Reviewer 1: Dr. I. Pérez

[Comment #1-1]: This is a quite complete paper about tropospheric ozone in East and Southeast Asia in the past 25 years. Many authors are involved, and the study considers an extensive station network and modelling studies where 80% of data are for training and 20% of data are for testing. The analysis is focused on the summertime and surface concentrations, profiles and trends are investigated. Finally, the contribution of anthropogenic emissions and meteorology are quantified. Due to the extension and intensity of this analysis, it merits to be published in Atmospheric Chemistry and Physics, although the following minor issues should be answered by the authors.

[Response #1-1]: We thank Dr. I. Pérez for the positive and valuable comments. All of them have been implemented in the revised manuscript. Please see our itemized responses below.

[Comment #1-2]: Some results could be mixed with the discussion in the current paper, due to their comparison with other studies. Perhaps the authors could indicate if both sections could be more separated.

[Response #1-2]: Thank you for your comment. In Sections 3, 4, and 5, we mainly focus on the interpretation of the results, incorporating comparisons with other relevant studies or supporting evidence from references where appropriate. We believe this structure helps readers contextualize the findings of this study within the broader literature. Section 5.3 is dedicated to an independent discussion of the mechanisms driving the summertime surface ozone increase in China from 2013 to 2019, drawing extensively on existing references. Section 6 is organized into two parts: the first half summarizes the key findings of this study, the second half addresses limitations and future directions. We hope this structure provides a balanced and coherent presentation of both the results and discussions.

[Comment #1-3]: Limitations of this study could be highlighted. Moreover, a comment about results extrapolation to the future would be acknowledged by the readers.

**[Response #1-3]: Thank you for pointing it out. We have added the following discussion in Section 6. "*The quantitative ozone response to precursor emissions and climate change, as simulated by multi-models in this study, holds significant implications for future ozone projections. In the free troposphere, our results have shown that ozone changes largely aligned with trends in NO_x emissions over the ESEA. In the future, continued reductions in NO_x and VOCs emissions in China are expected to further decrease its contribution to global tropospheric ozone burden (Han et al., 2024). At the surface, although emission control measures since 2013 have contributed to ozone enhancement in China, they are projected to reduce ozone as emission reductions deepen (Li et al., 2019c; Lu et al., 2021a). In other parts of ESEA, while future emission scenarios will be highly dependent on policy decisions, it is apparent that emissions from Southeast Asia will significantly affect both local ozone air quality and global tropospheric ozone burden due to the high efficiency of ozone chemical production and strong vertical transport in this region. Our simulations also capture the positive response of surface ozone concentrations over the ESEA to global warming. In consistent, multiple model results predict that the positive slope of surface ozone concentration with increasing temperature (also known as the ozone climate penalty) will persist in this heavily polluted region under future scenarios, in contrast to the ozone decrease in remote regions (Zanis et al., 2022), although such penalty effect is expected to diminish as emission reductions progress (Chang et al., 2024; Li et al., 2025). The ozone*

***climate penalty effect requires further reduction in anthropogenic emissions of ozone precursors.*"**

Reference

Chang, K.-L., McDonald, B. C., and Cooper, O. R.: Surface ozone trend variability across the United States and the impact of heatwaves (1990–2023), Atmospheric Chemistry and Physics Discussions, https://doi.org/10.5194/egusphere-2024-3674, 2024.

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Zanis, P., Akritidis, D., Turnock, S., Naik, V., Szopa, S., Georgoulias, A. K., Bauer, S. E., Deushi, M., Horowitz, L. W., Keeble, J., Le Sager, P., O'Connor, F. M., Oshima, N., Tsigaridis, K., and van Noije, T.: Climate change penalty and benefit on surface ozone: a global perspective based on CMIP6 earth system models, Environmental Research Letters, 17, https://doi.org/10.1088/1748-9326/ac4a34, 2022.

[Comment #1-4]: Minor remarks.

L. 367. "aaply" or "apply"?

L. 621. "Aisa" or "Asia"?

[Response #1-4]: Corrected as suggested.