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Topic: Biogeochemistry

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ABSTRACT Subject :

Strong transport of anthropogenic carbon from the Antarctic shelf to deep Southern Ocean triggers rapid acidification

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Flows of dense shelf water are an efficient way for pumping CO2 to deep ocean along the continental shelf-slope, particularly around the Antarctic Bottom Water (AABW) formation area where much of the global bottom water is formed. However, the contribution of the formation of AABW to sequestering anthropogenic carbon (Cant) and its consequence are unknown. Here, using an integrated observational dataset, we find that the CO2 sink at Antarctic coastal regions reaches 44 Tg C yr-1, accounting for 22% of the global coastal CO2 uptake, which is twice higher than previous estimates. Moreover, we show that the strong CO2 uptake is attributed to the AABW-formation-driven mechanism, which transports Cant towards the deep sea (>2000 m) in the Pan-Antarctica. As a consequence, such transport would accumulate Cant in deep-water and trigger rapid acidification, i.e., pH declines at 0.0007±0.0002 yr-1, far faster than that of any other open ocean deep waters (<0.0002 yr-1). Our findings elucidate the prominent role for AABW in controlling the Southern Ocean carbon uptake and storage to mitigate climate change, whereas its side effects also warrant more attentions.