Abstract View

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Zonal Penetration Scale of Model Midlatitude Jets

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ABSTRACT

All available observations indicate that the most energetic time-dependent currents are located in the vicinity of intense large-scale oceanic current systems. This characteristic is also a basic property of eddy-resolving gyre-scale numerical models. An initial detailed intercomparison of two-layer eddy-resolving numerical experiments with observation focused on the largest scales of horizontal structure in patterns of abyssal eddy kinetic energy, and on time scales. The numerical experiments examined generally had relevant temporal and meridional scales, but not necessarily realistic zonal scales. The model eddy field did not penetrate as far from the western boundary as observed distributions, by a factor of 2 to 3.

The present study examines the physical processes that govern the model zonal penetration scale and suggests reasons for the previous discrepancy. It is demonstrated that a subtle balance exists between the complex instability processes that tend to tear the jet apart (restricting its zonal penetration) and the tendency for inertial processes to carry the intense current right across the basin. It would seem that any factor that changes the nature of the instability of the thin Gulf Stream jet will alter the penetration scale. In these models this means not only changing physical parameters and including different physics, but also changing such model dependent factors as vertical resolution. Earlier work suggested the need for enhanced vertical resolution to give realistic zonal penetration, but it is now clear that all stabilizing/destabilizing effects conspire together to give a particular penetration scale.

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