Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2020-968-RC2, 2020

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Turbulence-permitting air pollution simulation for the Stuttgart metropolitan area" *by* Thomas Schwitalla et al.

Anonymous Referee #2

Received and published: 26 December 2020

The Stuttgart area is characterized by complex topography and known for frequent occurrence of high pollution concentrations. The paper describes a demonstration case study for this area with WRF-Chem at a horizontal resolution of 50 m for a polluted winter day. Overall, the paper addresses an important and interesting topic as air quality studies at such a high resolution are not frequently presented. The paper should definitely be published as an interesting case study with a high-resolution air quality model. However, it may be considered as a bit premature to regard the described setup as an 'air quality forecasting system (AQFS)'.

Specific comments

Abstract, line 26: 'Together with information about the vertical distribution of PM10 and NO_2 from the model, AQFS will serve ...' What is the difference between the

described WRF-Chem simulation and AQFS? Are there any special tools developed for the AQFS? If so, they should also be described in more detail in the paper.

The introduction is quite long considering the length of the paper and not all points mentioned in the introduction are relevant in the context of the paper (e.g. lines 29-36, remarks offline air quality models or on aerosol-radiation interactions).

Line 86: In the meantime, PALM offers also several option to use e.g. COSMO of WRF as drivers (Kadasch et al. and Lin et al. in https://gmd.copernicus.org/articles/special_issue999.html as well as the implementation of WRF_interface, which is already included in the PALM system). Besides of this, this remark would better match in the context of lines 96-100.

Line 158: The statement about RADM2 is somewhat odd (63 chemical species including photolysis and more than reactions). Besides oif this, the number of 63 includes also water vapor and a passive compound.

The authors claim that the model can be applied 'in a forecast and warning mode' (line 173). On the other hand, it is obvious from the domain size and the high resolution the simulations must be quite demanding, which is also mentioned in line 174. How high was the computational effort for the described study (How long did the simulation take on how many nodes)? Besides of this, tools should be supplied to stakeholders for an AQFS.

Lines 208-209: The differences should be commented in more quantitative way (E.g. what is the difference between the spatial integral for a) and b)?).

Section 2.4: Lines 225-232 are not related to observation and should be moved to somewhere else. Chemistry observations from Fig. 5 should also be included here instead.

Lines 291-307: It is not clearly mentioned whether too persistent simulated clouds are really the reason to the too late drop in temperature.

Line 345: Some comments on the influence of the quite thick lowest layer on the results should be given and (in spite of the objections and restrictions) a small comparison with observed values.

Line 357 'nocturnal boundary layer height': This is hardly visible in Fig. 11, either us different colors or indicate the PBL height in the figure.

Line 362 'that PM10 is a diagnosed quantity in our model setup.' What does this statement mean? I assume that Figures 12 and 13 show instantaneous values of the concentrations. What is the temporal variability at this high resolution? A presentation of the diurnal course of the pollutants should also be included. What is the effect of the too late drop in temperature on pollutant concentrations?

Figures 1, 2, 3, 8, 12 and 13: The lat-lon presentation used here is quite unfavorable.

Figure 4: Prep_chem_sources and MOZBC are separate tools, why are the put together? What is the meaning of the dashed arrow?

Figure 7: It is hard to distinguish any details. A presentation ut to a height of 400 hPa would be sufficient.

Figure 11: It is hard to distungish the PBL height from this figure, either change colors or indicate the PBL height.

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2020-968, 2020.