Reservoir Modeling and Uncertainty Estimation: A Comparison between Stochastic and Deterministic Inversion

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ABSTRACT

The complexity of the reservoirs and the challenges of the present-day hydrocarbon exploration have led to the need of improved methods for discovering and producing hydrocarbons. Therefore, seismic inversion has become standard practice in the industry not only for obtaining a geometric description of the main subsurface structures but also for estimating properties such as lithologies and fluids based on acoustic impedance.

Stochastic inversion delivers multiple alternative acoustic impedance cubes of higher resolution compared to deterministic inversion while honoring both seismic and petrophysical data. Consequently, it offers an alternative approach to capture the uncertainty in the property distribution because it allows addressing the impact of the limitation in the seismic resolution on the modelled reservoir property.

The study area is represented by the Oseberg South Field which is a producing oil field in the northern North Sea. This study focuses on the reservoir level represented by the Middle Jurassic Brent Group, specifically the Tarbert Formation. This formation consists of shoreline sediments deposited by the retrograding Brent delta. The seal is represented by shales with very low porosity at the base and tight carbonates at the top. This limestone is also present within the reservoir interval and it is only partly visible on the seismic profile. It is important to separate between reservoir and non-reservoir intervals in order to get more accurate volumetrics and a better understanding of the reservoir connectivity.

In this study stochastic inversion has delivered added value in capturing the property distribution uncertainty which is show-cased by the facies and porosity modelling. Deterministic inversion does not allow getting hold of the property uncertainty via the seismic data. We think that the impact of the seismic data on the reservoir model is potentially making the uncertain-

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ty estimation more reliable compared to numerical techniques such as Gauss simulation.