

## ***Interactive comment on “VEIN v0.2.2: an R package for bottom-up Vehicular Emissions Inventories” by Sergio Ibarra-Espinosa et al.***

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**Response to referees' comments:** Thank you for your comments. Please see revised draft of manuscript, included as a LaTeX supplement, with the PDF already compiled with the name vein.pdf, with changes marked in red. We included the number of each comment in the draft between parenthesis.

### **Referee 1:**

**COMMENT 1:** Minor Comments. This paper presents almost comprehensive review of emission inventories available in different parts of the world in page 2, line 1-7. It would have been nice if they can include about how US-EPA develops their emission inventory as part of NEI.

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**REPLY 1:** We added text on page 2, lines 6-8, which shows a brief description of the NEI inventory indicating that is compiled by the US-EPA every three years and it is based on data from State, local and tribal agencies.

**COMMENT 2:** The authors can mention about how their study improved methodology compared to Andrade et. al., 2015 in page 2 and line 24-26.

**REPLY 2:** We added text on page 2, lines 34-3 and page 3, line 1. We mentioned that, despite that inventories made by Andrade et al 2015 are useful, they still suffer limitations in spatial and temporal representativeness of the emissions due to the top-down approach.

**COMMENT 3:** Even though, the paper referred about top-down emission process studies like Ntziachristos and Sampras, 2016 and Andrade et al 2015, it did not cover the examples for bottom-up methods. Following study proposed a comprehensive methodology for bottom-up vehicular emission processing for air quality models. @articleperugu2017developing, title=Developing high-resolution urban scale heavy-duty truck emission inventory using the data-driven truck activity model output, author=Perugu, Harikishan and Wei, Heng and Yao, Zhuo, journal=Atmospheric Environment, volume=155, pages=210–230, year=2017, publisher=Pergamon. This study can be referred in page 2, line 19.

**REPLY 3:** We added text on page 2, lines 21-23. The paper suggested by the referee 1 is very appropriated because it proposes a bottom-up emission estimation method consisting in a traffic generation at link level using Spatial Regression for trucks (SPARE-Trucks) and emission rates from MOVES.

**COMMENT 4:** Author could explain "deterioration" in page 3, line 13 when it was first time introduced. May be authors were referring vehicle deterioration in terms of emission performance.

**REPLY 4:** We added text on page 6, lines 6-9. We are referring to the loss of perfor-

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mance of gasoline vehicles equipped with catalysts due to accumulated mileage.

**COMMENT 5:**  $F^*_{i,j,k}$  in the equation 3 should be explained. Is it generic flow for link types of  $l$ ? What kind of classification was used so that a particular link is identified that it belongs to type " $l$ ".

**REPLY 5:** We added text on page 4, lines 11-12.  $F^*_{i,j,k}$  was defined in equation (2) as the traffic flow. The only difference with  $F_{i,j,k,l}$  is that the traffic flow was extrapolated using the temporal factors for the other hours " $l$ ".

**COMMENT 6:** In page 3, line 19-22. It was mentioned that Capacity is found to be average of peak and free-flow speeds. But capacity of a highway link is constant throughout the day, based on their functional classification. May be authors referring traffic flow, which change hour by hour, and corresponding line has to be modified accordingly.

**REPLY 6:** We added text on page 4, lines 26-30. The text was misleading. The capacity is an attribute that is available in the travel demand model and this was used, with the BPR curves in equation 4, to calculate the speed at different hours. But when it is available the peak and free flow speeds, it could be calculated a simple average to obtain an average speed per link and then distribute these three speeds (peak, free flow and average), in the hours of the study.

**COMMENT 7:** In the selection of emission factors section, the authors have discussed about vehicle type, technology and years of use etc.. I did not see important factor like fuel composition, is it inherently taken care in emission rates based on years of use? It also looks like mostly these factors were borrowed from COPERT, I assume that model would have already taken care about it. Then, please include that clarification in this section.

**REPLY 7:** We added on page 5, lines 13-16. Good observation. Fuel properties do have an effect on emission factors measured with different fuels. Previously we did not specify this aspect because when using emission factors based on local measurements

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(not COPERT) there is no necessity of corrections. However, when using COPERT EF, corrections must be made. We included this information in the texts, suggesting the authors performs corrections in the case they use COPERT EF.

**COMMENT 8:** page 5, line 20. How were vehicle deterioration factors were obtained?

**REPLY 8:** We added text on page 6, lines 6-9. Deterioration factors comes from European emission guidelines, however, the user can use different deterioration factors.

**COMMENT 9:** Page 6, line 4-6, there is minor confusion about calculating cold start emissions on links. Theoretically, start emissions happen when vehicle started or if it is in idle condition after start. May be authors trying to distribute the start emissions happened at parking locations to the links, isn't it? please clarify it.

**REPLY 9:** We added text on page 6, lines 13-14 and 24-27. As the information about the parking location is limited, we are proposing the assignation of the emissions into the links.

**COMMENT 10:** Page 6, line 21-22. it looks like only some seasonal days were selected in this step. You can add this as potential improvement for future versions if VEIN.

**REPLY 10:** We added text on page 7, lines 27-32. Currently, the methodology of evaporative emissions into VEIN is COPERT Tier 2. We expect to include Tier 3 methods in future versions. We are also interested in investigating the methods in MOVES to include them into VEIN. In the manuscript, we proposed an alternative method to convert the emissions factors into g/km.

**COMMENT 11:** page 7, line 3, equation 10 : The "running " loss emissions should be by distance isn't it? Why authors considered them emissions by parks?

**REPLY 11:** We added text on page 6, line 21-22. The units of evaporative running losses Tier 2 is g/trip and the emission factors of hot and warm soak are g/parking. Also, in the new version of the manuscript we mentioned that if the user knows the average distance per trip, the user could transform into g/km.

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**COMMENT 12:** Page 11, line 7, MASP CET , is it travel demand model or micro simulation model?

**REPLY 12:** We added text on page 12, lines 6-7. We replaced "traffic simulation" by "4-stage travel demand model"

**COMMENT 13:** page 11,line 12, you may use "size of" instead of weights.

**REPLY 13:** Done.

**COMMENT 14:** page 15, line 15, it looks alike the age vehicles were considered up to 41 years. However, the technology change in vehicles happened only 25 years before 2017. why did the researchers choose such a long time horizon as it looks the emissions from 31-41 years vehicles from figure 6(b) are very low.

**REPLY 14:** We added text on page 15, lines 31-33 and page 16, line 1. We considered a distribution of vehicles up to 41 years of use because it is more representative of the vehicles in circulation. VEIN can perform these calculations very quickly. This feature allows using VEIN as a tool for scrapping policies in order to accomplish emission targets.

**COMMENT 15:** .Page 20, line 27: PM species what is bcom? and line 28 what is iag.

**REPLY 15:** We added text on page 2, lines 25 and 26-28. 'bcom' is the name in the function 'speciate' for splitting Black Carbon and Organic Matter. 'iag' comes from Institute of Astronomy, Geophysics and Atmospheric Sciences from the University of São Paulo, because most of the speciation and air quality modeling in Brazil comes from this institute and the speciation 'iag' is based on measurements made by researchers of this institute.

**COMMENT 16:** page 20, line 32 , may be "in line" instead of on-line. **REPLY 16:** Done.

**COMMENT 17:** page 20, line 24, missing citation for Vera-Vela et al 18. page 23, line 6-7: may be (R) instead of (c)?

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**REPLY 17:** DONE. We also added pages 3-6 to indicate that we are developing another model named 'eixport' that will produce inputs not only for WRF-Chem, but also for BRAMS-SPM (Freitas et al., 2005), R-LINE (Snyder et al., 2013) and more.

**Language issues:** Page 2, line 17: it should be bottom-up. DONE.

page 2, line 33: when you first time introduce a abbreviation like VEIN, please provide the full name. DONE.

page 3, line 11: it should be involved. DONE.

page 10, table 1 : *emis\_paved*: It should be Re-suspension. DONE.

page 13, line 3: defined instead of defend. DONE.

page 21, line 2, may be inception instead of conception. DONE.

Please also note the supplement to this comment:

<https://www.geosci-model-dev-discuss.net/gmd-2017-193/gmd-2017-193-AC2-supplement.zip>

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Interactive comment on Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2017-193>, 2017.

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