

Interactive comment on “Sensitivity of local air quality to the interplay between small- and large-scale circulations: a Large Eddy Simulation study” by Tobias Wolf-Grosse et al.

Anonymous Referee #1

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This article is an example of a successful application of LES to explain the observed increase of pollution concentration in the city due to the interplay between the large-scale circulation and the circulation forced by the local topographic and thermal forcing. The conclusions are confirmed by the comparison of the numerically obtained effects and the measurements. The authors showed that the physically reasonable results can be obtained even under the highly simplified setup of the numerical experiment. This result justifies the use of the standing-alone LES for post-processing of the data obtained from large-scale forecasting models to clarify the local air quality predictions over urban areas.

The following corrections should be done before the paper is published:

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1) Page 5, line 30 - page 6, line 7. This paragraph can be greatly shortened or removed. There is no necessity to describe the intrinsic details of the code which are not directly connected to the physical problem.

2) The model resolution is 10 m (page 6, line 24), so the grid step is not fine enough to perform building resolved simulation. The methods of accounting of the urbanized surface should be described, at least the roughness parameter and the displacement height should be specified. Are the results sensitive to the chosen drag coefficients?

3) Page 8, lines 23-24. It might be explained what the authors mean when writing about the temperature at the level 2 m. The method of extrapolation from the rough grid should be specified.

4) Page 8, line 30. The authors wrote "The land surface temperature can therefore adapt to the fjord temperature due to the advection of relatively warmer air". It is not evident and depends on the heat fluxes balance. Moreover, the breeze circulation should transfer air from the land to the fjord (as it is shown in Fig. 4) but not vice versa.

5) Figure 5 should be redrawn, because the discontinuities in wind direction are artificial and connected with periodicity of the angle scale.

Common comments:

a) The volume of the paper could be reduced by avoiding long discussions.

b) The grid resolution sensitivity tests are not presented. It will be better to perform at least two additional runs for any presented case with finer and rougher grids to ensure the stability of the results and conclusions.

c) PALM code permits the calculations inside the non-periodic domains. It is recommended to perform at least one additional numerical experiment to show that the periodicity does not influence the results.

d) It would be better to present some turbulence statistics (at least the second mo-

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ments) in ABL above the land and the sea to ensure that LES reproduces turbulent dynamics.

I am in favor of publishing this paper in Atmos. Chem. Phys. after clarifying these issues.

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-892, 2016.