Imaging of the Deep Galicia margin using ocean bottom seismic data

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Continental rifting and breakup are the first order tectonic process that initiates the plate tectonic cycle and results in the formation of passive rifted margins. The Galicia margin, west of Iberia, is archetypical for magma-poor rifted margins where a number of key concepts of rifting processes have been developed and tested. Seismic imaging has been instrumental in understanding rifting in the Galicia margin. In this talk, I present a high-resolution P-wave velocity model of the Deep Galicia margin (DGM) where the final breakup of the continental crust happened. The velocity model is derived employing a 3D acoustic full waveform inversion (FWI) technique in the time domain using sparsely acquired wide-angle ocean bottom seismometer (OBS) data. Comparison of the 3D FWI model result with 2D result derived along a profile through the 3D seismic volume highlighted the differences between the imaging methods in a real-world setting. Differences in the data residuals of the 2-D, 2.5-D and 3-D inversions suggest that 2-D inversion can be prone to overfitting when using a sparse data set.

First-order multiples from the OBS data can be used to develop seismic images using a technique called mirror imaging. We developed seismic images of the DGM in time and depth domains using mirror imaging. In this technique, the seafloor along with the OBS is mirror imaged with respect to the sea-surface and placed at a depth of twice the water column depth. Such an adjustment allows incorporation of the multiples in to migration algorithms just like primary reflections. Mirror imaging can become a standard processing step in studies where no multichannel data are available.