Geophysical Research Abstracts
Vol. 20, EGU2018-18329, 2018
EGU General Assembly 2018

Evaluation of automated seafloor classification algorithms for the mapping and monitoring of cold-water coral habitats

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Habitats formed by framework-building cold-water corals (e.g Lophelia pertusa, Madrepora oculata, Solenosmilia variabilis) are recognised by the UN as Vulnerable Marine Ecosystems in need of protection. Mapping and monitoring are necessary to support adequate management. The species are known to occur in a variety of settings: they are found in association with large cold-water coral mounds, but also in patchy distributions of individual, metre-sized coral stands or small coral reefs. To obtain an accurate insight in the spatial distribution of these small coral patches and reefs, and to map the occurrence of live coral colonies versus dead framework and coral rubble over extensive areas, high-resolution sub-metre pixel resolution acoustic data (sidescan sonar and multibeam backscatter) are needed. Identification and delineation of the coral cover in a repeatable and automated way, however, is the main challenge before routine monitoring of these patchy reefs can be carried out. A wide range of automated seafloor classification methods has been developed over the past two decades. Because cold-water corals can mainly be recognised in acoustic maps from their image texture, the application of Grey Level Co-occurrence Matrices (GLCMs) to define their signature is a logical approach that has been successfully applied in proof-of-concept studies. However, also Object Based Image Analysis (OBIA) has been demonstrated to be a valuable approach for backscatter classification. Here we use high-resolution sidescan sonar data collected as part of the ERC CODEMAP project and the UK MAREMAP programme at several locations in the Rockall Trough and on Rockall Bank, NE Atlantic. We compare the results obtained with GLCMs and OBIA, and evaluate the accuracy, repeatability and time investment of the automated techniques against traditional manual delineation. Our investigations indicate that automated techniques perform at least as accurate as manual mapping methods. Correct positioning of the high-resolution maps and groundtruthing data may be one of the main challenges to enable future monitoring programmes based on automated classification techniques.