Building feasible geological model for seismic inversion studies: the impacts regarding the *a priori* model during the whole process

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Abstract

Seismic inversion is an important approach for petroelastical characterization covering most of the hydrocarbon reservoirs needs. The usage of acoustic and elastic properties aids in the definition of other characteristics such as porosity, permeability and facies classification of the reservoir rocks. One of the fundamental steps when dealing with the generation of the acoustic and elastic volumetric properties model is the methodology of how to build *a priori* model. This built model is the entry point where the well-log properties are extrapolated moving the study from 1D to 3D model. This *a priori* model will be perturbed or combined with the seismic volumes obtaining the final result of the desired inversion. It has a significant weight in the geological facies distribution once the passband data is deficient for its separation. When building the *a priori* model we need to take into account two main aspects: 1) how the stratigraphic grid is built having in consideration the interpretation of seismic horizons and faults, which reflects the geological complexity of our target, and 2) how we perform the property extrapolation in this 3D stratigraphic grid. Even with the robustness already presented in previous works concerning models named as *a priori*, the results need further steps before the project consideration and incorporation. The common methods for building these models still present many difficulties when incorporating faults, and it leads to insufficient details of the resulting structural models, sometimes not respecting the stratigraphy and its adequate displacement. We experience this iniquity especially in the regions affected by the faults, and this is a key aspect for the presalt reservoirs of the Brazilian coast. In addition, the well-log extrapolation within this simplification also will not respect the geological reality because it will fill a not representative structural model, that is this model that contains all the described weakness during its building procedure. In this work, we present a step further regarding way in building *a priori* models using geological modeling tools. That proposed methodology allows us to use besides the mapped horizons, the entire available fault mapped elements. Over this delivered *a priori* model we perform the petrophysical properties grid filling, and the final model gives more confidence for the project decision. The usage of all the geological features modeling allows us to have a better definition of stratigraphy, structures and fault displaces, and all these aspects together deliver optimization of properties extrapolation, enabling us to run several geostatistical approaches for uncertainties analysis, as well as the incorporation of migration seismic velocity during the process.