Geophysical Research Abstracts
Vol. 19, EGU2017-12971, 2017
EGU General Assembly 2017

The vertical structure of ocean eddies

Joe LaCasce, Marta Sanchez de La Lama, and Helle Fuhr
University of Oslo, MetOs, Geophysics, Oslo, Norway (j.h.lacasce@geo.uio.no)

The interpretation of satellite-derived sea surface height data requires an understanding of how the ocean surface reflects subsurface motion. To this end, Wunsch (J. Phys. Oceanogr., 1997) examined data from a large set of current meters, projecting the velocities onto baroclinic modes. His results suggested much of the variance was captured by the barotropic and first baroclinic modes. However, EOFs, calculated with the same data, suggested only a single mode, decaying montonically from the surface to near zero at the bottom.

We analyze a larger set of current meter data and confirm that the primary EOF has this structure. We demonstrate moreover that this EOF matches the first baroclinic mode obtained over a steeply sloping or rough bottom (as opposed to a flat bottom, as traditionally assumed). This structure is found in all regions of the world ocean, including over the relatively flat abyssal plains in the ocean interior.

We then consider why the bottom inhibits deep motion. Solving for baroclinic modes with exponential stratification and a slope, we show that the steep bottom limit obtains with only a modest slope, of order 10-4. Such slopes occur essentially everywhere, which explains the current meter results. The results have profound implications for ocean analysis. Rather than focusing on traditional barotropic and baroclinic modes, a more fruitful approach would be one involving surface-trapped baroclinic modes and topographic waves.