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Improved location estimates for seismicity along the northern North Atlantic Ridge

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Accurate location estimation for earthquakes along mid-oceanic ridges is essential to better understanding the relationship between seismic activity and tectonic mechanisms. Locating oceanic earthquakes is difficult due the lack of stations at local distances. In particular, location estimates for lower magnitude seismic events may be significantly biased due to limited numbers of high quality recordings and poor station coverage. We have applied two independent procedures on different sets of events along the mid-Atlantic ridge between Iceland and north of Svalbard in order to obtain an improved overview of the distribution of seismicity in this region over the last three decades. In the first procedure, a double-difference algorithm was applied to cross-correlation measurements on Rayleigh waves generated by larger magnitude events. In the second procedure, a Bayesian multiple event location algorithm was performed on body-wave arrival time measurements both at regional and teleseismic distances. Both procedures result in a greatly reduced spread in hypocenter estimates, and visualizing the resulting distributions of seismicity together on a high-resolution sea-bed map indicates far better alignment of events and a better correspondence between hypocenter estimates and tectonic features. The two independent event location procedures show a far more consistent pattern of seismicity than is apparent from existing event catalogs and regions of significant seismic activity and regions of sparse seismic activity are far better separated. The improved location estimates will allow for improved calibration of seismic traveltimes.