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Ocean Science Discussions

Interactive comment on "Inferring the zonal distribution of measured changes in the meridional overturning circulation" *by* A. M. de Boer and H. L. Johnson

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Thank you for your comment. As you point out, one potential problem of the BLC05 analysis is that the results could have been contaminated by short term variability. This is one of several problems raised by critics, but is not directly relevant to our argument. Because our purpose is to interpret the BLC05 results in light of their own assumptions, we take at face value their claim that the relevant time scales are resolved. It is therefore appropriate that we too neglect variability on time scales shorter than annual in our analysis.

Long baroclinic Rossby waves, however, take about 4 years to cross the Atlantic basin at 25 degrees N and therefore, as you rightly point out, their consequences for our argu-

ment should be considered. (Note that, throughout your comment, we assume that by Delta P you mean (nabla)**2 P.) The energy in short Rossby waves (with wavelengths shorter than the Rossby deformation radius, Ld) travels eastward from the western boundary and is dissipated within our non-linear western boundary region. In contrast, long Rossby waves are seen throughout the basin. The importance of these Rossby waves to the vorticity budget can be estimated from a scaling analysis of your Eq. (5). The ratio of term 3 to term 1, i.e., the relative importance of the Rossby wave vorticity, is given by (Ld/L)**2, where we have used the dispersion relation for long Rossby waves to substitute for the time scale. Therefore, the long Rossby waves that are found in the basin interior, with length scales larger than Ld, have a negligible effect on the vorticity budget.

In summary, we agree that long baroclinic Rossby waves exist in our linear region, but believe that on the interannual and longer timescales considered by BLC05, their effect on the vorticity budget is too small to explain the increase in southward meridional transport found in the upper layer. We will revise our manuscript to include a discussion of these transient effects.

Interactive comment on Ocean Sci. Discuss., 3, 1653, 2006.