Partition Between Barotropic And First Baroclinic Modes from Altimetric Velocities and Argo Float Mid-depth Displacements
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2. Data
 Estimates of parking depth velocities (YOMAHA 07 dataset) 1997-2007
- pre-programmed parking depth at 1000 m and 1500 m
- no time inversion/duplication in the sequence of fixes
- baroclinicity error < velocities values

Data selection:

3. Mean Flow and variability from Argo floats
 The mean is computed by averaging all the data within R=500 km of the position of a velocity estimate, applying an elliptical Gaussian weight w function of the distance:

\[ w(x,y) = e^{-\left(\frac{x^2}{\sigma_x^2} + \frac{y^2}{\sigma_y^2}\right)} \]

\[ \sigma_x = 70 \text{ (70) km at middle and high latitudes, away from boundary currents} \]
\[ \sigma_y = 15000 \text{ km}^2 \]

\[ \sigma_x, \sigma_y \text{ are defined to take into account the anisotropy of velocities:} \]
\[ \sigma_x \approx 70 \text{ (70) km at middle and high latitudes, away from boundary currents} \]
\[ \sigma_y = 15000 \text{ km}^2 \]

4. Correlation Between Surface and Mid-depth Velocity Anomalies

Correlation coefficient between the surface and the 1000 m depth meridional velocity anomalies
Correlation is computed at each observation location, the statistics taking into account all the points within 500 km at the same depth.

Global correlation (poleward 20°):
0.56(0.54) for meridional (zonal) component.

5. Partition Between the Barotropic Mode and the First Baroclinic Mode

A) Velocity magnitude at 1000 m compared to the one at the surface

\[ F(1000)/F(0) \]

obtained by minimizing

\[ \sum (|v_1(1000)| - |v_2|)^2 \]

If the anomalous flow is the sum of a barotropic and a first baroclinic mode one can expect a linear relation between \( R \) and \( F(1000)/F(0) \).
We checked if such a relation exist at a given latitude :

\[ R = a F(1000)/F(0) + b \]

C) First baroclinic mode to the barotropic mode contribution

\[ B/A \]

for surface velocity anomalies.

6. Conclusion

- Nature of the correlation between geostrophic surface velocity anomalies derived from altimetry and the mid-depth velocity anomalies derived form Argo float displacements:
  The correlation of surface anomalies with depth can be dependent on the wavenumber and period. In region of high EKE, there are evidences that the correlation is due to large eddies with 300-400 km wavelength, in accordance with a vertically coherent velocity structure observed for such anomalies [eg 5]. In areas of lower eddy kinetic energy such as SEP, the correlation is largely due to structures with 200-300 km wavelength and period longer than 8 months.

- Fraction of \( u \) or \( v \) components in the first baroclinic mode versus the barotropic one, at the surface

The partition, valid for the part of the surface variability correlated with the one at mid-depth, is latitude dependent: the first baroclinic mode dominates equatorward 30°, while the barotropic mode is more important poleward. This is consistent with the results of [3]. Finally, one can expect that the increase of Argo dataset and further corrections on mid-depth velocities estimates will improve the determination of the partition between the barotropic and the first baroclinic modes.

7. Références


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