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Automated processing strategies for rapid generation of calibrated images of water-layer reflectivity.

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The recent discovery that seismic reflection profiles can image oceanic thermohaline structure means that the seismic database collected by the oil industry can potentially be used to investigate the interior of the deep ocean. The vast size of the legacy oil industry database demands rapid, automated processing flows to enable evaluation of its oceanographic potential. Such flows are possible because of the initial simplicity of water-layer processing. We suggest that the following design features are important: to rapidly process large volumes of data to a good and consistent standard; to permit comparison of data collected using different acquisition systems; and to use freely available software that can be easily obtained and installed, including by oceanographers with no previous experience in seismic reflection methods. We have tested various processing strategies on profiles from several different legacy seismic surveys collected within Rockall Trough, NE Atlantic. The following simple processing flow produces good results on all of the datasets: amplitude normalization, noise removal, NMO correction using a simplified velocity field, and stacking over a limited offset range. Calibration of reflection amplitudes between surveys is achieved in an approximate manner using direct arrival energy as a common reference. This can account for small intra-survey variations in source energy and bandwidth, although it is impossible to exactly match surveys acquired with very different source characteristics. Although background noise levels (e.g. swell noise and cable tug) may be significant, in general the most problematic noise comes from the direct arrivals themselves, which are especially dominant at near offsets and shallow reflection times. A variety of methods of dip-filtering may be used to effectively suppress this energy. As ever, there are trade-offs between ease of implementation and impact on amplitude and fre-

quency content in the prestack data. Conventional hyperbolic velocity corrections are based on simple zero-dip, dip-compensated or non-hyperbolic relationships between time and source-receiver offset to define the velocity field. For reflections within the water-layer, particularly at longer offsets, the geometry of the reflection can be affected by oceanographic processes as well as seismic velocity variations. Our flow therefore uses a constant velocity function, which can be derived from near offsets or generalised oceanographic parameters to produce an initial stacked image. The processing flow executes rapidly and produces good results on a range of datasets. Parameterisation is simplified due to the restricted number of processing steps required. All processing can be performed using a free, script-based package such as Seismic Un*x, enabling reproduction by other groups. Both stacked images and pre-stack gathers for more detailed analysis of water motion can be generated automatically. Overall, the approach developed illustrates the feasibility of reprocessing large volumes of legacy seismic data in a consistent and repeatable manner for minimal expense. In future, this sort of approach should facilitate the generation of a global atlas of high-quality and readily comparable images of water-layer reflectivity.