# Modeling of Channel Stacking Patterns Controlled by Near Wellbore Modeling

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## Abstract

Reservoir models of deep-water channels rely upon low-resolution but spatially extensive seismic data, high vertical resolution but spatially sparse well log data and geomodeling methods. The results cannot predict architecture below seismic resolution or between well logs. Usually, the data and interpretations that provide constraints for modeling workflows do not capture sub-seismic scale architecture. Therefore, standard modeling methods do not generate models that include details that can impact hydrocarbon flow and recovery, and constraining models to well and seismic data is problematic.

Employing >5000 m of measured sections in the Upper Tres Pasos Fm. is feasible to predict deep-water channel architecture, specifically channel stacking patterns with 1D information analogous to well data. This research performed near-wellbore modeling to generate multiple scenarios of channel stacking patterns constrained by machine learning. These results anchor points to correlate deep-water channels between wellbores using surface-based modeling.

Machine learning workflows generate channel position probabilities (i.e., axis, off-axis, margin) within a measured section given the interpreted top/bases of channel elements. These probabilities constitute the input for Monte Carlo simulations capturing channel element stacking patterns at the measured section locations. More constraints can be added to make stacking patterns more realisitic (e.g., minimum distance a channel migrates from the previous channel, constraining to transition probabilities). The most likely 2D stacking pattern scenarios defined channel centerline points, and volumes of the individual channel elements can be generated connected them. The volumes will depict the complex transition from thick-bedded sandstones in the axis to thin-bedded sandstones and mudstones in the margins.

Surface-based modeling offers a way to depict reservoirs of hydrocarbons, water or low-enthalpy geothermal systems in which small-scale heterogeneity needs to be captured explicitly by bounding surfaces because it impacts fluid flow, improving our forecasts of resources exploitation. Furthermore, predicting heterogeneity controlled by depositional architecture is critical for transport and storage capacity in $CO_2$ reservoirs. The dataset provided and the advent of these flexible and accurate methods to depict the subsurface offer the opportunity to overcome the historical limitations of grid-based models and allow us to assess multi-scale architecture that controls fluid flow. This research aims to show the results of modeling of deep-water channels, which includes a 1D identification of facies, 2D arrangement of stacking patterns and 3D connectivity/compartmentalization in the inter-wellbore region.

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