# Reservoir Mapping and Geosteering Using a Combination of Extra-Deep Azimuthal Resistivity and Seismic Profiles

**Richard Tilsley-Baker[1], Jose Eustaquio Barbosa[1]**

[1]Statoil

## ABSTRACT

Extra-deep reading propagation resistivity tools have been deployed in various reservoir settings around the world in recent years in an effort to further improve efficiencies in reservoir development. For many years, field development relied on standard and azimuthal propagation resistivity tools with depths of investigation up to approximately 5m for geosteering and well placement. While effective at geosteering against adjacent boundaries to maintain position in oil-bearing formation, deeper resistivity measurements enable a closer correlation with seismic models and provide more complete reservoir mapping.

The first extra-deep propagation resistivity tools were developed by employing lower frequency waves, increasing antenna spacing and eventually adding lower frequency azimuthal signals. The new designs greatly increased the depth of detection and also added directional components. However, because of the greater volume of formation being investigated, the deeper readings bring extra complexity and uncertainty to the interpretation process so that innovative inversion software is required to support the tools and produce results that can be used in real-time.

The larger scale results of the extra-deep measurements have created an opportunity to compare seismic profiles with real-time data from the well bore. The comparison can be used to validate or correct the seismic model and to improve confidence in the use of seismic data during drilling.

This presentation shows the results of wells drilled using extra-deep resistivity tools on the Peregrino field operated by Statoil Brazil. The reservoir comprises complex and channelized high-energy gravity flows with largely unmapped sands of limited lateral extent and thicknesses ranging from 2m to 25m. Originally developed to improve net sand drilled in the Peregrino heavy oil reservoir by enabling a more strategic approach to geosteering, the tool deployment brought additional benefits in reservoir understanding which impacts seismic model interpretation, future well planning, completion strategies and pilot holes.