Mapping of Coastal Cliff Erosion in Denmark

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Coastal cliff erosion is often an underestimated process to understand shoreline evolution in Denmark. Cliff failure occurs episodically and not always coincides with the highest waves, making prediction difficult. Therefore, comprehensive knowledge about the spatial distribution of cliff erosion in Denmark and the historical rates of change are required to predict future shoreline change and sediment distribution. The erosion of coastal cliffs delivers a substantial amount of sediment into the coastal zone and future changes in storm intensities and frequencies might influence the rates of cliff erosion.

Historical aerial images, dating back to the mid of the 20th century are combined with a current high resolution digital elevation model (DEM), to map coastal cliff erosion across Denmark's coastline and to calculate rates of change over the last decades at selected sites. Countrywide oblique aerial images further assist in mapping coastal cliff erosion processes. Landslides are characterized by polygons in the DEM. Morphometric indices are calculated out of the length, width and height of each site to distinguish between different processes. Furthermore, the rate of change is derived from the spatial displacement of the crown.

In this presentation, we present a map of around 1500 (and counting) coastal cliff erosion sites mapped all across Denmark. Steep cliffs mainly occur at the Danish inner coast and along the fjords, determining the presence of coastal cliff erosion. The multi-temporal analysis of shoreline changes revealed erosion rates up to 30 m in the last 20 years leading to considerable loss of land and sediment redistribution. The spatial distribution of the mapped coastal cliff erosion processes (e.g. topples, slides etc.) shows a connection to the maximum extend of the ice sheet covering most parts of Denmark during the Last Glacial Period (Weichsel). This indicates an ongoing emergence for the postglacial landscape and highlights the importance of coastal cliff erosion in landscape evolution.