Stochastic AVO modeling and Bayesian AVO Inversion to Predict Hydrocarbon vs. Brine Occurrence in Sand Reservoirs

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This paper presents the summary of some 10 years long experience with a quite new approach at exploiting seismic AVO information. The request for increased effectiveness and reliability and in general of a more advanced implementation of the AVO method, capable of quantitatively predicting the distribution and characteristics of fluids, or even the petrophysical characteristics of the reservoir was set years ago as a top level development goal. This need has been targeted by implementing a bayesian inversion of seismic AVO data, which is based upon a stochastic AVO modelling phase, that allow "interpretation-steered" extrapolation of known AVO information from the available wells in the area. The method is aimed at determining the probability that an assigned AVO response, measured from real pre-stack seismic data, can be ascribed to the presence of either brine, gas, oil in a sand reservoir, given the specific geological parameterization. The developed SW tool compares the real AVO response at the several targets in the study area with a generalized I/G model, which takes into account the expected (or guessed) variability of all the petrophysical parameters which are expected to impact onto the AVO phenomenon. This probabilistic model is developed through the statistical analysis of all available wireline logs and borehole processed data in a large area of interest. From a practical viewpoint, the AVO Fluid Inversion allows effective and powerful extrapolation of the AVO information to any new exploration target belonging to an homogeneous geological-petrophysical scenario. The computation results, typically provided in the form of fluid probability maps, represent a new way to leverage pre-stack seismic information to benefit the prospect generation and ranking process.