Multidisciplinary Simulation, Estimation, and Assimilation Systems

Seminar Series

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On the Crossover of Boundary Currents in an Idealized Model of the Red Sea

Abstract: Crossover of boundary currents in the Red Sea is seen in mean circulation schemes from several models. This work studies buoyancy-forced circulation in an idealized Red Sea. The mechanism that controls the crossover of boundary currents is explored by using an eddy-resolving numerical model and an analytical estimate on a β-plane. The observational support is also reviewed. The surface buoyancy loss increases northward in the idealized model. The resolved mean circulation consists of an anticyclonic gyre in the south and a cyclonic gyre in the north. In mid-basin, the northward surface flow crosses from the western boundary to the eastern boundary. Numerical experiments with different parameters indicate that the crossover latitude of the boundary currents changes with f_0, β and the meridional gradient of surface buoyancy forcing. An *ad hoc* analytical model is developed based on PV dynamics and successfully predicts the crossover latitude of boundary currents. In the analytical estimate, the sign of PV advection determines the location of the northward boundary currents. It is the competition between the advection of planetary PV and the buoyancy-loss related term that determines the crossover latitude.

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