Eddy Propagation in the Global Oceans

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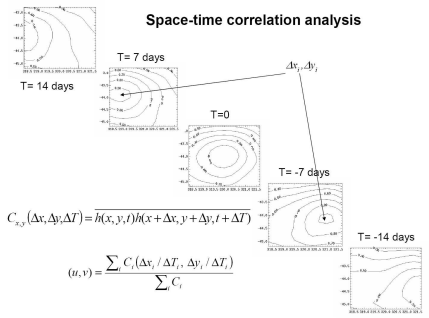
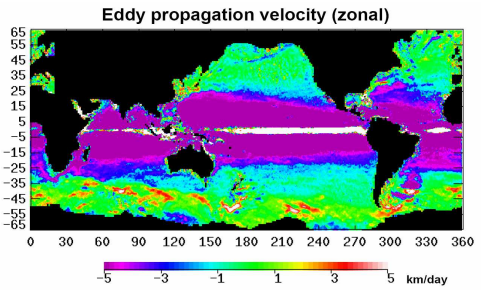
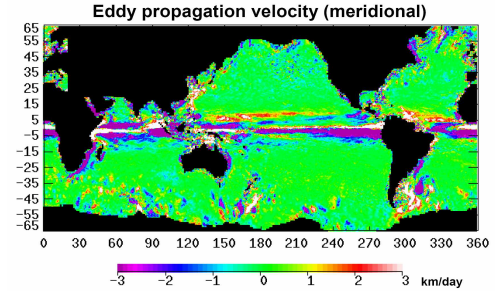
Ocean eddies were the first signals of ocean circulation detected by satellite altimetry. Standard deviation of sea surface height (SSH) showing global ocean mesoscale variability has become a signature product from altimetry. Now the decade-long merged data set from TOPEX/Poseidon (T/P) and ERS altimeters has offered opportunities to study the patterns of the movement of eddies and their propagation velocity (Brachet et al., 2004; Fu, 2006) In this study the merged sea level anomaly data produced by AVISO are used to estimate the propagation velocity of ocean eddy variability in the global oceans. A technique of space-time correlation analysis is applied to the SSH time series to determine the propagation velocity.



The search window is incrementally increased until the maximum is located at a given time lag within a time lag window of +/- 30 days. The result is then dominated by the energy-containing variability, or the "eddy variability" at a given location.

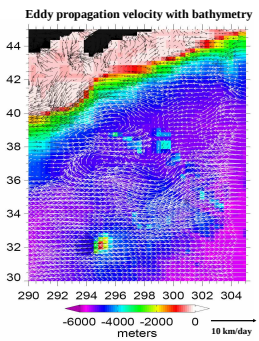


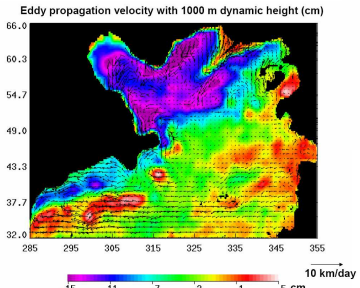
Features to note: equatorial eastward high-speed zone (up to 70 km/day), subtropical westward high-speed zone (up to 25 km /day), high speed zone in barotropic gyres (south of the Gulf Stream, Argentine basin), eastward velocity in the Gulf Stream, ACC.



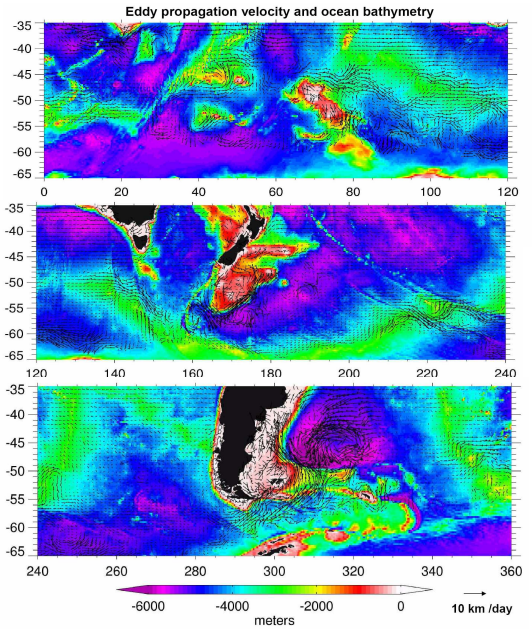
Features to note: high values in the tropics- divergence in the eastern basin and convergence in the western basin; boundary currents; alternating bands along the Agulhas Current and ACC.

North Atlantic Ocean

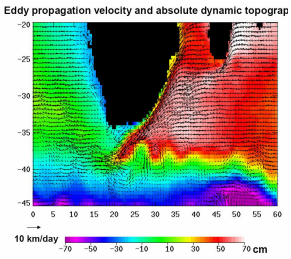




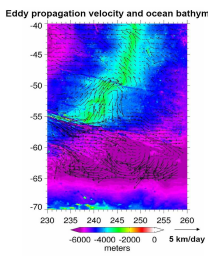
The Southern Ocean



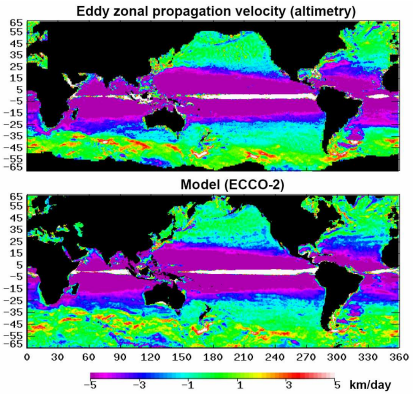
The Agulhas Current

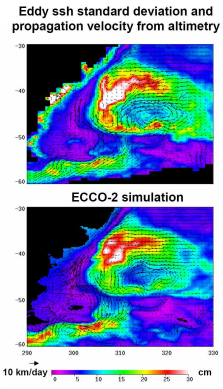


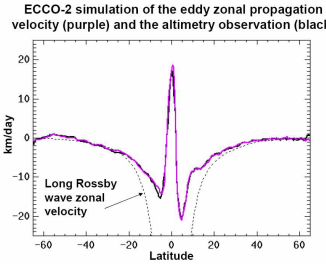
Menard Fracture Zone



Comparison with MIT OGCM simulation (18-km resolution)







Conclusions

- **Eddy variability has intrinsic westward propagation.**
- **Eddy propagation is heavily steered by ocean currents and bottom topography.**
- **Westward currents with large vertical extent are most effective in carrying eddies.**
- **Strong eastward currents with large vertical extent such as ACC do carry eddies eastward.**
- **Eddy-permitting ocean models are able to simulate the general patterns of eddy propagation.**
- **Agreement between model simulation and observations of the latitudinal variation of zonal propagation is excellent.**

References

Brachet, S., P.Y. Le Traon, and C. Le Provost, Mesoscale variability from a high-resolution model and from altimeter data in the North Atlantic Ocean, J. Geophys. Res., 109, C12025, doi:10.1029/2004JC002360, 2004.

Fu, L.-L., 2006: Pathways of eddies in the South Atlantic revealed from satellite altimeter observations, *Geophysical Research Letters*, 33, L14610, doi:10.1029/2006GL026245