Semi-automatic interpretation of intra-Alagoas unconformity: a case study in the pre-salt layer of Atapu field

Lívia Lovatte Fonseca*[1,2], Gabriela Figueiredo Marinho[1,3], Wagner Moreira Lupinacci[1,4], [1]UFF, [2]Ies Brazil, [3]Aspen Tecnology, [4]INCT-GP

Abstract

The pre-salt reservoirs are inserted in a context of great complexity, with high depths, thick overlayed salt and inherent heterogeneity of carbonate rocks. Such factors contribute to the low resolution of the seismic data, making the seismic interpretation process very challenging. These difficulties require technologies that support conventional methods of reservoir characterization. Therefore, the recognition of intra-Alagoas unconformity (IAU) is considered a challenge in stratigraphic studies of the Santos Basin since its reflector does not have great lateral continuity and is often eroded by the Salt Base. The importance of the IAU is related to the geological framework that it configures, being a transgressive surface, in the transition from the rift phase to the post-rift phase, marking the beginning of a phase of greater tectonic quiescence and subdividing the Barra Velha Formation (Fm) into lower and upper. The objective of this work was to evaluate the applicability of recognizing the IAU through semi-automatic methods. The proposed methodology identifies the main stratigraphic surfaces internal to the Barra Velha Fm. in the Atapu field, an important oil producing field in Santos Basin, Brazil. The methodology consisted of two stages: interpretation of the main unconformities and faults of the pre-salt play and generation of a structural model and the semi-automatic recognition of the internal reflectors of the Barra Velha Fm. through the workflow proposed by the SKUA-GOCAD software. This second phase began with the insertion of seeds, points uniformly distributed throughout the seismic data that, based on parameters that define the horizontal and vertical distances between them, will propagate the information from that point to the volume through the seismic propagator method. The result of this step was the recognition of three intra-formational horizons, the patches, including the one corresponding to the IAU. This identification was based on patterns such as high positive amplitude values, poor lateral continuity, and erosive truncation termination in the upper reflectors. The result of this automatic recognition was not successful in half of the studied area, due to the presence of faults, the low resolution of the seismic data or erosion. Thus, it was necessary to manually insert the seeds and generate new patches in these regions where propagation failed. At the end of this stage, the horizon still showed areas without data, but which, through seismic sections, we verified that these were regions where IAU was eroded. The location of these regions compared to the basement map revealed a direct link between the structural highs present in the field and the processes that eroded the IAU, suggesting that the uplift of the pre-salt section was sufficient to expose the sediments and to have erosion processes and, possibly reworking. Therefore, the use of the semi-automatic interpretation tool proved to be efficient in places where the reflector presents good continuity. However, in areas of low resolution of seismic data, was necessary to manually force the propagation. Thus, the methodology can provide insights into depositional events, but strict quality control is recommended.