

Response to the reviewers' comments

We thank the reviewers for the comments which we have addressed in a point-by-point fashion below. The line numbers in this response file refer to the numbers in the final revised manuscript with no changes marked. Comments by reviewers are reproduced in a black font below. Our responses follow each comment in a blue font. Text additions to the manuscript, for example, significantly modified sentences, appear in the revised manuscript in red color.

Reviewer: 1

Comments:

This study analyzed the pesticides in the gas and particle phase of air samples collected in the North China Plain and then investigated the gas-particle partitioning of pesticides by applying models, showing absorption as the main mechanism of gas-particle partitioning. Pesticides are a typical class of organic pollutants in the atmosphere, especially in the rural and agricultural production regions. Studying the abundance and gas-particle partitioning of atmospheric pesticides will enhance our understanding of organic pollutants in the atmosphere. The manuscript was well written and fits the scope of ACP. Therefore, I recommend the publication of this manuscript after the following questions are addressed.

Response: We thank you for your positive evaluation of our work.

Specific comment:

1. *Introduction: The author stated that a large amount of pesticides release to atmosphere. However, there is no data presented. I suggest to present the data of concentration of pesticides in the atmosphere.*

Response:

Thanks for this suggestion. We agree that adding information about the actual pesticide concentrations detected in the atmosphere would improve the introduction. Therefore, we have now included relevant information in lines 54–67 in the revised manuscript as follows:

“Atmospheric pesticides have been monitored globally. Yera and Vasconcellos analyzed concentrations of pesticides such as atrazine in the atmosphere of the São Paulo region, Brazil, ranging from 17–210 pg m⁻³ (Yera et al., 2021). In Costa Rican banana plantations, Karla et al. (2026) reported that the highest concentrations of the detected pesticides were for pyrimethanil (34.3 ng/m³), followed by fenpropidin (9.0 ng/m³) and terbufos (8.4 ng/m³). Tian et al. (2021) conducted observational analysis and quantification of organochlorine pesticides in the atmosphere across nine cities in the Pearl River Delta region of China, finding that concentrations of 16 organochlorine pesticides in summer

(0.33–1431 pg m^{-3}) were higher than 0.26–893 pg m^{-3} in winter. In a study on the North China Plain (NCP), ten organochlorine pesticides with concentrations ranging from 11.67 to 865.60 pg m^{-3} were observed in atmospheric $\text{PM}_{2.5}$ in a rural area of Baoding City, Hebei Province (Sun et al., 2020). Another long-term monitoring study identified chlorpyrifos, carbendazim, and atrazine as the pesticides with the highest detection rates ($\geq 87\%$) in the NCP, with annual concentrations ranging from 1.71 to 16.05 pg m^{-3} (Zhao et al., 2023).”

Reference:

Barredo Yera, A. M., Vasconcellos, P. C.: Pesticides in the atmosphere of urban sites with different characteristics, *Process Saf Environ*, 156, 559-567, <https://doi.org/10.1016/j.psep.2021.10.049>, 2021.

Karla Solano Díaz, Clemens Ruepert, María Melania Ramírez Quesada, Jane A. Hoppin, Frank Wania, and Berna van Wendel de Joode.: Evaluation of passive air sampling for monitoring Current-Use Pesticide pollution near large-scale banana plantations in Costa Rica. *Environ. Sci. Technol.*, 60 (4), 3384-3393, <http://doi.org/10.1021/acs.est.5c11224>, 2026.

Tian L, Li J, Zhao S, Tang J, Li J, Guo H, et al. DDT, Chlordane, and Hexachlorobenzene in the Air of the Pearl River Delta Revisited: A Tale of Source, History, and Monsoon. *Environ. Sci. Technol.*, 55(14): 9740-9749, <http://doi.org/10.1021/acs.est.1c01045>, 2021.

Sun, H., Chen, H., Yao, L., Chen, J. P., Zhu, Z. H., Wei, Y. Q., Ding, X., Chen, J. M.. Sources and health risks of $\text{PM}_{2.5}$ -bound polychlorinated biphenyls (PCBs) and organochlorine pesticides (OCPs) in a North China rural area, *J. Environ. Sci.*, 95, 240-247, <https://doi.org/10.1016/j.jes.2020.03.051>, 2020.

Zhao, M., Wu, J., D. M. Figueiredo, Zhang, Y., Zou, Z. Y., Cao, Y. X., Li, J. J., Chen, X., Shi, S. P., Wei, Z. Y., Li, J. D., Zhang, H. Y., Zhao, E. C., V. Geissen, C. J. Ritsema, Liu, X. J., Han, J. J. and Wang, K.: Spatial-temporal distribution and potential risk of pesticides in ambient air in the North China Plain, *Environ. Int.*, 182, 108342, <http://doi.org/10.1016/j.envint.2023.108342>, 2023.

2. *Line 97-106: The author showed the information of the geographical information of Quzhou County. But it did not tell us the amount of pesticides used in this county and the pesticide utilization rate, which is more relevant to this study.*

Response:

We thank the reviewer for this helpful comment. Upon reviewing relevant literature and statistical yearbooks, we did not find the local pesticide data specific to Quzhou County. Considering this limitation, provincial statistics of the amount of pesticides used from Hebei Province and the pesticide utilization rate of China are provided as a reference for the agricultural backdrop. To clarify this point, we have now incorporated relevant explanations in **lines 110–120** in the revised manuscript as follows:

“ Quzhou County is a typical agricultural county in the NCP, located in the northeastern part of Handan City, Hebei Province (geographical coordinates: 36°35'43"–36°57'56"N, 114°50'22"–115°13'27"E; Yu et al., 2021). The total crop planting area in Hebei Province was around 8 million hectares with the pesticide usage of approximately 50,000 tons in 2023 (Hebei Provincial Bureau of Statistics, 2024). The pesticide utilization rate in Hebei Province is approximately 30%, which is lower than 50–60% observed in developed countries (Skevas et al., 2014). Given its representative agricultural setting in the NCP, Quzhou County serves as an ideal location for investigating the gas–particle partitioning of atmospheric pesticides in the NCP, thereby contributing to a more comprehensive understanding of pesticide distribution across the NCP.”

Reference:

Yu, B. G., Liu, Y.-M., Chen, X.-X., Cao, W.-Q., Ding, T. B. and Zou, C. Q.: Foliar Zinc Application to Wheat May Lessen the Zinc Deficiency Burden in Rural Quzhou, China, *Frontiers in Nutrition*, 8, <http://doi.org/10.3389/fnut.2021.697817>, 2021.

Hebei Provincial Bureau of Statistics. Hebei statistical yearbook 2024. China Statistics Press. 2024.

Skevas T, Stefanou SE, Oude Lansink A. Pesticide use, environmental spillovers and efficiency: A DEA risk-adjusted efficiency approach applied to Dutch arable farming. *Eur J Oper Res*, 237(2), 658-664, <https://doi.org/10.1016/j.ejor.2014.01.046>, 2014

3. *Line 132: why these 38 pesticides were selected for the method development?*

Response:

We thank you for this insightful comment. The selection of these 38 pesticides is based on their high detection frequency in both gas and particulate phases, as reported in previous studies conducted in the North China Plain—for example, Zhao et al. (2023) and Mu et al. (2022). Key pesticides such as imidacloprid, thiamethoxam, clothianidin, carbendazim, thiophanate-methyl, and chlorobenzuron were detected in over 80% of atmospheric samples in the region. This consistently high detection rate suggests that these compounds

likely represent the predominant pesticides in the atmosphere of the North China Plain. To clarify this further, we have now added this information **in lines 151-154** in the revised manuscript as follows:

“The selection of these 38 pesticides is based on their high detection frequency in both gas and particulate phases, as reported in previous studies conducted in the North China Plain by Zhao et al. (2023) and Mu et al. (2022).”

Zhao, M. Y., Wu, J. X., D. M. Figueiredo, Zhang, Y., Zou, Z. Y., Cao, Y. X., Li, J. J., Chen, X., Shi, S. P., Wei, Z. Y., Li, J. D., Zhang, H. Y., Zhao, E. C., V. Geissen, C. J. Ritsema, Liu, X. J., Han, J. J. and Wang, K.: Spatial-temporal distribution and potential risk of pesticides in ambient air in the North China Plain, *Environ. Int.*, 182, 108342, <http://doi.org/10.1016/j.envint.2023.108342>, 2023.

Mu, H. Y. Zhang, J. C. Yang, X. M., Wang, K., Xu, W., Zhang, H. Y., Liu, X. J., C. J. Ritsema, V. Geissen, Pesticide screening and health risk assessment of residential dust in a rural region of the North China Plain, *Chemosphere*, 303, 2, <https://doi.org/10.1016/j.chemosphere.2022.135115>, 2022.

4. *Line 191: The proportions of organic matter used in the model simulations were set to 5%–30%. Although these values were not based on actual measurements, it would be better to provide supporting references. It is recommended to refer to the reported ranges of organic matter content in particulate matter from the literature to strengthen the relevant discussion.*

Response:

We thank you for this suggestion. We refer to a study by Iakovides et al. (2022) regarding the organic matter content range in particulate matter, which reported a measured range of 9% to 41%. This is highly consistent with our assumed values, thus validating the reliability of our simulation results. This reference has now been added in the revised manuscript **in lines 220-223**: Here, f_{om} denotes the fraction of organic matter in aerosols. Four f_{om} values (5%, 10%, 20% and 30%) were adopted following Jiang et al. (2020), and this range is highly consistent with the measured organic matter fraction of 9% to 41% for aerosols reported by Iakovides et al. (2022). This strong consistency also enhances the credibility of our simulation results.

Reference:

Iakovides, M., K. Oikonomou, J. Sciare, and N. Mihalopoulos.: Evidence of stockpile contamination for legacy polychlorinated biphenyls and organochlorine pesticides in the

urban environment of Cyprus (Eastern Mediterranean): influence of meteorology on air level variability and gas/particle partitioning based on equilibrium and steady-state models, *J. Hazard. Mater.*, 439, 129544, <http://doi.org/10.1016/j.jhazmat.2022.129544>, 2022.

5. *Line 256-258: "... attributed to its high vapor pressure-second only to propamocarb-facilitating its volatilization..."*, this sentence is not clear. Please rephrase it.

Response:

We appreciate the suggestion and have rephrased the corresponding sentence **in lines 287-290** in the revised manuscript: Among the gas-phase samples, pyrimethanil (an aminopyrimidine fungicide) showed the highest mean concentration at 93.00 $\mu\text{g}/\text{m}^3$ across the 14 PUF samples, attributable to its high vapor pressure. In contrast, fenbuconazole (a triazole fungicide) with low vapor pressure had the lowest mean concentration of only 0.05 pg/m^3 .

6. *Line 271-293: The concentration of atmospheric pesticides varied between different sampling dates. I suggest to present the sampling dates of previous studies for a better comparison.*

Response:

We thank the reviewer for this good comment. We have now added the sampling time from the references to facilitate comparative analysis **in lines 301-323**: ... This is at the same level as the gaseous pesticides reported by Zhao et al. (2023) **from their year-round monitoring** in Quzhou County, the NCP (0.6–26 pg/m^3). ... of Beijing, China (35.8 pg/m^3 , **March and October**) and nearly three times greater than the $\text{PM}_{2.5}$ -bound concentration reported for a rural area of Zhengzhou City, China (80.9 pg/m^3 , **March and October 2019**) a conventional agricultural region, as reported by Zhou et al. (Zhou et al., 2020). ...in our study was higher than that in the rural area of Zhengzhou City, China (48.00 pg/m^3 , 17.70 pg/m^3 , 7.20 pg/m^3 and 7.95 pg/m^3 , respectively, **March and October 2019**), ... Hu et al. (2024) reported concentrations of acetaminprid, atrazine, imidacloprid, and nicosulfuron detected **during the sampling period from March to October 2018**. The measured concentrations were $4.88 \times 10^5 \text{ pg}/\text{m}^3$, $2.17 \times 10^3 \text{ pg}/\text{m}^3$, $4.11 \times 10^4 \text{ pg}/\text{m}^3$, and $3.46 \times 10^4 \text{ pg}/\text{m}^3$, respectively.

7. *Line 311: replace "soi" by "soil"*.

Response:

It has been corrected now.

8. Figure 2, S1 and S2: Is it possible to mark the date of booting and heading stages of wheat in the figures? Then the readers can clearly see how the pesticides application affect the concentration of atmospheric pesticides.

Response:

We appreciate the suggestion. In the North China Plain, the booting and heading stages of wheat usually occur from **early April to mid-May**. We have now incorporated this temporal information into the discussion of section 3.3 (lines 346-350) and have delineated these stages in Figures 2, S1, and S2 by shading the corresponding periods: Although the temporal distribution patterns of other pesticides in the gas and particulate phases do not exhibit a high degree of consistency, a notable increase in particulate-phase concentrations was observed from April to mid-May (Figures S1-S2). Notably, this period corresponds to the key pre-harvest window for pest and disease control in wheat, which coincides with the booting and heading stages (early April to mid-May).

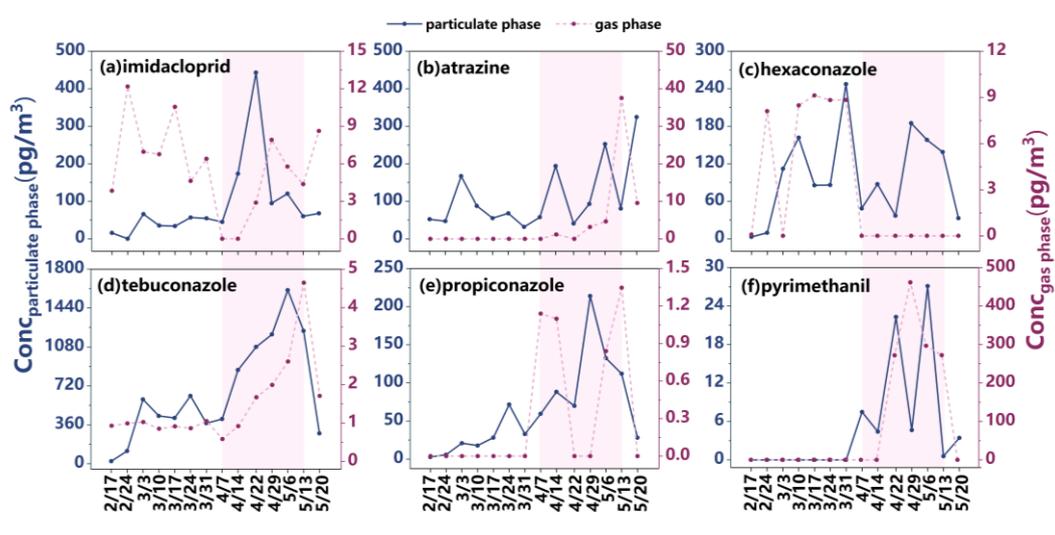


Figure 2. The concentration trend of different pesticides with sampling dates in particulate phase (full line) and gas phase (dotted line) from February 2023 to May 2023. (a) imidacloprid. (b) atrazine. (c) hexaconazole. (d) tebuconazole. (e) propiconazole. (f) pyrimethanil. The left coordinate axis represents the concentration of pesticide in particulate phase and the right coordinate axis represents the concentration in gas phase. In the figure, the purple shadow denotes the wheat growth stages from booting to heading.

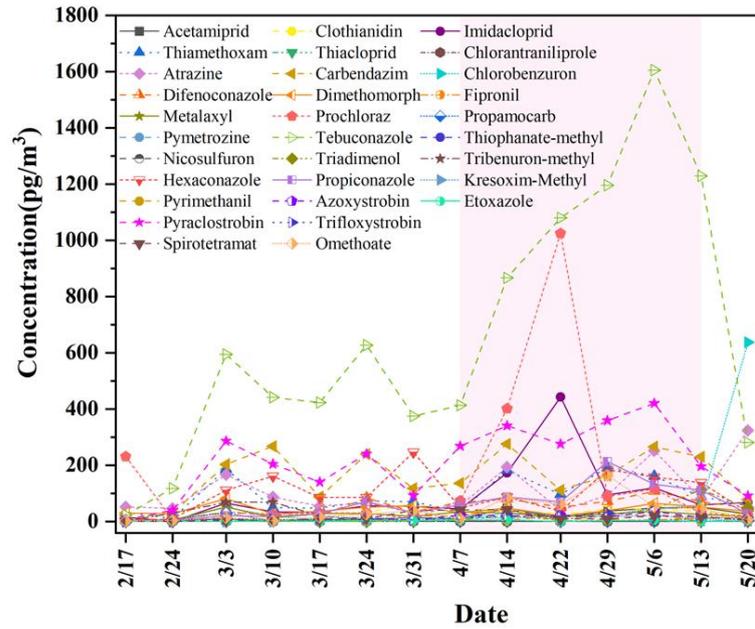


Figure S1. The trend of different pesticide concentrations in particulate phase with time during the sampling period from February 2023 to May 2023. The mean concentrations of 31 pesticides during the sampling period are shown in the plot. Different colors indicate different pesticides. In the figure, the purple shadow denotes the wheat growth stages from booting to heading.

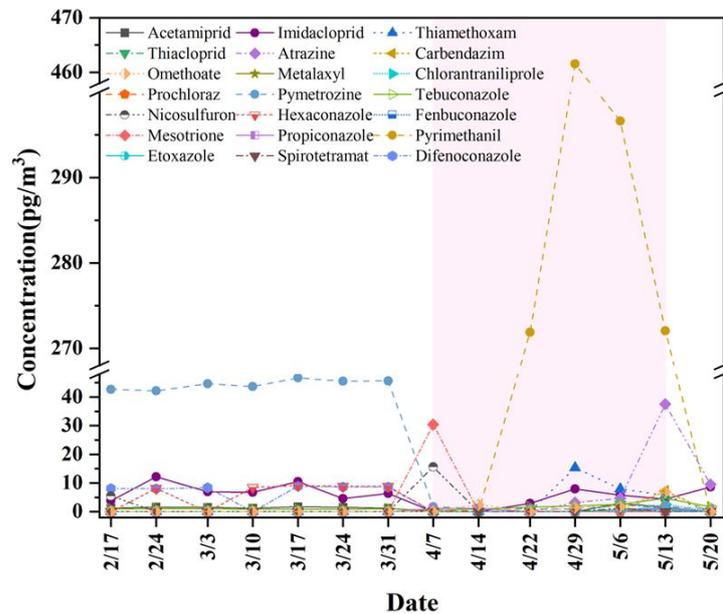


Figure S2. The trend of different pesticide concentrations in gas phase with time during the sampling period from February 2023 to May 2023. The mean concentrations of 21 pesticides during the sampling period are shown in the plot. Different colors indicate

different pesticides. In the figure, the purple shadow denotes the wheat growth stages from booting to heading.

9. Figure S5: the color refers to the relative humidity during the sampling day? Is it an averaged relative humidity? Please clarify it in the figure caption.

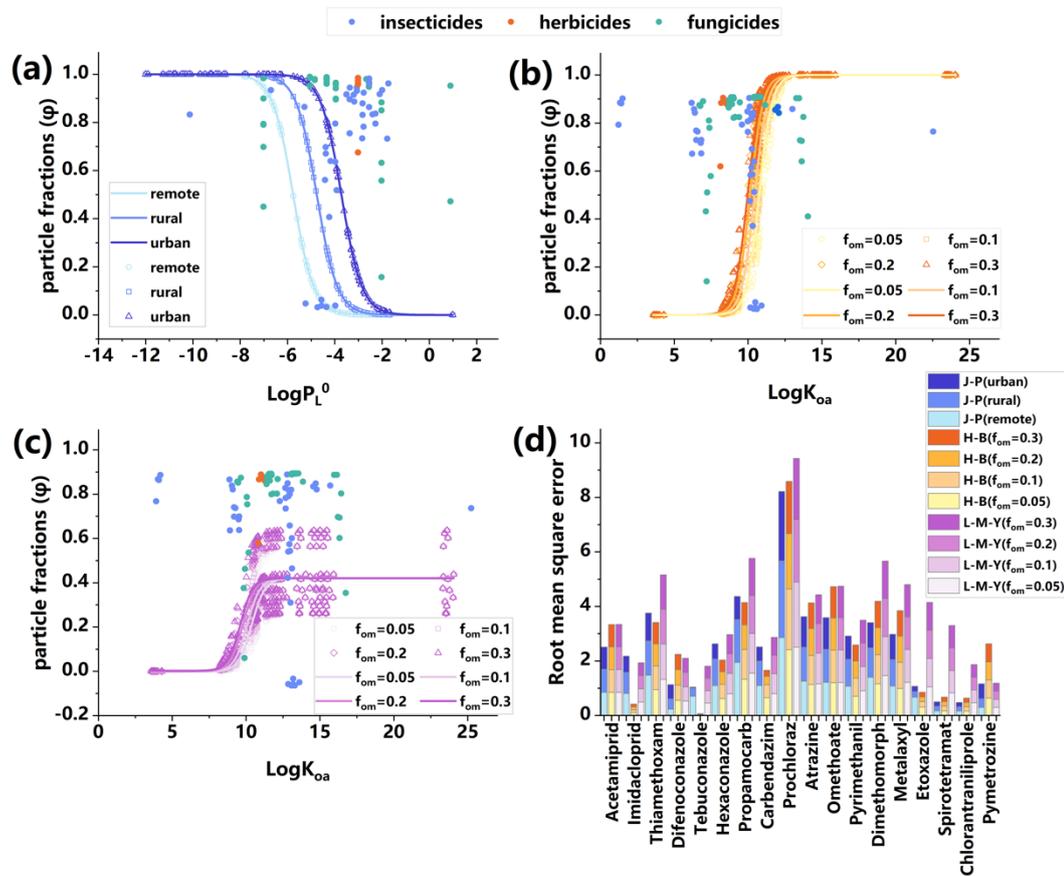
Response:

Yes, it is an average relative humidity, which has been clarified in the figure caption:
 Figure S5: The correlation between particulate-phase pesticide concentration and temperature is shown, with color representing the average relative humidity during the sampling day.

10. Figure 5: It looks busy. I suggest to clarify/improve the figure caption to make it more understandable.

Response:

We thank you for this comment and have clarified the caption of Figure 5 as follows:



“Measured vs. predicted particle fractions (ϕ) by applying J-P model (a), H-B model (b) and L-M-Y model (c) for 18 major pesticides detected both in particulate phase and gas phase. (d) The root mean square error (RMSE) of the particle phase fractions of 18 pesticides predicted by the J-P model, H-B model and L-M-Y model. The empty dots of different colors represent the predicted ϕ values from three models, while the solid dots correspond to the measured ϕ values for various pesticides (insecticides, herbicides, and fungicides) examined in this study. The curves illustrate the predicted trends of ϕ values (represented by empty dots). In Figure 5(a), the line colors indicate different levels of contaminated aerosol surface area per air volume unit across remote, rural, and urban areas. In Figures 5(b) and 5(c), the colors correspond to different fractions of organic matter (f_{om}) in the aerosols.”

11. Limitation: I suggest to conduct the similar experiment in different seasons in the future, since the gas-particle partitioning of pesticides in the atmosphere is influenced by pesticide application and meteorology.

Response:

We thank the reviewer for this good comment. Seasonal variations in both pesticide application rates and temperature, which governs atmospheric partitioning, warrant a dedicated study on the seasonal mechanisms of pesticide gas-particle partitioning, which can be further investigated in the future study. The related information has now been added in the Limitation of the revised manuscript as follows:

“In addition, it is also important to note the limitation imposed by the sampling timeframe (March to May). Seasonal shifts can alter both pesticide usage and meteorological factors, leading to substantial differences in gas-particle partitioning across the year. Consequently, the findings may not fully represent year-round patterns. Future research should include year-round monitoring to address this temporal variation.”

Reviewer: 2

Comments:

The study by Guo et al. simultaneously collected gas- and particle-phase pesticides in the atmosphere at a rural site in the North China Plain (NCP) at weekly intervals from February to May and analyzed the gas-particle partitioning of pesticides. Based on the data from continuously collected gas- and particle-phase samples, the authors explored the distribution

profiles of 33 pesticides in the gas and particle phases and then assessed the effects of meteorological factors on pesticide concentrations, and compared the gas-particle partitioning behavior of pesticides using three models, explaining the underlying mechanisms. This study provides valuable new data on the atmospheric fate of pesticides and employs appropriate statistical and modeling tools. The manuscript is generally well organized and written in a professional tone. Below, I offer specific comments to strengthen the work. With these revisions, I believe the paper will be suitable for Atmospheric Chemistry and Physics.

Response: We thank you for your positive comment on our study.

Specific comments:

1. *Line 63: The phrase “gas-particle partitioning” in the sentence “The conventional Junge-Pankow model attributes particle/gas partitioning” should be consistent with the term “gas-particle partitioning” used throughout the text. Please review all relevant instances in the manuscript.*

Response:

We thank you for this comment and it has been revised in the whole manuscript.

2. *Lines 109–115: In this study, a high-vol sampler fitted with PUF and filter was used to collect both gas- and aerosol-phase pesticides. I am wondering which component was positioned upstream in the sampling line—that is, was the PUF fitted first, followed by the filter, or vice versa? This should be clearly specified.*

Response:

We thank you for this comment and we have provided additional details regarding the sampling process **in lines 128-130** in the revised manuscript as follows:

“Air is first directed through the QFF for the collection of TSP, and subsequently through the PUF sampler for the collection of gaseous pesticides.”

3. *Lines 112-113: The seven-day integrated sampling period may allow for redistribution or chemical changes on the samplers. It would be helpful to elaborate on how this could bias the gas/particle ratio, perhaps by comparing the results with those from shorter-duration studies.*

Response:

Thank you for this good comment. Yes, during a long-time sample collection, it may cause the redistribution of pesticides between gas and particle phase and the degradation of pesticides. However, we think the sampling period of seven days is not a long period compared to the sampling time of several weeks in other studies. We reviewed two studies related to the sampling of CUPs (currently used pesticides) to support this and conducted relevant discussions. We have now added the related discussion **in lines 443-451** in the revised manuscript as follows:

“In addition to pesticide application patterns, an extended sampling duration may lead to the redistribution or degradation of pesticides during the sampling process itself, which could consequently affect the measured partition coefficient (K_p) values. However, a recent study by Karla et al. (2026) showed that the pesticide concentrations in PUF samplers collected in one week were consistent with that in three weeks, indicating no significant degradation or diffusion of pesticides in PUF samplers within three weeks. Therefore, the impact of redistribution and/or degradation process of pesticides during one-week sampling period on the gas-particle partitioning of pesticides is very limited.”

Reference:

Karla Solano Díaz, Clemens Ruepert, María Melania Ramírez Quesada, Jane A. Hoppin, Frank Wania, and Berna van Wendel de Joode.: Evaluation of passive air sampling for monitoring Current-Use Pesticide pollution near large-scale banana plantations in Costa Rica. *Environ. Sci. Technol.*, 60 (4), 3384-3393, <http://doi.org/10.1021/acs.est.5c11224>, 2026.

4. *Line 169: It would be beneficial to first explain why the Junge-Pankow (J-P) adsorption model, Harner-Bidleman (H-B) Koa absorption model, and L-M-Y model were selected to simulate the gas-particle phase distribution of pesticides, followed by a separate introduction of each model.*

Response:

Thank you for raising this important point, which helps clarify the logic of our article. The justification for selecting these three models to simulate the gas-particle partitioning of pesticides is provided **in lines 189–197** in the revised manuscript: **The gas-particle partitioning of soluble organic pollutants in the atmosphere is influenced by processes such as adsorption, absorption, as well as the removal of particulate matter through dry and wet**

deposition. To examine the dominant partitioning mechanisms, we tested three conceptual models, each representing a distinct hypothesis, by simulating relevant gas-particle partitioning parameters. For this purpose, we applied three established models that are widely used to simulate this process, namely the Junge-Pankow (J-P) adsorption model (Pankow, 1987; Iakovides et al., 2022), Harner-Bidleman (H-B) Koa absorption model (Iakovides et al., 2022; Harner and Bidleman, 1998; He and Balasubramanian, 2009), and L-M-Y model (Li et al., 2015).

Reference:

Pankow, J. F.: Review and comparative analysis of the theories on partitioning between the gas and aerosol particulate phases in the atmosphere, *Atmospheric Environment* (1967), 21(11), 2275-2283, [http://doi.org/10.1016/0004-6981\(87\)90363-5](http://doi.org/10.1016/0004-6981(87)90363-5), 1987.

Iakovides, M., K. Oikonomou, J. Sciare, and N. Mihalopoulos.: Evidence of stockpile contamination for legacy polychlorinated biphenyls and organochlorine pesticides in the urban environment of Cyprus (Eastern Mediterranean): influence of meteorology on air level variability and gas/particle partitioning based on equilibrium and steady-state models, *J. Hazard. Mater.*, 439, 129544, <http://doi.org/10.1016/j.jhazmat.2022.129544>, 2022.

Harner, T., and T. F. Bidleman.: Octanol– air partition coefficient for describing particle/gas partitioning of aromatic compounds in urban air, *Environ. Sci. Technol.*, 32(10), 1494-1502, [http://doi.org/10.1016/S1352-2310\(97\)00013-7](http://doi.org/10.1016/S1352-2310(97)00013-7), 1998.

He, J. and R.: Balasubramanian. A study of gas/particle partitioning of SVOCs in the tropical atmosphere of Southeast Asia, *Atmos. Environ.*, 43(29), 4375-4383, <http://doi.org/10.1016/j.atmosenv.2009.03.055>, 2009.

Li, Y. -F., Ma, W. -L., Yang, M.: Prediction of gas/particle partitioning of polybrominated diphenyl ethers (PBDEs) in global air: A theoretical study, *Atmos. Chem. Phys.*, 15(4), 1669-1681, <https://doi.org/10.5194/acp-15-1669-2015>, 2015.

5. *Lines 282-291: The formats of "48.00 pg/m³, 17.70 pg/m³, 7.20 pg/m³, and 7.95 pg/m³" and "21.66, 114.72, 96.19, and 2.17 pg/m³" are inconsistent, please ensure consistent unit formatting for all concentration values throughout the text.*

Response:

We have checked and ensured the consistency of concentration units throughout the entire text, and the following revisions have been made **in lines 323 – 326**: The mean

concentration of the above pesticides in our study (21.66 pg/m³, 114.72 pg/m³, 96.19 pg/m³ and 2.17 pg/m³) was lower than that of the research in Liaocheng City, China, which may be related to the low pesticide application near the sampling site during the sampling period in this study.

6. *Line 311: It contains a spelling error: “soi to the atmosphere” should be “soil to the atmosphere”.*

Response:

Thanks, and we have corrected the spelling error in the revised manuscript.

7. *Section 3.4: The authors mention that rising temperature promotes particle-phase concentration, which is counterintuitive since higher temperatures typically drive partitioning toward the gas phase. Although the authors provide some explanation, a more detailed and clearer clarification is needed.*

Response:

We appreciate this suggestion. Yes, we commonly think that the increase of temperature can improve the partitioning from particle phase to gas phase. However, in fact, the increase in particle-phase concentration driven by rising temperatures is not attributable to a single factor but rather results from multiple, interrelated complex mechanisms. In Section 3.4, several revisions have been made to improve readers' comprehension. Firstly, we have refined the explanation for this phenomenon in the range of lines 384–388 in the revised manuscript: This phenomenon deserves attention and requires further analysis of its underlying causes. Wang et al. (2024) identified temperature as the primary factor influencing the gas-particle partitioning of polycyclic aromatic hydrocarbons (PAHs). This provides a possible explanation, but further verification is needed in our study. Secondly, we have now concluded our discussion at the end of Section 3.4 in lines 420–425 in the revised manuscript: Therefore, as temperature increased, elevated concentrations of pesticides in the particulate phase were observed in this study, accompanied by a rise in log K_p values. This indicates an increase in the C_p/C_g ratio with temperature. Pearson correlation and linear regression analyses suggest that this trend is likely not governed by a single factor, but rather results from multiple interacting drivers, including the physicochemical properties of pesticides, increasing relative humidity, the transition of particles to a liquid-like phase, and heightened pesticide application.

8. *Section 3.5: All models assume equilibrium; however, field conditions may not be at equilibrium, as the authors note. It would be helpful to clarify how this limitation affects the comparison. For example, the L-M-Y model (non-equilibrium steady state) underestimates ϕ . Do the authors conclude that equilibrium is more appropriate for this dataset? They suggest that equilibrium conditions were closer than steady state, which is reasonable, but they could further explain why short-range local sources might drive quasi-equilibrium partitioning.*

Response:

We fully agree with the points you have raised. Our study found that when simulating the gas-particle partitioning of pesticides, the equilibrium-based H-B model performed better than the non-equilibrium steady-state L-M-Y model. This suggests that during the observation period, the system may have been in a quasi-equilibrium state. A possible explanation is that the pollution in the study area primarily originated from local short-range emissions, as the sampling sites were located near farmland. We have now supplemented the discussion with a deeper analysis and interpretation of this phenomenon **in lines 565–574** in the revised manuscript as follow:

“However, field conditions may not be at equilibrium, a possible explanation is that the pollution in the study area primarily originated from local short-range emissions, as the sampling sites were located near farmland. High-intensity, close-range emissions could have established strong concentration gradients in the media surrounding the source, thereby dominating the short-term atmospheric partitioning behavior of pesticides near our sampling points and driving it rapidly toward local equilibrium. At the same time, regional atmospheric advection and long-range transport likely exerted a relatively weak influence given the spatial and temporal scales of this study. Therefore, although environmental systems are generally open and non-equilibrium on macroscopic and long-term scales, under specific localized and short-term conditions, equilibrium models may still serve as effective simulation tools.”