

Atmos. Chem. Phys. Discuss., author comment AC2  
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## Reply on RC2

Alice Maison et al.

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Author comment on "Parameterizing the aerodynamic effect of trees in street canyons for the street network model MUNICH using the CFD model Code\_Saturne" by Alice Maison et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-287-AC2>, 2022

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Maison et al have proposed a simple parametrization to account for the effect of trees in street canyons for the MUNICH model. The authors made a comparison between the MUNICH parametrization and the Code Saturn as shown in figure 4 and table 2. Hence, the proposed parametrizations seem reasonable. Evaluating the effect of the ecosystemic services that urban trees provide is essential for climate change, air pollution, and well-being. Actually, in the introduction Maison et al it is shown contradictory results about the positive or negative effects of urban trees. The abstract shows that the tree crown slowed down the flow and reduced the average horizontal velocity up to 68%.

Main issues:

- Then, my main question, is why the authors are not providing a comparison of air pollution of MUNICH with and without this new parametrization? Please, include this comparison for a real case. This type of comparison will be beneficial for policymaking.

**Authors' response:** The purpose of this article is to describe in detail the tree aerodynamic parameterization. In the future, we plan to compare the urban tree impacts on air quality more complex urban setting by taking into account the tree crown aerodynamic effect (using the parameterizations developed in the present paper) but also the radiative effect, the dry deposition on tree leaves and the biogenic organic volatile compounds emitted by the trees. However, the combined effects of trees are complex to model, and this can not be done in a paragraph of this paper. For example, the impact of dry deposition differs completely depending on the pollutant considered (it is highly dependent on the volatility and solubility of the pollutant). In future work, the combined effects will be taken into account and simulations will be compared to measurements results collected in a real case in the city of Paris. We hope this study will help policymakers in their choice of urban tree species and management.

To illustrate the impact of the aerodynamic effect of trees on concentrations, simulations are set up by emitting carbon monoxide (considered as an inert gaseous pollutant) in the street. These simulations are presented and discussed in Appendix D.

Minor issues:

- In general, the article is well written. However, it is not clear if MUNICH includes deposition. If not, any plans?

**Authors' response:** MUNICH includes dry deposition of gaseous pollutants and aerosols on walls and street ground (Kim et al., 2022; Lugon et al., 2021). The dry deposition on tree leaves has been implemented but it is not published yet. Existing parameterizations based on a resistive approach are used for gas (Hicks et al., 1987; Walmsley and Wesely, 1996; Wesely, 1987; Zhang et al., 2002, 2003) and for aerosols (Giardina and Buffa, 2018; Zhang, 2001).

We mentioned at the end of the conclusion that the dry deposition of gaseous pollutants and aerosols on tree leaves will be considered in MUNICH in future studies (see the response to the next question).

- I believe the authors need to explore more the benefits of urban trees and attempt to close the discussion started in the introduction.

**Authors' response:** This paper focuses on building a parameterisation of the aerodynamic effect of trees, so that the model can be used over cities. Other effects, such as dry deposition, thermo-radiative effects and emissions of volatile organic compounds will be taken into account in a future study, where the parameterisation built here will be applied. The conclusion is modified to give more details about this perspective (Line 359):

"The perspectives of this study are to quantify the effect of street trees on air quality from the street level to the scale of the city of Paris. Dry deposition of gaseous pollutants and aerosols on tree leaves as well as emission of biogenic organic volatile compounds related to tree water stress will be considered in MUNICH. The contribution of biogenic and anthropic precursors to the formation of organic aerosols over an entire city will be compared."

- Please, considering discuss these articles:

[https://link.springer.com/chapter/10.1007/978-3-319-97013-4\\_8](https://link.springer.com/chapter/10.1007/978-3-319-97013-4_8)

[https://www.sciencedirect.com/science/article/pii/S1618866706000173?casa\\_token=HwWC\\_pLGhWcAAAAA:pGyo5L5EjxJ4eOz9TOifebygB70OtepGHXbEVVltMo5g7dM-ug4yANgARo9zA\\_639IKNWJanWJc#!](https://www.sciencedirect.com/science/article/pii/S1618866706000173?casa_token=HwWC_pLGhWcAAAAA:pGyo5L5EjxJ4eOz9TOifebygB70OtepGHXbEVVltMo5g7dM-ug4yANgARo9zA_639IKNWJanWJc#!)

**Authors' response:** The issue of pollutant deposition on leaves is discussed Lines 47-50 and the reference Nowak et al., (2006) which was just before is moved in this paragraph.

We added Line 50 a sentence to discuss BVOC emissions: "Trees may also affect atmospheric chemistry by emitting biogenic volatile organic compound (BVOC), which may lead to the formation of ozone and secondary organic aerosols (Calfapietra et al., 2013, Prendez et al., 2019, Gu et al., 2021)".

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