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The control of the Southern Hemisphere Westerlies on the position of the Subtropical Front

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In recent years the latitudinal position of the Subtropical Front (STF) has emerged as a key parameter in the global climate. A poleward positioned front may allow a greater salt flux from the Indian to the Atlantic Ocean and so drives a stronger Atlantic Meridional Overturning Circulation. Observed or predicted meridional shifts in the STF are usually attributed to climate induced shifts in the Southern Hemisphere Westerlies winds. Here, the accepted view that the STF aligns with the zero windstress curl (WSC) is challenged. Based on the STF climatologies of Orsi (1995), Belkin and Gordon (1996), and Graham and De Boer (2013), and on satellite scatterometry winds, we find that the zero WSC contour lies $\sim$10º, $\sim$8º, and $\sim$5º poleward of the front for the three climatologies, respectively. Output from the eddy-permitting coupled climate model HiGEM indicates that the STF corresponds to the southern boundary of the subtropical gyre, as previously suggested, but the position of this boundary does not extend to the latitude of zero WSC. The transport between the gyre and the zero WSC contour is forced by strong bottom pressure torque that is a product of the interaction of the Antarctic Circumpolar Current (ACC) with the ocean floor topography. We suggest that the position of the STF is not simply controlled by the latitude of zero WSC but rather by the northward extent of the ACC and the complex dynamics that regulate the separation of the western boundary currents from continents. This work clarifies previous misconceptions and contributes to our understanding of how the STF and the Atlantic Meridional Overturning Circulation may respond to a wind shift under future warming.