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Impact of contrasting glacial input on pelagic and benthic processes in Young Sound, NE Greenland

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Increasing freshwater run-off, due to rapid melting of the Greenland Ice Sheet (GIS), has so far largely unquantified consequences for fjord ecosystems. It has been shown that run-off potentially carries high amounts of lithogenic material, organic matter (OM), and dissolved nutrients. The characteristics of the entrained material however depends on glacier type, bedrock lithology and glacial comminution, as well as the pathway of glacial discharge. A long transport over land or the passage through a lake may transform the material before entering the fjord. The approximately 90 km long Tyrolerfjord-Young Sound system is impacted by various glacial sources, with Tyroler- and Zackenberg River being most important. Tyroler River at the head of the fjord system mainly drains run-off from the GIS and water enters the fjord after only a few km long passage over land. Zackenberg River, located approximately 60 km from the fjord head, flows over land for several km, passes through a lake and receives meltwater from local glaciers and annual snowmelt. Thus, these two rivers constitute contrasting sources of glacial input to the fjord system.

We investigated the impact of these contrasting glacial sources on processes in the water column, the fjord sediments, and the pelagic-benthic coupling in this complex system. Along a transect from the innermost fjord onto the shelf of the Greenland Sea we quantified OM content, C/N ratios and isotopy in the suspended, sinking and sediment compartments. Furthermore, we quantified and characterized Fe and Mn in glacial source material, the water column and fjord sediment. Within the sediment we took oxygen microprofiles to calculate diffusive oxygen uptake (DOU) and quantified sulfate reduction rates. Together with porewater profiles of Fe and Mn, these data show the overall sediment respiration and predominant microbial respiration pathways. We find that in the inner fjord Mn-reduction is important, while further out Fe-reduction gets more important. Altogether our observations provide an improved understanding on how the pelagic “mill” works under these contrasting conditions and how contrasting glacial input impacts the benthic system. This will allow us to add more certainty on the impact of changing glacial input on fjord ecosystems.