Marlim R3D: A Realistic Model for mCSEM Simulations: Phase I – Model Building

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ABSTRACT

The marine Controlled-Source Electromagnetic (mCSEM) method provides complementary information to seismic imaging in the exploration of sedimentary basins. The mCSEM can be used to help in subsalt structural imaging, but mainly for reservoir scanning and appraisal (ref) as EM methods are especially sensible to the fluid content within the rocks. The mCSEM interpretation workflow is heavily based on inversion and forward--modeling for hypothesis testing (ref1,ref2). Until the recent past, the effectiveness of a given interpretation workflow was achieved after the drilling results (Ref), as there was any geological complex model available to serve as a benchmark. The Society of Exploration Geophysics (SEG) recognized that gap and launched the SEAM (SEG Advanced Modeling)-Phase I project aiming to advance the geophysical science through the construction of a multi-physics subsurface model and generation of an associated dataset (Ref). SEAM Phase-I, a representation of the deepwater Gulf of Mexico salt domain, was designed to take as much realism and geological complexity as possible. Following the success of that first model, SEG launched SEAM Phase-II focused on the solution of land seismic challenges like near-surface complexities and fractured reservoirs. In the present work, we introduce and describe the workflow to build up Marlim--R3D, a realistic and complex geoelectric model of a turbidite post-salt reservoir of the Brazilian continental margin. Marlim--R3D aims to be a reference model for mcSEM modeling and inversion studies of such kind of reservoirs. Our model is based on previous seismic interpretation (ref) and constrained by the input of available well-log information. The workflow used is composed of six sequential steps: Seismic and Well-log Dataset, Vp (P-wave velocity) Cube, Vp--Resistivity Calibration, Resistivity Cube, Time-depth Conversion, Quality-Control Check. As a result, we built two resistivity cube (both horizontal and vertical resistivity and an associated dataset composed by main interpreted stratigraphic horizons, pseudo-well logs, and the resistivity cubes. All these elements will be freely available for research and educational purposes, but also for industry benchmark. Marlim--R3D is released under the open-source Creative Common License (https://creativecommons.org/licenses/by/3.0/br/), at the Zenodo platform (https://zenodo.org).