# Midlatitude-equatorial dynamics of a grounded deep western boundary current

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A theoretical study of the nonlinear hemispheric-scale midlatitude and cross-equatorial steady-state dynamics of a grounded deep western boundary current (DWBC) is described. The domain considered is an idealized differentially rotating meridionally aligned basin with zonally varying parabolic bottom topography so that the model ocean shallows on the western and eastern sides of the basin. Away from the equator, the equatorward flow is governed by nonlinear planetary-geostrophic dynamics on sloping topography in which the potential vorticity equation can be explicitly solved. As the flow enters the equatorial region, it speeds up and becomes increasingly nonlinear and passes through two distinguished inertial layers referred to as the “intermediate” and “inner” inertial equatorial boundary layers, respectively. The flow in the intermediate equatorial region is shown to acceleration and turn eastward forming a narrow equatorial jet. The large-scale structure of the flow within the inner equatorial region corresponds to a zonally aligned nonlinear stationary planetary wave pattern that meanders about the equator in which the flow exits the equatorial region on the eastern side of the basin. If the DWBC exits the equatorial region into the opposite hemisphere from its source hemisphere, the characteristics of the flow must necessarily intersect within the inner equatorial region. It is in the regions of intersecting characteristics that dissipation makes a leading order contribution to the dynamics and induces the requisite potential vorticity adjustment permitting the cross-equatorial flow of a DWBC that is in planetary-geostrophic dynamical balance in mid-latitudes.