

Influence of recent climate change on permafrost coast dynamics in the Kara Sea, Russian Arctic Ocean

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Recent years of increasing air temperature in the Arctic have known to lead a significant increase in the retreat speed of permafrost coast, which has threatened livelihoods and infrastructure along the coasts. The Kara Sea hosts more than 25% of the total length of Arctic coasts. Despite many works for more than six decades, little is known about how the Kara Sea coasts, affected by permafrost and sea-ice, may have changed through time and what the climatic and environmental drivers are. To understand the dominant climatic factors influencing the dynamic processes along the permafrost and sea-ice affected coastline, we study dynamics of permafrost coast along the Baydaratskaya Bay of Kara Sea, Western Siberia, during the rapidly retreated period 2005–2016, by handheld differential GPS mapping, satellite imagery, measurements of ground temperature and subsurface resistivity, and meteorological data. These multidisciplinary data reveal that the activity of wind-driven ocean wave during the sea ice-free (open water) days influences the magnitude of coastal retreat in the study area, while that recent temperature rise less contributes to enhancing coastal retreat during the study period. This suggests that the magnitude of wave activity over the sea ice-free days controls the quantities of the eroded sediment and the associated release of nutrient to the nearshore zone, which might result in influencing infrastructure along the permafrost coast and marine ecosystem in the proximal ocean.

Keywords: Permafrost coast, Kara Sea, Sea ice, Wind-driven ocean wave