Robust Multiple Attenuation Workflow and Flexible Anisotropic Tomography for Better Imaging. Shallow Water Case Study, Gulf of Suez

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ABSTRACT

In this paper we will show how the optimization of multiple attenuation sequence along with the adaptive multi-scale tomography workflow have helped to achieve better image in the pre salt interval in Gulf of Suez. In many offshore exploration areas, successful separation of primaries and multiples plays an important role. Leaving multiples in the data is leading to incorrect velocity updates and ultimately to the false image. When dealing with shallow water environments, like in the Gulf of Suez, the separation between primaries and multiples becomes more difficult. The water bottom reflection is either not recorded at all or recorded on only few near offset traces because the critical reflection angle is usually reached quickly. Unfortunately, this limits the effectiveness of any convolution based multiple attenuation algorithm. In addition to that, the presence of strong reflectors in the subsurface like the top and base salt generates significant interbed multiple energy. Interbed multiples appear as less distinct arrivals in the seismic section making them very difficult to remove. In this paper we are showing an optimized approach that reduces the effect of the surface and interbed related multiples in the data through a combination of wave-field extrapolation methods followed by cascaded convolution based algorithms. Although the internal multiples are modelled in the strike direction (direction of the acquisition), their subtraction was done in the dip direction which has significantly improved the results. Optimized multiple attenuation workflow is the key differentiator that yielded better preconditioned data for the imaging. Further, we have used flexible multi-scale tomography workflow that has allowed us to implement geological constrains during the update of the model. Geological constraints were achieved through the use of different weighting schemes of the input data (weighting along predefined horizons and zones of interest). Use of weighting in combination with multi-scale steering filters has helped to obtain higher resolution velocity contrast. Imaging of sub-salt targets in the shallow waters of Gulf of Suez requires inventive approach to data preconditioning. This was achieved through robust multiple attenuation sequence. Further In this paper we have illustrated that steering tomography constrained by geological information has helped to overcome the imaging challenges and produce a high quality product that is ready for interpretation.