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Observations of Seasonal Variations in Sea Bottom Temperature and Salinity in Bykovsky Bay in the Laptev Sea

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Following inundation due to coastal erosion or increasing relative sea level, flooded permafrost is separated from the atmosphere by sea ice and water. The boundary condition for further permafrost evolution is given by seabed salinity and temperature. Few records of seasonal variations in these parameters exist, limiting our ability to predict the speed of subsea peramfrost degradation, or to correlate borehole observations with near-shore processes. For subsea permafrost, seabottom temperature drives sediment warming and variations in salinity can increase the rate of penetration of the seawater salt front into the sediment.
A borehole transect drilled in 1983 in the nearshore zone off Mamontovy Khayata on the Bykovsky Peninsula in the Laptev Sea resulted in a description of subsea sediment temperature and the inclination of the top of the ice-bearing permafrost perpendicular to the coast out to a distance of 3 km. Before erosion, the landscape at Mamontovy Khayata is composed of ice-rich periglacial deposits down to and beneath current sea level, most of which are removed during erosion. Thermokarst features dominate the landscape and affect coastal bluff height and the resilience of sediments to coastal erosion and abrasion. We installed dataloggers on the seabed in 2007 to measure bottom water temperature and salinity at hourly intervals. Temperature variations are higher than expected, and together with salinity demonstrate the changing seasonal importance of warm, fresh river water and colder, saltier sea water that has been observed elsewhere. During winter, bottom water temperatures stabilize at the freezing point, but rise slowly during the winter, during a period of increasing salinity. We propose that this warming corresponds to the loss of heat from the underlying sediment. We compare integrated rates of warming of subsea and terrestrial permafrost and estimate the increase in the rate of subsea permafrost thermal degradation after inundation.