

Authors response on the Anonymous Referee #3 review of “The regional impact of urban emissions on air quality in Europe: the role of the urban canopy effects”

We thank anonymous referee #3 for his positive and constructive comments. We will address them one-by-one and our point-by-point responses follow below. All of the editorial/typographical comments will be addressed in the revision. Reviewer's comments are italicized.

General comments:

Some basic information on the selected cities should be provided, e.g. area, population, population density, main emission sources, etc. What are the differences/similarities between the cities?

Authors response: We provided information on the criteria for the city selection as well as a table (Tab.2.) containing some basic information about the size/population of the cities. Some information on the most important emissions from these cities is added in the text too. All these information show that the analyzed cities are very similar in terms of size/population, but the share of the main emission categories/sectors is different.

Chapter 3.1. The validation part should be extended. Some measures of the model performance evaluation should be added. The Authors said that the full validation is described in Huszar et al. (2020b), however that paper gives the validation only for 4 out of 6 analyzed cities. The source (database) of the measurements and type of the stations used for the validation should be also provided.

Authors response: We indeed admit that an explicit validation for each city should be added and relying on that done for only one of them is not sufficient. We therefor added a comparison of the modelled and measured monthly means of the analyzed species pollutants for each of the city based on all available urban background AirBase station (new Figure.3). Now, it is clear stated in the text what type of AirBase station is used.

Authors further implemented all specific comments on corrections listed below (mainly replacement of text with correction and removal of unnecessary text).

Specific comments:

Line 1: replace „air-quality” by „air quality”

Line 2: replace „scales” by „scale”

Line 9: replace „rural one while” by „rural one, while”

Line 15: replace „In case of” by „In the case of”

Line 17: replace „air-pollution” by „air pollution”

Line 36: replace „Zha et al., 2019) while for turbulence (especially the vertical eddy diffusivity), strong” by „Zha et al., 2019), while for turbulence (especially the vertical eddy diffusivity) a strong”

Line 39: replace „scales” by „scale”

Line 40: replace „ones” by „one”

Line 45: replace „as well and” by „as well as”

Line 57: correct „et al., 20110(@).”

Line 58: please use subscript in „PNO₃”

Lines 59-61: replace „Emissions of ammonia(NH₃), although not emitted largely by cities, are an efficient contributor to formation of sulfate and nitrate aerosol (by forming ammonium-sulfates and ammonium-nitrates) and its importance in connection with city emissions is highlighted by many (e.g. Behera and Sharma, 2010, and references therein).”

by

„Ammonia (NH₃), although not emitted largely by cities, is an efficient contributor to formation of sulfate and nitrate aerosol (by forming ammonium-sulfates and ammonium-nitrates) and its importance in connection with city emissions is highlighted in many studies (e.g. Behera and Sharma, 2010, and references therein).”

Lines 69-73: replace „On global scale, e.g. Lawrence et al. (2007), Butler and Lawrence (2009), Folberth et al. (2010) or Stock et al. (2013) estimated urban emissions impact, while on regional scales, many studies focused on agglomerations in southern Europe (e.g. Im et al., 2011a, b; Im and Kanakidou, 2012; Finardi et al., 2014), but focused also on other important urban centers like Paris (Skylakou et al., 2014; Markakis et al., 2015) or London (Hodneborg et al., 2011; Hood et al., 2018).”

by

„On a global scale, the urban emissions impact was estimated by e.g. Lawrence et al. (2007), Butler and Lawrence (2009), Folberth et al. (2010) or Stock et al. (2013), while on regional scales, many studies focused on agglomerations in southern Europe (e.g. Im et al., 2011a, b; Im and Kanakidou, 2012; Finardi et al., 2014), but also on other important urban centers like Paris (Skylakou et al., 2014; Markakis et al., 2015) or London (Hodneborg et al., 2011; Hood et al., 2018).”

Line 77: replace „available while” by „available, while”

Line 80: replace „CO as tracer recently in (Panagi et al., 2020).” by „CO as a tracer recently by Panagi et al. (2020).”

Lines 88-89: replace „particle matter (PM) while” by „particulate matter (PM), while”

Lines 99-100: remove „into account”

Lines 101-102: replace „Here we propose a study that connects the two aspects” by „In this study we propose the combination of the two aspects”

Line 107: replace „will be dedicated” by „will be paid”

Line 108: replace „(see e.g. Huszar et al. (2020a)).” by „(see e.g. Huszar et al., 2020a).”

Line 109: replace „particle matter” by „particulate matter”

Line 109: replace „then” by „than”

Line 118: replace „Two models regional climate models” by „Two regional climate models”

Line 129: replace „based on (Oleson et al., 2008).” by „based on Oleson et al. (2008).”

Line 131: replace „(Chen and Sun, 2002, PLIN;)” by „(PLIN; Chen and Sun, 2002)”

Lines 132-133: replace „(SLUCM; (Kusaka et al., 2001))” by „(SLUCM; Kusaka et al., 2001)”

Lines 134-135: replace „(RADM2; Stockwell et al. (1990, 2011))” by „(RADM2; Stockwell et al., 1990; 2011)”

Line 136: replace „(MADE/SORGAM; Schell et al. (2001))” by „(MADE/SORGAM; Schell et al., 2001)”

Line 145: replace „in to” by „into”

Lines 146-147: replace „CAMx code <http://www.camx.com/download/support-software.aspx> was used for WRF data while”

by

„CAMx code (<http://www.camx.com/download/support-software.aspx>) was used for WRF data, while”

Line 148: replace „eddy diffusion” by „eddy-diffusion”

Line 154: replace „9km, 3km and 1km resolution” by „9 km, 3 km and 1 km resolution”

Line 167: replace „simulations,the” by „simulations, the”

Line 170: The parenthese is empty

Line 172: replace „considered while” by „considered, while”

Line 175: replace „The fulfill the goal” by „To fulfill the goal”

Line 175: replace „have to performed” by „have been performed”

Line 180: replace „Tab.1” by „Table 1”

Line 186: replace „considered while” by „considered, while”

Line 189: replace „eddy diffusion” by „eddy-diffusion”

Line 208: replace „republic” by „Republic”

Line 211: replace „nitrogen(NOx)” by „nitrogen (NOx)”

Line 240: replace „the regional climate” by „RCM”

Line 240: replace „Tab. 1” by „Table 1”

Line 242: replace „models” by „model”

Line 253: replace „ozone while” by „ozone, while”

Line 261: replace „expect” by „except”

Line 273: replace „impact shown in the first one while” by „impact is shown in the first one, while”

Line 285: replace „not confined” by „not limited”

Line 290: replace „(seen in Huszar et al. (2020b))” by „(see Huszar et al., 2020b)”

Line 294: replace „then” by „than”

Line 297: replace „then” by „than”

Line 298: replace „then” by „than”

Line 301: replace „For PM_{2.5} again,” by „For PM_{2.5} (Fig. 5) again,”

Line 301: replace „NO₂.The” by „NO₂. The”

Line 302: replace „0.5µgm⁻³” by „0.5 µgm⁻³”

Line 304: replace „6µgm⁻³” by „6 µgm⁻³”

Line 310: replace „During JJA,” by „During JJA (Fig. 6),”

Line 316: replace „on regional ozone” by „on regional ozone (Fig. 7)”

Line 318: replace „In case CAMx” by „In case of CAMx”

Line 325: replace „due to urban” by „due to the urban”

Line 332: replace „ozone while” by „ozone, while”

Line 340: replace „hours while” by „hours, while”

Lines 340-341: replace „different of urban emission impact” by „different impact of urban emission”

Line 341: replace „therefor” by „therefore”

Line 348: replace „respectively while” by „respectively, while”

Line 351: replace „respectively while” by „respectively, while”

Line 353: replace „and4.” by „and 4.”

Line 354: replace „models” by „model”

Line 361: replace „respectively while” by „respectively, while”

Line 363: replace „and6.” by „and 6.”

Line 365: replace „In case of ozone,” by „In case of ozone (Fig. 10),”

Line 369: replace „cases while” by „cases, while”

Line 375: replace „WRF-Chem) while in JJA, the” by „WRF-Chem), while in JJA the”

Line 385: replace „rule” by „role”

Line 395: replace „ozone, Fig. 13,” by „ozone (Fig. 13),”

Line 399: replace „Fig/ 7.” by „Fig. 7.”

Line 409: replace „are considered” by „is considered”

Line 420: replace „case.” by „case are presented.”

Line 427: replace „windspeeds” by „wind speed”

Line 431: replace „with highest” by „with the highest”

Line 440: replace „air-quality” by „air quality”

Line 446: replace „to measurements” by „to the measurements”

Line 455: replace „by (Nopmongcol et al., 2012).” by „by Nopmongcol et al. (2012).”

Line 491: replace „eddy diffusion” by „eddy-diffusion”

Line 491: replace „wind-speeds” by „wind speed”

Line 520: replace „and important” by „an important”

Line 521: replace „This caused” by „This is caused”

Line 524: replace „are largest” by „are the largest”

Line 524: replace „wind-speed” by „wind speed”

Line 526: replace „During that the” by „During that time the”

Line 531: replace „eddy diffusion” by „eddy-diffusion”

Line 533: replace „see (Karlický et al., 2020).” by „see Karlický et al., 2020).”

Line 535: replace „their” by „the”

Line 538: replace „wind-speed” by „wind speed”

Line 539: replace „the the modulation” by „the modulation”

Page 29, Fig. 3 caption: replace „five selected cities” by „six selected cities”

Page 35, Fig. 11 caption: replace „The urban emission impact (UEI) of selected cities” by „The impact of urban emission (UEI) for selected cities”

Page 38, Fig. 14 caption: replace „eddy diffusion” by „eddy-diffusion”