We would like to thank both reviewers for their time and valuable comments, which greatly improved the manuscript. Our responses to the reviewers' comments are given below. Please note that references to specific lines in the manuscript correspond to the author's track changes file.

Larysa Pysarenko, 08 Jun 2024

\Paper entitled “Description and validation of VERT 1.0, an R-based framework for estimating road transport emissions from traffic flows”, describes VERT (Vehicular Emissions from Road Traffic) created in R package, that allows estimating traffic emissions. This topic is essential for improving emission inventories for different spatial and temporal resolutions. In general, minor revision is recommended.

General comments:

1) Line 134 and Eq. 3. The authors mention experimental coefficients. What are the values of these coefficients? Are they incorporated into the VERT code? It would be better to provide more details on the procedure for their estimation. Were these coefficients approximated by a polynomial trend or somehow else?

The requested details have been added to the main text at lines 141-147. As stated, the values of these coefficients depend on the vehicle type, fuel, emission standard, engine size, road characteristics, and heavy duty vehicle load. They were estimated through regression analysis, resulting in a polynomial curve that fits the observed data. For more information on the procedure used for their determination, please refer to Kouridis et al. (2010) and Ntziachristos and Samaras (2023). These experimental coefficients are incorporated into VERT via dedicated data frames, such as ‘*vert::EF$hot_ef_ldv_emep.eea.2020’*,‘*vert::EF$hot_ef_ldv_emep.eea.2023’*, *vert::EF$hot_ef_hdv_emep.eea.2020’*, and ‘*vert::EF$hot_ef_hdv_emep.eea.2023’*. These data frames can be inspected, modified, or updated by users who wish to test their own experimental coefficients.

Also, there are some hesitations concerning the term “D/velocity” in Eq.3. Taking into account that VERT can be used for simulating hourly emissions, do authors consider the possibility of almost zero vehicle speeds? It relatively frequently occurs in megapolises during rush hours or under some emergency conditions on the roads.

The experimental coefficients mentioned above are considered reliable by the EMEP/EEA methodology within a speed range of approximately 5-20 km h^{-1} to 100-140 km h^{-1}, depending on vehicle category. It is recognised that in traffic jams or very congested situations, particularly in large cities, vehicles may operate at very low speeds. To better represent emissions under such conditions, a correction factor has been introduced into VERT to account for increased emissions at very low speeds. Specifically, when the vehicle speed falls below the threshold of the validity range of the proposed coefficients, the time spent on the road is increased by a factor of w, calculated as reported in the main text (lines 148-155). However, it is important to highlight that the model is tailored to driving scenarios and therefore idling emissions may not be accurately estimated.

2) Line 314-320. The authors mentioned the complex topography of the studied domain. It will be useful to provide additional details on land cover and topography data input to the model. Also, there is no information about meteorological input, including its temporal and spatial resolution.

The requested details about land cover, topography, and meteorological inputs have been added to the manuscript at lines 361-369. Specifically, the land cover data were sourced from the Corine Land Cover database (CCL, 2018), and topography data were obtained from the Geoportale Emilia-Romagna (2023). Meteorological input data, including hourly observations, were provided by three stations (CMP, DEX, and OSS) located at altitudes of 10, 40, and 50 meters above ground level. Figure 3 panel (c) has also been updated.

During the revision of the main manuscript, we identified and corrected a number of additional errors, which are summarized below:

- Figure 1 has been revised to include parking lots in addition to roads (see the right box under the output section). Additionally, the blue bubble indicating meteorological input has been added to the wear_emis.R and PM_resusp.R functions to reflect their dependence on meteorology.

- There were typographical errors in Table 1, which have now been corrected. Specifically, lines 1 and 2 were swapped for some statistics.

- Reference Update: The reference for Bigi et al. (2023) has been updated from "under discussion" to "published". Now the published version is the following:
  Bigi, A., Veratti, G., Andrews, E., Collaud Coen, M., Guerrieri, L., Bernardoni, V., Massabò, D., Ferrero, L., Teggi, S., and Ghermandi, G.: Aerosol absorption using in situ filter-based photometers and ground-based sun photometry in the Po Valley urban atmosphere, Atmospheric Chemistry and Physics, 23, 14 841–14 869, https://doi.org/10.5194/acp-23-14841-2023, publisher: Copernicus GmbH, 2023.

- The apex *k* has been added to the terms *n*.veh and *L* in Eq. 11.

References:

CCL: CORINE Land Cover, https://land.copernicus.eu/en/products/corine-land-cover, 2018.

Geoportale-Emilia-Romagna: Servizi cartografici regionali, https://geoportale.regione.emilia-romagna.it, 2023

Kouridis, C., Gkatzoflias, D., Kioutsoukis, I., Ntziachristos, L., Pastorello, C., and Dilara, P.: Uncertainty Estimates and Guidance for Road Transport Emission Calculations, https://doi.org/10.2788/78236, iSBN: 9789279153075 ISSN: 1018-5593, 2010.

Ntziachristos, L. and Samaras, Z.: 1.A.3.b.i-iv Road transport 2019 — European Environment Agency, https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/part-b-sectoral-guidance-chapters/1-energy/1-a-combustion/1-a-3-b-i/view, 2023.