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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Analysis of cirrus cloud over the Tibetan Plateau from CALIPSO data: an altitude perspective" *by* Feng Zhang et al.

Anonymous Referee #1

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The paper by Feng et al. investigates the geographical distributions of cirrus at three selected altitude ranges over the Tibetan Plateau using the cirrus occurrence number from CALIPSO satellite product. The authors attribute the cirrus formation at altitudes below 9 km, between 9-12 km, and above 12 km to three kinds of atmospheric dynamic factors, respectively, i.e., large-scale orographic uplift, gravity wave induced vertical uplift, and deep convection. However, while referring numerical previous studies, they did not provide stronger evidences from the data of this study to support their viewpoints. Most discussions in the current version of the paper are too descriptive to meet the high quality of an ACP research article. While admitting that the study is interesting, I do think that more in depth analyses need to be done before its acceptance.

Specific comments:

1. Sect. 2.1: The cirrus occurrence number from CALIPSO is used to investigate the geographical distribution of cirrus in the study. How about the geographical distribution of the effective sampling number of CALIPSO over the TP? Are there much more default values in some regions than others? Will the inhomogeneous distribution of effective sampling data result in large biases in the calculated distributions of cirrus occurrence number?

2. P7, L12 – P8, L12 and Fig. 1: I would like to see a plot showing the geographic distribution of terrain height in the region. Several variables (e.g., surface diabatic heating, radiation cooling, latent heat, sensible heat, and water vapor evaporation) are mentioned in the discussion, but none of them are displayed. Are there any signals at higher altitudes to see the influence of topographic height on cirrus? In which study and by what model is the cirrus formation simulated (stated in P8, L4-5)?

3. P8, L13 – P10, L9 and Fig. 2: It seems that the negative gravity wave acceleration cannot fully explain the distribution pattern of cirrus occurrence number shown in the figure. Could the geographical distributions of other relevant variables, such as gravity wave induced fluctuations of water vapor and temperature, be investigated? Is it possible that shallow or mid-level convection in this region play a role in the formation of cirrus?

4. P10, L10 – L12, L2 and Fig. 3: Here it might not be fully appropriate to state that deep convection is another cirrus formation mechanism (P10, L12) since atmospheric dynamics and microphysical processes in the formation of cirrus should be distinguished and described clearly. Can the difference between the timing of the CALIPSO overpasses and the period of daily OLR data fully explain the difference between the location of maximum cirrus number and the center of low OLR shown in the figure? From the geographical distribution of OLR, one can clearly see strong convection activity in most areas of eastern TP, where the cirrus occurrence number is very small. Does this indicate that the cirrus formation (occurrence number) cannot be well explained by the convection activity (OLR) at this altitude range?

5. P12, L3-11 and Table 1: What does the symbol "-" stand for in Table 1? Can the scatter plots be shown with figures?

Technical issues:

P1, L19-21: The sentence needs to be rephrased.

P1, L21: "exhibits".

P9, L16: What does "along with smaller particle size" mean? Smaller aerosol particles, or smaller cirrus particles?

P9, L19: What do you mean by saying the wave accelerations are on the order of +/- 1 m s-1? The values are too high or too low?

P10, L5: The concept of the Froude number needs to be described or explained.

P10, L12: "triggered"?

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