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The effect of interior mixing on eddy exchange across a front

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Eddy fluxes are important in providing a cross front exchange, which is usually understood in terms of a surface diabatic transfer and an adiabatic, interior transport. However, observations clearly reveal tidal mixing throughout the water column in shallow coastal seas, as well as interior mixing over extensive regions of the Southern Ocean (Naveira Garabato et al., 2004). Consequently, we examine how the presence of tidal mixing alters cross-front, eddy-driven exchange. We consider a generic case where a front separates an onshore region of well-mixed waters from tidal mixing and offshore stratified waters, which is investigated using an eddy-resolving, isopycnic model including bottom mixing along a re-entrant channel. The inclusion of the tidal mixing leads to a lateral diabatic eddy transfer occurring all along the front, rather than being confined only within a surface diabatic layer. Using the Transformed Eulerian-Mean framework, it is possible to show that for the steady state, there is an eddy exchange across the front in the form of two overturning cells involving eddy shoreward fluxes of water from the surface and the bottom together with a compensating offshore flux of intermediate waters. The relative strength of each of these overturning cells is controlled by the imposed surface diabatic forcing and bottom mixing, in agreement with the water-mass transformation theory of Walin (1982).

References:

A.C. Naveira Garabato, K.L. Polzin, B.A. King, K.J. Heywood, M. Visbeck (2004) “Widespread Intense Turbulent Mixing in the Southern Ocean”. Science, 303, 210-213

Walin, G., 1982, “On the relation between sea-surface heat flow and thermal circulation in the ocean”, Tellus, 34, 187-195

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