Geoscientific Model Development Discussions

Geosci. Model Dev. Discuss., referee comment RC1
https://doi.org/10.5194/gmd-2020-432-RC1, 2021

Comment on gmd-2020-432

Anonymous Referee #1

Referee comment on "urbanChemFoam 1.0: large-eddy simulation of non-stationary chemical transport of traffic emissions in an idealized street canyon" by Edward C. Chan and Timothy M. Butler, Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2020-432-RC1, 2021

Recommendation: Publication after minor revisions

The authors present a new LES-based chemistry transport model developed in the OpenFOAM software environment. The implementation shown here describes the dispersion of nitrogen oxides and ozone from road traffic emissions and their simplified chemical transformation in an idealised street canyon. In addition to a brief evaluation of dynamic parameters with measurements, a comparison of results from a stationary and a time-varying simulation is provided.

The manuscript is very well written and understandable and well-illustrated. The text could nonetheless use another round of editing to eliminate several typos.

My main objection is that despite the interesting quantification of the discrepancies between stationary and non-stationary simulations, the study does not show the full potential of the transient setup – the transition between nocturnal and daytime boundary layer and vice versa. In particular, the morning hours would be very interesting with regard to chemistry and boundary layer processes (onset of boundary-layer growth and photochemistry, emission peak) and exposure research. How does urbanChemFoam capture this transition?

In addition, radiation effects of buildings, which are interesting on the scale considered, are not included in this study. This could at least be discussed in the form of a possible outlook.

Minor comments:

- Page 3, line 81: Missing word: '…uniform along both' – lanes?
- Page 3, line 90: 'regional model results'.
- Page 7, line 174: 'additional gaseous'.
- Page 7, line 196: obsolete 'of' in 'at the surface level'.
- Page 10, line 280: obsolete 'with' in 'using the coarse'.
- Page 10, line 280: obsolete 'the' in 'by the RANS'.
- Page 11, lines 314/315: Please add 'UTC' to all time values.
- Page 11, line 324: '… is then partitioned into …'
- Page 12, line 334: Please resolve 'LIC' in the text.
- Page 13, line 373: Check unit. Shouldn't it be [m s^{-1}] for velocity.
- Page 13, line 376: 'concentration levels'
- Page 13, line 381: I would rather refer to it as a diurnal cycle than a time series.
- Page 14, line 415: Meant is WRF-chem.
- Fig. 3: Obsolete 'of' in '…profiles of the resolved …'.
- Figs. 3, 5, 8-10: Maybe better include the legend in the figures.
- Fig. 12: Do the background conditions apply to these results? Some concentrations appear lower than the boundary conditions (cf. Figs. 6 and 12). Suggestion: indicate sun rise/set or night times by grey shadings in the panels.