Buzios life-of-field seismic: 4D modeling and acquisition planning.

Monica Costa, Carlos Eduardo Abreu, Eliane Born, Maria Taryn Relvas, Victor Mund, Leonardo Teixeira, Rafaela Reis, Luiz Eduardo Queiroz, José Borba Junior, Felipe Vidal, Ciro Climaco, Filipe Borges, Marcos Grochau, Paulo Johann, Ana Maria Moliterno, Joao Paulo Carneiro, Julia Guerreiro, Fátima Brazil, Petrobras.

Abstract

Discovered in 2010, Buzios Field is located 180 km from the coast of Rio de Janeiro, on the South Atlantic margin. Currently, it is the world's largest ultra-deepwater oilfield under development, with production starting in 2018. Its reservoirs consist of aptian carbonate rocks, including Barra Velha and Itapema formations.

Seismic monitoring of the pre-salt carbonate reservoirs, despite several technical challenges such as water depth, overburden structures, and the low compressibility of the rocks and their heterogeneities, has been proven feasible through the success of the Pilot 4D OBN Seismic Project in Tupi. However, the size of Buzios field and the dimensions of the production project bring further difficulties to the seismic acquisition design and planning to properly detect the expected 4D anomalies.

For feasibility studies, we used three petroelastic models (BVE-superior, BVE-inferior, and ITP) validated by laboratory data. These models were crucial in understanding the production effects on the elastic properties of the reservoir rocks and indicated the complexities of interpreting the combined effects of pressure variation and saturation. Special studies were employed in the design of receiver and shot areas to optimize data acquisition surveys while ensuring excellent repeatability.

Since Buzios is a supergiant field, it requires an efficient seismic monitoring strategy. Smaller and more frequent surveys, focusing on producing projects and adjacent areas, may show changes around injection wells and can be combined with standard 4D acquisitions that cover the entire field to monitor fluid front advances. The installation of a permanent system that utilizes the latest seismic recording technology and provides greater flexibility for the future monitoring strategy of the field is also under investigation.

The effort put into proper planning of the Buzios seismic monitoring project impacts the greater sustainability of Petrobras' seismic portfolio by reducing environmental risks and decreasing the time and costs involved in the seismic cycle.

It is expected that the seismic monitoring of Buzios will reduce uncertainties and improve the predictability of fluid arrival in a scenario with three production/injection zones of high structural complexity. It will support proactive field production management by understanding the preferential fluid pathways in the porous medium in conjunction with well tracer information. Additionally, 4D seismic monitoring allows the identification of unswept zones, creating opportunities for additional wells to maintain production and increase the recovery factor.