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Depositional and paleoenvironmental changes in Arctic Svalbard fjords during the last deglaciation: Insights from Grain Size End-Member Modeling

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Grain size end-member (EM) modeling is a statistical method employed to identify and quantify dominant grain size distributions in marine sediments, contributing to a comprehensive understanding of sediment transport and deposition mechanisms. Despite its utility in various marine sediments, the application of this modeling approach to glacimarine fjord sediments in polar regions remains relatively unexplored.

This study investigates the grain size distributions of glacimarine sediment cores collected from the Wijdefjorden and off Kongsfjorden in the Arctic Svalbard archipelago. By integrating grain-size EMs with lithologic and acoustic facies, we delineate distinct EM groups associated with specific depositional processes and environments. This study shows that Svalbard fjord systems underwent significant depositional changes influenced by glacial retreat during the last deglaciation to the early Holocene, coinciding with enhanced Atlantic Water inflow. Conversely, the late Holocene noticed reduced Atlantic Water inflow, aligning with glacial advances, and resulted in notable changes in depositional environments. This study underscores the efficiency of EM modeling as a valuable tool for comprehending grain size distributions and reconstructing depositional processes in glacimarine sediments within the fjord complex systems of Svalbard. Consequently, this approach enhances our understanding of the interconnected dynamics involving climate change, glacier dynamics, and oceanic forcing in glaciated polar environments throughout past glacial-interglacial climate changes.