EP24A-09 Permafrost Thaw Subsidence, Sea-Level Rise, and Coastal Erosion are Transforming the Alaska North Slope (Invited)

Tuesday, 10 December 2024

17:20 - 17:28

146 B (Convention Center)

Abstract

Arctic shorelines are vulnerable to climate change impacts as sea level rises, permafrost thaws, storms intensify, and sea ice thins. Seventy-five years of aerial and satellite observations have established coastal erosion as an increasing Arctic hazard. However, other hazards at play---for instance, the cumulative impact that sea-level rise and permafrost thaw subsidence will have on permafrost shorelines---have received less attention, preventing assessments of these processes' impacts compared to and combined with coastal erosion. Alaska's Arctic Coastal Plain (ACP) is ideal for such assessments because of the high density observations of topography, coastal retreat rates, and permafrost characteristics, and importance to Indigenous communities.

Here we produce the first 21st century projections of Arctic shoreline position that include erosion, permafrost subsidence, and sea-level rise. Focusing on the ACP, we merge 5 meter topography, satellite-derived coastal lake depth estimates, and empirical assessments of land subsidence due to permafrost thaw with projections of coastal erosion and sea-level rise for medium and high emissions scenarios from the Intergovernmental Panel on Climate Change's AR6 Report. We find that by 2100, erosion and inundation will together transform the ACP, causing 6-8x more land loss than coastal erosion alone causes and disturbing 8-11x more organic carbon. Without mitigating measures, by 2100 coastal change could damage 40-65% of infrastructure in present-day ACP coastal cities and towns, and 10-20% of oilfield infrastructure. Our findings highlight the risks that compounding climate hazards pose to coastal communities, and underscore the need for adaptive planning for communities within zones of 21st century land loss.

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