

How melting glaciers are changing Arctic fjords:

Tracking sediment particles in coastal waters

As the polar and sub-polar regions continue to warm, glaciers and permafrost are melting at an accelerating pace. This melting not only adds freshwater to the ocean but also carries large amounts of fine sediment, tiny particles of rock and soil eroded by glaciers, into nearby fjords. The sediment delivered by meltwater can spread nutrients essential to marine life, but when too much sediment enters the water, it can block sunlight and disrupt the balance of coastal ecosystems. This phenomenon known as coastal darkening already concerns one fifth of the global ocean area and glacial melt is one of its causes. One area, where the sediments have decreased the volume of marine habitats, is the zone between North Atlantic and Arctic oceans, around the Svalbard archipelago.

One important factor influencing how these sediments behave is the shape and structure of the fjord itself. In particular, underwater ridges called bathymetric sills can act like natural barriers. These sills can trap sediment close to the glacier, affecting where it ends up and how it settles. Depending on the layering of warmer, saltier ocean water and cooler, fresher meltwater, these sediment-rich plumes might stay deep below the surface, making them harder to detect from space. The coastal currents, which distribute the sediments, change as the glacial melt intensifies during summer months. These changes are difficult to capture through short-term field studies.

This research focuses on Hansbukta, a small bay in the Svalbard archipelago, which is separated from the larger Hornsund fjord by a shallow sill. Using a unique dataset collected over multiple years and seasons, the study aims to understand how the shape of the seafloor and seasonal changes in water flow influence where and how sediments spread and settle. The team is also investigating flocculation, a process where fine particles stick together to form larger clumps that sink more easily. An upcoming three-week field campaign will collect new data on water currents, particle size, and sedimentation to better understand how the sill may help trap sediment in the bay.

By exploring these local processes, the research will shed light on similar systems around the Arctic and Antarctic where glaciers are rapidly melting. The results will help scientists predict how changes in sediment flow could impact marine environments in a warming world.