Atmospheric
Chemistry
and Physics
Discussions

Interactive comment on "Interannual variability of the boreal summer tropical UTLS in observations and CCMVal-2 simulations" *by* Markus Kunze et al.

Anonymous Referee #2

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General comments:

This paper contains some interesting analyses regarding transport dynamics associated with the Asian summer monsoon that could potentially be important scientific contributions and worthy of publication in Atmospheric Chemistry and Physics. However, as it stands, the paper has severe weaknesses that make it unpublishable in its current form. The most glaring problems are that it is poorly organized, lacks focus, and the logic of their analysis is often lost in descriptive details that are not relevant to the main points of the paper. An example of the lack of focus concerns Sec. 4 that discusses the 'assessment' of atmospheric models from CCMVal to reproduce temperature, water vapor and ozone distributions. This section is awash with details and confusing analysis that neither produces a finding significant enough to state in the abstract nor one that is (apparently) used in subsequent analysis.

There are also problems with the logic of the arguments themselves – although the organizational problems of the paper make it difficult to properly assess the logic of these arguments. Consider the contention that the Tibetan plateau is the primary source of water vapor for the monsoon anti-cyclone. The sole evidence for that seems to be a peak in the correlation between temperature variability and their monsoon index found in the atmospheric models over the Tibetan plateau (at the 360 K potential temperature surface). Not only does this argument fail to show any dynamical relationship to water vapor variability, but the reliability of temperature signal is questionable; in comparisons to ERA-interim, the authors do not show values at 360 K, but they do show values at 380 K that are not in good agreement. A second example concerns the contention the anti-cyclone transports water into the mid-latitude stratosphere, but not into the tropical pipe. It seems that the sole evidence for this is the large water vapor mixing ratios found to the north of the anti-cyclone, but not to the south. Such a water vapor distribution could certainly arise for the reason that the authors contend, but they provide no evidence for a dynamical link that shows that the high water vapor concentrations are due, at least in part, to transport by the anti-cyclone. Furthermore, the results from Sec. 4 show large discrepancies between water vapor distributions from the CCMVal models and satellite observations.

I suggest that the paper be rejected but that the authors be encouraged to resubmit after a thorough overhaul that provides clear logical arguments backed up with strong evidence. For the revision, I suggest that the authors choose some small number (e.g., 3-5) of important points, choose the results that best illustrate those points and how uncertain they are, and then rewrite Secs. 4 and 5 accordingly. In particular, there are important aspects of the circulation that are not well reproduced by the CCMs (for example, water vapor distributions) that could easily undermine the results. A more careful and logical discussion will help determine just how strong of a case the authors actually have.

Specific Comments:

Many of the figures are crowded into too small of a space and not well labeled, making them difficult to understand. Please add explicit labels on the figures that help distinguish the different panels. For example: Fig. 1 should label the top panel MIDX and the bottom panel WIDX and Nino 3.4, Fig. 2 should label the top panels as 150 hPa stream function and the bottom panels velocity potential, and so on. Also, consider dividing the individual panels in a way that does not crowd them into such small spaces. Perhaps some of the panels can be left out of the paper.

Page 1, lines 4-7: State briefly what the CCM assessment is.

P. 1 L. 15-16: Be more clear: what is meant by 'consistent'? Weaker than what?

P. 7 L. 11-12: It is over-simplified to state that the 3 terms in equation (1) 'represent' the Hadley , Walker, and Monsoon circulations. That is, each term contains more than just those circulation features. It would be, for example, better to say something like 'Chi-star-prime is influenced by the monsoon circulation'.

P. 7, L. 17: Explain why you add an artificial seasonal cycle to MIDX (by changing from using maximum values of χ to minimum values). Given the strong seasonality of the monsoon, it should be possible to find an index that has a strong seasonal cycle without any artificial inflation.

Figures 3 and 4: The discussion of these figures is particularly chaotic and confusing.

P. 21 L. 4-5: Please clarify this discussion. It seems to me that Fig. 10a indicates positive regressions for MIDX onto OLR over BoB, Myanmar, and Taiwan. Doesn't that indicate weaker convection over these regions – instead of stronger as you state? Or do you mean to say 'we also get a decrease in convective activity over the BoB . . .'

Appendices: The Appendices are too terse to be useful. The autocorrelations discussed in Appendix B are not referred to in the main text (except at the end of Sec. 3 which merely states that autocorrelations were treated) and should be removed unless a more articulate discussion of how the autocorrelations affect the analysis is provided.

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Appendix A is also not necessary. You could simply mention that the criteria for significance are derived from the Z-test and refer the reader to Stouffer et al. (1949) and Whitlock (2005) for details.

Technical details:

Fig. 1 caption: Add the term 'WIDX' to the description. For example, 'bottom: index for the Walker circulation (WIDX; solid)'

P. 6 L. 4: Regarding 'graduate'. Do you intend this word to mean 'to make more gradual'? If so, this is an awkward use – if not, it's difficult to understand the meaning of the phrase. It would be better to use a different word.

P. 6, L. 8: Change 'indication for the' to 'indication of the '.

P. 6 L. 10: No comma after 'model'.

P. 7 L. 5: Change 'allows to express' to 'allows us to express' or some other grammatically correct wording.

P. 7 L. 24: The clause 'whereas the nino3.4 . . . variability' is a non sequitur – it implies contrasting behavior but no source of the contrast is given. Perhaps you intend to say something like 'the regression onto WIDX emphasizes the west Pacific circulation response to inter-annual SST variations whereas regression onto nino3.4 describes the larger (scale) response to ENSO variability.'

P. 10 L3: Change relative to 'relatively'. Also you should state what you are comparing to when you say it is relatively small (i.e., relative to what?).

P. 12 L. 6: Add (e.g., in parentheses) that the heating rates are displayed with red lines.

P. 21 L. 13: Change 'round' to 'around'

P. 21 L. 25: Change 'South to the AMA' to 'South of the AMA'.

P. 22 L. 5: Remove 'in' from 'temperature from in nine re-analysis datasets'.

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