Localized Rapid Warming of West Antarctic Subsurface Waters by Remote Winds

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The largest rates of Antarctic glacial ice mass loss are occurring to the west of the Antarctica Peninsula in regions where warming of subsurface continental shelf waters is also largest. However, the physical mechanisms responsible for this warming remain unknown. Here we show how localized changes in coastal winds off East Antarctica can produce significant subsurface temperature anomalies (>2C) around the entire continent. We demonstrate how coastal-trapped Kelvin waves communicate the wind disturbance around the Antarctic coastline. The warming is focused on the western flank of the Antarctic Peninsula because the anomalous circulation induced by the coastal-trapped waves is intensified by the steep continental slope there, and because of the presence of pre-existing warm subsurface water. The coastal-trapped waves leads to an adjustment of the flow that shoals isotherms and brings warm deep water upwards onto the continental shelf and closer to the coast. This result demonstrates the unique vulnerability of the West Antarctic region to a changing climate.

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