Automated classification and OBIA of sidescan sonar imagery and multibeam bathymetry to map submarine canyons

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

[1]National Oceanography Centre, Southampton, UK, K.Ismail@noc.soton.ac.uk

Submarine canyons are important geological features that incise the continental slope and serve as conduits to the deep abyssal plains. The deep and complex topography, strong currents and occurrence of high turbidity affect the habitat heterogeneity, making canyons potential hotspots for biological activity, with high faunal diversity supported on hard substrata and mobile sediments. However, the high terrain variability makes canyons difficult to be mapped efficiently. Therefore a comparison of different methods to produce robust marine landscape maps is needed to support future marine monitoring programmes.

A combined multibeam and sidescan sonar survey of Whittard Canyon was carried out as part of the EU FP7 project HERMIONE, and the UK OCEANS2025/MAREMAP programme. Within the project CODEMAP, it is now used to generate a landscape map for Whittard Canyon using automated classification and object-based image analysis (OBIA). The aim of this study is to find the most robust, repeatable, and capable method of processing many remotely acquired acoustic data in a more efficient manner.

Three approaches to map the submarine canyon are compared to find their advantages and disadvantages. The first method consists of landscape map generated with pixel-based automated classification using statistical means. The second method uses all available abiotic variables from multibeam bathymetry, backscatter, sidescan sonar and its derivatives as layers to run the OBIA method. And finally the third method is a combination of automated classification and OBIA, using sidescan sonar imagery at a fine scale as a single layer to generate OBIA segmentation, followed by a supervised classification of the segments using training objects.

The results are evaluated using traditional digitization, based on visual assessment of the sidescan imagery and video transects. The advantage of using OBIA is that it allows incorporation of fine scale features into the broad-scale map as image segmentation was carried out on the fine scale sidescan sonar imagery. In addition, the segmentation aspect of OBIA results in a better-resolved boundary between classes, based on features in the imagery instead of a pixelated representation. However, using OBIA as a standalone method is very subjective and its rule-based method is environment-exclusive, i.e. the rule set is only applicable on datasets with the same type of data and covering a similar environment. Automated classification has the advantage of being very objective but the final maps are often pixelated and the boundaries between classes are often too structured.