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Numerical Investigation on the Propulsion of Northern South China Sea Winter Counter-Wind Current

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The propulsion of Northern South China Sea (NSCS) winter counter-wind current (also named as the South China Sea Warm Current (SCSWC)) is investigated with a regional implementation of a primitive equation model forced by climatological force. The diagnostic calculations followed by a period of prognostic calculations reproduced the northeastward SCSWC, which flowed across the NSCS continental shelf, while the southwestward slope current flowed at the seaward side of it. Momentum budget in the NSCS continental shelf/slope area reveals that there is a high pressure belt imposed on the shelf break. In the cross-shelf momentum balance, the pressure gradient is mainly balanced by Coriolis force. The bottom stress and pressure gradient balanced the wind stress in the along-shelf direction. Term balances for the potential vorticity equation suggested that the local transport in the NSCS continental slope is driven by the interaction of vortex stretching, bottom pressure torque of JEBAR, and nonlinear advection. The analysis, combined with the conservation theory of potential vorticity, provide a reasonable evidence that the slope current leak mass and momentum onto the continental shelf when it flows across the contours of planetary potential vorticity (f/H). The onshore component of the current, while climbing the continental slope, veered in the anticyclonic tendency for the compensated negative potential vorticity, which continuously feeds the SCSWC at the out edge of the continental shelf.