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Subglacial drainage evolution modulates tidewater glacier ice flow variability

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The response of the Greenland's tidewater glaciers to environmental forcing remains one of the largest uncertainties in projections of future sea level rise. The new sentinel satellite constellation has revolutionised our ability to monitor these glaciers; enabling high spatial and temporal resolution estimation of ice flow speeds, regardless of cloud cover and throughout the dark of the arctic winter. Here, we present contrasting ice velocity estimates of three tidewater glaciers in southwest Greenland. We observed contrasting seasonal ice velocity patterns, which appear to be controlled principally by subglacial drainage evolution. Two of the studied glaciers typically sped up briefly following melt onset, but subsequently slowed to below pre-melt speeds for the remainder of the melt season, after which ice flow speeds gradually increased until the following melt season. In contrast, the fastest glacier, Kangiata Nunata Sermia, was characterised near it's terminus by a large and sustained speed-up during the melt season without compensatory slow-down. We attribute these contrasting seasonal velocity patterns to runoff forcing modulated by subglacial drainage evolution, as inferred from plume modelling, with Kangiata Nunata Sermia influenced by a persistently distributed near-terminus subglacial drainage system.