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# *Interactive comment on* "Variability of the transport of anthropogenic $CO_2$ at the Greenland–Portugal OVIDE section: controlling mechanisms" *by* P. Zunino et al.

**Anonymous Referee #1**

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This study seems to be a follow-up of a study by Pérez et al. (2013). Using more data than used in Pérez et al. (2013), the authors attempt to clarify the details of anthropogenic CO2 transport, which is the most important factor in storing anthropogenic CO2 in the subpolar North Atlantic. The method (inversion calculation) used for this purpose is appropriate, and the interpretation seems to be reasonable. However, I have some major and minor comments listed below. As a whole, this paper can be published in Biogeosciences after minor-to-moderate revision.

Major comments: 1.In doing calculation similar to that made in this study, Ekman transport is also examined. How do you evaluate the term in the calculation?



2.Errors of Cant should be relatively large compared to those in the upper layers. But in the inversion calculation, the same weight seems to be taken in a water column. Does the calculation leads to proper results?

3.In Fig. 3, Tcant shows temporal variations, which seem to me, should be judged to be almost constant between 1997 and 2008, from the error bars. Only the value in 2010 is larger than the rest. The authors take the changes of Tcant as variability, i.e., signal, but is it really so? This question arises because the inversion calculation presents rather different results by a slight change of calculation conditions.

Minor comments: 1. Abstract, lines 3-5; for six times, FOUREC 1997 is lacking.

2. Abstract, line 26; not "TCant increase" but "TCant trend"?

3. Page 16104, lines 25 to bottom; the observation-based estimations also include large errors in the calculations. Thus for not only models but observation-based estimations also, improvements are necessary. By the way, the observation-based estimations use so-called "inversion" calculation. So I think "ocean inversion" in Table 1 is not appropriate, causing a little bit confusion.

4. Page 16105, line 23; according to impression of reading Pérez et al. (2013), not "on the TCant variability" but "on anthropogenic CO2 storage".

5. Page 16107, line 24; in Fig. 2, Cant of AABW shows 5-10 $\mu$mol kg-1. Close to 0 $\mu$mol kg-1?

6. Page 16109, line 12; "the same way than", "the same way as".

7. Page 16110, line 8; "the latter", "Tisop Cant?"

8. Page 16110, line 9, "same methodology than Alvarez et al. (2003)", "same methodology as in Alvarez et al. (2003)".

9. Page 16111, line 26; "section average", "horizontal average".

10. Page 16113, line 15; “section-average”, “horizontal average”?

11. Page 16114, line 1; “a similar intensity than”, “similar intensity to”.

12. Page 16114, line 8; “two different elements”, “three different elements”.

13. Page 16114, line 22; before giving a definition, the MOC index appears here.

14. Page 16115, lines 13-14; what is the difference the upper and lower limbs of MOCsigma and those of MOC?

15. Page 16115, line 14; “MOC$\sigma$ is the intensity of the MOC”, how is the intensity decided? The maximum of transport stream function as made by Mercier et al. (2013)?

16. Page 16116, line 2; does MOC included in the estimator have isopycnal contribution?

17. Page 16116, line 5; “the latter”, “Tisop Cant”

18. Page 16116, line 20; TCant not TCant?

19. Page 16117, line 4; “decreased at a rate of "-0.68$\pm$0.65”, “decreased at a rate of 0.68$\pm$0.65”?

20. Page 16117, line 5; for the sign of “-”, the same question as in no. 19.

21. Page 16117, line 15; for the sign of “-”, the same question as in no. 19.

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Interactive comment on Biogeosciences Discuss., 10, 16101, 2013.