

Atmos. Chem. Phys. Discuss., referee comment RC1  
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## Comment on acp-2021-81

Anonymous Referee #2

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Referee comment on "Dispersion of particulate matter (PM<sub>2.5</sub>) from wood combustion for residential heating: optimization of mitigation actions based on large-eddy simulations" by Tobias Wolf et al., Atmos. Chem. Phys. Discuss.,  
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Dear authors,

This manuscript represents a large-eddy simulation (LES) modelling study investigating the transport and concentrations of PM<sub>2.5</sub> originating from wood combustion in Bergen, Norway. The study applies the LES model PALM with some useful user-code modifications. The manuscript focuses on the pollutant exposure of urban dwellers with the main goal to understand the spatial distribution and transport of PM<sub>2.5</sub> under weather conditions that are found the worst for air quality. Furthermore, the study aims to quantify the effect of replacing older fireplaces with newer ones on the air quality in the whole city and separately in its districts.

My general comments were provided already in the previous review phase:

*The research questions and methods are novel. However, the biggest issue is that, at its current state, the manuscript does not fulfil one of the main aims of ACP: "The journal scope is focused on studies with general implications for atmospheric science rather than investigations that are primarily of local or technical interest." Currently, the manuscript is very Bergen specific and resembles a project report to the municipality. Hence, for the manuscript to fit into the scope of ACP, a major review is needed.*

Some general comments:

1. As mentioned above, the manuscript is now only focused on the city of Bergen and hence the results are lacking general implications. For instance, no comparison with previous studies applying more simplified geometries or real topographies is given. Furthermore, there is rather a lot of discussion about the funding of these kinds of studies by cities, which I think does not fit the scope of ACP.
2. Now the manuscript is difficult to follow. This is partly related to the language and partly to the structure of the manuscript. At least these points require improvements:
  - The aims of the study must be stated clearly
  - Sections 1 & 2 should be merged because they overlap a lot regarding the content.

- The language requires revision. Firstly, the paragraphs are lacking coherence and the text is missing flow. Secondly, the application of articles (a/the) and prepositions must be double-checked.

I hope these comments will be answered in this review phase. Another general comment:

- What boundary conditions are applied for the passive PM2.5?

Specific comments (P=page, L=line):

P1 L7: "emission" --> "emissions"

P1 L17-18: I would leave this definition of LES out of the abstract

P1 L20-21: "with the worst air pollution" --> "that typically lead to the weakest air quality"?

P1 L21: "Bergen" --> "Bergen, Norway"

P1 L21: "True laser" sounds wrong. I understand that you are meaning "topography from laser scanning" here

P2 L22: "at the regular mesh" is unnecessary detailed here

P2 L28: "limited incentives" --> "limitation incentives"?

P2 L38: "in short run" --> "in the short run"

P3 L46 – P4 L79: This paragraph is long and difficult to follow. You could split it up into two or more parts.

P3 L47-48: "with the meteorological background set up by shifting weather" sounds peculiar. How about: "with the temporally varying prevailing meteorological conditions"?

P3 L48: I would move "e.g. in Bergen, Norway" to the end of this phrase: "... stagnation zones, as shown in Bergen, Norway"

P3 L51: "(Chandler, 1976), (Bai, 2018)." --> "(Chandler, 1976; Bai, 2018)."

P3 L55: "That is likely true". I would not be so sure. Low-cost sensors are not the most reliable data sources.

P3 L58: "Locked within silo". What does this mean?

P3 L60-61: I do not think that information about project funding belongs here.

P4 L75: "massive-parallel"? You mean "supercomputers that can be applied to run massively parallelized simulations"?

P4 L83: "by Wolf et al. (Wolf-Grosse et al., 2017a; Wolf et al. 2020)" --> "by Wolf-Grosse et al. (2017a) and Wolf et al. (2020)"

Section 2: A general figure of the area of interest (i.e., Bergen) and its districts would be useful.

P5 L 104: "Bergen has clean air brought to the city with westerlies from the Atlantic Ocean" sounds wrong. Why not simply: "the prevailing westerly wind provides clean from the Atlantic Ocean to Bergen"?

P5 L113: "There is a strong anti-correlation between air quality and air temperature in Bergen (Wolf and Esau, 2014)." This is not Bergen-specific but applies to maybe most of the cities?

P5 L 114: "calm weather periods" --> high-pressure systems leading to weak winds?

P6 L141: "PALM resolves" --> "LES resolves"

P6 L141-142: "PALM explicitly resolves a part of relevant three-dimensional atmospheric turbulence dynamics as well as turbulence". I do not understand the meaning of this phrase. Yes, LES directly resolves the turbulence structures that are larger than the grid and parametrises the rest.

P7 L150: "runs"

P7 L 156: "chemical processes". Aerosol dynamics can also have an impact.

P7 L 164: Open "NO2"

P7 L167: "The domain includes buffer zones used for linear interpolation between the opposing period boundaries of 1000 m width". The meaning of this phrase is not clear to me.

P8 L169: "the largest achieved urban simulations so far". Are you sure?

P8 L179-184: Are the temperatures applied just some generic values or have you taken them from measurements or model simulations?

P8 L191-192: "We have already identified the typical meteorological conditions that correspond to the high urban pollution episodes (Wolf et al., 2014)." --> I would write "The typical meteorological conditions that correspond to the high urban pollution episodes in Bergen have been identified in a previous study by Wolf et al. (2014)"

P9 L194-196: These side comments about the boundary conditions applied for PALM are a bit confusing.

P9 L215: "Since 1995 installation only the new ovens are allowed". Something missing here?

Section 4: please refer more to the figures. I will make it easier to follow the text.

P11 L252: "the actual local conditions". Which conditions?

P11 L253: "in more densely populated districts". This can be expected only if the emissions correlate with the population density.

P11 L255: "in some stagnation zones". It would be easier to follow the manuscript if you indicated these areas in the respective figures.

P11 L262: "e.g., over Nordåsvannet at 60.32 N and 5.32 E." You could mark this in the respective figure.

P12 L281-282: "Artificially defining emissions..." This belongs to the methods section.

Figures 4-6: I find it difficult to distinguish different districts on the figures. How about 1) combining the figures to one figure and always showing the same area in the map OR 2) adding a smaller map to each figure to show the location of the specific district on the big map?

P14 L329: a dot missing after "Table 1"

P14 L330: is the limit 40 ug/m<sup>3</sup> for the daily average or temporal values?

P14 L332: "households are under the current distribution of ovens exposed to high air pollution." The word order is confusing.

P15 L362: "Feliuss et al. study (Feliuss et al., 2019) however" --> "Feliuss et al. (2019), however,"

P16 L385: I guess the user-code modifications should be provided as well?