

Interactive comment on “Modelling the aerosol chemical composition of the tropopause over the Tibetan Plateau during the Asian summer monsoon” by Jianzhong Ma et al.

Anonymous Referee #2

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General Comments:

This interesting work studies the aerosol chemical composition in the Asian Tropopause Aerosol Layer (ATAL), and uses EMAC model running at a high resolution to investigate the links between ATAL and Asian Summer Monsoon (ASM). The aerosol properties in the ATAL have been the subject of discussion over the past decade and have received quite some attention recently. I agree with the Reviewer#1 that the results of this work nicely complement previous studies. The manuscript is well written, the methodology is detailed described and sound, and the results are well presented and discussed. The authors have addressed most of my concerns in the response to

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Reviewer#1. I feel this work is suitable for publication in ACP after address the following minor concerns.

Specific comments:

- 1) It would be best to rephrase some expressions in the manuscript, considering the similarity index of 23% (see Similarity Report). No doubt regarding the originality of this work, which will be mentioned in my later comments, but I feel some re-wording to credit the previous works in a better way would help improve this manuscript.
- 2) About the altitudes of 15-18 km. In order to avoid confusion, please find a suitable place to clearly state that whether it is above the sea level or over ground.
- 3) P5L24. I am wondering that how is organic aerosol formation simulated in the ORACLE sub-model, if partitioning of secondary organic aerosol between gas and particle phases is not considered? Some elaboration may be needed here.
- 4) P10L19. The acronym ‘SS’ for sea spray. Please place it at the first time when ‘sea spray’ was used.
- 5) P10L32. The contribution of WASO and ALW to aerosol extinction is much higher in 2011 than in 2010/2012. Is it due to the pronounced Nabro eruption in 2011? This eruption may enhance the highly hygroscopic components in UTLS such as sulfate originated from SO₂, and enlarge the contributions from WASO and ALW? Some discussion about the difference between 2011 and 2010/2012 would be interesting to see.
- 6) P11L11. The definition of ‘Ca_{2+*}’ needs to be clarified. Cations of Na, K, Mg and Ca are accounted for as ‘Ca_{2+*}’. Here, you mean by mass, mol, or charge balancing? Furthermore, Na⁺ is also a typical tracer for sea salt. Drop sodium and just sum up calcium, magnesium and calcium. Would this be a better tracer for mineral dust?
- 7) P13L27. Typo? ‘ACM’ change to ASM ?
- 8) Section 3.5. A nice discussion to figure out the source of dust in the UTLS by

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holographic scanning the transport pathway from surface to 18 km. My first suggestion is: would it be more generally representative to show the results of 2010/2012, but place the results of 2011 in supplement? Anyway, it would not change the results significantly, because 'transport patterns are the same in 2010 and 2012 as in 2011'; however, 2011 is a special year tagged by the pronounced Nabro eruption with potential impacts on climate the general circulation, which may lead to unnecessary doubt from audience about its representative. The second suggestion is: would it be possible to have some discussion about the source or transport pathway of WASO and ALW (or water vapor), which also considerably contribute to aerosol extinction coefficient in the ATAL?

9) P17L9. I am curious that why finer resolution (T106L90) underestimate the convective vertical transport, but not the coarser resolution. Should the finer resolution represent convective processes better, although none of them explicitly describe the convective processes? Would you help me understand it.

10) The conclusion. I feel add some clear statement to highlight the originality and novelty of this work would help audience get the full picture of this nice study. In the introduction and results discussion, authors made extensive comparisons with previous studies to evaluate the results of this study. Add some sentences to clearly state the new findings or improvements of this study will be helpful. For example, including nitrate which is missing in lots of previous studies, find more dust contribution by updating dust emission scheme and etc.

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