

Response to Reviewers

No.: ACP-2025-10

Title: Anthropogenic and Natural Causes for the Interannual Variation of PM_{2.5} in East Asia During Summer Monsoon Periods From 2008 to 2018

Anonymous referee #3:

I would like to thank the authors for addressing the reviewers' comments. Before accepting the manuscript for publication, I encourage the authors to consider the following suggestions.

Response: We thank the editor for careful reading and valuable comments. We have responded to each specific comment in blue below. Please note that the line numbers given below refer to the clean version of the manuscript.

1. Line 194: The revised manuscript reports: “It is noteworthy that, as a principal greenhouse gas, CO₂ modifies meteorological parameters—such as radiation, temperature, and precipitation—which in turn influence PM_{2.5} levels. In this comparison, all meteorological changes derive solely from variations in CO₂ emissions, a mechanism fundamentally different from the meteorological influences identified in experiments SIM_{Base} and SIM_{MET=2008}.”

Please specify if the sentence “in this comparison” refers to the simulation SIM_{CO2=2008}.

Response: Thanks for pointing that out. We have revised the corresponding ambiguous wording in the manuscript to clearly specify that this refers to the comparison between the SIM_{Base} and SIM_{CO2=2008} experiments.

Changes in manuscript:

(L189–194): “It is noteworthy that, as a principal greenhouse gas, CO₂ modifies meteorological parameters—such as radiation, temperature, and precipitation—which in turn influence PM_{2.5} levels. In the comparison between experiments SIM_{Base} and SIM_{CO2=2008} (SIM_{Base} - SIM_{CO2=2008}), all meteorological changes derive solely from variations in CO₂ emissions, a mechanism fundamentally different from the meteorological influences identified in experiments SIM_{Base} and SIM_{MET=2008} (SIM_{Base} - SIM_{MET=2008}).”

2. Figure 4. It is not clear if PreG-2008 and PostG-2008 plot are the average of SIM_{base}-SIM_{MET=2008} for the different years. Could you please specify?

Response: Thank you for your valuable suggestion. We have revised the description in Figure 4 to clarify that PreG-2008 and PostG-2008 represent the multi-year average differences between experiments SIM_{Base} and SIM_{MET=2008}. The same clarification has also been applied to Figures 5 and Table 4-5.

Changes in manuscript:

(L317–321): “**Figure 4.** The PM_{2.5} (a–c, $\mu\text{g}/\text{m}^3$), precipitation (d–f, mm/day), wind speed (g–i, m/s), temperature (j–l, K), and Planetary Boundary Layer (PBL) height (m–o, m) during the EASM period in 2008 (left), and their mean changes due to meteorological variations in PreG (2009–2013, center) and PostG (2014–2018, right) phase relative to 2008, PreG-2008 and PostG-2008 represent the average annual differences between experiments SIM_{Base} and SIM_{MET=2008} (SIM_{Base} - SIM_{MET=2008}) for the periods 2009–2013 and 2014–2018, respectively.”

(L323–327): “**Table 4.** Impact of meteorological condition changes on PM_{2.5} ($\mu\text{g}/\text{m}^3$), precipitation (mm/day), wind speed (m/s), near-surface temperature (K), and Planetary Boundary Layer (PBL) height (m) during the EASM period in PreG (2009–2013) and PostG (2014–2018) phase relative to 2008, PreG and PostG represent the average annual differences between experiments SIM_{Base} and SIM_{MET=2008} (SIM_{Base} - SIM_{MET=2008}) for the periods 2009–2013 and 2014–2018, respectively.”

(L356–360): “**Figure 5.** The PM_{2.5} (a–c, $\mu\text{g}/\text{m}^3$), CO₂ (d–f, ppm), precipitation (g–i, mm/day), and isoprene (j–l, $\mu\text{g}/\text{m}^3$) during the EASM period in 2008 (left), and their mean changes due to CO₂ emission variations in PreG (2009–2013, center) and PostG (2014–2018, right) phase relative to 2008, PreG-2008 and PostG-2008 represent the average annual differences between experiments SIM_{Base} and SIM_{CO2=2008} (SIM_{Base} - SIM_{CO2=2008}) for the periods 2009–2013 and 2014–2018, respectively.”

(L362–365): “**Table 5.** Impact of CO₂ emission changes on PM_{2.5} ($\mu\text{g}/\text{m}^3$), CO₂ (ppm), precipitation (mm/day), and isoprene ($\mu\text{g}/\text{m}^3$) during the EASM period in PreG (2009–2013) and PostG (2014–2018) phase relative to 2008, PreG and PostG represent the average annual differences between experiments SIM_{Base} and SIM_{CO2=2008} (SIM_{Base} - SIM_{CO2=2008}) for the periods 2009–2013 and 2014–2018, respectively.”

3. Please rephrase “anthropogenic pollution emissions” with “anthropogenic pollutant Emissions.”

Response: Thanks for pointing that out. We have replaced all “anthropogenic pollution emissions” with “anthropogenic pollutant emissions” throughout the manuscript.

4. Please correct the following edits:

Line 18: “pollution” is repeated twice.

Line 51: The superscript “3” is repeated twice.

Response: Thanks for pointing that out. We have removed the redundant expressions from the manuscript.