Geosci. Model Dev. Discuss.,
https://doi.org/10.5194/gmd-2020-222-RC1, 2020

Geoscientific Model Development Discussions
Open Access
EGU

Interactive comment on "A Nested Multi-Scale System Implemented in the Large-Eddy Simulation Model PALM model system 6.0" *by* Antti Hellsten et al.

Anonymous Referee #1

Received and published: 13 October 2020

The authors developed an LES-LES nested multi-scale system in the PALM model. A key point is to keep unsteady turbulent behaviors in nesting LES-LES models. As far as I know, they developed the two-way coupling scheme in obstacle-resolving LES models for the first time in the world. They carefully evaluated them through the LES-LES numerical experiments on several types of turbulent flows such as NBL, CBL flows, building and hill flows. I strongly recommend publication of this manuscript after the following points are addressed.

Main comments 1. In page2 and line13: The authors mentioned "many numerical solution methods (e.g. finite-element and finite-volume methods)...". Recently, the

Printer-friendly version

Discussion paper

Lattice Boltzmann Method (LBM) has also come to be regarded as a useful tool and been applied to wind engineering field. Since the LBM has a merit of quite high-speed calculation, it can quickly conduct large-scale wind simulations even for urban areas resolved by a fine grid by massively parallel computing (e.g., Ahmad et al., 2017). Would you comment on the strength of the PALM model based on a finite difference method by comparison with the LBM method?

Ahmad et al.: Large-Eddy Simulation of the Gust Index in an Urban Area Using the Lattice Boltzmann Method, Boundary-Layer Meteorol, DOI 10.1007/s10546-017-0233-6, 2017.

2. In page3 and line6: The authors mentioned “according to our knowledge, WRF-LES is not applicable to blunt-obstacle resolving LES required for urban turbulence studies”. the limitation of the WRF-LES nesting system. Wiersema et al. (2020) developed the WRF-IBM (immersed boundary method) to enable multiscale simulations over highly complex terrain with dynamically downscaled boundary conditions from the meso-scale to the building-scale. Although their approach is one-way nesting system, they successfully simulated turbulent flows in the urban central district by the WRF using the IBM method. The authors should refer the WRF-IBM study and comment on it.

WIERSEMA et al.: Mesoscale to Microscale Simulations over Complex Terrain with the Immersed Boundary Method in the Weather Research and Forecasting Model, Mon. Wea. Rev. (2020) 148 (2): 577–595.

3. In page13: It is difficult for readers to understand “Canopy-restricted anterpolation”. Would you describe the idea of the aterpolation more clearly?

4. In page26: There seems to be different between the experiments and LES at a downstream position of 1.25H even for a fine reference simulation case. Is this due to the orthogonal grid system?

Minor comment 5. In page6: the left (1), right (1), south (2), north (2), → west (1), east (1),. . .? 6. In page26: Figure 13 and 14 → Figures 13 and 14

Interactive comment on Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2020-222, 2020.