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Mapping cold-water coral carbonate mounds: a comparison of semi-automated and manual methods

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Geological maps are traditionally produced manually using an expert-based mapping approach with a combination of ground observations collected during fieldwork and remote sensing data. There are some disadvantages using this approach, such as subjectivity, cost inefficiency and time used to produce map of sufficient quality at a large scale.

We investigate whether rule-based semi-automatic classification can replace manual mapping, using cold-water coral reefs as an example. Cold-water coral reefs are hotspots of biological diversity and play an important role as carbonate factories in the global carbon cycle. Carbonate mounds are the geological products of cold-water coral reefs. These mounds are readily identifiable in high-resolution multibeam echosounder data, but so far systematic mapping programs have relied mostly on visual interpretation and manual digitising.

To verify the mapping results and compare accuracies, we created a reference dataset of mound presence/absence points agreed upon by three mapping experts. Three methods of mapping carbonate mounds were tested and compared: (a) manual mapping, (b) pixel-based terrain analysis and (c) object-based image analysis. Based on the reference data, we found that all methods produced highly accurate results of approximately 90% overall accuracy. There were no statistically significant differences in the overall accuracies of the maps produced by the three approaches. We conclude that semi-automated rule-based methods might be a viable option when mapping carbonate mounds with high spatial detail over large areas with increased objectivity and time-efficiency. We expect that such approaches are also applicable to mapping other submarine geomorphological features such as drowned glacial landforms (e.g. moraines, esker) or iceberg ploughmarks.