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Warming of subsurface Antarctic coastal waters by poleward shifting Southern Ocean winds

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The intrusion of warm ocean water onto the Antarctic continental shelf causes increased melt rates at the base of floating ice shelves, a retreat of ice sheet grounding lines, and increased ice sheet discharge. Wind forcing can generate warm water intrusions by driving advection across the continental shelf break and vertical mixing. The southern hemisphere mid-latitude westerly winds have been strengthening and shifting poleward since the 1950s, and this wind trend is projected to amplify throughout the 21st century, but the impact of the changing winds on Antarctic coastal heat distribution is poorly understood. Here we show that projected wind changes, particularly a poleward wind shift at the latitudes of the Antarctic Peninsula, can produce an intense, near circumpolar warming (>2°C) of subsurface (200-700m depth) coastal waters. The warming results from an advective heat flux that is associated with weakened coastal currents. This implies that anthropogenically induced wind changes may dramatically increase the temperature of ocean water at ice sheet grounding lines and the base of floating ice shelves around the Antarctic continent, with potentially drastic consequences for global sea level rise.