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Comment on acp-2021-725

Anonymous Referee #1

Referee comment on "Development and application of a street-level meteorology and pollutant tracking system (S-TRACK)" by Huan Zhang et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-725-RC1, 2021

Referee's comments on Development and application of a street-level meteorology and pollutant tracking system (S-TRACK)

General comments

The authors present a new multi-modeling system S-TRACK which combines the Weather Research and Forecasting (WRF) model for the regional meteorological modeling and the STAR-CCM+ model for the street-scale air flow modeling and the FLEXPART model for a backward trajectory modeling.

The multi-scale modeling is an important issue to improve modeling performance of street-scale meteorology and air quality. In this manuscript, downscaling is conducted from the linking between the regional-scale model to the street-scale model. However, more detailed description for the linking is necessary (see my specific comments 1 and 5).

The most interesting part is a new research method to track the sources of pollutants in the street level using a backward trajectory modeling. The authors should give more analysis on the results as suggested in my specific comments 2 and 3.

A major revision is needed to improve the manuscript before the publication.

- Scientific significance: Good
- Scientific quality: Good
- Presentation quality: Fair

Specific comments

- The authors need to explain in more details how three components of S-TRACK are coupled. What is the major development by the authors to obtain the final simulation results? For example, in Figure 1, a regular and fine grid having the spatial resolution of 10 m is constructed by combining WRF and CFD results. Why is this refined grid necessary for FLEXPART? How is it done? An another example is in l. 164. According to the authors, WRF results fill some missing data from CFD results. It is not clear. What data are missing in CFD model? How have the authors filled this gap?
- I think that one of the major findings in this manuscript is the potential impact of the traffic source is the largest at 15 m (l. 309). However, the authors' interpretation is not clear. They linked the result to the distance of the building from the source. This result should be explained in details taking into account the background wind field. And this result should be added in Conclusion.
- Another major finding is in l. 329. The authors compare the contribution ratio during westerly wind and easterly wind. The higher ratio during westerly wind is explained by the building distribution. Why does the dense building distribution of upwind of the receptor site lead to a higher contribution ratio? If the authors can explain it, this result should be added in Conclusion and Abstract.
- In l. 21, "which is more obvious for high buildings and influencing air pollution transport at the street-level." is not discussed in the text. Is it related to any results of this study?
- One of important issues on the atmospheric modeling using CFD model is the computation time. How have you conducted a simulation on such a large domain in Figure 3 for about one month? Could you briefly explain the technical part in Appendix?

Minor comments

- l.12, l.86, l.93, and many other lines: the CFD model name should be given.
- l.26-27: please rewrite the sentence.
- l.37: why is the term "diffusion" used? Many times, "transport and diffusion" appear in the text (l.203, l.224). "diffusion" is one phenomena of transport.
- l.69: remove "In 2006"
- l.69-70: the sentence is not clear.
- l.74-75: the sentence is not clear. What do you mean with "the spatial resolution is affected by the numerical dispersion in the Eulerian model?"
- l.96-98: as Major comment 1, explain which data of WRF are used to fill the gap.
- l.116: remove "powerful". Please add the references that the STAR-CCM+ has been used for street-level simulation to show its modeling performance.
- l.122-123: correct the section title to "3D street-level grid generation". What do you mean "geometric model"?

- l.135 and l.138: correct “grids” to “grid cells”. Please don’t mix “grid” and “grid cells”
- l.139: I think the equations are not useful to explain the STAR-CCM+ model. Please rewrite this section focusing on the coupling of WRF model to STAR-CCM+.
- l.168: why are the turbulence options needed in FLEXPART? Presenting the main idea of the FLEXPART may be helpful. “CBL” can be removed.
- l.179: add Wind direction. It is presented in Figure 4.
- l.181: correct mean deviation to mean bias
- l.189-190: T and RH are underestimated. P and WP (correct W to WP) are overestimated.
- l.192: explain what is the significance test at least in Appendix.
- l.197-199: This sentence does not have proof. Please remove it.
- l.206: the averaged wind speed of 0.92 m/s is very now speed. Models cannot easily reproduce the low speed. Why is the observed wind speed very low? Is it a typical value on the simulation domain in winter?
- l.218: This sentence does not have proof. Please remove it.
- l.235: How is the influence of buildings on the wind field estimated? How do you know it is diminished?
- l.299-l.302: the authors may remind the results in Section 3.2 to link the differences in the wind field to potential contribution ratio.
- Figure 4: Why have you not compared WRF wind direction?
- Figure 5: Please make figures bigger and explain what is the divergence.
- Figure 7: Explain what is the density distribution in the text.
- Table 3: Are the potential contribution ratio the averaged value of all wind directions?