube (SIIC) of $\sim 30 \text{ Km}^2$. The porosity values were calculated using Fuzzy C-Means (FCM) (Bezdek, 1981) and Fuzzy Maximum Likelihood Estimation (FMLE) (Gath and Geva, 1989), using Gamma Ray, Density and Sonic logs. The FMLE model does not converge to the number of optimal fuzzy rules defined by the Fuzzy Validation Measurement of Fukuyama and Sugeno (1989). The resulting FCM model was modified, via the incorporation of neural networks and minimum squares, to calculate the parameters of the fuzzy models. The error difference after cross-validation was minimum and the improvement in time was significant. To calculate porosity and velocity we have also integrated conventional post-stack attributes and applied the FCM model. Low impedance bodies were observed in an east-west direction in the upper zone of the interval of interest, also observed in the SIIC.