GLCM or OBIA? Combining the best of both methods to map cold water coral stands in the Rockall area (NE Atlantic)

Veerle A. I. Huvenne[1], Tim P. Le Bas[1], Khaira Ismail[1] and Katleen Robert[1]

[1]National Oceanography Centre, Southampton, UK

Habitats based on the cold-water corals *Lophelia pertusa* and *Madrepora oculata* are some of the Vulnerable Marine Ecosystems recognised by the UN as in need of protection. Mapping and monitoring are necessary to support adequate management. The species are known to occur in the Rockall Trough and on Rockall Bank (NE Atlantic), where they can be found not only in association with large cold-water coral mounds (Mienis et al., 2006), but also in patchy distributions of individual, metre-sized coral stands (Wilson, 1979). To obtain an accurate insight in the spatial distribution of these coral patches, and to map the occurrence of live coral colonies versus dead framework and coral rubble, high-resolution sub-metre pixel resolution acoustic data (sidescan sonar and multibeam backscatter), is needed. Identification and delineation of the coral types in a repeatable and automated way, however, is the main challenge before routine monitoring of these patchy reefs can be carried out. As the corals can mainly be recognised 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 (e.g. Hühnerbach et al., 2008). However, also Object Based Image Analysis (OBIA) has been demonstrated to be a valuable approach for backscatter classification (e.g. Lucieer et al., 2011), and could provide advantages.

As part of the ERC project CODEMAP and the UK MAREMAP programme, high-resolution sidescan sonar mosaics (410 kHz, pixel size 20-50cm) were acquired in 2011 at several locations in the Darwin Mound area and on Rockall Bank, using the Autonomous Underwater Vehicle Autosub6000. Following processing with the NOC in-house software PRISM, the data were subjected to various approaches for seafloor classification, in order to map out the occurrences of live and dead coral stands, coral rubble and the different types of surrounding seabed environment. Ground-truthing was provided through ROV video and stills.

Comparisons are made between pure rule-based OBIA, applied to the original sidescan sonar images, and traditional supervised and unsupervised classifications based on 5 derived image texture layers, including GLCM Entropy and Dissimilarity. The former gives the opportunity to create a detailed and customised final map, whereas the latter methods are more objective and perform better at separating terrains with closely similar characteristics, but are computationally intensive. The optimal approach, however, if the computing power is available, might be to combine the techniques, applying a supervised classification to the OBIA-segmented image stack, incorporating the GLCM layers in the analysis.

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