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Modeling of stratigraphic columns using Markov Chains and Gibbs sampling algorithms, Campo Oritupano, Venezuela.

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The interbeded sandstones, siltstones and shale layers within the stratigraphic units of the Oficina Formation were stochastically characterized. The units within the Oritupano field are modeled using the information from 12 wells and a post-stack 3-D seismic cube. The Markov Chain algorithm was successful at maintaining the proportion of lithotypes of the columns in the study area. Different transition probability matrixes are evaluated by changing the length of the sequences represented in the transition matrix and how this choice of length affects ciclicity and the genetic relations between lithotypes. The Gibbs algorithm, using small sequences as building blocks for modeling, kept the main stratigraphic succession according to the geology. Although the modeled stratigraphy depends strongly on initial conditions, the use of longer sequences in the substitution helps not to overweight the transition counts from one lithotype to the same in the main diagonal of the probability matrix of the Markov Chain in the Gibbs algorithm. A methodology based on the phase spectrum of the seismic trace for tying the modeled sequences with the seismic data is evaluated and discussed. The results point to the phase spectrum as an alternate way to cross-correlate synthetic seismograms with the seismic trace in favor of the well known amplitude correlation. Finally, a map of net sand over the study area is generated from the modeled columns and compared with previous stratigraphic and facies analysis at the levels of interest.