Geophysical Research Abstracts
Vol. 15, EGU2013-10664, 2013
EGU General Assembly 2013

Meridional Rossby Wave Fronts and Vortices from AVISO Altimeter Data

Paulo Polito and Olga Sato
Instituto Oceanográfico da Universidade de São Paulo (polito@usp.br)

Recent studies suggested that the contribution of Rossby waves to the variability of the sea surface height has been overestimated and should be attributed to nonlinear vortices. That can happen because both vortices and baroclinic Rossby waves show up as westward–propagating features in the sea surface height record, often presented in the form of zonal–temporal (Hovmoller) diagrams. The main differences between them that have practical consequences are (1) that vortices enclose and transport water masses away from their place of origin and Rossby waves do not; and (2) Rossby waves have a clear role in the maintenance of western boundary currents and vortices do not. A vortex can be defined as a form of isolated and closed circulation, whose streamlines are approximately circular, that completes several turns before it decays. A typical wave is neither isolated nor circular, and is composed of several fronts that are perpendicular to the direction of propagation.

Long 1st mode baroclinic Rossby waves propagate mostly in the zonal direction, therefore one should expect meridionally elongated wave fronts. Their phase speed is strongly dependent on latitude, with faster phase speeds near the equator, therefore these wave fronts are distorted as time passes. The hypothesis of this study is that Rossby wave fronts can be detected in the AVISO sea level anomaly data. In this study we have separated the altimeter record in orthogonal components, using a chain of finite impulse response filters based on the propagation characteristics of these features in Hovmoller diagrams. Each of westward-propagating the components was then reassembled as a set of maps. In the maps of individual components (e.g., semiannual Rossby waves) we found clear evidences of meridionally elongated wave fronts, similar to what is expected from the theory. We have verified that these features are not particular to any geographical projection, oceanic basin or time, and are most clearly observed in mid-latitudes.

However, when we add all westward–propagating signals together, vortices are the predominant feature in the maps. From that we conclude that a significant part of the large scale variability in the altimeter record is due to Rossby waves. Many vortices can be interpreted as a superposition of long, first mode baroclinic waves of different periods. These waves travel with virtually the same phase speed and the vortex shape is preserved for several wave periods.