Geophysical Research Abstracts
Vol. 14, EGU2012-2117, 2012
EGU General Assembly 2012

Significant sink of ocean eddy energy near western boundaries and its potential influence on the large scale ocean circulation

X. Zhai (1), H.L. Johnson (2), D.P. Marshall (1), and O.A. Saenko (3)

(1) Atmospheric, Oceanic and Planetary Physics, University of Oxford, Oxford, United Kingdom (zhai@atm.ox.ac.uk), (2) Department of Earth Sciences, University of Oxford, Oxford, United Kingdom, (3) Canadian Centre for Climate Modelling and Analysis, Environment Canada, Victoria, Canada

Ocean eddies generated through instability of the mean flow play a vital role in balancing the energy budget of the global ocean. In equilibrium, the sources and sinks of eddy energy have to be balanced. However, where and how eddy energy is removed remains a large source of uncertainty. Ocean eddies are observed to propagate westward at speeds similar to the phase speeds of classical Rossby waves, but what happens to the eddies when they encounter the western boundary is unclear. Using a simple reduced-gravity model and satellite altimetry data, we show that the western boundary acts as a "graveyard" for the westward-propagating ocean eddies. We estimate a convergence of eddy energy near the western boundary of approximately 0.1$\sim$0.3 terawatts, poleward of 10 degree of latitude. This energy is most likely scattered into high-wavenumber vertical modes, resulting in energy dissipation and diapycnal mixing.

A set of sensitivity experiments are conducted using an ocean general circulation model to investigate the effect of this eddy energy sink on ocean stratification and large-scale circulation, through the impact of energy dissipation on diapycnal mixing. It is found that with the addition of the eddy energy sink, the deep ocean thermal structure becomes closer to that observed, and the overturning circulation and stratification in the abyss become stronger. The Drake Passage transport also increases and becomes closer to its observational estimates.