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# *Interactive comment on* "Water mass transformation in the North Atlantic over 1985–2002 simulated in an eddy-permitting model" *by* R. Marsh et al.

**R. Marsh et al.**

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On revision, we will more clearly outline the theory in section 3 ("Diagnostics") and refer to terms in the equations throughout the Results section. We will also expand our description of mixing processes in the Introduction. As further requested, we will provide more detail of the mixing schemes in OCCAM and the issue of eddy resolution at high latitudes.

It is not possible in a short time to diagnose the "spurious mixing" component of "total mixing" (the residual which we infer from the difference between net and surface-forced transformation rates). We will, however, discuss our results in light of this issue (in the Discussion section), with reference to the findings and recommendations of Griffies et al. (2000) and other studies.

In regard to the location of mixing, either near the surface or deeper in the water column, we can only discuss this issue. It would be impractical, on the short revision timescale, to separate mixing between “surface” and “interior” varieties, as this requires online computation of the diapycnal fluxes. The role of mesoscale eddies is likewise difficult to diagnose. In earlier work (Nurser et al. 1999), we found that lateral mixing in the mixed layer (a parameterisation of eddies) led to substantial water mass transformation at high latitudes, particularly in the vicinity of boundary currents around the subpolar gyre. In an eddy-rich model like OCCAM, this process may be dominant in those regions. This merits discussion, but again we cannot diagnose the mixing separately.

The suggestion to carry out “simulations whose sensitivity to mixing in the upper ocean and air-sea interaction is explored systematically” is appreciated, but we have neither the resources nor the time to do so. We only can argue that the total mixing transformation rate curves (especially for the “Subtropics” box) are physically reasonable, and compare well both with previous explicit diagnoses with other models (e.g. Nurser et al. 1999), and with inverse estimates (Lumpkin and Speer 2003). Given this apparent success, we claim that the simulation of annual “total mixing” rates over 1985-2002 in OCCAM is realistic, that this is in itself a result worthy of publication, and that further experimentation is not essential.

We thank reviewer 1 for these challenging insights, and we look forward to improving the paper accordingly.

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