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Antarctic Slope Current controls warm ocean intrusions towards Totten Glacier

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The Totten Glacier in East Antarctica has received increasing attention in recent years for its ice loss and warm oceanographic conditions observed at the ice shelf front. Here, we developed satellite estimates of temporally varying Totten Ice Shelf (TIS) melt rates and a high-resolution ocean model. We show that the Antarctic Slope Current (ASC) impedes ocean heat intrusions, and on-shelf intrusions enhance when the ASC weakens. The interannually varying strength of the ASC is primarily controlled by lateral ocean boundary conditions (and thus atmosphere and ocean circulations outside of the model domain) but also likely influenced by local wind stress curl and upstream descent of shelf water. We further show that heat intrusions towards the TIS are enhanced with coastal freshening, suggesting that freshening from ice loss in West Antarctica could start a chain reaction, leading to increased melt in East Antarctica, and further coastal freshening.