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Poleward shift in the Southern Ocean westerlies synchronous with the deglacial rise in atmospheric CO2

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The Southern Ocean westerly winds are hypothesised to play a key role in regulating atmospheric CO_2 over glacial-interglacial cycles; constraints on the paleo-latitude of the westerly winds have, however, remained allusive. Here we use changes in the spatial pattern of planktic foraminiferal $\partial^{18}O$ to track changes in the latitude of the Southern Ocean polar and subtropical fronts over the last deglaciation, which are closely tied to the position of the westerly winds. We find a ~5° equatorward shift in the position of the fronts (and thus westerlies) during the last glacial maximum relative to their Holocene position. Our reconstruction shows the poleward shift in the westerlies over deglaciation closely mirrors the sub-millennial scale variability seen in the rise in atmospheric CO_2. We propose that changes in the position of the westerly winds modulate CO_2 via changes in the extent of Southern Ocean sea ice and circulation of the abyssal ocean. Using climate model simulations, we explore the possibility of a feedback loop by which these CO_2/climatic changes may lead to further changes in the position of the westerly winds.