Influence of the barotropic mean flow on the Atlantic Equatorial Deep Jets

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Conclusions
- Eastward flanking jets shield the equatorial wave guide from extratropical Rossby waves
- Westward mean flow along the Equator widens the cross-equatorial structure
- Increasing lateral viscosity predominantly widens the Kelvin wave while the Rossby wave is confined by the flanking jets
- Focussing is not a likely feature of the Atlantic Equatorial Deep Jets

Models
- Ray tracing of Rossby waves:
  - based on the local $v = U_n + V \cos \left( \alpha - \frac{x}{L} \right)$
  - dispersion relation $f = f_n + V \cos \left( \alpha - \frac{x}{L} \right)$
  - quasi-geostrophic approximation is made if mean flow is considered
- Shallow water model:
  - single high order baroclinic mode
  - linearised about a barotropic mean flow
  - periodic forcing in the zonal momentum equation

Mean flow
- Velocity data are collected from 22 cruises at 23°W (Aug. 1999 - Nov. 2012)

Results
Influence of the mean flow on the inviscid free basin mode (Ray tracing)

Resonance of a forced, weakly damped basin mode

The shallow water model is apparently forced by oscillating forcing, which is confined to the Equator. For each run, the amplitude of the basin mode along the Equator is calculated as the root mean square of radial velocity, when the model is in a steady oscillating state. The expected resonance period is given by $T = \frac{\pi}{\omega}$.

Impact of lateral mixing on a forced basin mode

For relatively little mixing applied, the model without a mean flow shows a strong focussing to the centre of the basin which is absent in the run including mean flow. Increasing the lateral mixing leads to remarkably similar results in the velocity of the Equator for both cases, with and without mean flow. Also the location of maximum amplitude shifts seaward.

References

Acknowledgments

What's next
Why does the energy associated with the Equatorial Deep Jets propagate upward?