

Bayesian Approach for Constraining Facies Simulations with Seismic Information

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Abstrak

ABSTRACT

Subsurface models of lithology are often poorly constrained due to the lack of dense well control. Although limited in vertical resolution, high-quality three-dimensional (3-D) seismic data usually provide valuable information regarding the lateral variations of lithology. In this thesis, I will show how Bayesian approach can be used to generate seismically constrained models of lithology. Unlike cokriging-based simulation methods, this method does not rely on a generalized linear regression model, which is inadequate when combining discrete variables, such as lithology indicator; and continuous variables, such as seismic attributes. This method uses a Bayesian updating rule to construct a posterior probability distribution function of lithoclasses by using a priori information from well data and the seismic likelihood to constrain the 3-D geological scenarios produced by geostatistical technique, which is then sampled sequentially at all points in space to generate a set of realizations. The realizations define alternative, equiprobable lithologic models. The methodology was applied to delineate productive reservoir zone in Boonsville, Texas. To achieve better result in the Bayesian Sequential Indicator Simulation, I used acoustic impedance obtained from a seismic inversion process as the attribute to constrain the simulation. It is expected that by using this attribute, the separation of the litho-class conditional distribution will be well defined and at the same time minimizing the overlaps between the two distributions. The lithology classification obtained from BSIS is then integrated with the result of the seismic inversion to clearly delineate the productive zone in the field.