

Interactive comment on “African Easterly Waves in an Idealized General Circulation Model: Instability and Wavepacket Diagnostics” by Joshua White and Anantha Aiyyer

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We are grateful to reviewer 2 for their time and effort in helping improve the content of the paper.

1 Responses to comments

1. P. 2, l.45 and p.3, l. 62: It is not clear what you mean by “antifriction” in this context.

C1

Could you use a different word or provide a bit more explanation in the text?

Response: We have replaced this by: Destabilization by moist convection and dust aerosol forcing both in the section title as well as in the paragraph.

2. P. 3, l. 60: What do you mean my “the background PV gradient is single-signed”? Do you mean by that that there is no meridional reversal of the PV gradient?

Response: Yes.

3. P. 3, l. 78: “s” does not need to be in italics.

Response: Thanks! Good catch.

4. Figure 1 and others: Why don’t you call the time-longitude diagrams Hovmoeller plots? You do refer to them later in the text. They are a common type of diagram so why not be consistent throughout? Also, in Latex you can use the correct way of writing with two dots on the “o”, which I can’t do in Word.

Response: Done!

5. Figure 1: The caption would be easier to read if you move (a) before “the year 2006” and (b) before “2008”. You use this order of giving the labels of the subplots in some of the later figure captions. It would be good to be consistent. I think ERAI is more commonly abbreviated with a capital “I”.

Response: Corrected.

C2

6. P. 2, l. 94: "the wavepackets are collocated with the AEJ" – Are you referring to the right column of Figure 6? However, you are still talking about Fig. 1 and I can't see the location of the AEJ. Could you potentially add the jet location using contours?

Response: We have added the reference to Figure 3 for the location of the jet to make this clear.

7. P. 4, l. 93: Avoid using "significant" if you haven't carried out any significance tests.

Response: Agreed. Replaced it by "much."

8. P. 4, l. 97: Remove space before the full stop.

Response: Corrected.

9. P. 4: l. 99: Include "relation" or something similar after "this".

Response: Done

10. General comment: You start a number of sentences with "this" also in consecutive sentences. It is not always clear what "this" refers to and makes the sentences a bit unspecific. That could be avoided by adding, for instance, a noun after "this".

Response: We have attempted to do that where ever the context was not clear

11. P. 4, l. 101: What does "its" refer to? The wavepacket?

Response: Yes

C3

12. P. 6, l. 137: Remove "also".

Response: Done

13. P. 7, l. 155: What do you mean by "this posits"?

Response: We mean that this asserts or postulates

14. P. 7, l. 179: Hemispheres – plural needed here.

Response: Done

15. P. 8, l. 202, 204: Comma needed after the equation.

Response: Done

16. P. 8, l. 208-208: What do you mean by "it"?

Response: it refers to β

17. P. 8-9: l.211-220: After the dash start with an upper-case letter. I think it is a bit confusing that you give the total number of basic states of 779 before you explain how you create them. Could you say "in the following three types of basic states:" in line 201 and then insert after the itemization something like "In total that gives 779 basic states".

Response: Thanks! Done.

C4

18. P. 9, l. 222: "Each simulation". I'm not really sure how you run these simulations. Do you drive the GCM with each of the basic states? Could you make that clearer in the text?

Response: Yes, we do. The GCM is run 779 different times. Each run has a different basic state. This is now explicitly mentioned in Section 3.2.

19. Fig. 3: From the text it is clear that the figure is based on the climatological basic state, but that is not clear from the figure caption.

Response: We have added "JJAS 1987–2017 averaged" to the beginning of the figure caption.

20. Figs. 4, 7: Add "horizontal" before "wind".

Response: Corrected

21. P. 10, l. 229: "fixed heating produces a baroclinic vortex" – Where and why? A bit more explanation would be good here.

Response: We have now clarified that this is consistent with the results shown in Thorncroft et al. (2008). Since the analysis of the transient response is not the focus here, we hope that the interested reader will refer to Thorncroft et al. (2008).

22. P. 10. L. 235, p. 13, l. 266, p. 14, l. 273: Delete "clearly" and in other places too. "Clear" and "clearly" can mean different things to different people.

Response: Agreed. Done

23. Fig. 5: Why does panel (a) have no colour bar? Or is it the same as in (b)? That is not obvious. The black dot here and in other figures is a bit hard to see and it looks more like a half circle than a dot.

C5

Response: The label bar was originally left off since scale is not important with our linear model, but we have added the label bar to Fig 5(a) to be consistent. Also, we have changed "black dot" to "black semicircle at time 0 days"

24. Fig. 6 and a few other of the following figures: The labels are too small to read. Is that because of the resolution of the figure? Is that lower for the review process than for publication? It would be better to make sure that labels can be read easily.

Response: The figures have been enlarged.

25. P. 12, l. 246: When talking about surface westerlies, please refer to the right column of Fig. 6. I assume this is where you want the reader to look at.

Response: Done

26. P. 12, l. 250: "Consistent with it" – "it" refers to what?

Response: In the context of the preceding sentence, "it" refers to the reversal in PV gradient which along with the sign of the zonal flow, satisfies the condition for mixed barotropic-baroclinic instability.

27. Section 4.2: Why is the behaviour so different for the long-lived basic state compared to the short-lived and intermediate basic state?

Response: As we point out in the discussion, in all basic states, a near-stationary wavepacket ensues. Each state is unstable under inviscid conditions. Inclusion of damping, however effectively stabilizes the short and intermediate basic state. For the long-lived case, the energy conversions are sufficiently strong to overcome reasonable damping.

C6

28. P. 14, l. 283: Is there no commonly used symbol for the growth rate? A dot is missing at the end of the sentence.

Response: Added the dot.

29. P. 14, l. 292: p and A need to be defined as well.

Response: Done.

30. P. 16, l. 297: Perturbation velocity has already been defined. Remove the space before the comma.

Response: Done.

31. P. 14, l. 300: What do you mean by “half-wavelengths in the zonal direction”? **Response:**

To calculate the surface integral, we define the area A such that it spans half the wavelength in the east-west direction and 5–30N in the north-south direction. This is based on the work of Orlanski and Chang (1993) as adapted by Diaz and Aiyer (2015).

32. P. 14, l. 303-304: Remove the space before the degree symbols.

Response: Done.

33. Fig. 13. Here the labels are too small again. In the bottom row the labels seem to be partially cut off. Labelling the subfigures with a, b, c, d would be good. In the caption you refer only to panel (a) and not the others.

Response: We have increased the label size and fixed the bottom row labels that were partially cut off, and we have labeled the subfigures and called them out appropriately in the caption.

C7

34. P. 17, l. 307: Lower-case “in”.

Response: Done.

35. P. 17, l. 309: What do you mean by “these additional energy sources”? Are you referring to the destabilizing role of moist convection and SMD?

Response: Yes.

36. P. 17, l. 316 – 317. Three sentences begin with “this”. Particularly the last “this” is unspecific.

Response: Agreed, thanks. We have reworded and edited this section to make it clearer.

37. Fig. 14: Levels are cut off on the y-axis of panel (a). Lower-case ‘s’ for steamfunction and remove the space before the degree symbol.

Response: Done.

38. Fig. 15: The labels are too small.

Response: Label sizes have been increased.

39. P. 18, l. 321: Sometimes you reference equations as Eq. X and sometimes as Equation X. Please be consistent.

Response: Done.

C8

40. Fig 16: Panels need labels.

Response: Labels have been added.

41. P. 19, l. 328: Comma after “however”. **Response:** Done.

42. P. 19, l. 330: Comma after “case” and delete “this is”.

Response: Done.

43. P. 19, l. 335: Not clear what you mean by “this” here. Do you mean your study or analysis?

Response: Yes, the paper.

44. P. 19, l. 343: What do you mean “three additional simulations are performed”?

Response: It refers to the 3 ensemble averaged basic states. This sentence has been reworded.

45. P. 20, l. 347: PV has already been defined, so please use it.

Response: Done.

46. P. 20, l. 358: Insert “located” before “above”.

Response: Done.

C9

47. P. 20, l. 258-355: When you say stronger and higher please add compared to what. Consider adding a comma after “conversions” and replacing “this” with “which”.

Response: The comparison is relative to the short-lived case as noted in the previous sentence. We have edited the sentence per your recommendation.

48. P. 21, l. 379: You could remind the reader what you mean by “criticism regarding the limited zonal extent of the AEJ” as this is one of your main points.

Response: Done. The sentence now reads: This addresses the criticism that the limited zonal extent of the AEJ may be an impediment to AEW growth.

49. P. 21, l. 383: Do you mean your results? What does “this” refer to? There is another “this” in the next sentence. **Response:** Thanks again for pointing this out. We have edited the sentences for clarity.

50. P. 21, l. 395-396: The hyphens have a different length.

Response: Fixed it.

51. The list of references contains inconsistencies. For some papers the paper title is written so that every first letter of the word is a capital letter, but for some papers that is not the case.

Response: We used the WCD L^AT_EX template for typesetting and will work with the copy editors to fix this.