

Interactive comment on “Impact of typhoons on the composition of the upper troposphere within the Asian summer monsoon anticyclone: the SWOP campaign in Lhasa 2013” by Dan Li et al.

Anonymous Referee #1

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This paper examines three case studies on the impact of typhoons on ozone and water vapor in the upper troposphere at Lhasa, China. The data are from balloon ECC ozonesondes and cryogenic frost point hygrometers launched during a field campaign in August 2013. The CLaMS model is used to calculate air parcel 20-day back trajectories, and meteorological fields from ERA-I are used along with CALIOP backscatter data for identifying cloud-top altitudes near the Western Pacific typhoons.

The data are of sufficient quality for this analysis and the trajectory calculations are reasonably appropriate for tracing the origins of air parcels sampled by the balloon flights. The text is well organized and the figures are generally clear. Overall, this paper makes a strong contribution to the growing body of evidence for the importance

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of tropical cyclones to the composition of the upper troposphere in the Asian summer monsoon region. There are a few comments and suggestions for revisions as noted below.

1. abstract, line 11: “rotational subsidence” and “descend slowly along a circle” are not well defined or discussed in the text. Rotational subsidence implies that rotation is causing subsidence, which is not the case. And the slow descent is certainly not along a circle, but is rather more helical in shape. Finally, the 2-D projection of the trajectory is more elliptical than circular. The

2. p. 2 line 21: “. . .large-scale slow upward circulation within the ASM anticyclone. . .” would appear to contradict the subsidence noted above and seen in the trajectory calculations. Can this be clarified?

3. p. 3 line 20: grammar “will be displayed”

4. p. 4 section 2.2: There are surely uncertainties in the ERA-I wind fields as well as with the use of a 1x1 regular grid for the winds, which must be interpolated to the precise location of the balloon’s flight path. These uncertainties likely increase with time going backwards. Some attempt should be made to quantify these uncertainties on the back trajectories and how this may affect the conclusions that sampled air masses originated from the boundary layer beneath tropical cyclones.

5. p. 5 line 6: This definition of the top of the lower troposphere as $\zeta < 190$ K is unfamiliar to me and possibly to other ACP readers. It would be useful to clarify this.

6. p. 5 line 15: The definition of a cyclones intensity in terms of a pressure is not a standard practice (also used in Table 1). Intensity is usually defined by maximum surface wind, or the Saffir-Simpson scale or equivalent. The pressures quoted must be something like the minimum surface pressure or the average over some time interval of the central eye pressure. I suggest this be reworded and that the caption for Table include details on what this pressure represents.

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7. p. 6 lines 28-29: There are some potential problems with tropospheric PV that should be noted. While PV is an appropriate tracer for the stratosphere, it is not as well conserved in the troposphere and there are likely large uncertainties in tropospheric PV in ERA-I that might be important for this analysis. Furthermore, it is not clear that showing PV in Fig 4 actually adds new information to the case studies.

8. p. 7 line 2: "...observed right over the typhoon's track over the Western Pacific..." This statement implies that Fu et al (2013) observed typhoon Trami, when in fact they observed a different typhoon, Hai-Tang in 2005. This should be clarified.

9. p. 7 line 32: "...the average of total ozone profiles..." Total ozone is usually used to refer to the vertical column abundance, but I do not think that is what is meant here.

10. p. 8 lines 9-10: Last sentence of this paragraph is incomplete and unclear.

11. p. 9 line 1 "...the potential temperature of parcels increases slowly." In convective uplift, theta usually changes on a relatively rapid timescale (hours, not days). Please clarify.

12 Figure 8 caption: The white contours are probably vertical velocities from ERA-I, but this should be noted in the caption along with the units and contour intervals.

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