

## ***Interactive comment on “Observed and simulated estimates of the meridional overturning circulation at 26.5° N in the Atlantic” by J. Baehr et al.***

### **Anonymous Referee #1**

Received and published: 15 September 2009

The manuscript compares one year’s output of observations of the meridional overturning circulation from the Rapid array to model simulations of the ECCO-GODAE and ECHAM5/MPI-OM models. Both the magnitude and the variability of the MOC are considered. The work is interesting and relevant and I recommend publication subject to minor corrections.

#### GENERAL COMMENTS:

1) Terminology: My first general comment has to do with the terminology which is not clear. It is not clear where the eastern and western wedge transport fit in. Is there a distinction between the mid-ocean geostrophic transport and the mid-ocean transport and when does the mid-ocean transport include the wedge current and when not. To illustrate that these terms are not clearly defined nor used consistently, I’ll give some

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examples from the paper.

Page 1338 bottom and 1339 top: Here the authors seem to say that the geostrophic mid-ocean transport is that which is calculated from the density profiles through the thermal wind equation. The western wedge is calculated from current meters and not the geostrophic method so one would assume here it is not included in the mid-ocean geostrophic transport. It is also dynamically not more geostrophic than the Florida current so more reason to think it is not included in the mid-ocean geostrophic transport. Is it included when the authors refer only to the mid-ocean transport or is mid-ocean transport just short for mid-ocean geostrophic transport?

Page 1338, line 17-20 seem to reinforce that the wedge transport is not included in the mid-ocean geostrophic transport per se as it is mentioned separately and added here.

Page 1344, line 8-20: Given the above and the fact that the transport from the density gradients is discussed here I assume that the mid-ocean transport does not include the wedge? Or does it because the geostrophic adjective is not used here before mid-ocean? Also, it is stated that it is derived from the density field and nothing is said about the wedge transport. On the other hand it is compared to the full mid-ocean transport in the models. Perhaps the wedge transports are not important in terms of magnitude or variability but this is not clear to the reader. In fact, some idea of the magnitude and variability of both the eastern and western wedge transports should be included somewhere in paper. It should be clear when the wedge transports (either or both) are included and when not.

Page 1345, lines 20-25: Again, what is meant with the geostrophic transport here? It is important because there is talk of small disagreement between this transport plus the Ekman and Florida current and the full MOC.

I can go on and on. Please define all these terms clearly and use it consistently. I suggest that the authors define the mid-ocean transport (MOT) as the sum of the geostrophically calculated transport (GCT) and the wedge transport (WT) derived from

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current meters and then refer either to the MOT, GCT or WT as and when appropriate.

2) Calculation of Mid-Ocean transport: I have a few problems with this section.

Page 1345, line 20: What is meant with 'certain depths'?

Page 1345, line 20-25: The authors talk about the discrepancy between the mid-ocean transport + Ekman transport + FC and the MOC. Please define what is meant with the MOC. Is this the total net northward transport at a latitude integrated to a depth where this transport is a maximum? It seems here that sometimes MOC refers to the full depth dependent transport and sometimes to the maximum of the overturning stream-function. What is the likely cause of the discrepancy mentioned in these lines based on? Is the difference due to the mid-atlantic ridge, the wedge transport, the assumption of a level of no mention, or unresolved time-variability, or mesoscale eddies? Some mention of the major error/s would be appropriate.

In the definition of the dynamic method it is said that the full meridional transport is southwards at all depths. What full meridional transport is meant here? It cannot include the Ekman and Florida transport surely so why call it 'full'? It is not surprising to me that this definition in which the depth is set to be where the velocity goes to zero does not give as accurate results as the kinematic definition. It's probably not so bad because it correspond approximately to the depth of the Florida current.

3) Are the mooring over the mid-Atlantic ridge used at all in these estimates?

SPECIFIC COMMENTS:

Page 1336, line 15: What kind of forcing is included in the forward run? Is it run with the same surface forcing as the same month of the year before?

Page 1342, line 1-12: State at which moorings and/or longitudes the east-west differences are evaluated. Also in caption of Fig 2.

Page 1351, line 6: What is meant with density-driven component?

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Page 1351, line 23; Delete spurious question mark

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