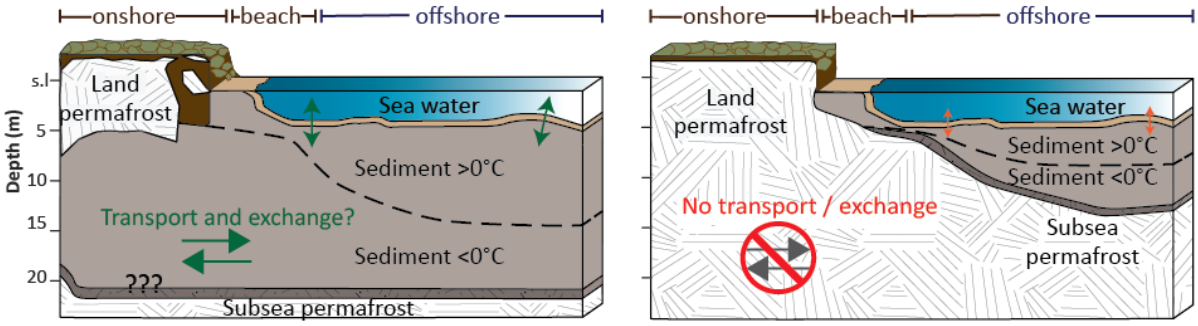
ICE-FREE LAGOON SEDIMENT IN AREAS OF 'CONTINUOUS' ARCTIC PERMAFROST REVEALED THROUGH ELECTRICAL RESISTIVITY IMAGING

Micaela Pedrazas Hinojosa

ABSTRACT

The Arctic is undergoing profound changes due to amplification of global warming in northern latitudes. One of the key features in the Arctic that has remained understudied is subsea permafrost. This coastal feature is assumed to be ice-rich and underlies the many coastal lagoons in the Arctic. Subsea permafrost, is estimated to store as much organic carbon as Earth's atmosphere and protects Arctic coastlines from erosion. However, subsea frozen sediment near the shoreline has not been thoroughly mapped and how much thawed sediment exists beneath the lagoon surface remains unclear. The presence or absence of ice beneath the surface, and its thawing are thus vital information that potentially represent a positive carbon feedback to the global climate system. Through modeling and direct observations of electrical resistivity across a lagoon on the Alaska Beaufort Sea coast during the summer, we found that the subsurface is ice-free down to at least 17 m under the lagoon and down to 22 m at the beach. This finding contrasts with the broadly held idea of continuity of permafrost across the land-sea interface extending from land to offshore. Since the subsurface beneath the beach and the lagoon are unfrozen to depths of at least ~ 20 m, there exists a significantly thawed portion of sediment beneath the lagoons, which may serve as a source and conduit for heat, water, and carbon exchange.



The figure shows two conceptual models. The right panel shows the prevailing idea where subsea permafrost is connected to land permafrost. The left is my model where there is extensive unfrozen sediment under the lagoon and the beach which extends further in-land.

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Meinhard Cardenas

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M. Bayani Cardenas, Supervisor