

## **Response to the reviews for revised version of**

### **“Dependency of simulated tropical Atlantic current variability on the wind forcing”**

**by Kristin Burmeister, Franziska U. Schwarzkopf, Willi Rath, Arne Biastoch, Peter Brandt, Joke F. Lübbecke, and Mark Inall**

We thank all reviewers for the constructive comments. We edited the text accordingly. Additionally, we increased the size of the wind stress arrows in Figure 1, increased the label font size in Figure 10 and moved former Figure A5 into the main manuscript (now Figure 12) extending it with timeseries for the NEUC and nSECu as suggested by the reviewer.

Detailed responses are found below. The comments by the reviewers are shown in black, our responses are given in red.

Review (by reviewer 2) of **Burmeister et al.**

#### **Dependency of simulated tropical Atlantic current variability on the wind forcing submitted to Ocean Sciences**

The paper has been very substantially revised. It has been significantly improved in many ways (e.g. the abstract and summary are better; much of the discussion of results is more quantitative and precise; the qualifications/uncertainties are summarised; there are some interesting additional results). Nearly all the responses to my suggestions are satisfactory. My opinion is that the paper should be accepted for publication following some relatively minor further revisions.

Given the number of substantial changes made, it's not surprising that some further iteration is likely to be worthwhile. I've made a number of suggestions below, nearly all of them quite minor, which could help to improve the paper's presentation. I start by commenting on the response to one of my main comments on the earlier draft.

Responses to my comments

Thank you for taking the trouble to include as part of your responses some additional figures. From the additional figure 1, I can see that the Ekman pumping fields are more or less what one might naively expect from those for the wind stress curl. The meridional Ekman transport fields for CORE and JRA are interesting (and at present the time-mean zonal wind fields which give rather similar information are not displayed in any of the figures) though again the differences between them, in the right hand plot, don't look large. As the various fields play different roles in the dynamics I still think there is a case for including more of those of figure 1 within one of the figures of the paper. But it is quite late in the day to do that, to get the most out of the figures showing the differences between fields one would probably need to use a more

discerning scale, and the discussion now mentions these fields in an appropriate way. So I leave this to the authors' discretion.

Thank you for the feedback. Since we feel that the additional plots do not add substantial further information and the paper contains already 12 figures we decided against including another figure.

#### Main suggestions

There are some new results quoted in the abstract about interannual to decadal variations in the nSEC and NECC. These seem to be genuinely interesting results but they are not presented until the very end of the results section (subsections 3.3.5 and 3.3.6), only one of them is illustrated by a figure, and that figure is in the appendix. Could a figure illustrating these results be included in the main body of the paper? Might sub-sections 3.3.5 and 3.3.6 come earlier in section 3.3?

Thank you for this suggestion. We extended former Figure A5 with a comparison between zonal wind stress and the NEUC as well as the nSECu and included it in the main text (now Figure 12). For consistency, the order of currents the sections and figures is generally the same (EUC, NEUC, SEUC, NECC, nSEC). This is why the results for the NECC and nSEC are coming last. To be consistent, we decided not to change the order of section 3.3.

#### Additional suggestions

1. Some aspects of the wording could be improved. In particular:

- the word “both” still appears 58 times. In many (but not all) cases it should be replaced by “the two” (e.g. lines 6 and 16) –  
Changed throughout the manuscript.
- the subject and the verb need to agree (both should either be singular or plural) (e.g. line 8)  
Changed throughout the manuscript.
- the tense of the verbs should be checked – the past tense is over-used  
Changed throughout the manuscript.

Perhaps Mark Inall as a native English speaker could review these aspects of the text.

2. Line 20: commonplace is one word. I can see that this sentence is trying to say something important but in my view it still doesn't quite work.

Thank you for pointing this out. We shorten the sentence for clarity (L20-22).

3. Line 27: ecosystem should be plural here

Changed (L 27).

4. Lines 63-64. Later you say that the Sverdrup transport also influences the EUC (which agrees

with the description of the EUC in Vallis' textbook 2017 section 22.3) . I suppose you are not implying here that the wind on the equator is the only factor driving the EUC but it could be read that way.

Thank you for pointing this out. We edited the sentence for clarity (L63-65)

5. Figure 1: Are the tiny black arrows on figures 1a, 1b and 1c surface wind stress vectors? I don't see any mention of them in the text or figure caption. If you keep the arrows would it be possible to make them slightly larger (at least in figure 1c) ?

Thank you for pointing this out. We edited the caption and increased the size of the arrows for clarity.

6. Line 104: replace "having additionally" by "with"

Changed (L105).

7. Line 124: described -> describe

Changed (L114).

8. Line 306: do you mean the near-equatorial currents? Geostrophy of course does not hold at the equator.

Thank you for highlighting. We edited the sentence accordingly (L307).

9. Line 309: change "this section" to "the 23oW section" and delete "along 23oW section" later in sentence

Changed (L309).

10. Line 338: The Angola Dome region is rather narrow in longitude; is the Ekman pumping of the SEUC really confined to this region? Also my impression from Fig 1 is that this region is somewhat south of the core of the SEUC.

The region between 7.5° and 4.5°S, 0.5°W and 2.5°E forms a subregion within the entire Angola Dome region. Doi et al. (2007, doi: 10.1175/2007JPO3552.1) found that two domes exist within the Angola dome region, with a weaker dome centred at 6°S, 1°E. The authors found the upwelling of the weaker dome to be associated with changes in the SEUC strength. The core position of the SEUC varies between 4°-5.5°S overlaps most of the time with the northern boundary of the weak dome region. Similarly, the core of the NEUC is located just south of the Guinea Dome region.

11. Line 348:  $U_{\psi}$  is the zonal transport between the N and S "bounds". It is strange to call it "the meridional divergence of the meridional Sverdrup flow"

Thank you for highlighting. We edited the sentence accordingly (L348-349).

12. Line 409 – incoherence isn't the right word

Thank you for pointing this out. We edited the sentence accordingly (L410).

13. Line 469: “boundary conditions” -> “parameters”

Changed (L424)

14. Line 482 is -> it

Changed (L483).

15. Line 519: delete “meridional”

Deleted (L520).

16. Figure 8 caption: “annual mean zonal wind stress anomalies with respect to the seasonal cycle” – is that what you mean to say?

Yes. The anomalies are calculated by removing the seasonal cycle (1980-2009) from the monthly mean output before temporally averaging to annual resolution. We edited the caption for clarity.

17. Figure 9 caption (b-g) should be (b-f)

Changed.

18. Line 555: “The transitioned” is “AMV” missing ?

Added (L556).

19. Lines 572-573: This sounds quite a significant result ( $R=0.75$ ). It would be nice to see a figure illustrating it (somewhat similar to Fig A5) so that the reader can better judge its significance.

Thank you for this suggestion. We extended former Figure A5 with a comparison between zonal wind stress and the NEUC as well as the nSECu and included it in the main text (Figure 12).

20. Line 583: delete second “on”

Deleted (L513).

21. Figure 10: The labels for CORE and JRA are really very small

Thank you for highlighting. We increased the font size of all labels in Fig. 10.

22. Line 661: “meridional Sverdrup” I think should be “zonal Sverdrup”

Changed (L662).

23. Line 617 & Figure A5: This is one of rather few results that is highlighted in the abstract. Figure A5 looks very convincing. Shouldn't it be one of the figures in the main text rather than the appendix? (see main suggestion above)

Please see answer to main suggestions above.

24. Line 623-624: This result is highlighted in the abstract. It would be good if it could be illustrated in a figure.

Please see answer to main suggestions above.

25. Line 638-639: "However..." please check this sentence.

Thank you for highlighting that the sentence was not clear. We edited it for clarity (L639-642).

26. Line 648: Figs 2 and 9 do not show wind stress fields?

Thank you for pointing out that we referenced to the wrong figures. We corrected that (L652).

27. Line 651: please check the position of "across the entire basin" in this sentence

Thank you for highlighting. We edited the sentence for clarity (L654-655).

28. Line 665: "Both" -> "The two"

Changed (L668).

29. Line 669: "are" -> "can be"

Changed (L672).

30. Line 673: "a strong" -> "an overly strong"

Changed (L676).

31. Line 675: I find this difficult to see. Was it highlighted earlier?

32. Line 684: omit "meridional"

Changed (L687).

33. Line 698-700: refer to Fig A5?

Changed (L702).

34. Line 719: "both" -> "the two"

Deleted both (L722).

35. Line 734: "onto" -> "on"

Changed (L644).