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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Strong variability of the Asian Tropopause Aerosol Layer (ATAL) in August 2016 at the Himalayan foothills" *by* Sreeharsha Hanumanthu et al.

Anonymous Referee #1

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Based on COBALD measurements in North India in 2016 August, the variability of the ATAL features is analyzed, and the source regions is simulated with trajectory model - CLaMS. Some interesting results are derived, such as the strong variability of the ATAL's altitude, vertical extend, and aerosol backscatter intensity. Some important transport pathways are identified for different ATAL intensity, such as continental convection and maritime typhoon. The phenomena with no ATAL detected is puzzling. Overall, this manuscript is well written and is recommended to be published in ACP. Minor issues: 1. P2L12: 17km –> 18km 2. P2L19-20: The Asian summer monsoon circulation is affected first by the land-sea contrast, and second by the presence of the Tibetan Plateau. Therefore, this sentence should be modified. 3. P2L21: The

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monsoon anticyclone is linked to deep convection in summer over the Indian subcontinent AND OTHER ASIAN MONSOON REGIONS. 4. P3L18-20: The Asian tropopause transition layer in summer is first investigated by Pan et al. (2014). Pan, L. L., L. C. Paulik, S. B. Honomichl, L. A. Munchak, J. Bian, H. B. Selkirk, and H. Vömel, 2014: Identification of the tropical tropopause transition layer using the ozone-water vapor relationship, J. Geophys. Res. Atmos., 119, doi:10.1002/2013JD020558. 5. P4L1-2: How to show the size, radius or diameter? 6. P4L3-4: 0.6W/m2 and 0.5K??? 7. P4L7-10: In some ATAL studies, volcanic eruptions are removed, because volcanic signal is much stronger than ATAL, which will mask the effect of ATAL. 8. P4L28-29: Nitrate aerosol is dominant in the ATAL is first suggested by Gu et al. (2016) by simulation. Gu, Y., H. Liao, and J. Bian, 2016: Summertime nitrate aerosol in the upper troposphere and lower stratosphere over the Tibetan Plateau and the South Asian summer monsoon region, Atmos. Chem. Phys., 16, 6641-6663, doi:10.5194/acp-16-6641-2016. 9. P6L30: CI>7.0, BSR940>2 AND Sice>70% –> OR 10. P6L30: Aerosol layers without cirrus can exist under the condition Sice > 70%. 11. P6L32: Could you provide the vertical range of UTLS? 12. P9L11-14: This "somewhat different picture" can be explained by the results from Pan et al. (2014) as mentioned above. The distribution of lapse-rate minimum levels is compact in potential temperature scale but diffuse in the altitude scale. 13. P10L1: This result can also explained by the results on CPT from Pan et al. (2014). 14. P18L1: The two branches are not easily found in the figure, could you show more clearly? 15. P27L1-6: Why post-monsoon cases are used as background signal for aerosols in the UTLS? Yes, there's no ATAL during winter. But, the general circulation is quite different for summer and winter, so obviously the source regions are different. Could you use cases with no ATAL during summer as background signal? 16. P27: For case 2, beside source regions, other parameters impacting ATAL such as temperature and Sice should also be considered. 17. P28L26: Some in situ measurements show that the aerosols concentration in the middle troposphere is very low, which should be considered in the argument. 18. P31L24-26: Factors impacting the variability of the ATAL include not only source regions, but also other parameters

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related the formation and growth of aerosol, the latter should also be considered. 19. P32L1-4: Possibly, satellite data for aerosol can be used. 20. P32L20-22: I think it's too early to talk about the regulations, because we still don't know whether the ATAL existence is good or bad to human beings.

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