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How high-resolution seismic processing can help in Geohazard detection

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Introduction (Font: Arial Bold, 10).

One of the main objectives of seismic imaging is to support well location and delimitation of reservoirs within E&P. In the recent past, the demand for new types of data, such as high-resolution data, has become routine, since this type of data aims to meet the need to improve the understanding of geological and geotechnical risks that can create dangerous conditions for the integrity of wells to be drilled (exploratory or production) and even seabed installations. Conventional 3D seismic data is usually processed with a focus on deeper geological objectives and therefore generally does not have the level of detail necessary to provide the best idea of the difficulties that will be encountered along the path of the wells or on the surface of the seabed. Because of this, new, more complex and computationally intensive workflows have been created, aiming to bring a better understanding of the shallower layers. This work will show examples where high-resolution images proved to be essential for more robust analysis of geohazards in the positions where some wells were drilled.

Method

Geohazards are places and conditions with the potential for the development of events that cause loss of life, damage to health, the environment or facilities. Bringing this definition to the context of well drilling, the study of Geohazards aims to avoid damage to equipment installed on the seabed, avoid total or partial loss of wells, avoid environmental fines related to leaks and reduce drilling costs (Non-productive time) and avoid accidents in well operation activities.

High-resolution seismic images are important tools to better interpret Geohazards in the path of wells and to support Geomechanical studies of oil fields.

Firstly, it is necessary to clarify that the data from reflection seismic used for high-resolution processing are the same as those used in "conventional" imaging.

Naturally, one wonders why all seismic processing is not done with high resolution?

The simplest answer is cost-benefit. From a computational point of view, high-resolution processing is expensive. To give you an idea, seismic migration, the stage responsible for image formation, would increase its computational cost by about a hundred times if a so-called conventional processing used the parameterization of a high-resolution processing.

In addition, the benefit of high-resolution processing is seen basically in the shallowest portion of the seismic section. This is due to the earth's own filter that absorbs high frequencies during propagation.

For high-resolution processing, an "adjustment" is made to the processing flow in such a way as to increase, mainly, the high-frequency content.

It was also necessary to limit the number of migrated offsets and the trace length to reduce the migration cost.

Results

The results highlight the improvement in the quality of imaging of possible geohazards in the post-salt section of the Campos and Santos basin. Among the improvements obtained, the gain in resolution in the imaging of internal reflectors, complex fault systems and small channels stands out. The high-resolution images obtained for these fields have enabled better interpretation of geohazards and, therefore, have contributed to the reduction of drilling costs and well losses.