Mapping shallow water bubbling reefs – a method comparison between topobathymetric lidar and multibeam echosounder

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Bubbling reefs are submarine structures formed by aggregating carbonate resulting from leaking gases. The reef formations can form pillars rising several meters above the sea floor. They support a high diversity of benthic communities, and in the EU Habitat Directive they are specifically mentioned as a natural habitat type that require conservation.

Knowledge about the presence, locations and shape of bubbling reefs are usually obtained by geophysical surveying using multibeam echosounder (MBES), sidescan sonar and/or seismic acquisition systems, combined with ground truth verification. However, this traditional survey method is time consuming, especially for full coverage surveys in shallow water. Full coverage surveys are a requirement to capture the bubbling reefs due to their relatively small spatial extent. Besides, traditional geophysical vessel borne surveys have their limitations in shallow water due to low spatial coverage and vessel draft.

In recent years, airborne topobathymetric (green wavelength) lidar has emerged as a new possible surveying method in shallow water (e.g. Andersen et al., 2017). Compared to vessel borne MBES, full coverage lidar surveys can be conducted within hours instead of days/weeks, while also including full coverage in the shallow water and a seamless transition between land and water. Thus, topobathymetric lidar may be a good choice for carrying out full coverage surveys in large shallow water areas. However, the accuracy and the resolution of the collected dataset are important in these surveys, not least when mapping small scale features such as bubbling reefs.

In this study, we investigated the potential of mapping bubbling reefs in shallow water (<10 m) using topobathymetric lidar. The main objective was to assess the performance of airborne topobathymetric lidar to detect and resolve small scale objects, i.e. bubbling reefs, by comparison to MBES data. Both MBES and lidar data were acquired in spring 2019 in a designated Natura 2000 area close to Hirsholmene in the northern Kattegat region in Denmark. The comparison of the two datasets included a quantification of the accuracy, and an assessment of the performance for mapping bubbling reefs.
Reference: