3D Elastic Inversion in Presence of Smooth Topography: Application to Real Data

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Abstract

Full Waveform Inversion (FWI) is one of the most challenging procedures to obtain quantitative information of the subsurface. On land seismic surveys, obtaining information from the recorded seismograms requires a full elastic approach. High-performance computing has made 3D elastic FWI possible. However, there is still a key issue for overcoming its computational burden and mitigate the requirement of having long-offset data, especially when complex simulation feature such topography are required. Here we introduce a Dynamic Offset Control that is a data selection method for adapting the longest receiver offset to the current inverted frequency. We illustrate our method with a real data set acquisition, which took place in the Zancara river basin (Spain). This is a high-resolution data set images a 500x500 m block. The goal of such unusual short acquisition is to study the shallowest geological structures. The study area is characterized by a relatively heterogeneous geology revealed by a borehole data available and features topographic variations on the order of a few meters. Although quite smooth, taking it into account is still crucial due to the shallow environment study here. This implies the use of a Full Staggered Grid together with mimetic operator to allow for correct free surface effect modeling. Our workflow, apart from the data selection method, is classical and could be characterized by the absence of pre-processing but band-pass filtering. The data are used "as is", and we used a normalized L2 norm in order to mitigate Q effects among others.