

Review OLYMPUS v1.0: Development of an integrated air pollutant and GHG urban emissions model
– Methodology and calibration of the greater Paris

This manuscript proposes an environmental decision-support tool which couples a population, road transport, building energy and emission model to estimate the spatial distribution of pollutant emissions across a city with an application to Greater Paris. Having such a spatially explicit model is valuable for intervention design in case emission inventories are not available. Having said this, the developed model is relevant to advance air pollution mitigation measures and future work in this field, in particular for air pollution from transport. The authors propose a model of good scientific quality and my main comments are related to the necessity of introducing clarity to the presentation and a discussion of limitations.

In particular the introduction needs development since the argument of the model development and its contribution, scale and scope are not quite clear and the literature review not comprehensive enough. First, how does the model consider exposure? In my understanding OLYMPUS only estimates emissions, not exposure. The link between city configuration, emissions and exposure is not clear in the argument and references are missing. Further, the literature review or argument for emissions from building energy consumption is missing. This comment links to the contribution of the model, which is not stated explicitly in the manuscript. I suggest to mention this clearly. There are other models which consider emissions from transport and building energy consumption, what is the specific contribution of OLYMPUS? What can the model help to decide?

The authors argue that OLYMPUS “was developed with the aim of taking into account connections between the types of urban organisations, regulatory constraints, energy consumption behaviours and pollutant emissions” (line 40). Please be more specific (and consistent): how do you define urban organisations (or city configuration (l. 8), built environment (l. 44), morphology (l.56))? Is it simply population distribution? Please clarify and make the underlying assumptions explicit. Which “regulatory constraints” does OLYMPUS consider? This is in my opinion not discussed in the article. I suggest to be more specific, also on the scale of which OLYMPUS considers all these model components. How do you “heighten the role of the built environment” (l.43), which “political and economic forcing” (l.43) are considered in the model? This is not clear and in my opinion misleading as population distribution is the only factor defining the built environment and I don’t recognize any political forces in the model. “[...] in the exposure of people to atmospheric pollutants” (l.43) – does the model have an exposure component which is not described in the manuscript?

Which pollutants are considered in the model and why these? Which pollutants are considered in the transport model and which in the energy model? The authors might want to be careful (and consistent) with the terminology at city scale: air pollutants, greenhouse gases, atmospheric pollutants etc. I assume the model only treats primary pollutants?

In general, the model considers much more detail for emissions from road transport than building energy consumption. How do the authors explain/justify this or discuss this as limitations?

The authors state that the household family type distribution etc is different between centre and suburb etc. How do you justify this assumption and how is it defined and implemented? Exogenously? What might be implications of this assumption? The authors might want to add this in the discussion.

It is mentioned that the approach produced a “satisfactory estimation” (l.36) and “generates good estimates” (l. 39). Further, “are very satisfactory” (l.44). How do you justify this?

There is the assumption that CENTER and URBAN areas include “the majority of building whereas suburban areas are the place where a larger part of individual houses are built” (l.17). How do you implement this assumption in the model, how do you justify it and how is it translated in the model? There are many assumption that it makes it difficult to understand how the model goes from population density to housing type, dwelling size etc.

How does the climate influence the transport model?

How does the calculation for hot and cold start emissions vary per pollutant type?

The conclusion needs development and further discussion on how future improvements could look like. Especially the authors state that one aim of the model is to analyse various policy options; yet, it only comes briefly in the conclusion (last paragraph). The authors might want to elaborate on this and discuss how this could be considered in the model. Further, model limitations need to be discussed further. For instance, how do you treat uncertainty?

Is the validation of the model done based on the same assumption as the model? That is, for instance, are both driven by the underlying population density assumption and therefore might yield similar results?

The scale of the different models is not clear throughout the manuscript. Please make this more explicit.

The authors might want to add a discussion of global vs local emissions, also given that they refer to air pollution, atmospheric pollution, greenhouse gas emissions and even exposure. At which scale is your model relevant and why?

I suggest elaborating on the overall model workflow and rationale in 2.1 about the main characteristics of the model and how the different sub-models play together. This could help the reader understanding the big picture before diving into the specifics of each module.

Overall, it is a very interesting model. However, the description needs to be clearer, the argument for it strengthened and presented in such a way that the reader can understand well underlying assumptions, the rationale of choices made and limitations of the approach.

Detailed comments

P.3, l. 23: Does the ABTD consider work and leisure trips?

The paragraph starting in l. 36 (P.3) is not clear, there is confusion on the technological specifications.

P.3, l. 28: “dwelling size of the household”?

L. 14: what does this mean: “[...] we proceeded to the implementation of a spatial component in the distribution...” Please clarify.

L. 45: what is the meaning of μ ?

There is no such format as a GIS format for data. This needs to be reviewed

Reference missing for the Huff random probability approach

The parameter “M” is defined twice: as the length of a link and as the number of km travelled

The same is true for VOC: Volume over capacities and emission type

What exactly is the definition of “tertiary emissions”?

What do you mean by “the age of the fleet” (l.29) in the building energy model? Please clarify this entire paragraph

Title and throughout the paper: It’s “Greater Paris” not the greater Paris

How do you justify that Paris has “the best public transport network”? Further, there are references missing in this entire paragraph.

P.17: the last sentence is cuff-off.

P. 2: “individual mobility in the exposure of individuals”?

P. 34: What do you mean by “reference methodologies”?

References are in many cases not put correctly (inside brackets rather than in text)

References need to be provided for all model and data sources mentioned and/or used in the article

P. 16: does the model over- or underestimate? (l.56)

“numerous economic studies have shown[..]” please provide example references

Finally, the manuscript needs to be thoroughly English proof-read