

Response to Reviewer

We thank Dr Manney for her second review, which we respond to the specific points made by below. For clarity, and following the notation in the written review, we define 'General Comments' as those in the written review and 'Specific Comments' as those labelled in the PDF attached to the review.

A General Comments

A. *I still believe that the motivation / reasoning for the choice of datasets used (specifically, why you want to use MLS rather than ERA5 for most of the “dynamical context” material) should be stated – it is a choice, both datasets are of a quality that supports the analysis you are doing – but I think most readers would like a brief statement (perhaps in the second to last paragraph of the introduction where you list the datasets you are using) of your reasons/philosophy in making that choice.*

The philosophical motivation for using Aeolus data is clearly outlined by lines 37-41 of the (current version of the) manuscript. The use of MLS for temperature rather than reanalysis is a consistent and logical extension of this philosophical position, and therefore we argue that to add further text describing is not necessary. Furthermore, for specialist readers who may be curious about this, our position has been explained already in more detail in our previous Response to Reviewers, which will be perpetually available with the published paper.

B. *While the 3D images in Figure 8 are improved over the versions in the original manuscript, they are still difficult to get much information out of and to see the (few) features that are pointed out in the text. While I don't insist that it be deleted, IMO this figure (and the corresponding supplementary figure, which should be updated with the same format changes as Figure 8 if retained) is unnecessary.*

Different readers mentally visualise and interact with data in quite different ways. The 3D plots, while perhaps uninformative to the reviewer, have been favourably responded to as a way to interpret the data at conferences where they have been presented and discussed and, as the reviewer implies by not “insist[ing] that it be deleted”, do not take anything away from those for whom they are less intuitively useful. We do however agree with the reviewer that the mismatch between Figure 8 and Figure S4 is unhelpful, and have removed Figure S4 and reference to it.

C. *Per the query in the author's responses, the Smith et al (2019) paper mentioned in my original review is <https://doi.org/10.1002/qj.3690>.*

[Wright] Thanks for this - now I've seen it I recognise having read it previously!

D. *Grammar and/or Style that substantially impairs clarity ... [like missing] Oxford commas, ... “due to” where what you mean is “because of” (along with numerous instances where you use it correctly), and where “which” rather than “that” is used for a restrictive clause.*

Our response to the stylistic comments provided in the previous round of reviews was perhaps somewhat terse. To expand upon this for clarity: many of the issues specified (viz., restrictive that/which, mandatory Oxford comma use, due/because) are well-documented differences between British (BrE) and American (AmE) written technical English, rather than scientific or drafting errors. As Copernicus journals provide professional copyediting after acceptance and we intend to select 'British English without the Oxford comma' at that stage (this is a standard option for Copernicus journals), changing these features of the written text is not a good use of research staff time at this stage of the process unless these differences

make the meaning obviously unclear (which we would strongly argue they do not), and is likely to introduce extra work for our copyediting colleagues at the next stage of the process.

Accordingly, while we acknowledge the time and energy the reviewer has spent on these comments, we have in general not made a large proportion of such requested changes; those we have changed are enumerated individually below in the 'Specific Comments' list. These differences may potentially be confusing for some AmE readers: however, we highlight that there are just as many stylistic features of AmE scientific writing which are confusing for BrE readers, and which are left intact (and often introduced by the copyeditors!) in AmE-edited journals.

B Specific Comments

1. **L008** Changed.
2. **L029** Interesting comment - I used to do this on all my papers where appropriate, but had a reviewer attack me quite hard on a recent manuscript because they found it "unnecessary" - so this very much demonstrates the variety of views of different readers! I've put this (and subsequent iterations of the same comment) back to have the [e.g.].
3. **L032** Added.
4. **L040** Changed.
5. **L041** Changed.
6. **L051** Changed.
7. **L052** Disagree - this is to contrast with the snow cover extent, which is not an atmospheric variable.
8. **L055** Disagree - required for flow in light of previous comment.
9. **L072** Doesn't seem to make any semantic difference, but changed anyway.
10. **L086** In this specific case we agree comma use is ambiguous, and have added one.
11. **L100** Doesn't do any harm and is more euphonious than the alternative, so unchanged.
12. **L117** Lettering fixed. The ordering of the MLS above the Aeolus data in Figure 1 is intentional, even though it is reversed from the text - it maintains the same order of panels as in Figures 4 and 5 below, which facilitates skim-reading.
13. **L120** Updated. The retrieval differences described by the DQD as having taken place between v4.2 and v5.0 for GPH and (sections 3.8.2 and 3.22.2) don't seem to affect the numbers we quote, but we are happy to be corrected on this.
14. **L124** As 13.
15. **L128** Clarified as 'binned onto'.
16. **L141** Removed.
17. **L146** Fixed.
18. **L148** Fixed.
19. **L157** Clarified.
20. **L165** A reference to the specific SRIP Special Issue paper on comparisons to obs rather than reanalysis systems in general has been added.
21. **L167** Changed.
22. **L168** Fixed.
23. **L181** Clarified.

24. **L193** It may be useful to a weather centre audience, and doesn't do any harm being included - but agreed, probably not worth doing in hindsight. However, since the work was done, it is marginally useful to include it for this reason, particular since Aeolus is assimilated into the OpAI and not ERA5.
25. **L224** Changed.
26. **L242** Changed.
27. **L261** Changed.
28. **L265** Actually the victim of a search-and-replace to update the numbering of the supplementary figures in the first revision - fixed!
29. **L266** Moved as suggested.
30. **Figure 4 and Figure 5** Agreed and increased in size.
31. **L278** Changed to 'substantive'.
32. **L291** Changed as suggested.
33. **L305 onwards** Changed as suggested.
34. **L324** Changed as suggested.
35. **L338** Fixed.
36. **L340** Changed to 'near-median values'.
37. **L350** Oops! Added 'is seen' so the sentence actually has a verb.
38. **L355** Changed as suggested.
39. **L372** Added as suggested.
40. **L374** Removed as suggested.
41. **L384** Fixed.
42. **L388** Altered as suggested (and with the same comment as [2] above!)
43. **L399** Agreed, removed.
44. **Figure 7 caption (x2)** Both changes made as suggested.
45. **Figure 8 caption** Changed as suggested.
46. **Figure 9 caption (x3)** All changed as suggested.
47. **L527** Text removed in response to Major Comment B.
48. **L531** Text removed as suggested.
49. **L534** Fixed!
50. **L547** Interestingly I (Wright) would read the symbol ">" to include the word 'is': I was taught to read the symbol as "is greater than", not just "greater than". So, I've left it without the added word for now, but happy to change if requested by the copyeditors.
51. **L549** "in the vortex-edge winds" removed.
52. **L553** Changed to "that observed by Aeolus earlier in the winter".
53. **L555** "and" replaced by comma.
54. **L561** "flows" removed from both cases.
55. **L587** Agreed, clearly this slipped through from the previous version (and has a grammatical error in as well!). Rephrased to be supported by the current data presentation.
56. **L594** text replaced with your (much better) phrase.
57. **L654** "at" changed to "by".

58. **L665** Changed as suggested.
59. **L666** “jumble” changed to “mixture” to remove the connotation of randomness.
60. **L690** Reference added.
61. **Figure 10 caption (x2)** Both fixed.
62. **L710** Changed as suggested.
63. **L713** Changed to “affected”, as suggested.
64. **L715** The paragraph has been modified and a reference to Lee et al, GRL 2019 added.
65. **L725** Unchanged - this represents potentially useful signposting for some readers given that different dates are shown here than in the figures above.
66. **L730** Changed as suggested.
67. **L731** Changed as suggested.
79. **L734** References added as suggested.
69. **L739** Additional clarifying text and two references have been added.
70. **Figure 11** The figure has been redrawn with bolder contours.
71. **L748** Changed to “low” as suggested.
72. **L753** A reference to Kodera et al, JGR 2013 has been added.
73. **L766** The text has been clarified and two references added.
74. **L769** Not quite sure how this clause leaked through - it was in the original version, but is not in the source code of the revision. Possibly a minor bug with latexdiff?
75. **L775** Disagreed - left unchanged (i.e. no comma added).
76. **L794** ‘Many aspects of’ added as suggested.
77. **L796** Prefixed with “Aeolus-”.
78. **L798** Added as suggested.
79. **L801 onwards** Agreed, but beyond the scope of this study.
80. **L802** “Zonal” added.
81. **L807** Preliminary data do show these features in the Mie data, so the statement is actually fairly supportable. These results have however not yet been published in the scientific literature due to lack of staff time.
82. **L818** Agreed, fixed.
83. **L930** Typo fixed.