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Process for automating the Domain Conversion of High Resolution 2D Seismic Lines (SBP – Sub Bottom Profile) using direct data from Ocean Boreholes to improve geolocation of biozones

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Introduction

For a better interpretation of the area in terms of petroleum systems, biozones are a very important source of information to identify the intervals of interest of a reservoir, since they indicate the intervals in time based on the characteristics related to a certain taxonomy of fossil content. To be able to better geolocate these biozones, 2D seismic lines in time were converted to depth domain for which it was necessary to generate a velocity model using tied wells with the high-resolution seismic and markers. One of the objectives was to better understand about the correlation of direct and indirect data, for example using Acoustic Impedance to find the trend for prediction of facies and dates, and with this, integrate laboratory information, contained in the wells, with the high-resolution seismic lines. To achieve this integration, it was essential to tie the wells with the seismic, using the biozones as the main markers and a wavelet suitable to create a corresponding synthetic seismogram. Another crucial goal was the developing an efficient flow to convert the 2D lines in time to depth in an agile manner. With these objectives, it was expected not only to improve the accuracy of seismic correlations, but also to optimize conversion processes, facilitating the analysis and interpretation of seismic data. The seismic used corresponds to 39 2D seismic lines in High Resolution time (SBP – Sub Bottom Profile) located in the Mero Field, in Santos Basin. This Case of Study was made by PETROBRAS in collaboration with SLB.

Method and/or Theory

To create the velocity model used in the conversion of the high-resolution seismic 2D lines, the information from the wells was used, and it was created a depth relationship (Time/Depth ratio: TDR) in the well ties, in such a way that the characteristics of the attributes of these wells fit with the seismic of the 2D lines with frequency content up to more than 20,000 Hz. This was made using a high-frequency wavelet in this case up to 1100 Hz, and once wells were adjusted, the model was generated using this new TDR´s wells. During the creation of the velocity model, several quality controls were carried out that helped to ensure the reliability of it. One of these analyses is the extraction of the velocity as log in the wells, where it is possible to observe in a faster way a comparison between the velocity curve Vp of the log and the velocity of the generated model, and find a very precise concordance between both velocities. After creating the Velocity Model, the 2D lines were converted from time to depth using an automation workflow in Petrel, in such a way that 39 high-resolution 2D lines were converted in 9 hours.

Results and Conclusions

In general, the results obtained showed a good result quite consistently with the depth data (seismic volume and interpretations). In cases where it counts with markers, was more precise, there may be a difference between the water bottom of the converted lines and water bottom surface up to 5 or 6 meters, but this may be acceptable. The correlations are very precise, due to the integration of the well information in the well ties with the seismic, as well as the biozone markers. The final model was consistent, producing a very satisfactory time-depth conversion relationship and at the same time robust enough to be used in the entire field Campo Mero, considering the modeled zone. It is concluded that this process can be used in other fields and with any 2D line quantity of any frequency content using the largest amount of information from wells to integrate and obtain images as accurately as possible.