

Response to Referee 1

We thank the reviewer for their additional thorough comments. We have addressed the minor corrections as detailed below. The reviewer's comments are shown in black, and our responses are shown in blue.

The manuscript is much improved compared to the previous version and I have only some minor comments, that should be considered before the final publication.

p2, L61: 'subsequent heating results in slow ascent at a rate of approximately 1.0-1.5 K per day within the AMA'

The ascent rate of depends on the used reanalysis. The number of 1.0-1.5 K per day is inferred from ERA-Interim reanalysis. Please check this in literature and make the statement more accurate.

Additional text (lines 61-64) that explains that the slow ascent rate is dependent upon reanalysis derivation with a supporting reference (Tegtmeier et al., 2020), and that the 1.0-1.5 K per day rate refers specifically to a study that utilized ERA-Interim (Legras & Bucci, 2020) has been added.

p3, L70: 'Muller et al., 2016' --> 'Müller et al., 2016'

The error has been corrected (line 73).

p5, L132: 'The study domain from 10°S to 55°N and from 40 to 115°E' --> 'The study domain from 10°S to 55°N and from 40 to 115°E (see Fig. 1)'

The suggested reference to Figure 1 has been included (line 134).

p6 L187: 'seasonal trends' --> 'intraseasonal variability'

The suggested wording was implemented (line 189).

p12 Fig. 3: To avoid any confusion it would be helpful to us in Fig. 3a others colors (e.g black and gray) in contrast to those used in Fig. 3b-d. In general all lines in Fig. 3 should be somewhat thicker.

Figure 3 has been updated with thicker lines in all panels, and the colors of the lines in panel a have been changed to black and gray.

p13 Tab.1: 'percent' --> 'fraction [%]'
'Area normalized percent' --> 'Area normalized [%]'

The headers in Table 1 have been changed as suggested.

p24 L478: 'There has been disagreement in prior work regarding whether oceanic or land-based convective source regions for the Asian monsoon anticyclone are more important.' Please add here to the discussion that differences in used reanalyses contribute to this disagreement.

Additional text noting that differences in reanalyses used across the studies referenced contribute to their disagreement has been added (lines 487-489): “Here, differences between the reanalyses used in modelling studies of Asian monsoon anticyclone convective source regions (e.g. Bergman et al., 2013; and Chen et al., 2012) contribute to the discrepancies amongst their conclusions.”

p25 L512: 'Our work also demonstrates that it is critical to consider multi-month time-scales given the large intraseasonal differences in the contributions of each source region. Confining an analysis to a single month would over-emphasize certain source regions while missing others.... '

The intraseasonal variability of different boundary source regions contribution to the Asian monsoon anticyclone is already discussed in Vogel et al. 2015. This reference should be mentioned within the discussion.

Discussion of the results of Vogel et al. (2015) regarding intraseasonal variability of different source regions to the Asian monsoon anticyclone has been added to the conclusion where our results on regional differences are first described (lines 472-474): “These findings are largely in agreement with Vogel et al. (2015), which examined the intraseasonal variability of convective source regions within the Asian monsoon region during 2012 with small differences likely arising from differences in time period considered and in the spatial regions considered.”

A reference has also been included in the final paragraph (lines 518-520): “Our work also demonstrates that it is critical to consider multi-month time-scales given the large intraseasonal differences in the contributions of each source region in agreement with Vogel et al. (2015).”

References

Legras, B. and Bucci, S.: Confinement of air in the Asian monsoon anticyclone and pathways of convective air to the stratosphere during the summer season, *Atmos. Chem. Phys.*, 20, 11045-11064, 2020.

Tegtmeier, S., Krüger, K., Birner, T., Davis, N. A., Davis, S., Fujiwara, M., Homeyer, C. R., Ivanciu, I., Kim, Y.-H., Legras, B., Manney, G. L., Nishimoto, E., Nützel, M., Kedzierski, R. P., Wang, J. S., Wang, T., and Wright, J. S.: Chapter 8: Tropical Tropopause Layer, SPARC Reanalysis Intercomparison Project (S-RIP) Final Report, No. 10, edited by: Fujiwara, M., Manney, G. L., Gray, L. J., and Wright, J. S., 2020b.

Vogel, B., Günther, G., Müller, R., Grooß, J.-U., and Riese, M., Impact of different Asian source regions on the composition of the Asian monsoon anticyclone and of the extratropical lowermost stratosphere, *Atmos. Chem. Phys.*, 15, 13699–13716, <https://doi.org/10.5194/acp-15-13699-2015>, 2015.