Near-inertial waves interacting with a coherent anticyclone off Peru

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Motivation

The interaction between near-inertial wave propagation and geostrophic flow was already investigated by Kunze (1985). Anticyclones can trap and enhance downward propagation of near-inertial wave energy. A critical-layer can be formed below these eddies where the associated vorticity anomaly vanishes. Several recent model studies point out the importance of this eddy near-inertial wave interaction for the downward transport of near-inertial energy into the deeper ocean. There it could provide an energy source for small-scale dissipation. However, observations of critical layer trapping are rare.

Experiment

A multi-platform observational study based on several gliders, moorings and shipboard measurements was carried out off Peru in January / February 2013 to investigate the interaction between mesoscale eddies and near-inertial waves.

Eddy formation

A coherent anticyclone formed in the study area allowing detailed investigation of its impact on the near-inertial energy distribution.

Eddy generation mechanism

Marshall and Tansley [2001] propose that the separation of a barotropic boundary current at a vertical sidewall takes place when \( r < L = (U/\beta)^{1/2} \). Using a modified condition for flow separation of a barotropic boundary current accounting for topographic beta, it is shown that the conditions for flow separation is indeed fulfilled.

Near-inertial waves

Enhanced near-inertial energy (NIE) is found at the eddy base possibly due to downward propagation of NIE within the anticyclone and NIW accumulation at a critical layer below.

Discussion

What are the sinks of NIE at the critical depth? Kunze et al. (1995) suggest three possible pathways: into (1) mean flow, (2) untrapped waves or (3) dissipation.

References:
