Pre-Salt seismic imaging and depth positioning uncertainties in the Campos and Santos Basins: challenges and warnings related to the structured overburden composed by carbonatic *rafts* and salt

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Abstract

Several considerations regarding ways of building velocity models for seismic imaging and depth positioning have been presented especially when dealing with geological complexities. The *pre-salt* reservoir in the offshore Brazilian margin emphasizes the need to incorporate those complexities in velocity models. There are several records of improvements observed in migration results after the incorporation of heterogeneities in the salt layer (Santos Basin). However, studies focusing on the impact of the *post-salt* carbonatic rocks, especially the *rafts*, on migration results are rare. The occurrences of those *rafts* in the Santos Basin overlying *pre-salt* reservoir areas, they are prevalent in Campos Basin oil fields ring-fences. The inter-relation between the salt section and *rafts* imposes some challenges to a proper interval velocity modeling of these features. First, it is mandatory to analyze the different lithologies that internally compose the *rafts* and how to represent the sedimentary variations coupled with the depositional history and the paleo basin geographical portions. Carbonatic platform built in a transitional phase context of passive margin may have different sedimentary composition due to paleo bathymetry and the proximity of siliciclastic source areas. This inter-relation among several siliciclastic and carbonatic layers of the sedimentary record is a key aspect to characterize the differences in the materials velocity behaviors. Second, we need to consider the burial effect because it will overprint different responses among the analyzed materials. Last, but still important, we need to observe the tectonic aspects regarding both the sin-tectonism and the post-tectonism of the basin. It is necessary to consider all these three aspects previously described when building velocity models for those *rafts*. In the Santos Basin, the salt section thickness varies from few meters to more than 3 km. The *rafts* in the Santos Basin, at least among the collected wells, are in the distal portion of the basin, with thickness generally thinner than 50 meters. On the other hand, when looking at Campos Basin (middle/proximal basin portion – External High Domain), the salt section is less thick (few meters to less than 1000 meters). However, the *rafts* sometimes are thicker than 1 km and bigger than few km in diameter. Those alternations in thickness, burial effects and tectonism impose several concerns regarding velocity. The burial effect is more significant in the proximal portion and the lithology variation in the distal portion of the basin. Jointly, it is important to consider the depositional environment and the tectonic evolution to investigate these effects. In this paper, we intend to discuss the importance of the relations among these three conjugated effects and the consequences for the velocity model estimation. Furthermore, we suggest ways of modeling interval velocity, even in areas without well information, resulting in accurate velocity models for many purposes, including seismic migration and depth positioning uncertainty analysis.