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The fast-changing coast of Tuktoyaktuk Peninsula (Beaufort Sea, Canada): geomorphological controls on changes between 1985 and 2020

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The average rate of coastal change in the Arctic Ocean is -0.5 m/yr, despite significant local and regional variations, with large areas well above -3 m/yr. Recent data suggest an acceleration of coastal retreat in specific areas due to an increasingly shorter sea ice season, higher storminess, warmer ocean waters and sea-level rise. Moreover, climate warming is inducing the subaerial degradation of permafrost and increasing land to sea sediment transportation. This work consists of the characterization and analysis of the main controlling factors influencing recent coastline change in the Tuktoyaktuk Peninsula, Northwest Territories, Canada. The specific objectives are I. mapping Tuktoyaktuk Peninsula's coastline at different time-steps using remote sensing imagery, II. quantifying the recent coastal change rates, III., characterizing the coastal morphology, IV. identifying the main controlling factors of the coastal change rates. A very high-resolution Pleiades survey from 2020, aerial photos from 1985 and the ArcticDEM were used. Results have shown an average coastline change rate of -1.06 m/yr between 1985 and 2020. While this number is higher than the Arctic average rate, it neglects to show the significance of extreme cases occurring in specific areas. Tundra cliffs are the main coastal setting, occupying c. 56% of the Tuktoyaktuk Peninsula coast and foreshore beaches represent 51%. The results display an influence of coastal geomorphology on change rates. The coastal retreat was higher in backshore tundra flats (-1.74 m/yr), whereas more aggradation cases exist in barrier beaches and sandspits (-0.81 m/yr). The presence of ice-wedge polygons contributes to increasing cliff retreat. Foreshore assessment may be crucial, as beaches present a hindering impact on coastal retreat (-0.76 m/yr), whereas foreshore tundra flats promote it (-1.74 m/yr). There are 48 areas with retreat rates higher than -4 m/yr, most being submersion cases.