General comments:

This study conducted simultaneous observations at the foot and top of Mount Hua, systematically analyzing the distribution characteristics of dicarboxylic acids (with a focus on oxalic acid, C_2) in PM$_{2.5}$ and size-segregated samples, along with their $\delta^{13}C$ composition during both non-dust and dust periods. The research data demonstrate novelty and provide important evidence for understanding the transformation processes of SOA and the interactions between dust and anthropogenic emissions in mountainous environments. While the manuscript is fundamentally sound, certain aspects require further clarification and refinement.

1. The introduction would benefit from smoother transitions between paragraphs. Currently, there's a noticeable jump from discussing research gaps (end of paragraph 2) to introducing nitrate-aged dust effects (paragraph 3) without adequate transitional phrasing.

2. Line 64-66: "Resultsshow that dust storms have a less pronounced impact on ground aerosols than on the free troposphere of the Guanzhong Plain (Liu et al., 2024)..." Please specify the exact chemical species (e.g., water-soluble ions, carbonaceous fractions) and the particle-size ranges examined by Liu et al., 2024, and clarify whether their sampling sites coincide with those of the present study to avoid any potential confusion.

3. Further refinement of language and optimization of sentence structure are needed. For instance, line 46-47, "Dust degrades air quality near its source and can be transported over long distances by winds, impacting the climate on hemispheric and global scales" could be improved to: "Dust not only impairs air quality locally but also undergoes long-range transport, ultimately affecting both hemispheric and global climate systems"; Line 60-62: "Originating in southern Mongolia and China's western Inner Mongolia, it was intense and far-reaching, causing rapid air quality deterioration

in the affected areas" can be revised as "This severe dust storm, originating from southern Mongolia and western Inner Mongolia, triggered rapid air quality deterioration across downwind regions".

4. Line 62: The introduction merely cites Figure S1 without clarifying its relevance. Revise the sentence so that specific elements of the figure are explicitly linked to the research questions.

5. Maintain terminological consistency: "secondary organic aerosols" was abbreviated as "SOA" in line 68; please use "SOA" throughout the manuscript (including lines 102 and 360) and avoid alternating with the full term.

6. Unify citation format: for example, line 38 "(Maher et al. 2010; Liang et al., 2022)" should be corrected to "(Maher et al., 2010; Liang et al., 2022)" with the comma added; please check the entire manuscript.

7. Line 121-139: The analytical methods lack sufficient detail. Please provide the exact column model, detection limits for target ions (e.g., Cl^-, NO_3^-, SO_4^{2-}) and for OC/EC, together with a full description of the drying protocol for dicarboxylic acid samples, the hexane-wash purification of their organic derivatives, and the nitrogen blow-down concentration procedure.

8. Line 129: Please specify the exact source(s) of the relative humidity and temperature data.

9. The discussion of results does not adequately compare with key reference. For example, although the study points out that oxalic acid (C_2) at the foot shows significant diurnal variations, while the top shows no significant differences, it does not compare these findings with reference on photochemical processes in similar topographical studies. Moreover, the study uses the C_2/C_4 ratio of 5.84 (at the top) as

an indicator of photochemical aging but fails to cite the classic study by Kawamura and Ikushima (1993), who first proposed that this ratio can indicate the degree of aging. It is recommended to supplement the study with references to Kawamura and Ikushima (1993) and other relevant studies in high-altitude regions to further substantiate the applicability of the C_2/C_4 ratio as an aging indicator.

10. Please provide an explanation for the notable discrepancy observed between the nitrate-dominated C_2 correlation (with an R^2 value of 0.79) that you have observed and the previously reported sulfate-dominated mechanisms by Meng et al. (2018) and Wang et al. (2012).

11. Line 265-268: the authors mention "the proportion of C_2 decreasing from 37.3% to 32.2% at the foot and increasing from 35.5% to 42.8% at the top" Is it sufficient to explain this solely based on humidity? Additionally, they mention that high humidity promotes the "secondary formation of C_2" Is this also referring to an aqueous-phase reaction?

12. It is recommended to divide the 16 subplots of Figure 3 into two groups for discussion: the correlations between precursors and C_2 at the foot and summit sites (Figures 3a-d, i-l), and the influences of inorganic ions and ALWC on C_2 (Figures 3e-h, m-p).

13. Please explicitly cite the relevant figure numbers in the text, for example by adding "(Figure 4c)" after the mention of "C_2/C_4 ratios" on line 282, to strengthen the linkage between the narrative and the figures.

14. Line 340-341: the authors need to clarify whether the conclusion that "aqueous secondary organic aerosols (aqSOA) formed on dust surfaces promote SOA formation and drive the transition of particle size distribution from submicron to supermicron

ranges" is based on the findings of Li et al. (2025) or represents original findings from this study. If it is a reference to the literature, it is recommended to clearly indicate the citation.

15. Line 364-366: Please ensure consistency in verb tense, and it is recommended to replace "oxalate" with "C_2" for consistency in terminology usage.

16. Please add the p-values for all correlation coefficients in Figures 3 and 6 so that readers can properly assess their statistical significance. Additionally, standardize the notation for dicarboxylic acids in Table 3 to match that used in Tables 1 and 2.

17. Line 442: "coarse/fine ratio" should be revised to "coarse/fine particle ratio" for greater precision.