Lower crustal structures at Rockall Trough (west of Ireland) by Full waveform inversion

Gaurav Tomar1,2, Christopher J. Bean1,2, and Satish C. Singh3

1Dublin Institute for Advanced Studies, Cosmic Physics, Dublin, Ireland (gauravtomar63@gmail.com)
2Irish Centre for Research in Applied Geosciences, Ireland
3Institut de Physique du Globe de Paris, France

Rockall trough lies to the west of Ireland in NE Atlantic, it has a complex geology and has been debated for controversial geology for more than two decades. We have performed Full waveform inversion (FWI) on 2D seismic data set that is recorded in 2013-14 by using 10 km long streamer, this 2D seismic line is situated near the North-West margin in the Rockall Bank area. Full waveform inversion (FWI) is a powerful technique for obtaining elastic properties of the sub-surface from the seismic data. FWI provides properties of the sub-surface at the scale of the wavelength of the data set. We used travel time tomography on downward extrapolated data set to obtain a smooth starting velocity model for FWI. Downward continuation is a technique that enhances the first arrival and also reduces the computation time for forward modelling in FWI. The velocity model obtained from refraction travel time tomography, indicates the velocity from 1.6-4 km/s for the sediments and we have also observed very high velocity ~ 6-7.5 km/s just 3 km below sea-floor. We have performed FWI using these TTT velocity model as a starting model and inverted the refractions along with the wide angle reflections in the frequency range of 3-10 hz. FWI results gives the velocity of 6-7.2 km/s as well as defines geological structures that can be seen in the migrated seismic section. These high velocity structures could be a part of the continental crust and/or lower oceanic crustal igneous rocks like Gabbro.