

# ***Interactive comment on “TNO\_CAMS high resolution European emission inventory 2000–2014 for anthropogenic CO<sub>2</sub> and future years following two different pathways” by Hugo A. C. Denier van der Gon et al.***

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General comment

The reasoning for the perceived importance of high-resolution spatial and temporal inventories should be further elaborated. Generally, the need for high-resolution spatial and temporal inventories is related to exposure assessments of air pollution and in that respect CO<sub>2</sub> is very different as the lifetime in the atmosphere is long and there is no direct effects on human health or other local effects. This is acknowledged in the

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paper (page 2, line 21-25). There is also no international requirements (UN or EU) that mandates that emission inventories should be done at a higher spatial or temporal resolution.

The paper cites an increasing need for independent verification, but since the current setup uses nationally reported data, the comparison will not be independent. Therefore, it is unclear based on the paper how the inventory presented would contribute to an independent verification of the European CO<sub>2</sub> emissions. Has the authors considered if spatial emissions reported under the CLRTAP convention could provide useful information to be included in the GHG model or contribute to verification of the proxies used in the GHG model. For sectors where poorly correlated spatial proxies are used, it could be interesting to consider if air pollution emissions could contribute to generating better proxy data; e.g. it could be assessed if gridded air pollution emissions could be a better proxy for residential wood combustion than population density. A similar assessment could be interesting to see for road transport and industry. Further, parties report emissions for large point sources (LPS). The gridded LPS emissions reported to CLRTAP include stack heights, which could be used for verification or improvement of the vertical profiles for the spatial CO<sub>2</sub>.

#### Comments regarding data access

Data for projection years should be made available as .csv files as well as .nc files as is the case for data for the historical years to increase the user-friendliness. It should be explained more clearly what is meant with the split of snap 7 in snap 71 to 75 as this is only clear if the user is familiar with the sectors on snap 2 level.

#### Specific comments

Page 1, line 15-16: It is not accurate to state that European countries that are Parties to the UNFCCC submit inventories to the UNFCCC Secretariat. This is only the case for Annex 1 Parties on a consistent and regular basis. This is also reflected later in the paper. Also, it should be noted that for several European countries, the reporting under

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the UNFCCC includes territories far from Europe. If the authors have used the data reported in the CRF tables as only being the European part of e.g. France, Denmark and the UK, then there will be an over allocation of emissions to the European part. This could be noted, e.g. in table S3.

Page 1, line 17ff: The postulate that interest in spatial GHG emissions is growing should be supported by references. Further it should be verified that city specific climate action plans are in focus, as GHG emission reductions as described does not have to be located in e.g. cities as is air pollution reductions.

Page 1, line 19: the spatial resolution is given as  $\sim 7 \times 7$  km, but later in the text as  $0.125^\circ \times 0.0625^\circ$  and on the data download web page as  $1/8 \times 1/16$  degree. This should be made consistent. Information about the coordinate system is missing in the paper, but is included on the download web.

Page 3, line 15: A more correct formulation would be that the Paris Agreement entered into force on 4 November 2016, which was the week before COP22. The entry into force happened thirty days after the date on which at least 55 Parties to the Convention accounting in total for at least an estimated 55 % of the total global greenhouse gas emissions had deposited their instruments of ratification, acceptance, approval or accession with the Depositary.

Page 3, line 18-20: The assertion that the Paris Agreement leads to a need for a higher spatial and temporal disaggregation than the currently used, i.e. country level and annual, is not supported. The INDCs are formulated at country level and are using annual emission reductions compared to a base year. So the need for high-resolution spatial and temporal CO<sub>2</sub> emission inventories should be further substantiated.

Page 3, line 20-23: It is unclear why the current inventories would not be capable of monitoring and verifying the emissions in case of emission reductions. This should be further elaborated.

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Page 4, line 4-6: Under the UNFCCC the reporting deadline is 15 April year X for the year X-2. That means that the inventory is submitted 1 year and 3.5 months after the end of the inventory year. The 1.5-2 years seems exaggerated.

Page 4, line 18: CRF is an abbreviation for Common Reporting Format (not Framework).

Page 6, line 13ff: In the chapter on international shipping it should be mentioned that the national inventories report based on fuel sold as a memo item. Also, it is not clear from the paper how international aviation has been considered.

Page 7: More information should be provided on the specific spatial proxies used. For each of the sectors presented in Table S4, the chosen proxy should be listed. The described proxies sound very coarse and it would therefore be useful to get a qualitative assessment of the spatial proxy for the individual sector. When one of the main objectives as stated in the paper is to provide an independent verification of e.g. city inventories, using very coarse proxies such as population or land cover will potentially introduce large uncertainties.

Page 7, line 7: the text refer to a selection table for spatial proxy data is mentioned. This table would be very relevant to include in the paper.

Page 7, line 9ff: the paper describe the spatial proxy data used in the model. More proxy data seem to be older versions. The PRTR data are updated annually, so it is unclear why a dataset from June 2012 has been used rather than an updated dataset from the time of the collection of inventory data (November 2016-February 2017 according to page 4 line 6). This will mean that the emission data and the spatial proxy will not be consistent and hence a higher uncertainty is introduced into the spatial modelling. Further, CORINE land cover from 2000 is used in stead of the 2012 version, and the TRANS-TOOLS 2005 version is used though version 2.5 from 2010 is available. Even if some of the data might be rough proxies and annual changes could be limited, the most updated versions should be used.

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Page 8, line 2ff: it is not clear to the reviewer why urban transport emissions are distributed by urban population density rather than following the TRANS-TOOLS. Is this because urban roads are generally under-represented in TRANS-TOOLS? This could be mentioned in the text.

Page 8, line 6ff: population density is in most cases a rough and poorly correlated spatial proxy for emission allocation, and the applicability is expected to differ between countries and sectors. In many cases this can lead to overestimation of emissions in cities with high population densities, and with the focus on making a data set useful for climate action plans for cities, this can lead to erroneous information to policy makers. To justify the use of the model for this purpose, it is necessary to provide uncertainty estimates and verification by comparison with spatial emissions for selected European cities. If this comparison is not possible to carry out within the scope of the work behind this paper, at least an assessment of the proxy data applicability should be included.

Page 8, line 12: “remaining” should be elaborated; which sectors and/or sources is dominating the “remaining” emissions and how large a share does these emissions make of the total emissions. Also these should be included in “a selection table for spatial proxy data” mentioned above.

Page 9, line 24: it is not clear to the reviewer if agricultural waste burning is considered process emissions. Please clarify.

Page 10, line 15-16: The paper should mention that flaring in the SNAP categorisation is under SNAP9 and not SNAP5. It is sensible that the fugitive emissions from fuels have been combined, but in case of comparison with other inventories, it should be noted that flaring technically belongs under SNAP9.

Page 10, line 16-17: In general, it should be specified which definition of point sources has been used in the inventory presented, e.g. whether it is the E-PRTR definition of point and diffuse sources. Different countries might have their own definitions that differ from the E-PRTR definition.

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Page 10, line 18-24: It seems that the map for residential wood combustion (figure 5) puts too high an emphasis on population density and fails to take into consideration the extent of district heating. Hence, the map shows high emission intensity in e.g. Copenhagen, Stockholm and Oslo and lower emissions in rural parts of the countries where wood is used to a far greater extent. Again, if the main purpose of the inventory is verification, the uncertainty should be assessed in order to know whether it is suitable to use as verification.

Page 10, line 26: Emissions from international navigation are reported to the UNFCCC as a memo item.

Page 11: line 1: it is not clear if the AIS data is used as proxy for international shipping, and if not, then what proxy is then applied in the model.

Page 12, line 1-22: No new information is presented on temporal profiles and it is not clear why temporal distribution of CO<sub>2</sub> emissions is important. Chapter 3.3 should be removed from the paper as it does not contain any new information or information that is necessary to understand the results as presented in this paper.

Page 12-13: As stated the emission projections used are not up to date. It is assumed that the emission changes per year from the 'old' projections can be used directly even if many policies and measures have been implemented in the time passed since the elaboration of the scenarios (2005 as starting point). This assumption seems to be highly questionable and it is doubtful that using these data combined with inventory data reported in 2016 will give a representative picture. All the same countries that report annual inventories also report emission projections every other year. While it is only mandatory to report a 'with measures' scenario and not also a 'with additional measures' and/or a 'without measures', these data could be analysed in order to provide some useful and more up to date information on the projected CO<sub>2</sub> emissions. As much newer data are available, this should either be incorporated into the paper or the part on emission scenarios should be dropped and the paper should focus differently.

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Page 14, line 7: There is a reference to 'blue dominates' in figure 9. However, figure 9 uses a green to red colour scale.

Page 14, line 33ff: The paper speaks of a rapidly increasing demand for independent verification. It is unclear why the authors believe that the current MRV rules are not sufficient to meet the demands and this should definitely be addressed in much more detail in the paper, i.e. why is the current inventories based on UNFCCC and IPCC rules not sufficient as a basis to evaluate trends in emissions. Furthermore, it is unclear how the current inventory presented contributes to meeting this perceived demand, as it is not independently estimating CO<sub>2</sub> emissions, and the results of this paper cannot be used to answer the questions posed on page 15, line 2-3.

Page 15, line 13-15: It is not explained why the demand for high-resolution spatial and temporal CO<sub>2</sub> inventories should dramatically increase. There is nothing in current UN or EU regulation that mandates that national inventories should be elaborated at a higher resolution (spatially and temporally). As mentioned in the paper, the spatial and temporal component is not important in terms of the ultimate goal of reducing the temperature increase and as such it is difficult to see that this would be in high demand.

Page 18, line 2: the link didn't work on the time for review.

Figure 4: the figure text are missing information that it is fossil CO<sub>2</sub>

Figure 7: uneven intervals on the x-axes should be corrected to avoid misinterpretation of the trends.

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