Geophysical Research Abstracts,
Vol. 10, EGU2008-A-09292, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-09292
EGU General Assembly 2008

On surface intensified Rossby waves in the mid-latitude North-Atlantic

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Decomposing midlatitude ocean sea level anomaly into contributions from different physical wave or eddy modes is currently an active area of research. Of particular interest is to understand the nature of the westward propagating signals that appear to propagate twice as fast as predicted by the so-called linear standard theory for the first baroclinic Rossby wave mode. To account for the discrepancy, such signals have so far been mostly interpreted as the manifestation of a first baroclinic vertical mode modified by the background mean flow and/or topography. Here, we re-examine the nature of the spectrum for baroclinic Rossby waves at mid-latitudes. We investigate the vertical propagation associated with the westward propagation of oceanic Rossby waves packets in a shear flow and examine analytically the possibility for such waves to be trapped in the surface layers due to the presence of turning levels at mid-depth. The conditions for trapping appear to be verified in the North Atlantic subtropical gyre for realistic mean shear and stratification profiles, the resulting wave propagating westward slightly faster than the first mode modified by the shear flow. The sea surface height signature of these surface-trapped Rossby waves is also studied and practical consequences for the analysis of baroclinic Rossby waves phase speed from satellite altimetry are suggested.