Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., referee comment RC2
https://doi.org/10.5194/acp-2022-371-RC2, 2022

Comment on acp-2022-371

Anonymous Referee #2

Referee comment on "Development and application of a multi-scale modeling framework for urban high-resolution NO_2 pollution mapping" by Zhaofeng Lv et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2022-371-RC2, 2022

General comments:

The regional to urban coupling allows the consideration of regional weather effects in local models and plays an important role in the improved prediction of local air pollution. The development of such multiscale modelling framework is interesting. This paper developed a hybrid CMAQ-RLINE_URBAN, which coupled the regional CMAQ Chemical Transport Model, RLINE local dispersion model and urban thermodynamic scheme. Intensive CFD street canyon simulations have been conducted for the application of Machine Learning. The hybrid model has been applied to one month simulation in Summer for Beijing as a case study. It performed better than the regional CMAQ model in predicting NO2 concentrations for roadside sites. However, there are still a number of major comments to be addressed,

Major comments:

- Literature review: Lack of discussion about the computational fluid dynamic (CFD). CFD can be classified into two categories: Reynolds-averaged Navier-Stokes (RANS) and Large-Eddy Simulation (LES), based on turbulence closure schemes(e.g. https://doi.org/10.1016/j.envpol.2016.04.052). Discussion about the comparison between RANS and LES is needed, and to justify the use of RANS in the present study (e.g. computationally faster than LES, but only resolve the mean time-averaged properties).
- Literature review: there is not enough information about local RLINE model, and also the coupled CMAQ-RLINE model. Then to justify the need of the further development of CMAQ-RLINE_URBAN in the present study. Also, the literature about the current status of regional-to-urban coupling is missing (e.g. https://doi.org/10.5194/acp-18-11221-2018, 2018).
- Resolution for the hybrid model CMAQ-RLINE_URBAN. The resolution of 50 m x 50 m is still coarse to resolve the street scale dispersion of road sources. Could such resolution be flexible (i.e. further to higher resolutions) in the hybrid model? The justification of

the use of 50 m x 50 m in the present study is needed.

- Machine learning is for air flow (wind speed) only. How is it linked to the pollutant dispersion? Would it be better than a traditional street canyon model (e.g. https://doi.org/10.1080/10962247.2020.1803158)?
- It is not clear how NOx photochemical scheme works? Does it explicitly resolve the simple NOx-O3 cycle? If VOCs chemistry is further considered, then it would likely make a substantial difference in predicting NO2 concentration (e.g. https://doi.org/10.1016/j.envpol.2017.01.076). It is suggested to add some discussion on this aspect.

Minor comments:

- Line 39: Which pollutant does these measures of industrial and domestic sources aim to tackle? Is it for PM2.5, rather than NO2?
- Lines 42-43: The poor dispersion caused by buildings along the street would also play a key role in it. High pollutant concentrations in street canyon environment are caused by combined effects of poor dispersion, increased traffic emissions and chemistry processes.
- Line 58: “has” should be “have”.
- Line 96: “Based on FORTRAN and R languages”, it is not clear. Which part is based on R? Is it for a post-processing tool?