Geosci. Model Dev. Discuss.,
https://doi.org/10.5194/gmd-2020-126-RC2, 2020

Geoscientific Model Development Discussions

Interactive comment on "Sensitivity analysis of the PALM model system 6.0 in the urban environment" *by* Michal Belda et al.

Anonymous Referee #2

Received and published: 14 December 2020

General comments: The sensitivity of the LES model framework PALM-4U to selected surface parameters and to a combination of surface properties representing potential planning scenarios are evaluated. While the study reveals some nice details on the capabilities of such LES modelling of a real urban environment, the study design could be clearly improved. - It is not clear why the scenarios are chosen in this particular way. For example, several planning scenarios appear rather unrealistic. - Further, scenarios discussed in full in the main manuscript should be reduced to only reveal the most important aspects of the modelling capabilities and urban planning assessment. Currently, it is very difficult for the reader to keep track of all the scenarios being discussed. This may also be related to the rather high number of figures which could be reduced to give a better overview to the reader. - A major drawback of the scenarios aiming to as-

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sess model sensitivity to certain input parameters is that no reference measurements are presented to determine model performance. So how do the SA scenarios really differ from the SB scenarios? - Finally, the analysis should really highlight the added value from the LES model setup, i.e. the spatial variability in meteorological indicators. Most of the “average” conclusions drawn (e.g. contrary impact on human thermal comfort and ventilation) can be expected from lower resolution modelling – there is a clear lack of references to e.g. evaluation of urban surface scheme.

Minor comments: P2, l50: PM10 defines particle up to diameter of 10 μm P3, l66: Why are two radiation models listed? What are they doing, respectively? P4, l87: How are the boundary conditions defined for the pollutants? Spatial variations in surface emissions? Horizontal advection and long-range transport? P4, l93: Why is there no urban scheme used in WRF? How does this impact the boundary conditions provided in the nesting (e.g. wind profiles, boundary layer height, . . .)? Are there relevant studies that should be cited here? P4, l108: so albedo and emissivity are independent of material category? P4, l110: define symbols at first occurrence P4, l150: Give some details on the building database. This a vector dataset? What is the level of detail? P5, l132: replace ‘housing’ by ‘residential’ or remove the word. P5, l144: what are ‘non-impervious’ anthropogenic surfaces? P6, Figure 1: include reference to Resler et al. (2017),in figure caption as this defines the ‘old domain’ P6, l151: provide reference for ABL height maximum in summer. P7, l160: why adding a flat buffer zone? How does this impact the flow? Provide a reference where readers can find more information on this aspect. P8, l177: where were the meteorological measurements conducted? Within the study area? What height above roof level? P8, l180: Maybe more appropriate to present results in local time rather than UTC? P8, l183: add reference for importance of traffic emissions. What fraction of PM10 in the area is from local traffic emissions? What is the role of other sources? What is the role of regional transport and local scale advection? P11, Table 2: some scenarios are rather unrealistic. Maybe provide some reasoning why these were tested? i.e. changing all roads to grass but then not changing vehicle emissions is a scenario that can not be translated to reality. P12, l222:

that's the reason why spin-up time is usually excluded from analysis. Please clarify you comment. P12, l228: please clarify. All indicators at 2m height above ground. What distance from the buildings? Which surface temperature is used as the indicator? P12, l229: what is meant by 'where necessary'? please explain. P13, Figure 4: Some odd model results should be discussed. This includes: very high LST in small gaps between buildings. Are these realistic? Where do they come from? Why do they not translate into high MRT? Also, Why are the PM10 concentrations only relevant in the two cross-roads? According to Figure 3 there are also emissions for the roads closer to the domain edges. Also, make sure symbols and variable names are defined and sued consistently. E.g. in the text and figure caption you use 'surface temperature' without defining the term 'LST' that appears in the Figure. P13, l154: Explain. Why is the importance of window fraction changing throughout the day? P13, l152: rephrase 'opposite behaviour to the air temperature in terms of the sign of the changes with higher absolute values'. Not clear. P18, l278: It is actually more interesting to see the spatial variability in impact of different scenarios. While average impact can be expected simply according to simple model physics and are in accordance with low-resolution simulations, the added value of the LES approach are the new insights into the spatial variability. This should be highlighted more clearly. But where are the analysis points marked that are shown e.g. in Figure 11? More detailed discussion could be nice. P19, Figure9: combine with Figure 10 to reduce the number of figures and make analysis more compact. P21, l330: Provide some interpretation. What explains the decrease in particle concentrations?

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