Pre-conditioning and semi-automated Seismostratigraphic interpretation with 2D lines of the Marlim field, Campos Basin

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Abstract

The Marlim oil and gas field complex is located in the central portion of the Campos Basin, offshore Brazil. It encompasses three main fields named Marlim, Southern Marlim and Eastern Marlim. The main producing reservoir of the Marlim field consists of an unconsolidated turbiditic sandstone of Oligocen to Miocene age. The present study focuses on the Eastern Marlim oilfield, discovered in January of 1987. Shortly after its production in 1991, it became the largest producing field in the area. The Marlim Field reservoir has been widely studied and constitutes an excellent dataset to investigate a new seismic interpretation methodology on 2D lines. A comprehensive Relative Geological Time (RGT) model creation workflow has been applied to this dataset. This chrono-stratigraphically consistent semi-automated method has been widely proven in quickly and efficiently exploiting 3D seismic volumes within different geological settings around the world. The result of the present study successfully demonstrates the efficiency of this innovative semi-automated global seismic interpretation approach on the Eastern Marlim 2D dataset. The method consists of using a cost minimization function to generate a consistent geological model directly from the reflectivity responses in seismic data. Following a thorough data pre-conditioning, the method can be described as a three-step computer-aided workflow, starting from the generation of a discrete stratigraphic framework from the reflector's polarity (the so-called Model-Grid) which, once computed, deliver a Relative Geological Time (RGT) model from which a series of chronostratigraphic surfaces (Horizon Stack) can be derived. Applied on the Eastern Marlim 2D data, the first step consisted in conditioning the data by applying two filters, Structure Oriented Smooth and Spectral Balancing, to improve reflectors continuity, remove noise and enhance seismic details. The conditioned data constituted a better input for Model-Grid generation. The next step was to edit the key horizons that were initially and automatically tracked by the minimum cost algorithm. Once validated, the RGT model has been computed from the interpolation of the previously refined horizons within the Model-Grid. Finally, depositional time surfaces have then been extracted as dynamic series of Horizon Stacks. Pre-conditioning of the data is an important step to enhance better seismic visualization and enable higher level of details and less noises within the 2D sections. The derived Horizon Stack enabled the stratal slicing of the turbidite system interval, bringing light on sedimentary and structural features and allowing a sharp representation of the paleo deep-water depositional environment. As a conclusion, this comprehensive workflow can play an important role in the energy domain, especially within the E&P industry, on both exploration and development stages. Thanks to this innovative technology, geoscientists can perform a high-quality seismic interpretation of the whole 2D seismic data, allowing e quick and easy extraction of numerous stratigraphic surfaces.