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## Arctic Coastal Bluff Erosion on Disko Island, Greenland

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The coasts of Greenland mostly consist of hard rock with relatively small rates of erosion. However, isostatic uplift following the retreat of Holocene ice sheets is creating soft sediment bluffs consisting of deltas or beach ridges. Hitherto, very little has been known about the rates and processes of soft sediment bluff erosion along the coast of Greenland. Here, we investigate a bluff section at the south coast of Disko Island in western Greenland. The height of the bluff ranges from one to 30 m along a three km long section of the coast. The bluff consists of a heterogeneous matrix of hard rock outcrops with pockets of coarse clastic sediments in between, overlain by parallel beach ridges with discontinuous permafrost. Sea ice along the coast limits wave activity between December and May.

A series of oblique aerial images from July 2019 and July 2021 was obtained to create Structure from Motion Multi-View Stereo (SfM MVS) point clouds. Changes were detected by multi-scale model-to-model cloud comparison (M3C2). Climate data from the nearby town of Qeqertarsuaq were used to identify precipitation events to estimate erosion events at the bluff. This data were utilized in conjunction with satellite derived bathymetry and wave data to estimate wave run-up and erosion at the coastline for a series of hydrodynamic conditions.

We find the absence of soil on top of the uplifted beach ridges strongly influences runoff patterns. Without the water retention capability of the soil, water directly infiltrates into the soft sediments, or runs off the surface of the hard rock areas. This leads to an accumulation of water in the soft sediment pockets and gullies, making them especially vulnerable to erosion. The sedimentary bluff is eroding by two coupled processes: (i) Precipitation-driven surface runoff downslope the bluff face and (ii) wave-driven erosion at the bluff base of sediment that is delivered by the surface runoff. Typical erosion rates are up to half a meter per year. Longer ice-free periods with extended wave action should further increase coastal bluff erosion rates in Greenland in the future.