



Warm water access to the continental shelf near the Totten Glacier

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Warm Modified Circumpolar Deep Water (MCDW) from the Southern Ocean drives rapid basal melt of the Totten Ice Shelf on the Sabrina Coast (East Antarctica), affecting the mass balance of the grounded Totten Glacier. Recent observations show that MCDW accesses the continental shelf through a depression at the shelf break. Here we show new oceanographic and bathymetric observations in the depression south of the shelf break that were collected for two consecutive years by profiling floats capable of drifting under sea ice. The depression provides a pathway for persistent inflow of warm (0-1°C) MCDW to the inner shelf. In Austral autumn and early winter MCDW intrusions are up to 0.5°C warmer and are ~75 m thicker than in spring and summer. Using a combination of offshore observations and an ocean model, we propose that seasonality of the flow on the continental slope explains the seasonality of the intrusions. The MCDW layer on the continental slope is warmer and thicker to the east of the depression than to the west. In autumn and early winter a strong, top-to-bottom westward current (Antarctic Slope Current) transports the warmer and thicker MCDW layer along the slope and is diverted poleward at the eastern entrance of the depression. A bottom eastward current (Antarctic Slope Undercurrent) develops in other months, allowing cooler and thinner intrusions to enter the depression from the west. Our study illustrates how circulation on the Antarctic slope regulates the ocean heat delivery to the continental shelf and ultimately to the ice shelves.