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## **Comment on gmd-2022-147**

Sergio Ibarra (Referee)

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Referee comment on "Yeti 1.0: a generalized framework for constructing bottom-up emission inventories from traffic sources at road-link resolutions" by Edward C. Chan et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2022-147-RC1>, 2022

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### **Review for Yeti**

Chan et al have presented a manuscript which introduces the Yeti model. Yeti is a collection of Python scripts to estimate vehicular emissions at street level. The model process the volume of traffic at different hours. The emission factors comes from the model HBEFA. HBEFA provides emission factors (g/km) depending on traffic situation, which represent a configuration type of road, level of congestion, environment and vehicular technology. To the best of my knowledge, there are not many open source models that estimate emissions using traffic situation emission factors. Hence, Yeti represent a valuable effort and an advance in this area. Nevertheless, the manuscript in its present form need to be modified in its current form due to major and minor issues:

Major issues:

The manuscript in not well written using too much ambiguity when describing concepts and explaining the model. Furthermore, there are no explanation to basic concepts such as traffic situation, or mentioning the PHEM model, which apparently generates the emission factors inside HBEFA. Also, the phrases in general are too long. The manuscript also presents lack of comparison with other estimates such as the % of cold start and evaporative emissions with other areas or cities. The expectation is that different estimates will converge to similar results, rather than produce equal values.

Minor issues

Long and ambiguous phrases on lines (lines 34-37, 54-58 and more). Also, there are paragraphs consisting in only two sentences. Each paragraph should have at least three

sentences.

Line 80. The authors mention that models WRF Chem and OpenFOAM which could be integrated with emissions models. Nevertheless, I would recommend the author to also mention the models MUNICH and CityChem, which have methods to estimate the dispersion of street emissions.

Section 2, I do not see definition of traffic situation.

The definition of the emission factors as "epsilon" symbols is not defined.

Regarding equation 2, it is not clear for me the temporal resolution of the data. Later, the author mention that the traffic counts represent certain hourly intervals during the day. Then, what are the units of the emissions of equation 2.

Cold start emissions, in equation 3 have the parameter N which represents hourly traffic counts. Is N different with the parameter in Eq 2 that represent traffic counts?

The methodology for cold starts expressed in Equation 2, assumes that these emissions only occurs in collectors and access roads. I understand that the authors are assuming that most of cold start emissions are in these type of roads, which are associated with higher residential areas where there are more cars. If this is the reasoning, I think it is plausible and reasonable considering the usual limited input data when performing emissions inventories. However, this should be stated explicitly, then, future estimates can improve the current limitation. For instance, an possible future improvement could be associate type of roads with residential density and land use. In conclusion, authors need to be explicit and direct.

Line 130: "fuels and various volatile fluids", what are various volatile fluids?.

Section 2.1.3, I liked it very much that you used an approach to project diurnal evaporative emission factors to hourly resolution.

Running Losses evaporative emissions, equation 7, parameter  $x_l$ . Are we assuming the value of 0.3 for  $x_l$ ?

Equation 8. As the non-exhaust emission factors represent both, resuspension and wear emissions, it still not clear form me, is it the sum or the average?

Line 272, what is categorical? The type of vehicle? Or a fraction that is associated with a vehicle category?

Section 3.3, do we have a different vehicular composition by hour?

Where are defined the level of services (LOS)?

What is the 5tpurpose of comparing emission factors from HBEFA 3.3 and 4.1?

Table 6, It is better to inform totals rather than averages. This is because the spatial distribution of traffic flow and emissions is not normal. There are few roads with most of emissions.

Table 6, it is also necessary to compare emission factors.

Line 321, t lower NOx emissions for 2020: "This is possible due to the introduction of diesel passenger vehicles with generally lower reported emission factors". This statement implies that we need to a comparison of the emission factors is needed. Furthermore, Carslaw et al (2011) found that diesel vehicles with newer emissions standards emit higher emissions on real world. We also have dieselgate. Then again, a comparison of the emission factors is needed.

How important are cold start and evaproative emissions ?

Is it possible to include other methodologies in Yeti rather than solely depending on HBEFA? For instance, include emission factors and functions to consider wear PM emissions separated from resuspension?

I think it would be better if Figurse 3 and 4 represented the whole city ather than specific roads.

Lines 361-363, I think it is necessary to include a plot of the volumes for the city, with an appropriate color scheme to easily identify the roads with highest volume.

Lines 390-394, as we can expect different vehicular by type of road, I do not think it is appropriate to compare emissions based on few roads.

Lines 400-404, what are aggregated emission factors?

Lines 414-415, which pollutant?

Line 420, what is the purpose of providing normalized street emissions (total by road / length of road)? I strongly believe it should be better to inform simply the totals.

Identify the areas with more surface emission fluxes is important. This can be done by gridding the street emissions into a spatial polygon grid. The process must be mass conservative, emanating that the emissions inside each pixel, should be the same as the emissions of the road inside that pixel. Here the emissions can be represented as fluxes (mass / area / time) or as emissions maps (mass / time). For reference, the EDGAR emission data can be obtained as emission fluxes (NetCDF) or mass/time (.txt). A standard recommendation for emission fluxes is mass/ hour / km<sup>2</sup> with spatial distancing of 1 km.

@article{carslaw2011recent, title={Recent evidence concerning higher NO<sub>x</sub> emissions from passenger cars and light duty vehicles}, author={Carslaw, David C and Beevers, Sean D and Tate, James E and Westmoreland, Emily J and Williams, Martin L}, journal={Atmospheric Environment}, volume={45}, number={39}, pages={7053--7063}, year={2011}, publisher={Elsevier}}