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High Arctic coastal zone under climate change - recent advances from Svalbard.

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In contrast to mid and low latitude coasts, relatively little is known regarding the potential impacts of climate and sea-level change on high latitude coastal margins. Indeed, many of the existing intellectual paradigms regarding the functioning of polar beaches are now out-dated, based on descriptive geomorphology and a limited process-based understanding. Existing sediment budget approaches in Svalbard have focused attention on quantifying the volumes of sediment transported by glacial rivers and derived from glacier erosion and reworking of fluvial catchment sediment. Little attention has been paid to the functioning of sediment storage and reworking systems within coastal zone. My research aims to address this deficiency by improving our understanding of the mechanisms of recent adjustment of the Arctic coastal zone to non-glacial conditions associated with the paraglacial period following the end of Little Ice Age. The preliminary results document dramatic changes in sediment flux and coastal response under an intervals characterised by a warming climate, retreating local ice masses, a shortened winter sea-ice season and melting permafrost. These (largely) terrestrial processes are interacting with an upwards trend in relative sea-level attributed to glacio-isostatic land subsidence and on-going global sea-level rise. The pristine coasts of Svalbard provide a superb opportunity to quantify how Arctic coasts are responding to rapid climate warming. In this paper, I summarise my PhD research to date by presenting initial results from an analysis of digital aerial photogrammetry, combined with field-based geomorphological mapping. The geographical focus is Petunia Bay, one of the most protected bays of the Svalbard archipelago, which is characterized by a semi-arid, sub-polar climate, limited wave fetch and tidal range, and rapid retreat rate of all surrounding glaciers. Landscape and coastal change is mapped using combination of DEM-s developed over a 70 year period between 1936 and 2009, combined with field-based geomorphological mapping. I also detail the characteristics of beach sediment from several beach settings together with modern beach classification methods to identify potential factors controlling the morphodynamics of these polar beaches. My work highlights the need for a greater understanding of the controls on polar coastal sediment budgets, especially given the potential for accelerated climate warming and sea-level rise in the coming decades and centuries.