Author's response

Dear Editor,
Thank you for reviewing our manuscript number ESS-2021-2018. We have gone through all the referee's commentaries and adjusted the manuscript accordingly. After this paragraph you will find our responses. The style used in the response letter is the following: the original general comments made by the referee are kept in normal text (initiated with R), our responses are *in blue italics initiating with A* (Authors). The corresponding edit in the manuscript will be included in red.

Referee comments 1 (RC1)
Anonymous Referee #1, 09 Sep 2021

High definition spatial distribution maps of on road transport exhaust emissions in Chile 1990-2020; Osses et al.; essd-2021-218.

R1: This manuscript describes the methodological aspects in preparing a high resolution (0.01ºx0.01º) inventory of road transport emission for Chile for years 1990-2020. It includes GHG gases (CO_2 CH4) and air quality pollutants (CO, VOC, NOx, PM, and BC). Special emphasis is given to latter one. It considers the impact of changing emissions standards in emissions trends. The analysis includes a comparison with international EDGAR data set, showing good agreement in CO2 but important differences in SLCP.

R1: General comments

R1: The comparison with EDGAR is a very important and useful analysis that benefit the international inventory community to achieve better and reliable global emissions models. A good/plausible explanation is given for the encountered differences with EDGAR.

A: Given the importance of the comparison highlighted by the Reviewer, the analysis has been expanded (see next answer) and additional explanations have been added to the text in section 3.2.4.

R1: In this line it is recommendable that the authors also include a comparison with the **Community Emissions Data System (**CEDS). Moreover, to better emphasizes the uncertainties level of the proposed inventory, it should show, if possible, in a summary table, other emissions calculated for Chile, either national/regional or by cities, for GHG and/or SCLP if available.

A: We appreciate the comment since we fully agree it is important to reinforce the comparison analysis. Thus, in addition to EDGAR, CEDS and CAMS datasets for Chile have been included in section 3.2.4, with extended comments explaining similarities and differences. Additionally, the official inventory reported by the Chilean government for GHG (INGEI) and a national estimate of transport emissions using LEAP model have been added to the comparison analysis. In summary, our emission inventory for exhaust on-road transportation emissions (INEMA) is compared with two local national inventories (INGEI, LEAP) and three global models (EDGAR, CAMS, CEDS).

R1: The manuscript is well written, is suitable for the inventory special issue and is acceptable for publication after some minor revisions and additional comments.

A: We appreciate the recommendation and performed a complete general revision to the whole final text, adding minor revisions and to integrate the new comparisons and comments.

R1: Other comments:

R1: Line 60 page 8

R1: Determining the active fleet is always a complicated matter, especially when a long time series is calculated. The calculation of active fleet should include deregistration and scrapped rate for each vehicle cohort. This produces that a new registered vehicle in year n will be out of the roads in year n + m (number of active years). Since you are using (new?) registered vehicles, have you estimated how many years each (type of) vehicles with technology j are active? Also fuel consumption an emission factors degrade with aging vehicles. Have you considered any emission factor and fuel consumption function correction for each cohort? Also, VKT may be affected by aging vehicles. Although you calibrate the number of vehicles by fuel sales, some comments should be said with respect to the above point. How are the numbers of vehicles estimated in Figures 2?

A: We did not use new registered vehicles. Data provided by INE corresponds to annual registration of vehicles, i.e., the vehicles that each year pay their circulation permit after having approved the periodic technical inspection (explained in line 326, page 17). We added this explanation to the methodological section, in sub-section 2.1.

Using annual registration of in-use vehicles partially solves the problem of deregistration and scrapped rate for each vehicle cohort. However, some of the vehicles with annual circulation permit may be not used, may have very low circulation rates, or may be used in a different region of that of their registration. To consider these issues, we contrasted calculated fuel consumption (TFC) with real fuel sales by region (line 158), and used a correction factor to adjust the number of registered vehicles in each region, as explained in sub-section 2.2 of the methodology.

Regarding the emission factors degrading with age, we used COPERT emission factors which consider aging factors for some of the categories and emission components. We added a line explaining this in the subsection 2.3 of the methodology: "COPERT V considers correction of emission factors by vehicle age for light vehicle categories EURO 3 & 4 and for VOC, CO, NOx. These corrections were also applied".

We did not calibrate fuel consumption by vehicle age. We acknowledge these limitations of the dataset in the conclusions in a new paragraph.

R1: Some additional considerations should be added with respect to changes in mobility indicators since these are mentioned in the results. Number of vehicles per household, number of vehicles per inhabitants, number of vehicles/GDP per capita and so on. This extra information, although not strictly necessary will enrich your paper and analysis.

A: Thanks for the comment. We considered mentioning some of these general mobility indicators in the description but decided not to do it. The paper covers 30 years and most of these parameters change each year and by region, making difficult to provide a clear summary of information. We agree this information is not strictly necessary, it would enrich the analysis, but it might confuse the readers since those mobility indicators are not part of the inputs for our emission model.

R1: Line 110 page 9:

R1: The English should be rephrased, probably the word “between” is not correct and may be replaced by “among”. You are distributing the region’s emissions proportionally to the population density of that region. What is the finest population density scale available in your calculation? Are the roads weighting factors constant to all regions in Chile?

A: Yes, now on page 10 line 218 it should read “among”. The finest population density corresponds to a city according to definition of the National Statistics Institute (INE), i.e., an urban area with more than 5000 inhabitants. The weighting factors vary by region, urban and interurban areas, and by city, and they were provided by the Transport Secretariat, SECTRA (Osses et al, 2010). This explanation and its reference have been added at sub-section 2.4 of the methodology, lines 214-215, page 10.

R1: Although the spatial disaggregation’s methodology is in general understandable, some extra details should be added. It needs some extra clarifications, with regards to the spatial scales. Emissions are calculated in “Regions”, then is downscaled to what? … Districts? -> Municipalities? … How do you derive urban from non-urban areas? Are the roads weights similar in urban / rural areas? Readers may profit from the methodology used in your calculations.

A: Regions are downscaled to urban and interurban roads using the data provided by SECTRA, and then urban areas are downscaled to cities in the region, with are urban areas with at least 5000 inhabitants. This explanation has been added to sub-section 2.4 of the methodology, lines 220-223, page 10.

R1: Line 145 page 12

R1: Check typo error “if” : The vehicles in category if heavy diesel…”

A: Yes, it should say “of”, it was mended.

R1: Figure 6: Caption should declare the emissions color scale (e.g. “same as Figure 5”) o added to the figure.

A: Thanks for the observation, “same as Figure 5” was added to the caption.

R1: Figure 10, page 22. The Figure shows CO/NOX ratios for other countries. Please define the references for these data.

A: The references correspond to the three global databases used for comparisons (EDGAR/CAMS/CEDS). This has been added to the figure caption.