Reservoir Resistivity Mapping Using Nonlinear 3-D Inversion of Marine Controlled-Source Electromagnetic (CSEM) Data

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Marine controlled-source electromagnetic (MCSEM) surveys are a promising method for Upstream hydrocarbon applications. Significant technical challenges exist in the realistic modeling and accurate inversion of such data. These challenges are due primarily to the computational costs for geologic problems of realistic scale, the relatively sparse coverage and useful bandwidth of the data, the usually subtle responses (i.e. weak scattered fields) of deep targets, and the strongly ill-posed nature of the electromagnetic inverse problem. However, recent inversion results from several locations in deepwater West Africa illustrate the progress that has been made in confronting these technical challenges. Results from nonlinear three-dimensional (3-D) inversions show that the derived resistivity images can, under appropriate conditions, play a useful role in mapping reservoired hydrocarbons. Joint interpretation of the 3-D resistivity images and reflection seismic data shows clear promise for more effective geophysical imaging of the subsurface and subsequent application to Upstream problems.