Seafloor sediment classification of the Sylt Outer Reef, German Bight from 2016 -2018 using ensemble modelling

Daphnie Galvez¹,⁴, Svenja Papenmeier¹,², Alexander Bartholomä³, and Karen Helen Wiltshire⁵
¹Alfred Wegener Institute-Wadden Sea Station, Coastal Geology, Germany (daphnie.galvez@awi.de)
²Leibniz Institute for Baltic Sea Research Warnemünde, Seestraße 15, 18119 Rostock, Germany
³Senckenberg am Meer, Südstrand 40, 26382 Wilhelmshaven, Germany
⁴Consiglio Nazionale delle Ricerche, Istituto di Scienze Marine (CNR-ISMAR), Arsenale Tesa 104, Castello 2737/F - 30122 Venezia, Italy

Recent studies on seafloor mapping have presented different modelling methods to map and classify marine sediment distribution. However, are these methods classify different sediment classes the same way? And how do we choose the right model for a certain set of sediment classes? In this study, we aim to address these issues by using ensemble modelling to map the distribution of different sediment class on a dynamic, shallow continental shelf. Our data were derived from side-scan mosaics and multibeam data repeatedly collected from 2016 to 2018 in the Sylt Outer Reef (German Bight). We used a probabilistic approach for each class separately and then compared the predicted probability for each class, to see which class is more likely to be assigned to the location. Each sediment class was predicted using a combination of different classification modelling techniques, and then the result of these models was ensembled to produced one final prediction. This approach avoids selecting one single method, limits model selection bias and can provide information on the trends and variation across models. Furthermore, we also looked on the temporal changes in sediment distributions by comparing the sediment class predictions from 2016 to 2018.

Our analysis suggest that combining different modelling techniques (i.e. random forest, boosting regression trees etc.) provide higher predictive accuracy than using one single modelling method. The resulting sediment distribution maps are more objective and are produced faster than manual delineated maps often considered by stakeholders. We also identify some limitations in having small sample size and we proposed that by combining certain models and choosing the proper amount of pseudo-absence or background data can address this issue.