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## Depth and properties of freshwater export from the Greenland Ice Sheet modulated by ice-ocean processes

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Freshwater export from the Greenland Ice Sheet to the surrounding ocean has increased by 50% since the early 1990s, and may triple over the coming century under high greenhouse gas emissions. This increasing freshwater has the potential to influence both the regional and large-scale ocean, including marine ecosystems. Yet quantification of these impacts remains uncertain in part due to poor characterization of freshwater export, and in particular the transformation of freshwater around the ice sheet margin by ice-ocean processes, such as submarine melting, plumes and fjord circulation. Here, we combine in-situ observations, ocean reanalyses and simple models for ice-ocean processes to estimate the depth and properties of freshwater export around the full Greenland ice sheet from 1991 to present. The results show significant regional variability driven primarily by the depth at which freshwater runoff leaves the ice sheet. Areas with deeply-grounded marine-terminating glaciers are likely to export freshwater to the ocean as a dilute mixture of freshwater and externally-sourced deep water masses, while freshwater from areas with many land-terminating glaciers is exported as a more concentrated mixture of freshwater and near-surface waters. A handful of large glacier-fjord systems dominate ice sheet freshwater export, and the vast majority of freshwater export occurs subsurface. Our results provide an ice sheet-wide first-order characterization of how ice-ocean processes modulate Greenland freshwater export, and are an important step towards accurate representation of Greenland freshwater in large-scale ocean models.