Barotropic Transport Variability in Drake Passage from the cDrake experiment

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1. cDrake Objectives

- Quantify ACC transport and dynamics.
- Determine horizontal and vertical structure of the time-varying transport.
- Describe the eddy field.
- Guide future monitoring.
- Assess model skill.

2. Motivation

- ISOS concluded that barotropic ACC transport could be monitored using across passage pressure differences.
- Hughes et al. (1999) provided a theoretical case for a southern barotropic transport mode that is highly correlated to bottom pressure on the southern side of the ACC.
- Observationally, this mode is difficult to observe, local baroclinic processes swamp the larger-scale barotropic variability.

3. Data

- 38 current and pressure recording inverted echo sounders (CPIES).
- Array deployed in 2007.
- Annual telemetry cruises until 2011 recovery.
- Pressure data are derifted and detided (including MF and Mm: Egbert and Erofeeva, 2002).

4. Bottom Pressure Records

- Bottom pressure in the dynamics array is strongly influenced by ACC meandering (cyclogenesis).
- Variance within the dynamics array is two times higher than to the north and three times higher than to the south.

5. Transport Estimates

- Barotropic transports are estimated by bottom pressure differences across the passage.
  - C17-C02, C16-C02 span a wide fraction of the passage.
  - C15-C03 derives from sites that are locally correlated.
  - Multiple-site averages further reduce local small-scale eddy variability.
- Yet these ‘best’ estimates are quite different -- Transports are sensitive to the choice of endpoint, particularly the northern endpoint.

6. Empirical Orthogonal Functions

- EOF 1 – a passage-wide uniform-amplitude signal.
  - spectral peaks near 10 and 4 days
- EOF 2 – a transport mode and correlates well with the multiple-site transport estimate.
  - broad spectral peak centered at 30 days

7. Relationship with Atmospheric Forcing

- Both modes are coherent and in phase with the Antarctic Oscillation Index but at different frequencies.

8. Conclusions

- cDrake OS2010 Posters
  - Wednesday
  - IT35M-04. Constituents of sea surface height variability in Drake Passage.
  - D. Cutting

- Thursday
  - IT45K-22. The Vertical Structure of the ACC in Drake Passage from Direct Velocity Observations and the SOSE.
  - Y. Firing

- cDrake OS2010 Presentations
  - Friday 8:15
  - ITS1E-02. Deep Cyclogenesis in Drake Passage.
  - T.K. Chereskin

Also see:
http://www.po.gso.uri.edu/dynamics/Drake
http://tryfan.ucsd.edu/cpies/cpies.htm

References

Egbert, G. D. and S. Erofeeva (2002). Efficient inverse modeling of barotropic ocean tides. JTECH, 19
AAO Index http://www.cpc.noaa.gov/products/precip/CWlink/daily_ao_index/aao_index.html
Barotropic Mf and Mm tides. http://www.oce.orst.edu/research/po/research/tide/

For further information, see:
http://www.po.gso.uri.edu/dynamics/Drake
http://tryfan.ucsd.edu/cpies/cpies.htm