Full-waveform inversion of industry data from the South Atlantic

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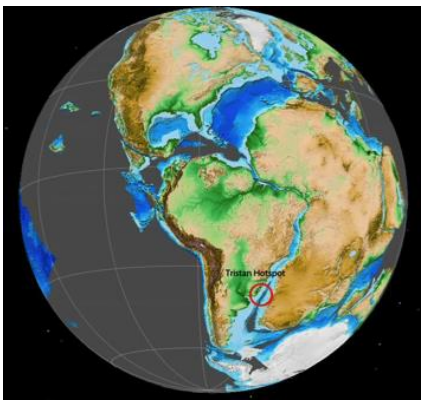
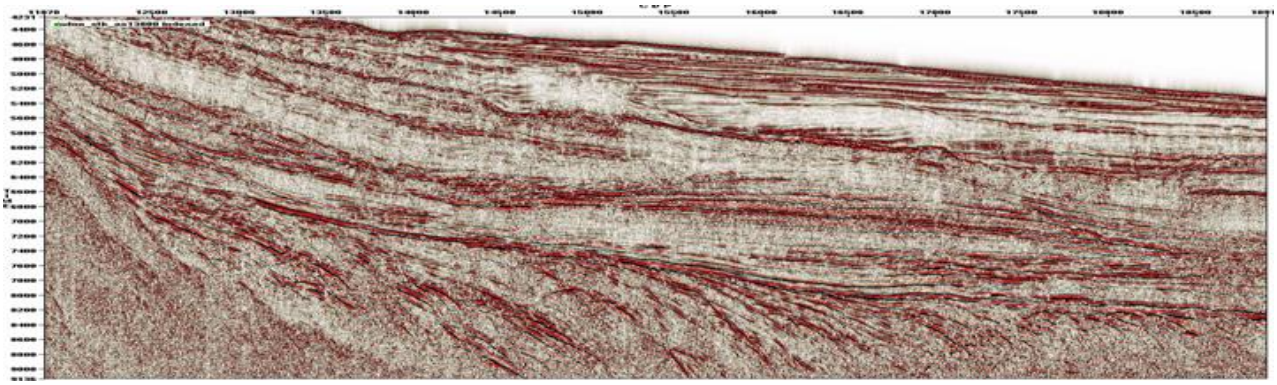
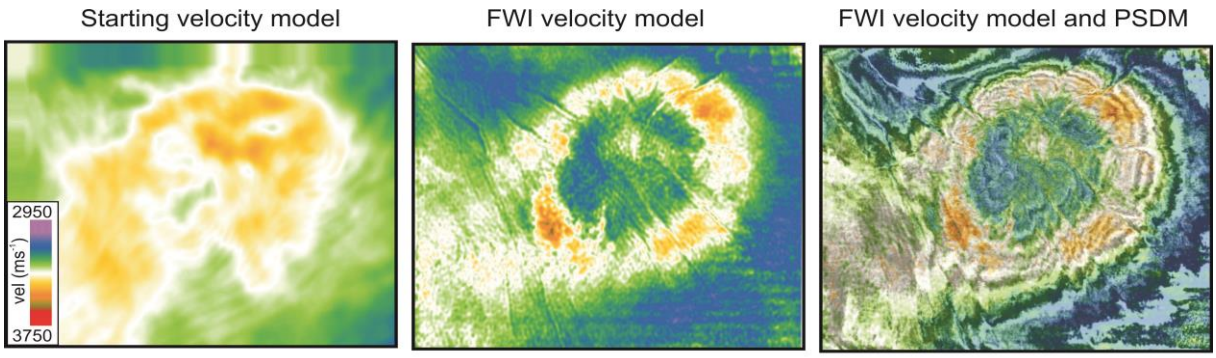


The aim of this project is to apply newly developed 2D full-waveform tomographic inversion code to better-understand the process of continental break-up. We will use industry-collected seismic reflection data from the South American margins of the South Atlantic that image spectacular seaward dipping reflectors. These reflectors are thought to be massive basaltic lava flows formed by rifting above a mantle plume, yet their along-strike pattern does not appear to fit with a simple plume-initiation model. This project will investigate why this is the case by producing high fidelity seismic velocity models from which the role of magmatism during margin formation will be determined.



Example seismic line from South Atlantic continental margin, with seaward dipping reflectors below the sub-horizontal sediments; image length ~ 50 km; vertical scale ~10km; from ION website.

Full-wavefield inversion (FWI) involves finding a velocity model that is able to match the full seismic wavefield wiggle-for-wiggle. The method, which is now widely used by the petroleum industry, involves iteratively updating an initial starting model using a linearized local inversion. The principal advantage of FWI is the recovered velocity models have a high spatial resolution. In the figure below, the starting model (left) was obtained using conventional industry methods, and the FWI velocity model (centre) was obtained by inverting the low-frequency (4-7 Hz) refracted wavefield. The faults in the FWI velocity model correlate well with the migrated seismic data (right).



Horizontal slices at 1350 m (Morgan et al., 2013)

We are looking for geophysicists, physicists, computer scientists, applied mathematicians, engineers and others with a numerical background and an interest in imaging the Earth. Applications from those with experience in scientific and high-performance computing are particularly welcome. For UK and EU students, the projects will either be funded by the petroleum industry or through a departmental scholarship; opportunities for internships are likely. The student will join a research team working on other aspects of the evolution of the South Atlantic margins and applications of FWI in other tectonic settings.

PLEASE NOTE: CLOSING DATE FOR APPLICATIONS is 31 January 2017. Please contact Jenny Collier (jenny.collier@imperial.ac.uk) for further information.

Morgan et al. 2013, Next generation seismic experiments: Wide-angle, multi-azimuthal, 3D full-waveform inversion, *Geophys. J. Int*, doi: 10.1093/gji/ggt345.