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Mapping and quantifying geodiversity in land-water transition zones using MBES and topobathymetric LiDAR

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Land-water transition zones, like e.g. coastal and fluvial environments, are valuable ecosystems which are often characterised by high biodiversity and geodiversity. However, often these land-water transition zones are difficult or even impossible to map and investigate in high spatial resolution due to the challenging environmental conditions. Combining vessel borne shallow water multibeam echosounder (MBES) surveys ,to cover the subtidal coastal areas and the river channel areas, with airborne topobathymetric light detection and ranging (LiDAR) surveys, to cover the intertidal and supratidal coastal areas and the river floodplain areas, potentially enables full-coverage and high-resolution mapping in these challenging environments.
We have carried out MBES and topobathymetric LiDAR surveys in the Knudedyb tidal inlet system, a coastal environment in the Danish Wadden Sea which is part of the Wadden Sea National Park and UNESCO World Heritage, and in the Ribe Vesterå, a fluvial environment in the Ribe Å river catchment discharging into the Knudedyb tidal basin. Detailed digital elevation models (DEMs) with a grid cell size of 0.5 m x 0.5 m were generated from the MBES and the LiDAR point clouds, which both have point densities in the order of 20 points/m2. Morphometric analyses of the DEMs enabled the identification and mapping of the different landforms within the coastal and fluvial environments.
Hereby, we demonstrate that vessel borne MBES and airborne topobathymetric LiDAR, here in combination, are promising tools for seamless mapping across land-water transition zones as well as for the quantification of a range of landforms at landscape scale in different land-water transition zone environments. Hence, we demonstrate the potential for mapping and quantifying geomorphological diversity, which is one of the main components of geodiversity and a prerequisite for assessing geoheritage.

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