

# Response to comments of Referee 1

## Specific comments:

### 1) Title

In the title the emphasis is given both to natural and urban topography. The effect of urban topography is taken into account by the microscale model, but it is not discussed in the paper. For this reason, the Authors should either improve the discussion of the effects of urban topography on air pollutant dispersion or remove urban topography from the title.

It is true that urban effects are not really discussed in our manuscript as they were already extensively discussed in our previous simulation study. Therefore, we decided to change the title as suggested by another Referee. The new title is: "Air pollution trapping in the Dresden Basin from urban gray-zone scale modeling."

### 2) Paper organization

I found that the Section on principal-component analysis is not well connected with the rest of the paper. In particular, it is not clear what is the added value of this additional analysis in characterizing the effect of topography on pollutant dispersion in the Dresden basin. Therefore, the motivation and the added value of this additional analysis should be better explained.

We agree that this Section was not well connected to the rest of the paper. First of all, we removed the more technical part of the principal-component wind field analysis, as it is already covered in the work by Ludwig et al. (2004). As a result, the motivation of the principal component analysis is now better explained at the beginning of Section 3.4. We also revised other parts of this Section. For example, we focus the discussion more on the BC age concentration patterns instead of the mass concentration patterns, because we think that differences in the transport can be better seen in the age concentration.

## Minor and technical remarks

Line 60 and line 66: use lowercase after colons.

Corrected.

Line 81: “mean age of stratospheric age”: repetition.

Corrected.

Line 109: “for a MORE realistic simulation...”

Changed accordingly.

Equation 1:  $c$  is not introduced.

The definition of  $c$  is now included.

Equation 3:  $c_a$  is not introduced.

We replaced “ $\alpha$ ” with  $c_a$  for the age concentration in the whole manuscript.

Line 247: delete the full stop after “planes”.

Deleted.

Caption Figure 4: change “Section A” with “Appendix A”.

Changed accordingly.

Title Section 3.1.2: change “March” with “May”.

Corrected.

Some Section titles are repeated: “Age-concentration modeling – proof of concept”, “Principal-component analysis”.

Repeated titles are removed.

Line 466: “with generally lower wind speeds than in cases...” probably something is missing in this sentence.

This half sentence was removed.

Line 498: change “vise versa” with “vice versa”.

Corrected.

Line 536: I would change “reflects the real distribution of air pollutant sources” with something similar to “reflects the presence of accumulation or recirculation areas”.

We replaced it with “The age concentration can therefore be considered a more appropriate metric that reflects the accumulations from a realistic distribution of air pollutant sources.”

Figure 5: it would be interesting to have also a map of the total emissions, and not only of the emissions within the first vertical layer.

All the emissions from the elevated layers are now shown in a second plot. By the way, we decided to move this Figure to an extra supplemental file (together with some other figures), because it is not really discussed in the manuscript.

Figure 7 and 8: in my opinion for the interpretation of the results it would be clearer to plot the time series of wind speed and direction and not of the two horizontal wind components.

We agree therein and changed the Figures accordingly.