Abstract View

Volume 27, Issue 6 (June 1997)

Journal of Physical Oceanography
Article: pp. 1038–1053 | Full Text | PDF (405K)

Kinematics of the Pacific Equatorial Undercurrent: An Eulerian and Lagrangian Approach from GCM Results

Bruno Blanke and Stéphane Raynaud

Laboratoire d'Océanographie Dynamique et de Climatologie, Centre National de la Recherche Scientifique, Paris, France

(Manuscript received January 26, 1996, in final form October 18, 1996)

DOI: 10.1175/1520-0485(1997)027<1038:KOTPEU>2.0.CO;2

ABSTRACT

Three-dimensional monthly velocity fields from an ocean general circulation model are used to study the annual mean mass balance of the Pacific Equatorial Undercurrent (EUC). Eulerian diagnostics are used to evaluate the various meridional, vertical, and zonal mass fluxes related to the EUC. There are several distinct regimes along the equator, showing clear asymmetries between the western and eastern parts of the basin, and between the northern and southern edges of the EUC. Meridional fluxes are decomposed into pure Ekman divergence and geostrophic convergence, and it is shown that the asymmetries are mainly related to the spatial structure of the Ekman divergence, and thus to that of the trade winds. Lagrangian calculations are used to evaluate accurately the mass transfers between various sections of the EUC and between the EUC domain and the Tropics. The authors show that geostrophic convergence only ventilates the upper layers of the EUC and that the EUC really is a tongue of water flowing from the western Pacific to the Galapagos Islands and beyond. Finally, Lagrangian integrations extended to extratropical regions show that the EUC contributes to an exchange of water between the southern and northern Pacific (and the Indian Ocean through the Indonesian Throughflow): The equatorial zonal pressure gradient draws water from the western boundary currents that originate mostly in the south subtropical gyre. The poleward Ekman divergence associated with the equatorial upwelling distributes EUC water over the surface, with significant recirculation within the EUC (more than 15% of the total transport at 150°W).