Geophysical Research Abstracts, Vol. 7, 02138, 2005
SRef-ID: 1607-7962/gra/EGU05-A-02138

Ageostrophic transport in the upper layer along 53°N in the North Atlantic

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The response of the upper layer dynamics to short-term (synoptic) variations of atmospheric forcing in the North Atlantic is analyzed using profiling measurements taken at 42 stations along 53^0N in April 2001. The shipboard ADCP data obtained concurrent with CTD profiles allowed estimation of the Ekman transport based on in situ measurements and meteorological observations. Atmospheric forcing during 12 days of measurements was characterized by high winds and negative surface heat balance. The sea surface temperature was on the average 2.5^0C higher than the air temperature. The transect, which followed the climatologic position of zero annually-averaged wind stress curl crossed the Labrador Current and multiple branches and meanders of the North Atlantic Current. The basin-scale variation of wind stress curl is likely responsible for the observed general deepening of the thermocline from the west to the east. Mesoscale thermohaline frontal intrusions were mainly observed in the pycnocline not affecting the vertical structure of density in the upper mixed layer. Three strong storms were encountered during the measurements, and the wind stress at drift stations reached 0.2 - 0.4 N/m^2.

The averaged amplitude of Ekman transport $< M_E >$ calculated using the wind stress is about 1 m^2/s, but during the storms, the magnitude of M_E goes up to 3.4 - 3.5 m^2/s. The ageostrophic flows in the upper layer were mainly southward and eastward. The meridional ageostrophic transports M_y, were usually larger than that calculated using the residuals between ADCP and geostrophic velocities, M_{AG}, but it was in the same direction as M_y when $|M_{AG}|$ exceeds 0.3 m^2/s.

The current reversal depth (CRD specified as the shallowest depth where current vec-

tor changes the sign of its rotation) was calculated. The mean estimates for CRD = 48 m appeared to be very close to those for the mixed layer depth suggesting that the drift currents were mostly confined to the upper mixed layer.