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# The eddy-mean flow interaction and the intrusion of western boundary current into the South China Sea type basin in an idealized model

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In this paper, an ideal model on the role of mesoscale eddies in the Kuroshio intruding into the South China Sea (SCS) is developed, which represents the northwestern Pacific and the SCS by two rectangle basins connected by a gap. In the case of only considering intrinsic ocean variability, a time-dependent western boundary current (WBC) driven by steady wind is modeled under both eddy-resolving and non-eddy-resolving resolutions. Almost all simulated WBC intrudes into the adjacent sea in the form of loop current with multiple-state transitions and eddy-shedding process, which has aperiodic variations on intraseasonal or interannual scales, determined by the eddy-induced WBC variation. For the parameters considered in this paper, the WBC intrusion exhibits a 30∼90-day cycle in the presence of the subgrid-scale eddy forcing (SSEF), but a 300∼500-day cycle in the absence of SSEF.
Moreover, the roles of the resolved (grid-scale) and unresolved (subgrid-scale) eddies in the WBC intrusion are studied. It is found that the unresolved eddy-flow interaction strongly regulates the WBC intrusion through the PV forcing induced by shear flows and baroclinic processes. But the resolved eddy forcing, which is dominated by the eddy-eddy interaction solely through baroclinic processes, shows weak correlation to the WBC intrusion. The associated eddy-induced PV exchange between the two basins is mainly accomplished by isopycnal-thickness eddy fluxes, particularly by the cross-front PV fluxes due to the unresolved eddy. And the unresolved eddy-flow interaction, as well as resolved and unresolved eddy-eddy interactions, mainly governs the PV transport for the WBC intrusion.