

Atmos. Chem. Phys. Discuss., referee comment RC1  
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## Comment on acp-2021-224

Young-Ha Kim (Referee)

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Referee comment on "Intercomparison of middle atmospheric meteorological analyses for the Northern Hemisphere winter 2009–2010" by John P. McCormack et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-224-RC1>, 2021

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The paper compares, among four high-altitude analyses, the representation of the zonal-mean temperature and wind and the amplitudes of planetary and tidal waves. The result serves as an initial estimate of uncertainty of the high-altitude analyses. The analysis period is not long but benefits such an estimate by including an important phenomenon of wintertime variations, the sudden stratospheric warming. Although this is an initial analysis (based on the authors' statements), the result already contains plenty of information, and I believe that it will provide a useful insight that can contribute to the future improvement of the middle-atmosphere assimilation and to the whole-atmosphere modeling.

The paper is written in a logical manner, and the quality of presentation of the results is good. I recommend this paper for publication with technical corrections. Please check the below.

[ Specific comments ]

(mostly technical)

**L19** : "can" consistently represent ? If you would mean that they are currently consistent, it seems to be contradictory to the "large discrepancies" in L29.

**Fig. 1** : The "tropopause" is at the ground.

**L64** : I would suggest removing "(non-orographic)" because this could be misleading (as there exist primary orographic waves in general).

**L72** : Please remove the comma after "predict".

**L96** : "in the equatorial region the lack of wind measurements ..."

**L100** : "that" to "than"

**L117** : Maybe one of the two "constrained" might be removable.

**L154-155** : "which previous ... system." : This seems to need to be rephrased.

**L159** : "horizontal and vertical" or "zonal and meridional" ? (By the way, has there been a place where  $v$  or  $w$  is used for this intercomparison ?)

**L183** : "produces global synoptic gridded atmospheric data sets" : repetitive (L159)

**Section 2.1-2.4** : Horizontal and vertical resolutions of the four models : Would these be easier to read from a table rather than from the text in each section ?

**L226** : "for the surface" to "from the surface"

**L227-228** : Maybe the second "system" (L228) should be removed.

**L261** : "additional" : to what ? (Or just remove this word.)

**L299** : " $\gamma_{45}$  is ... latitude" on the surface ?

**Fig. 2 caption** : I could not find the thin horizontal line in the figure.

**L330-331** : "Between 50 km and 80 km" : the summer/winter polar mesopause explained in this sentence exists outside of this range of altitude.

**L355** : "0 deg S" to "0 deg" (or "0")

**L353-366** : Regarding the mean wind (and temperature) bias in WACCMX+DART : Could you please provide some potential reasons or relevant references for this bias, if possible ?

**L382** : "... state." : A reference would be helpful.

**L384-385 (also in L464 and L495)** : "suggesting that differences in the treatment of gravity wave drag may be a primary factor explaining the large differences among the analyses above 80 km" : Provided the existence of the difference in parameterized GW processes between models (which I fully agree), what would be the role of the differences in the data assimilation methods ? Would the larger difference between WACCMX+DART and the others than the difference among the latter three (shown in Figs. 2 and 3) mean that the difference in GW parameterization is also larger for WACCMX+DART from the others ?

**L420** : "eastward" : Would it be "westward" ?

**L500** : I would suggest changing "Difference among ... in the analyses" to "The spread of ... among the analyses".

**L516** : "addition"

**L521** : "in daily-mean temperature at ..."

**L548** : "in each hemisphere during summer" : It was not clear to me. Is it mean the northern summer ? Or, the solstices ?

**L554** : "4-6 days" ? (or 0.24 cpd ?)

**L555** : "high-altitude" to "high-latitude" ?

**L599** : "seasonal" to "altitude" ?

**L601-609 and L639-641** : In these lines, the day-to-day variations of tides associated with SSWs in previous studies are being discussed. I would suggest moving this content to L653 where I see it is more relevant (with Figs. 17-19), as the current paragraphs are explaining the monthly mean amplitudes of tides.)

**L611-612** : "latitude and ... January 2010" : repetitive (L599-600)

**L620-622** : The peak amplitude of the tide seems to appear slightly (5-10 km) below the top of each model. Would it be related to some damping mechanisms near the model top ?

**L644** : But at quite different latitudes : 35 deg S in MERRA2 and 5 deg S in JAGUAR-DAS

**Figs. 17-19** : 1) I would suggest exchanging (b) and (c) in order to be in the consistent order with the previous figures. 2) If the vertical lines indicate the boundaries of the months, please provide this information in the caption. If they are not, please include "(Day XX)" (the x-axis value) after "early February" in L671 and L676.

**L656-659** : Could it be removed but with just referring Section 2 ?

**L660-661** : This might be removable. : repetitive (L654-655)

**L679** : Would it be possible to check the statistical confidence in the wavelet spectrum ? (like in Torrence and Compo, 1998, BAMS)

**L684** : "to convective sources" : A reference would be helpful.

**L694-695** : Please rephrase this sentence.

**L717** : I would suggest adding "at the equator" after "50 km altitude".

Throughout the text, there exist expressions like "from 10-20 km" or "between 10-20 km". I would suggest revising these to either "from 10 to 20 km" ("between 10 and 20 km") or "at 10-20 km". The lines where I found those are : L35, 44, 162-164, 234, 238, 239, 294, 335, 365, 441, 547, 586, 589, 694, 698, 715