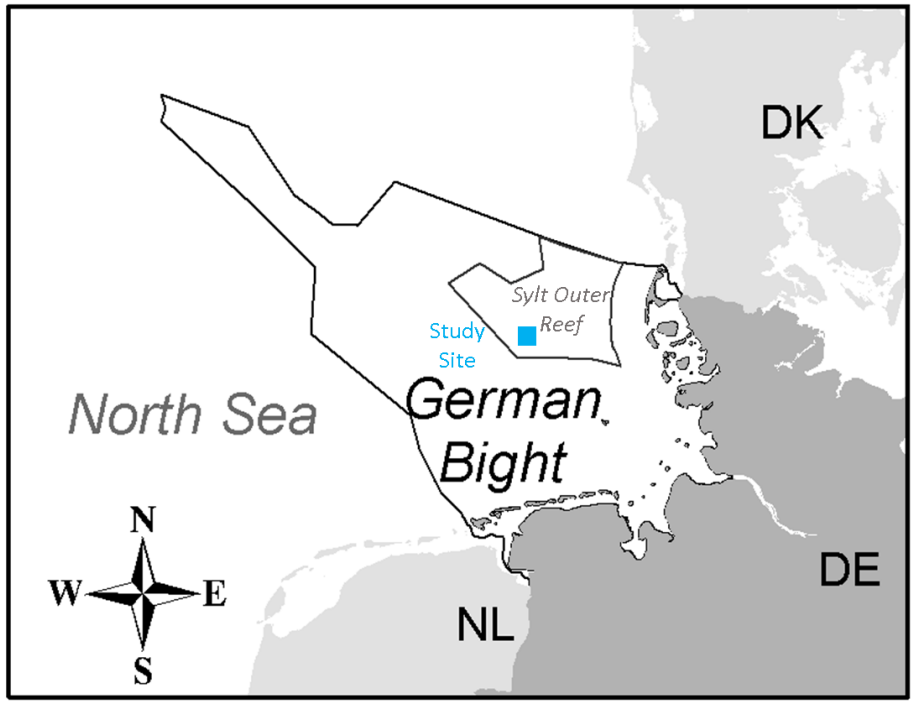
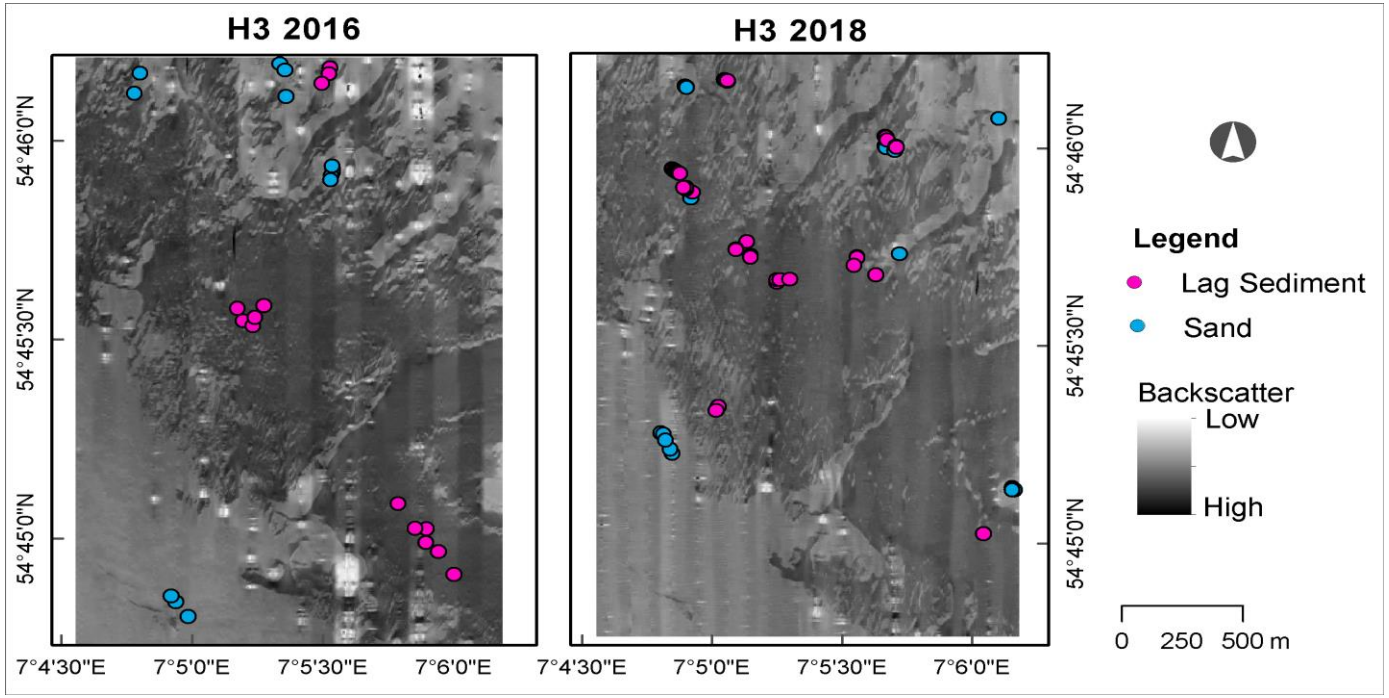
Seafloor sediment classification of the Sylt Outer Reef, German Bight from 2016 -2018 using ensemble modelling

Daphnie Galvez, Svenja Papenmeier, Alexander Bartholomae, Karen Helen Wiltshire

AIM:

To generate seafloor sediment distribution maps of the selected site in the Sylt Outer Reef (German North Sea) and to address spatiotemporal shifts in sediment distribution





The study area is approximately 4.7 km2 characterized by one large elongated sorted bedform feature oriented towards northwest-southeast direction

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RESEARCH PROBLEM:

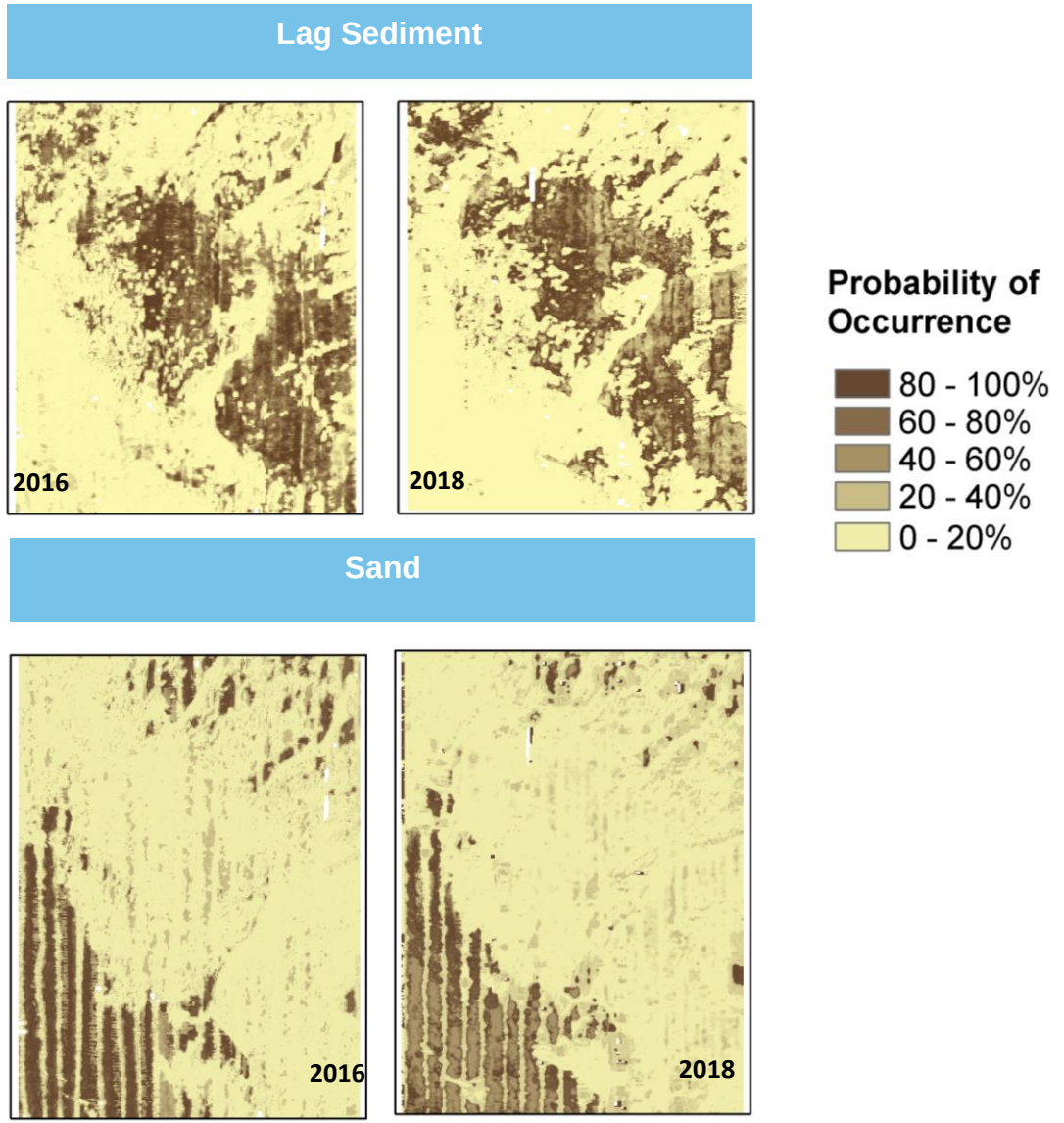
The selected site is embedded within a large continuous dataset of regional-scale hydroacoustic seafloor data, but only a limited amount of ground-truth data exist locally

METHOD:

- Class-specific predictions using ensemble modelling **to map the areas with limited or without ground-truth data**
- We used the 'biomod2' package in R to perform ensemble modelling
- Four classification algorithms were used: ANN, CTA, GBM and Random Forest

RESULT:

By modelling each substrate class separately, **each class was predicted without bias** to the class with more ground-truth data



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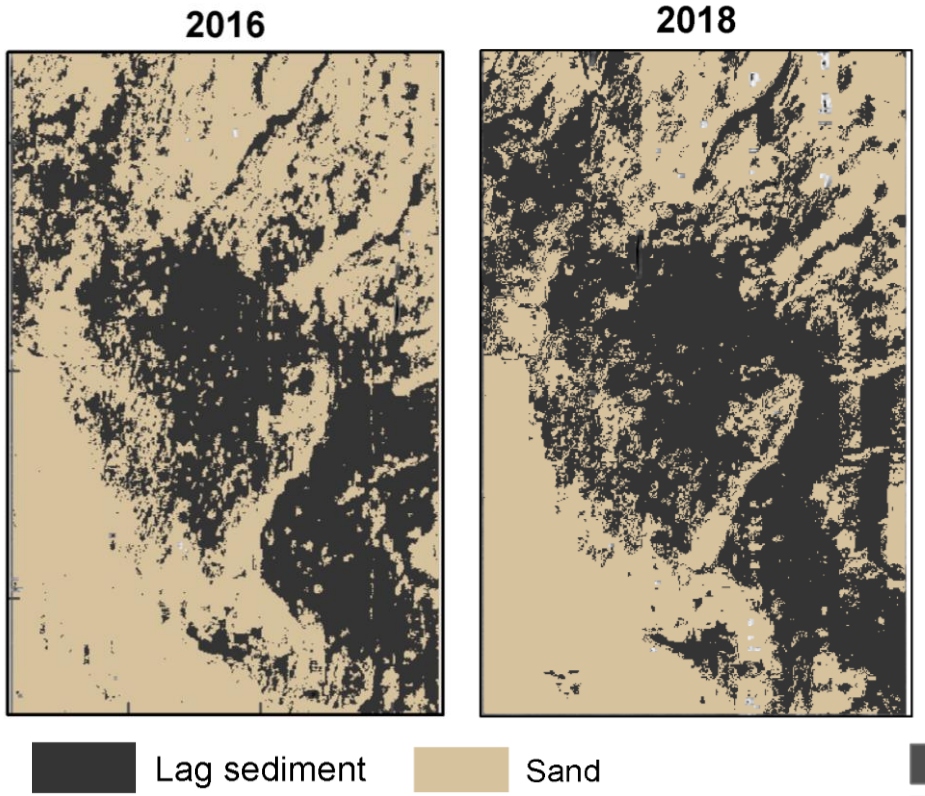
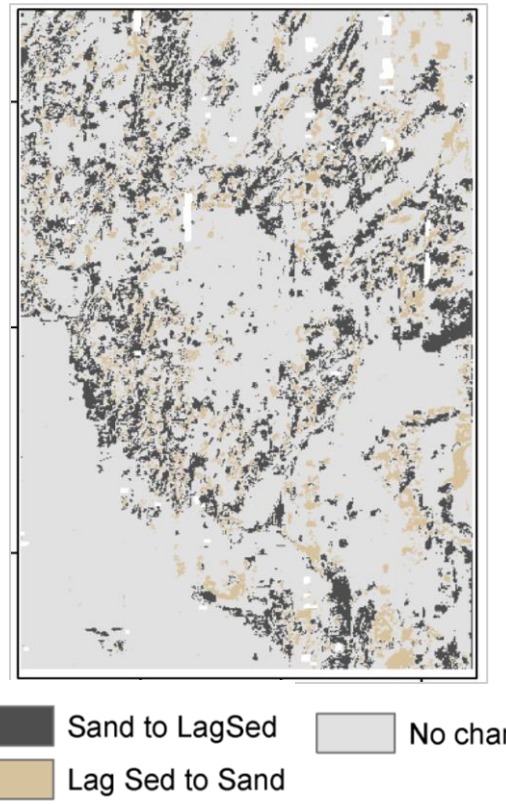
ENSEMBLE MAPS



Sediment Shifts from 2016 to 2018



ENSEMBLE MODEL SCORES

Date and Substrate class	TSS	ROC	Kappa
2016 LagSed	0.91	0.98	0.63
2016 Sand	0.90	0.98	0.66
2018 LagSed	0.91	0.99	0.90
2018 Sand	0.85	0.98	0.72

HIGHLIGHTS

- Our approach was able to predict undersampled substrate classes and produced valuable seafloor substrate maps.
- Maps were used to detect sediment shifts from 2016-2018, and we found that more lag sediments were uncovered
- We recommend to use at least 4 model algorithms to achieve good prediction

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