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Meridional Flow of Source Driven Grounded Abyssal Flow in a Wind Driven Basin with Topography

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A hybrid 3-layer quasi-geostrophic/planetary geostrophic (QG/PG) model is introduced to examine the baroclinic evolution and meridional flow of abyssal currents in a wind-driven, stratified and differentially-rotating basin with variable bottom topography. The model resolves mesoscale processes and allows for the formation of a wind driven surface intensified ocean circulation, with a poleward western boundary current, and a source driven equatorward flowing deep western boundary undercurrent. Baroclinic and barotropic instability within the surface intensified western boundary current, and baroclinic instability between the abyssal current and the overlying wind driven circulation, is resolved. The model allows for finite amplitude variations in the height field of the abyssal current so that groundings in the thickness or isopycnal field associated with the undercurrent are resolved.A southern boundary upwelling scheme is introduced, within the context of a closed basin with no-slip boundary conditions, to balance the northern source of abyssal water thereby allowing the meridional transport of abyssal water to evolve toward a steady state.

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