

## Response to comments of Referee 3

### Specific comments:

Introduction: it is unclear as to why the Dresden Basin is an important region to study for the Special Issue. There are also no discussions on the health impacts of air pollution in this region. Observations from either satellite or ground-based measurements should be addressed to support the significance of air pollution in this region.

We primarily decided to study the Dresden Basin with our model, because not much is known about air pollution in this rather small urban basin. The Dresden Basin can be considered to be too small to resolve the meteorological aspects relevant to air pollution dispersion with a mesoscale model. On the other hand, it is still too extensive to feasibly cover it with classic urban microscale simulations. Therefore, it is an interesting target for our microscale/urban gray zone model. From theoretical considerations, it can be expected that under stable weather conditions, air quality can substantially degrade within this basin, because it is mostly urban, rather small, and also well-secluded as the downstream exit is very narrow. Another important factor is that the Dresden Basin is connected to the much larger and often heavily polluted Most Basin located up the valley in the Czech Republic. To better support the significance of air pollution in this region, we further include Sentinel 5P satellite NO<sub>2</sub> observations in the supplemental pdf file of the manuscript and refer to it in the introduction.

Figure 3. The map does not indicate the absolute coordinates of the study region, so readers who are unfamiliar with the region would not be able to efficiently locate the exact region. I suggest that the authors either add a separate map to show the geographic location of Dresden or modify the coordinates of the current map to absolute coordinates. Also, "hmsl" needs to be defined.

We revised Figure 3 to include domain D4 in the nesting chain. Furthermore, the absolute geographical coordinates are now shown instead of the coordinates of the rotated-pole lat/lon grid (on which the mesoscale simulations were actually performed). We replaced "hmsl" with " $z_{asl}$ ", which means height above sea level (also defined now in the caption of Figure 3.)

P33 Line 724: It is unclear how aerosols are represented in the RRTM since they will affect the radiative fluxes. It would be helpful to readers if the authors describe the aerosol optical properties of the air pollution in the Dresden Basin in terms of single scattering albedo, asymmetry parameter and Ångström exponent.

This was actually a mistake in our description. RRTM can consider aerosol and clouds, but we considered only cloud radiative effects in our simulations. Considering that cloud radiative effects from fog /low-altitude clouds are of orders of magnitude more important than boundary-layer aerosol effects, we think this is a valid first-order approximation. However, clearly, air pollution within the boundary layer has a significant radiative effect too. But in order to consider it realistically, other aerosol types besides BC (e.g., sulfate) have to be included in the simulation too, which would require air chemistry in our microscale simulations. This is, however, not yet included in our actual model version.

P2 Line 37: Remove "In fact"

Removed.

Figure 2: "in experiment two" should be a new sentence

Changed accordingly.

Sections 3.3 and 3.5 do not have contents. Please fix the section numbers of the whole manuscript.

Double sections are removed.