FESOM

Finite Element Southern Ocean Model

A global finite element ocean model:

Circulation and bottom pressure anomalies in the South Atlantic

AWI

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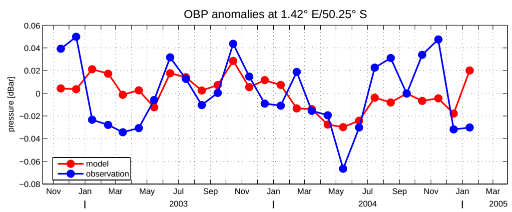
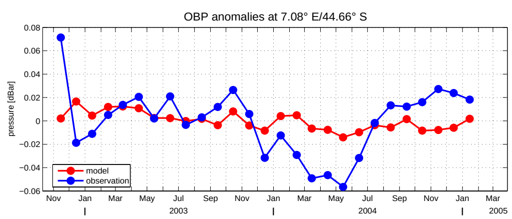
Introduction

For the validation of the GRACE mission that aims at a more accurate determination of the geoid an investigation of ocean bottom pressure (OBP) anomalies and circulation in the South Atlantic is performed. For this purpose we use bottom pressure data recorded by Pressure Inverted Echo Sounders (PIES), radar altimeter and gravity data provided by satellite geodesy and utilize the 3D finite element global coupled sea ice–ocean model (FESOM) which has recently been developed at the AWI.

Validation OBP: Model vs. PIES

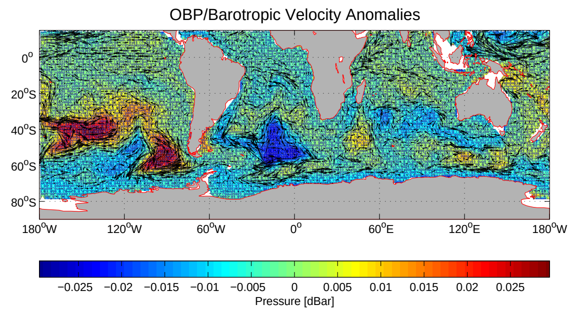


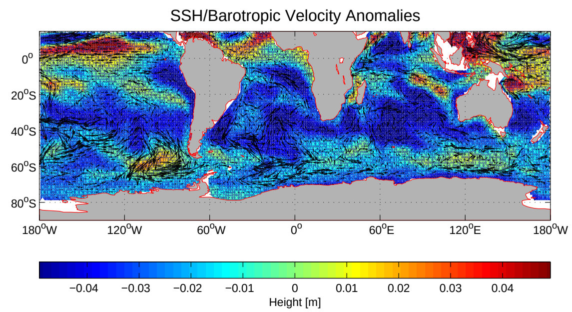


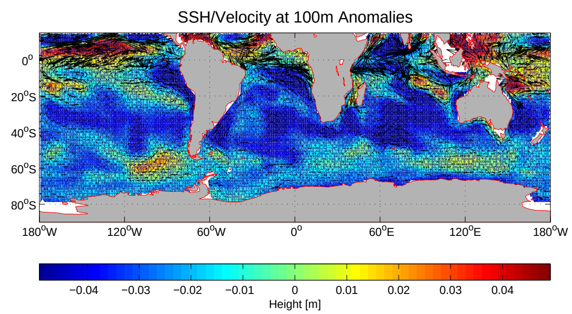
Comparison of simulated and observed monthly mean ocean bottom pressure time series at locations on the northern slope of the Atlantic-Indian Ridge (top) and in the Cape Basin (bottom) shows that patterns of variability are well captured in the ACC region, although amplitudes are underestimated. Further north, in the region of influence of the Agulhas Current, deviation becomes more expressed due to eddies not captured by the model at 1.5˚resolution. This calls for a local refinement of the computional grid, which can be easily accomplished due to the finite element approach.

Concerning the GRACE mission similar comparisons are performed with GRACE and PIES data (see Poster A. Macrander, Session OS12/G2).

Barotropic Velocity, OBP, and SSH Anomalies





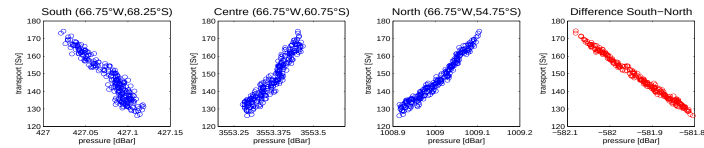


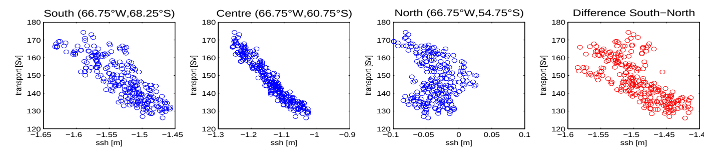
Model results (shown are typical examples of monthly means) indicate that anomalies of vertically integrated velocities are correlated to bottom pressure anomalies much stronger than to SSH anomalies. Correlation between SSH anomalies and velocities is strongest at the 100 m level, i.e. immediately beneath the Ekman layer.

Reference

Hughes, C. W., M. P. Meredith and K. Heywood, 1999: Wind-Driven Transport Fluctuations through Drake Passage: A Southern Mode. *J. Phys. Oceanogr.*, **29**, 1971-1992

Characteristic Quantities for Drake Passage Transport



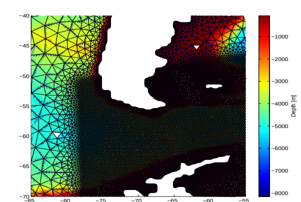


Scatter plots of ACC transport through Drake Passage vs. ocean bottom pressure (top) and sea surface height (bottom) indicate that OBP records at the coasts of Drake Passage give a better measure of ACC transport than SSH gradients. This complements findings of Hughes et al. (1999) who demonstrated a close correlation to OBP records only on the southern coast.

Conclusions

- Vertically integrated velocity anomalies in the Southern Ocean are strongly correlated with OBP anomalies (not with SSH).
- OBP at either coast of Drake Passage seems to be a good measure of ACC transport (better than SSH gradient).
- The model underestimates OBP variability.

Outlook



In order to consider mesoscale processes the model will be run on a grid with a resolution of 1/4˚ in the South Atlantic in the nearest future.

Model results will be compared to PIES and SSH data and used to validate GRACE gravity anomaly measurements.