Geophysical Research Abstracts,
Vol. 10, EGU2008-A-04223, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-04223
EGU General Assembly 2008

Large-scale mass and transport fluctuations in the North Atlantic at daily and seasonal time scales

T. Kanzow (1), H. Bryden (1), R. Bingham (2), C. Hughes (2), S. Cunningham (1)

(1) National Oceanography Centre, Southampton, UK, (2) Proudman Oceanographic Laboratory, Liverpool, UK

Ocean bottom pressure (OBP) is a measure of the mass of the entire water column and the overlying atmosphere. Continuous observations of spatial differences in OBP allow for the calculation of time-variable near bottom spatially-integrated geostrophic flow. Since April 2004 OBP measurements have been carried out in the subtropical North Atlantic (along 26 N) - at the base of the western margin, at the base of both flanks the Mid-Atlantic Ridge (MAR) and at the eastern margin - under the auspices of the RAPID-MOC programme. Simultaneous OBP measurements from the tropical Northwest Atlantic (MOVE project) and from the western margin of the mid-latitude North-Atlantic (RAPID-Wave project) are also available.

The current study focuses on OBP variability at periods shorter than 10 days (high frequency) and seasonal time scales. In the high frequency limit, OBP displays coherent (in phase) fluctuations over the entire zonal extent of the Atlantic (6000 km). These fluctuations are most likely to be linked to the global atmospheric Rossby-Haurwitz pressure pattern, as our correlation analysis of global daily fields of sea level pressure (SLP) implies. We find positive correlations between observed OBP and SLP over large parts of the Atlantic and negative correlations with the West-Pacific. Although fluctuating in phase, the amplitudes of OBP are significantly larger at the western than at the eastern margin (+/- 1.4 mbar vs. +/- 0.9 mbar), implying that there is meridional flow (showing fluctuations of +/- 8 Sv) associated with it. A mode analysis reveals that time variable pressure gradients (or geostrophic transports) are significantly larger across the western basin of the Atlantic than across the MAR or the eastern basin. The de-correlation scale of the transports clearly exceeds 1000 km, and could

be the signature of Rossby waves. Thus, parts of the variability in OBP appears to be a rather static response to atmospheric pressure, which does not involve changes in sea surface height (SSH). Another part of the response is dynamical, which - given the large transport coherence scales - should result in large scale high-frequency SSH fluctuations.

We also observe pronounced OBP variability on seasonal time scales at different sites in the subtropical Atlantic. Parts of the signal appear to be related to temporal changes in regional wind stress curl. Near the MAR the de-correlation scale for these signals clearly exceeds 1000 km. Thus, like in the high-frequency limit, seasonal changes in the zonal pressure gradient across the MAR appear to be weak, which has an important bearing on the observation of the meridional overturning circulation. Given the large coherence scales, we can test whether OBP derived from remote sensing (GRACE) can be used to study the Sverdrup response of the ocean.