Dear editor and referee#2:

Thank you very much for your time and attentions on this work. The comments and suggestions are very useful to improve our manuscript. Following is a point-by-point response to referee #2's comments. Texts in italic are the comments, and those in black bold are our responses. We hope that you will find the changes satisfactory.

The authors presented an interesting work that integrates the Weather Forecasting Model (WRF), Computational Fluid Dynamics (CFD) and Flexible Particle (FLEXPART) to study local circulations at a neighbourhood scale and the potential contribution of one street as a source of air pollution. The authors analyzed local wind circulation under different regional wind regimes. The methods used by the authors are robust and the meteorology simulated shows good agreement as shown in figure 4. However, conclusions, as stated in lines 338-339, authors say: "In general, the S-TRACK system is effective in simulating meteorological and air pollution problems" has no strong basis. This is because the is no real emissions and only one street was evaluated. Specifically:

Specific comments

1) in the abstract, the authors state: "The results of the study are helpful to understand the characteristics of wind environment and effect of traffic emissions in the area...", however, there are no traffic emissions in the study.

<u>Response:</u> Thank you sincerely for pointing it out. In the current study, we did not have the detailed information about the traffic emissions from the road, so we assumed that the road traffic emissions are uniformly distributed. During the backward trajectory simulation, the particles as long as passing within 5 m height above the road is considered to be a potential contribution from the road emissions to the receptor site. Using the methods of residence time analysis (RTA) to determine the magnitude of the potential contribution, the RTA is expressed as follows.

$$R_{i,j} = \frac{\tau_{i,j}}{t},$$

where $R_{i,j}$ indicates the contribution ratio of the grid (i, j) to receptor; $\tau_{i,j}$ means the residence time in the grid (i, j) and t means the total residence time in all grids. There is some uncertainty in this approach. Your suggestion is

much appreciated, and we have modified the section as: "<u>The results of the study are helpful to understand the characteristics of wind environment. With the hypothesis that traffic emissions are uniformly distributed on roads, the effect of traffic emissions in the area is revealed as well, which is important to improve urban living environment and control air pollution.</u>" In addition, we also provide additional clarification for this situation in Section 3.3.

2) The authors presented the potential impacts of only one street. however, we do not know anything about that street, type of traffic, the diurnal cycle of traffic by type of vehicle and as shown in Figures 3a, there are many streets surrounding the area. For instance, Figure 7b shows that the street might be important for site S2, but this site is closer to a perpendicular street (east), as shown in figure 3a. In a summary, despite that the results are interesting, more work is needed to provide the basis for the conclusions.

<u>Response:</u> Indeed, there are many roads around the area that may have impacts on the receptor sites. According to your suggestions, we have selected four main roads in the region as shown in revised Figure R4a to analyze the potential impact characteristics of traffic sources on receptor sites. The widths of roads (including greenery and open space) R1-R4 are about 90, 40, 30 and 30 meters, respectively. We have done our best to collect the information of the roads. During January 2019, the average hourly traffic volumes are about 2300 (R1), 490 (R2), 400 (R3) and 90 (R4) cars, respectively. We assume that the road emissions are uniformly emitted. The magnitude of the potential contribution of the four main roads of the sub-domain B to each receptor site is shown in the Table R4. Following your suggestions, we have analyzed the potential contribution of the four roads to the receptor sites (S2-S8) at different heights separately in Section 3.3.1 in the revised manuscript, and found that road R1 had the largest potential contribution to the receptor sites. Accordingly, in the subsequent analysis in the manuscript, we only considered the contribution of R1 to different positions (i.e., S1 and S2 sites).

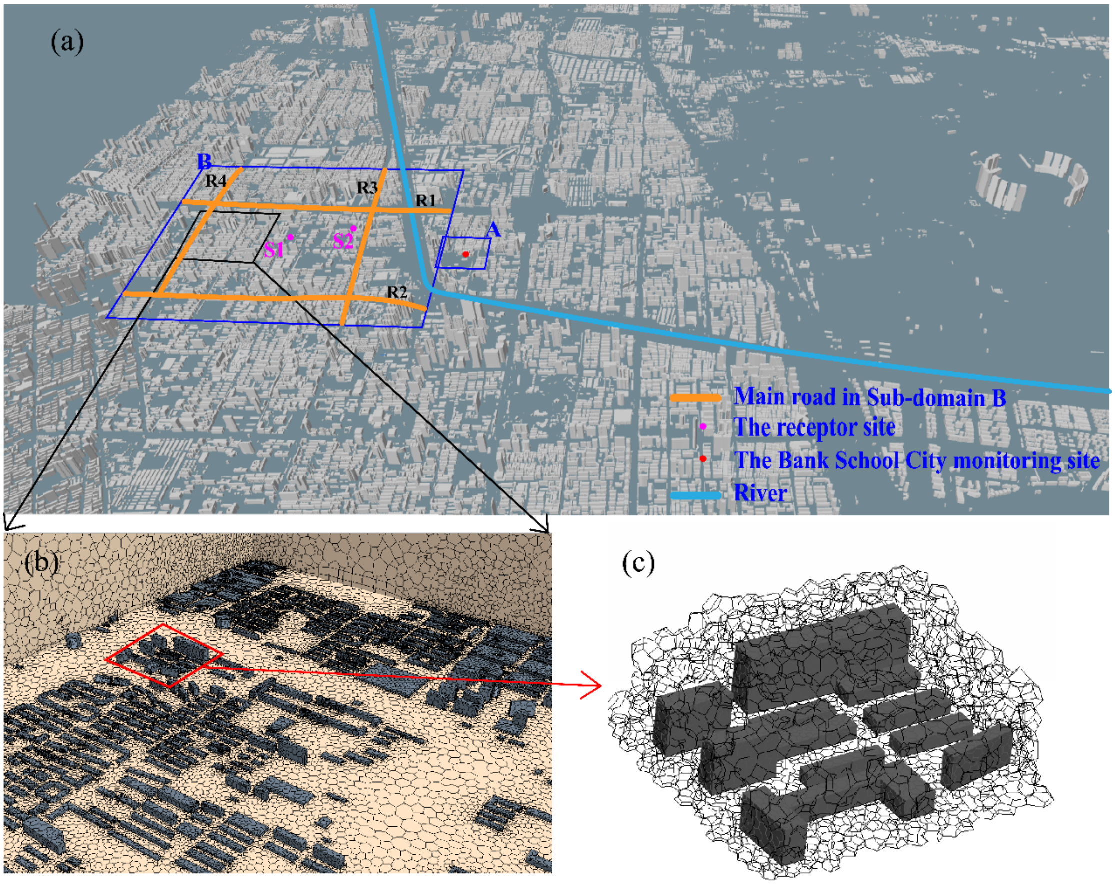

Figure R4: The computational domain of the CFD model is shown in (a). Sub-domain B is used to analyze the potential impact of traffic source on receptor sites in the region, with magenta dots (S1 and S2) indicating the receptor sites and Orange line indicating the main roads in Sub-domain B.

Table R4. Locations of receptor sites and the corresponding potential contribution ratios.

Receptor site	Location (x, y, z)	potential contribution ratio				
		R1	R2	R3	R4	All
S1	(-3200 m, -1420 m, 2 m)	1.81%	-	-	-	-
S2	(-2500 m, -1300 m, 2 m)	2.38%	0.18%	**1.32%**	0.16%	4.05%
S3	(-2500 m, -1300 m, 5 m)	2.57%	0.29%	1.28%	0.10%	4.25%
S4	(-2500 m, -1300 m, 10 m)	2.71%	0.32%	1.18%	0.12%	4.33%
S5	(-2500 m, -1300 m, 15 m)	**2.98%**	0.27%	1.22%	0.20%	**4.67%**
S6	(-2500 m, -1300 m, 20 m)	2.75%	0.37%	1.09%	0.17%	4.38%
S7	(-2500 m, -1300 m, 40 m)	2.30%	0.39%	0.70%	0.25%	3.64%
S8	(-2500 m, -1300 m, 50 m)	1.94%	**0.57%**	0.68%	**0.36%**	3.55%

3) Figure 1 shows that the results are interpolated but the authors do not show the methods and reasons for this interpolation.

<u>Response:</u> In this study, the method, used to interpolate the simulation results of WRF and STAR-CCM+ into a 10m×10m regular grid, is the nearest neighbor interpolation method. The nearest neighbor method is based on a comparison of the distribution of distances between a point and the nearest neighboring points of a set of randomly distributed data. The principle of the nearest neighbor interpolation is to select the value at the nearest location to the inserted grid as the value of the grid point. It is effective for interpolating data with uniformly spaced distribution (e.g., WRF simulation results) as well as tightly integrated data (e.g., CFD simulation results). Compared with other interpolation methods, the method also has the advantages of small computational effort, simple algorithm, fast operation speed, and easy implementation(Yang et al., 2004). We have added the description in Section 2.1 in the revised manuscript.

Reference：

Yang, C. S., Kao, S. P., Lee, F. B., and Hung, P. S.: Twelve different interpolation methods: A case study of Surfer 8.0, In: Proceedings of ISPRS Congress, 20, 778-785, 2004.

Minor issues:

1. The authors simulated between December 30 2018 and January 31, 2019. Why this period?

<u>Response:</u> An El Niño event occurred in January 2019 according to the Oceanic Niño Index (ONI). The occurrence of El Niño generally favors a warm winter and weak winter winds. Winds are one of the most important meteorological factors affecting the transport of pollutants. Therefore, it is more meaningful to study the wind environment and pollutant transport during this time period. We have explained the reason for choosing January 2019 as the simulation period in the manuscript.

2. Line 69: add space before Fast and remove space in "(2006"

<u>Response:</u> It has been corrected.

3. Lines 84-88. Only one phrase for a 5 lines paragraph. Each paragraph must be formed by at least three phrases, introduction, body and conclusion.

Response: **We have rewritten the paragraph in the revised manuscript.**

4. Line 124: Why do you need drone aerial photography? I think it is very good, but I'm surprised that you are not trying other sources.

Response: **Drone aerial photography technology can quickly obtain all kinds of basic data such as the geometric shape of urban buildings, roof height and vector data of the top of buildings with high resolution, high timeliness and accuracy. The information can be used to build a more realistic 3D model. Considering other methods, such as processing various scale line planning topographic maps or satellite remote sensing maps to collect urban building data, there are shortcomings such as poor visibility or high cost. Therefore, the drone aerial photography technique is chosen to obtain the city 3D modeling. We have added the description in the revised manuscript.**

5. Lines 162-164: "This... FLEXPART", this phrase is redundant.

Response: **It has been deleted.**

6. Lines 172: What was the number of particles released?

Response: **In the course of simulation, 5 tracer particles are released per hour, and the total number of particles released was 3590 tracer particles. We have detailed it in the manuscript.**

7. Lines 197-198: Simulating well the PBL is important to the dispersion of pollutants. How are the results? The authors can include more results in the supplementary material.

Response: **Thanks for your suggestion. The bulk Richardson number (Ri) method was taken to estimate the BLH base on the sounding data of Zhengzhou. Ri is expressed as：**

$$R_i(z) = \frac{(g/\theta_{vs})(\theta_{vz} - \theta_{vs})(z - z_s)}{(u_z - u_s)^2 + (v_z - v_s)^2 + (bu_*^2)},$$

where z means height above ground, s means the surface, g means the acceleration of gravity, θ_v means the virtual potential temperature, u and v mean the component of wind speed, and u_* means the surface friction velocity. u_* can be ignored here due to it is small relative to the wind shear (Vogelezang and Holtslag, 1996). Previous theoretical and laboratory studies suggested that when Ri is smaller than a critical value (~0.25), the laminar flow becomes unstable (Stull, 1988). Therefore, the lowest level z at which the interpolated Ri exceeds the critical value of 0.25 is referred to as PBLH in this study, which is referred to the criterion used by Seidel et al. (2012). The R value is 0.57, passed the 99% significance test. It can be seen from figure R5 that the variation of boundary layer height is generally captured.**

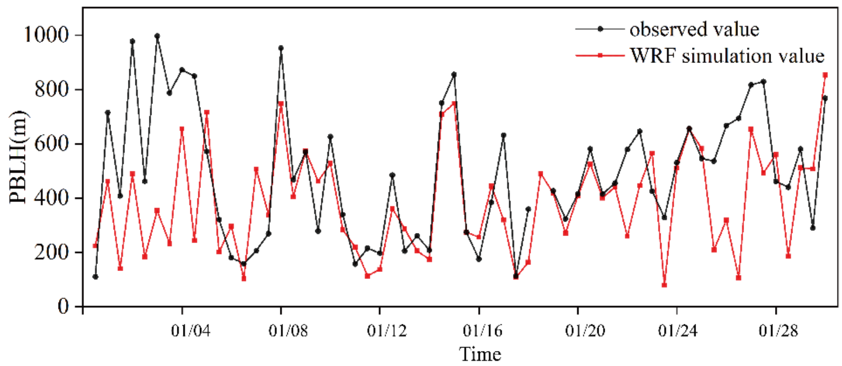

Figure R5. Time series of the observed (black) and simulated (red) PBLH at 8:00 and 20:00 Beijing time (BJT) in Zhengzhou sounding site.

Reference:

Seidel, D. J., Zhang, Y., Beljaars, A., Golaz, J. C., Jacobson, A. R., and Medeiros, B.: Climatology of the planetary boundary layer over the continental United States and Europe, Journal of Geophysical Research Atmospheres, 117, https://doi.org/10.1029/2012JD018143, 2012.

Stull, R. B.: An Introduction to Boundary Layer Meteorology, Springer Netherlands, Dordrecht,1988.

Vogelezang, D. and Holtslag, A.: Evaluation and model impacts of alternative boundary-layer height formulations, Bound.-Lay. Meteorol., 81, 245-269, https://doi.org/10.1007/BF02430331, 1996.

8. Lines 219: This line seems incomplete.

<u>Response:</u> Another referee thought this sentence does not have proof and should be deleted. Therefore, we have removed it from the manuscript.

9. Section 3.2.1. There are many parts where English needs to be improved with a more technical language. For instance line 232 authors say: "The wind is larger", maybe more intense is more appropriate. Lines 234-237 needs edit/improvement.

Response: Thank you very much for pointing this out. We have improved the English of the whole manuscript, including the Section 3.2.1. Please see in the marked-up manuscript.

10. Line 240: change climb or fall subsidence or other.

Response: "climb or fall" has been changed to "rise or subsidence".

11. Line 244: Change pile up for other.

Response: "pile up" has been changed to "accumulate".

12. Line 261: Line seems repeated.

Response: It has been deleted.

13. Figure 5 showing streamlines and divergence. Consider merging streamlines with shaded values for divergence. In that way, it would be easier to see diffluence.

Response: Thank you for the suggestion. The streamlines and divergence has been merged in Figure 5 in the revised manuscript.

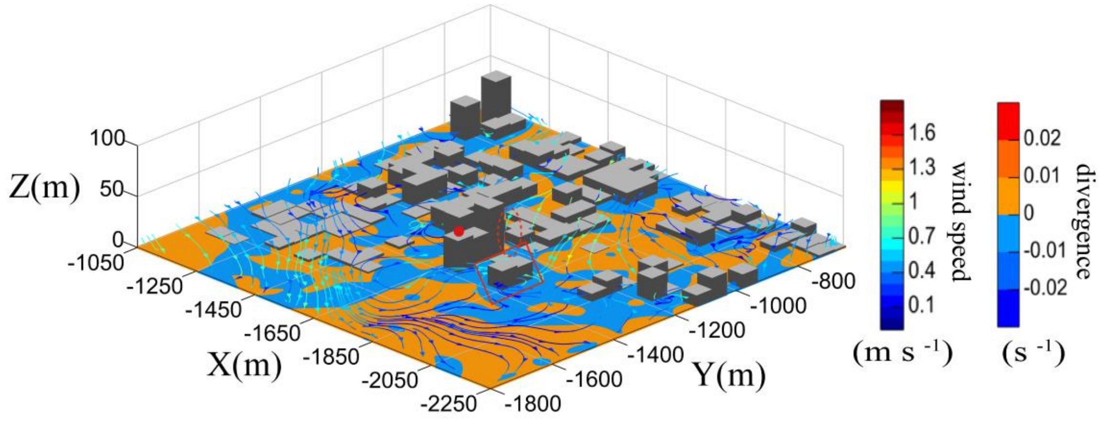

Figure 5. The simulated winds and divergence at the near-surface averaged in January 2019 in the sub-domain A.