

Timm Schoening
GEOMAR Helmholtz-Centre for Ocean Research Kiel

Comparison of automated nodule detection strategies

Manganese nodules are a marine mineral resource of varying abundance in the world's oceans. Several countries and companies are currently exploring nodule claims in the central Pacific Ocean. Economical aspects drive the mapping of nodule abundance to pinpoint potential mining sites whereas ecological research focuses on nodule-associated fauna and potential impacts of deep sea mining.

All exploration, both economical and ecological, relies on nodule distribution maps. These maps can be obtained through sampling and survey gear of varying resolution. Hydro-acoustics allow to determine seafloor characteristics (bathymetry, backscatter) over square-kilometres at low resolution. Benthic sampling provides nodule size distributions at low aerial coverage. Optical imaging provides a bridge technology to link those two sampling domains and allows to map and monitor nodules abundances at centimetre resolution over square-kilometres.

Extracting semantic and quantitative data from optical images requires manual labour in the form of image annotation or pattern recognition software to automate the analysis. As manual annotation is error-prone and time-consuming, automated solutions are becoming more popular. Several automated methods to segment the nodules from the sediment background have been proposed in recent years. While those methods have shown their ability to successfully determine nodule abundance in the form of nodule frequencies and size distributions, they have not become standard tools yet.

To overcome this current limitation, selected nodule detection algorithms will be assessed with regard to different optical image datasets. Different methodologies will be compared, the required manual input be assessed and their runtimes and applicability to unseen footage be discussed.