



## **Warm-Water Intrusions Trigger Seasonal and Interannual Thinning, Speedup of Jakobshavn Isbrae**

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Jakobshavn Isbrae, the largest outlet glacier in Greenland, has sped up during the last decades following a major, ocean warm-water intrusion event, and has lost the bulk of its ice shelf. It is unknown whether absent an ice shelf, the ocean's role in modulating outlet glacier behavior still exists. The warming climate may cause surface melting water penetrating to the bed and change the behaviour of JI. Here we show strong evidence that ocean's role in modulating ice velocity of JI terminus is larger than atmosphere. We observe that, absent an ice shelf, seasonal and interannual varying ocean warm-water intrusions still lead to grounding line retreat, rapid thinning at the terminus, and speedup of the glacier. Moreover, we find that the glacier responds to ocean temperature change on a relatively fast ( $\sim 100$  days) timescale, thus underpinning the ocean's role in modulating both seasonal and interannual variations in glacier behavior. This fast response to warm-water intrusions indicates that outlet glaciers, even those without floating ice shelves such is the case now for Jakobshavn Isbrae, are sensitive to ocean temperature change.