



The use of multibeam backscatter intensity data as a tool for mapping glacial deposits in the Central North Sea, UK

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Multibeam backscatter intensity data acquired offshore eastern Scotland and north-eastern England have been used to map drumlin fields, large arcuate moraine ridges, smaller scale moraine ridges, and incised channels on the sea floor. The study area includes the catchments of the previously proposed, but only partly mapped, Strathmore, Forth–Tay, and Tweed palaeo-ice streams. The ice sheet glacial landscape is extremely well preserved on the sea bed and comprehensive mapping of the seafloor geomorphology has been undertaken. The authors demonstrate the value in utilising not only digital terrain models (both NEXTMap and multibeam bathymetry derived) in undertaking geomorphological mapping, but also examining the backscatter intensity data that is often overlooked. Backscatter intensity maps were generated using FM Geocoder by the British Geological Survey. FM Geocoder corrects the backscatter intensities registered by the multibeam echosounder system, and then geometrically corrects and positions each acoustic sample in a backscatter mosaic. The backscatter intensity data were gridded at the best resolution per dataset (between 2 and 5 m). The strength of the backscattering is dependent upon sediment type, grain size, survey conditions, sea-bed roughness, compaction and slope. A combination of manual interpretation and semi-automated classification of the backscatter intensity data (a predictive method for mapping variations in surficial sea-bed sediments) has been undertaken in the study area. The combination of the two methodologies has produced a robust glacial geomorphological map for the study area.

Four separate drumlin fields have been mapped in the study area indicative of fast-flowing and persistent ice-sheet flow configurations. A number of individual drumlins are also identified located outside the fields. The drumlins show as areas of high backscatter intensity compared to the surrounding sea bed, indicating the drumlins comprise mixed sediments of gravelly sands and sandy gravels compared to the surrounding sandy and muddy sediments. Moraines are indicated as areas of high backscatter intensity and comprise coarse grained sediments. A range of moraine sizes have been identified from large scale moraines reflecting both frontal still stands or re-advances of the ice-sheet margin, de geer moraines and smaller moraines that may represent annual variations. Meltwater channels and tunnel valleys are revealed as areas of low backscatter intensity reflecting post-glacial soft sediment infill of the depressions incised into coarser grained and higher strength glacial deposits by these features.