Response to Community Comment

We thank the reviewer for their time and for these helpful comments. We carefully considered all your comments and made every effort to address them in this revised manuscript. In this response letter, we have repeated each of the reviewers' comments and provided our responses individually. Our responses are marked in blue. We also used "C1" to indicate the community's comments and "CA1" for our responses.

Community Comment

C1: (This is a community comment, not a review.)

I enjoyed reading this manuscript by Ryoo et al. Here, they have derived source-receptor relationships using the FLEXPART-ERA5 model and have shown how the most influential source regions change across different percentiles of the ozone distribution in the Western North America. They identify a large influence of South Asia, Southern East Asia, and Southeast Asia in contributing to low ozone percentiles over the Western North America. I would like to point out that these results are in agreement with our recently published findings in ACP (Ansari et al, 2025) where we used explicit NOx and VOC emissions tagging and showed an increasing influence of foreign anthropogenic NOx and to a lesser extent global shipping NOx (see Figures 10, S8, and S10) over NW US, SW US, and Western Canada regions between 2000-2018.

The findings become clearer when you focus on the winter months in those figures, which correspond to the low-percentile values analysed here. We have also shown, in Figure 17, that the increasing trend in wintertime and springtime ozone over western US is mainly due to increasing transport of foreign-NOx-produced O3 and not so much due to the reduced wintertime titration due to declining local NOx. Again, these findings are consistent with the results shown in this study.

CA1: Thank you so much for your time and thoughtful review.

C2: Another recent study (Li et al., 2023) which used the same explicit dual-tagging technique found increasing contributions of Asian NOx emissions to Western US ozone, particularly in wintertime (see Figure 7 third row, left panel) over the 1995-2019 period.

It would be good to include findings from these studies in the introduction and/or discussion sections to make the study more up-to-date with recent work in the field.

CA2: Thank you for letting us know the reference. We included their findings in the results (3.1) section of the revised manuscript, as responded in Reviewer #2 (see response A2-6).

“These characteristic transport dynamics are also evident on a seasonal basis: transport patterns weaken slightly and become more localized over WNA during boreal summer (June–August; JJA), whereas they strengthen during boreal spring (March–May; MAM) and boreal winter (December–February; DJF) (Fig. S4).

This seasonal behavior aligns with findings by Ansari et al. (2025), who utilized explicit NO_X and VOC emission tagging to demonstrate an increasing influence of foreign anthropogenic NO_X and, to a lesser extent, global shipping NO_X, over the northwestern United States between 2000 and 2018. Similarly, Li et al. (2023) used the same explicit dual-tagging technique and found increasing contributions of Asian NO_X emissions to Western U.S. O_3, particularly during winter from 1995 to 2019, further supporting our analysis. Taken together, these findings confirm that the geographic origin of an air mass is a key driver of O_3 variability over WNA.“

C3: Also, what the authors refer to as "Southeast Asia" here is quite different from the conventional definition of Southeast Asia. This can cause some confusion in the minds of readers-in-a-hurry who only read the abstract or try to cite the study without actually looking at the figures. The dominant source region identified here is in fact (Southern East Asia + South Asia + Southeast Asia).

CA3: Your comment is well taken. We acknowledge that defining such a broad geographic domain as 'Southeast (SE) Asia' may cause confusion for readers who are focused on highly localized regions within Asia. However, as you noted, significant transboundary transport occurs across these boundaries (e.g., Samphutthanont et al., 2026), making it inherently difficult to isolate highly localized source signatures using the relatively coarse resolution of our trajectory analysis.

While an explicit modeling approach that utilizes emission-tagging technology (e.g., Ansari et al., 2025) would be required to separate these adjacent source regions definitively, our current domain configuration is designed to capture the broad, macro-scale location of SE Asian transport pathways compared to typical domain. We agree that this is an important clarification for readers. Accordingly, we have updated the 'Data and Methodology' section in the revised manuscript to explicitly address the constraints of this regional definition as follows:

“*Although our ‘SE Asia’ domain (60-130°E, 0-25°N) spans South Asia, Southeast Asia, and southern East Asia, this macro-scale boundary was intentionally chosen to capture broad, interconnected transport pathways. Strong transboundary mixing across these neighboring zones (e.g., Samphutthanont et al., 2026) makes separating individual sub-regional signatures difficult over multi-day trajectories. Therefore, this domain is designed to capture the overarching regional transport footprint and ensure solid statistical sampling, rather than pinpoint localized source areas.*”

C4: I wish the authors the best with the rest of the review process.

CA4: We sincerely appreciate your encouraging remarks. We are addressing all of the reviewers' comments, including your constructive suggestions, and are committed to successfully revising the manuscript.

Tabish Ansari

References

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