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Atmospheric Chemistry and Physics Discussions

Interactive comment on "An important mechanism sustaining the atmospheric "water tower" over the Tibetan Plateau" *by* X. Xu et al.

X. Xu et al.

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We are grateful to the reviewer for the encouraging comments and careful revisions which helped to improve the quality of our paper. In the following we quoted each review question in the square brackets and added our response after each paragraph.

[General comments This paper uses NCEP/NCAR reanalysis datasets to understand the hydrological cycle over the Tibetan Plateau. The authors show that plateau's thermal structure leads to the formation of two CISK type systems, characterized by lower level convergence and upper level divergence, which ladders the moist air up to the plateau. The analysis is sound and the results are well presented. I only have few minor concerns. Overall, I recommend the paper for publication in ACP after the authors

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address following comments.]

Reply 1: The encouraging comments are great appreciated.

[Specific comments Page 18259, Line 8: What are the longitude bounds for the region you considered for regional mean?]

Reply 2: The longitude bounds are between 93oE and 94oE. Accordingly, we have clarified the description the in the revised text and caption of Fig. 2.

[Page 18260, Lines 14-18: You say that frequency of occurrence of cumulonimbus clouds is 2.5 times the regional mean. Can you clarify which region are you referring to? Figure 6 shows that cloud fraction is much higher over southern slopes of Tibetan plateau. Given this, why should cloud fraction be higher over the Tibetan plateau?]

Reply 3: We have clarified these with "the annual occurrences of convective clouds (cumulonimbus) over the TP are observed with 2.5 times of the regional mean over the other areas of China" in the revised manuscript. Also, we have modified some sentence in Sect. 3.3 with "Figure 6 presents the spatial distribution of total cloud cover over the TP and its surrounding area in July 2008. During the Asian summer monsoon period, the dense cloud covers existed over the regions from the Bay of Bengal, South Asian monsoon region to the southern TP." High cloud fraction in Fig.6 are also located in the South Asian (Indian) summer monsoon region but excluding the other areas of China, which is caused by the two ladders of CISK system presented in this manuscript.

[Page 18260, Line 17: You mention Fig. 6 before Figs. 3-5. I would recommend rearranging figures based on the flow of text.]

Reply 4: Following the reviewer's suggestion, we have mentioned the "see Section 3.3" instead of the "Fig. 6" in that sentence to keep the structure of manuscript.

[Page 18260, Line 26-28: Can you please elaborate how elevated wet island prevents mixing of tropical air with the extra-tropical air?]

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Reply 5: Yes, it is elaborated with “the large TP topography prevents dry and cool extratropical air from “ventilating” the moist and warm tropics and subtropics” in the revised manuscript.

[Page 18261, Line 11-16: This is a very long sentence. Please consider breaking the sentence into smaller sentences. It is also not clear what you mean here by saying “correlation of Q1 with divergence in contours”. The caption of Figure 3 mentions “daily correlation”. Do you average daily correlations to construct middle panel of Figure 3?]

Reply 6: Thanks for the careful revision of reviewer.

We have broken this sentence into the short sentences in the revised manuscript as follows: “ The middle panel of Figure 3 presents the correlation vectors of the TP heat source column strength Q1 over the TP to the W- and V-wind components at the vertical sections around the TP averaged in July of 2000-2009. In this study, zonal, meridional and a vertical components of the correlation vector are derived through the correlation coefficients of Q1 to U- ,V- and W- wind (or transport flux) components, respectively, where the arrow length denotes the combined correlation with a longer arrow implying a better correlation, and the arrow direction means the direction of anomalous wind (or transport flux) induced by the TP-thermal effect. Therefore, the middle panel of Figure 3 indicates that the air ascent motions induced by the TP heating are profound over the TP during the summer monsoon period.”.

We don’t average daily correlations to construct middle panel of Figure 3. The caption of Figure 3 (middle panel) is changed into “Vertical sections of the correlations of the daily TP heat source column Q1 to the divergences (filled contours) and the correction vectors of daily Q1 to V- and W-wind components in July of 2000-2009. . . .” in the revised version.

[Page 18261, Line 20: Change “and also” to “but also”]

Reply 7: It is changed.

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[Page 18264, Line 6: Change “Bengal Bay” to “Bay of Bengal”.]

Reply 8: It is corrected.

[Figure 2: You say that zonal means are calculated along 93o-94o E. However, NCEP/NCAR reanalysis datasets are available at 2.5o resolution? How do you go from 2.5o to 1o for constructing zonal means?]

Reply 8: The NCEP/NCAR reanalysis datasets are available at 1o resolution after 2000. In this study, we used the NCEP/NCAR data of 2000-2009.

[Figure 3: What do you mean by “correction vectors”?]

Reply 9: In the revised manuscript, we have added the following description of “correction vectors” (also see the reply 6):

In this study, zonal, meridional and a vertical components of the correlation vector are derived through the correlation coefficients of Q1 to U- ,V- and W- wind (or transport flux) components, respectively, where the arrow length denotes the combined correlation with a longer arrow implying a better correlation, and the arrow direction means the direction of anomalous wind (or transport flux) induced by the TP-thermal effect.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 18255, 2014.