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# Ocean circulation and basal melting below the Fimbul Ice Shelf, Antarctica

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The mechanisms by which oceanic heat is delivered to Antarctic ice shelves are a major source of uncertainty when assessing the response of the Antarctic ice sheet to climate change. Here, we combine observations below the Fimbul Ice Shelf with high resolution ocean modeling to study the heat exchange of the ice shelf cavity with the open ocean and quantify ice shelf basal melting. Situated at the prime meridian, the Fimbul Ice Shelf is the sixth largest ice shelf in Antarctica, being fed by Jutulstraumen, the largest ice stream in western Dronning Maud Land. Its oceanographic configuration is typical for the ice shelves along the coast of the Eastern Weddell Sea, where only a narrow continental shelf protects the glaciated coast from intrusions of Warm Deep Water and estimates of melting has varied widely over a number of studies. Our results reveal an unexpected level of complexity to supply of oceanic heat for basal melting. Two different water masses reach the ice base at different times of the year: (i) bursts of Modified Warm Deep Water access the cavity at depth in late winter and, (ii) fresher surface water flushes large parts of the ice base with temperatures above freezing during late summer. This suggests a “bi-modal” cavity circulation, rather than a steady ice-pump mechanism, where the strength of basal melting is controlled by both solar heating at the surface as well as by the eddy-driven on-shore transport of warm water at depth. Hence, we find that that successful modeling of basal melt rates in this sector of Antarctica crucially depends achieving a more realistic representation of the coastal processes and water masses involved.