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The lack of stochastic methods applied to the modeling of complex oil and natural gas reservoirs has led to a technological gap between the practices in use in the country and abroad. Decisions during the exploration and engineering phases of reservoirs, in general, require an adequate understanding of the geological model to reduce the uncertainties of the locations and drilling of exploratory wells. Although the tools currently available have been used with relative success, there is a need for advances in current solutions in the modeling of complex reservoirs, which take into account geological data and multiple correlated seismic attributes. Geostatistics assumes a decisive role in the integration of this information in a context of geological uncertainty of the models. Another area that has shown advances is Deep Learning, which, especially generative adversarial networks (GANs), have been applied to several problems inherent to exploratory interpretation involving multiple attributes. As examples, the automatic identification and classification of geological structures and the prediction of petrophysical properties can be highlighted, with a focus on reducing time and uncertainties in the decision-making process. The main objective of this work is to investigate the use of Machine Learning techniques combined with Multiple Point Geostatistical Simulation to improve reservoir modeling. The methodology consists in comparing two workflows: (a) the traditional workflow applying the SNESIM algorithm to the Training Image (TI) (b) proposed workflow with a GAN capable of creating images with similar features from the TI, and then, applying the SNESIM algorithm. Results so far show the potential in the proposed workflow given the increased diversity of Training Images and reduced uncertainty after SNESIM algorithm realizations.