The changing climate and landscape mosaic means more but less labile organic carbon exports from glacierized watersheds.

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Glaciers can provide highly labile dissolved organic carbon (DOC) to downstream freshwater and marine ecosystems. In contrast, the surrounding watershed is a source of more humic, less labile DOC. As climate change progresses, glaciers will continue to rapidly melt and retreat, while vegetation type and distribution on the surrounding landscape will shift, particularly in high latitude and altitude regions such as Alaska. This will likely be coupled with shifts in the timing, form, and intensity of precipitation and snowmelt, which will alter seasonal patterns in the degree and pathways of DOC mobilization to streams and rivers. While the general characteristics of DOC quality and export are established in glacierized watersheds, less is known about how these characteristics may be changing as the entire landscape changes, particularly in late fall through early spring when access to sites is challenging. To characterize current and expected future DOC quality and export characteristics, we established monitoring sites in a series of watersheds representative of the range of landscape types in South Central Alaska including lowland forests, mid-elevation alder, and high-elevation tundra and talus. At each site, we collected grab samples for nutrients and 15-minute water-quality data with sondes over 3 years (2021-23). We found that during winter and prior to the onset of snowmelt, streamflow is largely derived from high conductance groundwater and subglacial drainage. Fluorescent dissolved organic matter (fDOM, a proxy for DOC), from sonde measurements, is at a high baseline relative to other times of year and undergoes an initial snowmelt flush in all watersheds. Forested and shrub-dominated watersheds have the highest concentrations of DOC (computed from fDOM measurements) during the summer melt season, with high DOC peaks during precipitation events, which increase in frequency and magnitude in the fall. While DOC concentrations are low in the glacier dominated locations, the DOC flux is high due to high melt volumes, and the DOC is much more labile than the other watersheds as suggested by fluorescence index (FI). In the future we might expect increased concentrations of lower lability DOC from glaciated watersheds as well as increased DOC flushing events in fall and winter as high intensity rain and rain on snow events become more frequent. The organic carbon delivered from the glacierized landscape may thus become less available to the marine food web as glaciers recede.