Initial along-strike refraction tomography results from the ENAM Community Seismic Experiment along the East Coast Magnetic Anomaly

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The Eastern North American Margin (ENAM) has been repeatedly studied with offshore margin-perpendicular seismic profiles to better understand the development of rifting and the interplay between extension and magmatism during the breakup of Pangea. The prominent along-shore East Coast Magnetic Anomaly (ECMA) correlates with seismically mapped extrusive volcanics and elevated lower crust velocities (V_p >7.0 km/s) that suggest extensive magmatism. However, this relationship is based on widely separated datasets leaving the details of along-strike changes in crustal architecture related to this magmatism unconstrained. Understanding the margin along strike can provide important details on differential magmatism or segmentation.

We present crustal-scale active-source seismic data from the ENAM Community Seismic Experiment collected offshore the margin in 2014. We analyzed seismic gathers from 21 ocean bottom seismometers along two shore-parallel lines that follow the ECMA for ~500 km centered near Cape Hatteras, North Carolina. The seismic gathers show multiple sedimentary phases along with pronounced crust and mantle returns. There are several anomalous regions across both lines of early, faster than sediment ($V_p \approx 5$ km/s) arrivals within short (< 30 km) source-receiver offsets and abrupt discontinuities in the arrival time of some longer (> 70 km) offsets. We used first arrival travel times to create an initial velocity model and then an iterative process of raytracing and tomographic inversion to improve the model.

Our first arrival model shows variations in shallow sediment thickness and seismic velocity. The short offset, high velocity arrivals and the abrupt discontinuities in far offset arrivals could be the result of salt diapirism near the OBS, which has been imaged using multi-channel seismic reflection data. We will use the first arrival models to create a starting model with multiple layers for the raytracing iteration with multiple picked phases. Further, the layer boundaries imaged in multi-channel seismic reflection data from the same experiment will be incorporated into the velocity models during future inversions.