

Interactive comment on “Comparison of large-scale dynamical variability in the extratropical stratosphere among the JRA-55 family data sets” by Masakazu Taguchi

Anonymous Referee #1

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General Comments

This paper compares extratropical dynamic variability between three JRA-55 data sets: the standard reanalysis product (JRA-55), a product which assimilates all observations except for satellite data (JRA-55C), and a product which uses the same NWP model without any assimilation of observations (JRA-55AMIP). Without satellite observations, JRA-55C misses or delays several major sudden stratospheric warmings (MSSWs), and with no data assimilation, JRA-55AMIP has a much lower MSSW frequency. The author explores these differences in detail and with scientifically sound methods. I think this paper is appropriate for ACP and presents interesting results, and I would recommend for publication, after addressing my minor concerns below.

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One general but minor comment I have is that the use of the STDD, CONV, and AMIP acronyms was not particularly useful and in fact made things more muddled. I would recommend just sticking with JRA-55, JRA-55C, and JRA-55AMIP. If the author thinks the acronyms add something, then the acronyms should at least be used earlier in the abstract/introduction so that readers become used to seeing them prior to section 2.

The other general comment I have is that I appreciated the creativity the author used to make the plots, some of which were very useful ways of visualizing the results; but Figure 8 went a bit overboard, with different symbols, colors, letters and numbers. Some of these attributes may be useful, like the colors; but the different symbols didn't seem to point to anything of particular interest. Right now the text reads (Page 8, Line 21-22 and Line 27-28): "Both overestimations and underestimations in the zonal wind by CONV occur for these cases", which indicates that these symbols are not adding much to our understanding and making the plot more difficult to read. The author could just make a note in the text that they also considered biases in the CONV winds relative to the STDD winds but didn't notice any systematic relationship.

Specific Comments

Page 1, Line 9, 19: It is not entirely clear what "conventional" observations include until section 2. It would be better to directly state here that this means everything except satellite data.

Page 1, Line 13: Readers unfamiliar with vortex geometry diagnostics may be unfamiliar with "aspect ratio" of the polar vortex; might be good to briefly relate this to displacements/splits here to be clear. Also in section 2.2.2.

Page 2, Line 17: Here, is "This study" referring to S-RIP, or to the current study?

Page 3, Line 21: prior to 1979, how different are the CONV and STDD products?

Page 5, Line 9-10: Might mention that the tropospheric jets seem shifted, which may (or may not) be consistent with biases in the stratosphere.

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Page 6, Lines 32-33, Figure 5: Maybe I'm just confused about what exactly this plot is showing, but I don't understand why in panel (b), the black dots representing STDD don't seem to match the location of the STDD dots in panel (a). This makes lines 32-33 also confusing, as the statement does seem accurate based on the red/black dots in panel (b) but does not seem accurate when comparing panel (b) to panel (a).

Page 7, Line 5-6: Might mention that this implies few splits in AMIP.

Page 8, Line 19-20: the closeness to the y-axis may indicate a large contribution from the wave component, but in terms of proximity to the y-axis, there seems to be many "red"/weak wind points as well as strong ones. Might need to rephrase to clarify that for large values of the y-component, the zonal wind is stronger.

Page 9, Line 5: Just to clarify, in Figure 9 are you comparing the products using dates from STDD for both, or the central dates of each product?

Page 10, Line 12-13: Just to clarify, in Figure 11 are the grey lines all the cases between 25-75th percentile? Also, is the number of cases in your stated 25-75th percentile range similar for AMIP and STDD? It looks somewhat similar in Figure 10 but might be worth mentioning. Also you could consider drawing in light dashed lines the 25th and 75th percentile lines in Figure 10, as a way to clarify what you are plotting in Figure 11.

Page 12, Line 10-12: Is there a difference in latitude of maximum heat flux/EPFD forcing, or a difference in the maximum winds of the climatological polar jet in these data sets (or the edge of the vortex)? Could that also have an influence?

Page 15, Table 1 caption: make clear that "differences" are the number of days between onset dates.

Page 16, Figure 1: It wasn't entirely clear from this figure whether values between -5 to +5 are not significant (since they still are shaded)- could this be more clear? Or are any shaded values significant? I guess it's confusing since the colorbar doesn't have any white, non-significant level.

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Page 18-19, Figures 3-4: I think these could be made more clear by staying consistent across panels and always making STDD line dashed, even in panel (a),(d). Also state in the caption what the non-bold and bold lines refer to.

Page 19, Figure 4: I would add in DJF to the plot titles for the top row and SON to the plot titles for the bottom row.

Page 26, Figure 11: by residual $[v]$, do you mean the TEM term $v\text{-bar star}$? Or what is meant by residual $[v]$? (and page 10, line 17).

Technical Corrections

Page 1, Line 18: change “It shows” to “We find”

Page 1, Line 21: “vital” is maybe not quite the right word here

Page 1, Line 26: “Some of weak conditions” → remove “of”

Page 2, Line 5: “the middle atmosphere science”; remove “the”, change to middle atmosphere dynamics

Page 2, Line 10: Missing “with” after “associated”

Page 2, Line 11: “metrological” should be “meteorological”

Page 2, Line 13: I would change “go along with” to “are part of”

Page 2, Line 33: I’m not sure what is meant by “articulate design”. Maybe “meticulous” would work better? Same with Page 11, Line 25.

Page 5, Line 22: change “at the grid points are” to “at this location is”

Page 5, Line 32: delete “the”, change “wind” to “winds”

Page 7, Line 23: should be Fig 6b,d.

Page 8, Line 3: change “whereas even in” to “and even” (remove “in”)

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Page 8, Line 10: change to “Figure 8 presents scatter plots of the zonal and wave components contributing to the total RMSD values for these cases.”

Page 8, Line 12: Change “on” to “of”

Page 9, Line 20-21: change to “explained in terms of wave forcing from the troposphere and/or the vortex response in the stratosphere.”

Page 10, Line 13: change to “25th” and “75th”

Page 10, Line 16: might say “This feature is quite similar between the two products by construction” since you have chosen the range of heat flux values to be similar.

Page 10, Line 23: not sure “contributed by” is the right phrase here. Maybe “can be attributed to”.

Page 10, Line 33: change “use” to “uses”

Page 11, Line 15: change “larger in magnitude as going toward” to “increases in magnitude toward”

Page 11, Line 30: change “These differences of CONV” to “The differences in CONV”

Page 12, Line 19: change “should” to “could” (since model biases are potentially possible in CONV as well, given lack of non-satellite data in stratosphere).

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