

Interactive comment on “The Hestia Fossil Fuel CO₂ Emissions Data Product for the Los Angeles Megacity (Hestia-LA)” by Kevin R. Gurney et al.

Anonymous Referee #2

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General Comments

1. The Hestia data products provide bottom-up fossil fuel emissions at the urban scale with building/street and hourly space-time resolution. The data feed into atmospheric CO₂ inversion studies and can help guide to climate change mitigation options, including disaggregation of national goals/policies to the local level. This paper focuses on the Los Angeles Megacity, the Combined Statistical Area that includes Los Angeles, Orange, Riverside, San Bernardino, and Ventura counties, providing CO₂ emissions results at a spatial resolution of 1km by 1km for the years 2010-2015. The input data are from the Vulcan Project, adjusted where superior local and downscaled data are available. It was found that the study area emitted 48.06 MtC/yr. Of note, Hestia emissions were found to be 10.7% larger than the estimate by the local metropolitan

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planning agency, the Southern California Association of Governments (SCAG).

2. The Hestia-LA data product, and the Vulcan dataset in general, are exciting advances in the urban greenhouse gas emissions quantification field. In particular, the data product goes beyond traditional carbon inventories used by city planning agencies to include a higher spatial and temporal resolution. This makes the data product particularly exciting for the development of highly impactful and targeted carbon reduction policies in cities.

Specific Comments

3. This reviewer has a keen interest in urban planning and policy-related efforts for greenhouse gas emissions reduction in cities. As such, the comments are intended to help improve the paper's accessibility to a planning/policy audience and help specify the policy-related importance of the Hestia-LA work.

4. This work is of interest to a variety of readers, including policy makers and urban planning professionals. With that in mind, I would recommend defining a few of the atmospheric-science-specific words and phrases earlier on in the introduction, particularly "flux" and "inversion", ideally in the context of other phrases that are more recognizable to the policy maker or layperson (e.g., "emissions", "CO2 emissions"). For example, the term "flux" begins to appear regularly on page 3 (e.g., "flux measurements", "flux estimation", "surface fluxes"), and it could be confusing to a reader who isn't used to the terminology. This would make the content more accessible to policy audiences.

5. The introduction does a good job in describing the body of work on greenhouse gas accounting in the urban environment, including the gap in existing methods that the Hestia Project aims to address. The discussion of policy-related issues on p2-3 are good: lines 50-55 (contributions from city-based policies to meeting national/global commitments), 64-68 (data and aggregation difficulties), 95-99 (translation to urban mitigation efforts). I would have liked to see a few more lines on the benefits and draw-

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backs of policy-related/traditional greenhouse gas emissions inventories (mentioned on p2, line 64 - note that these two citations do not actually appear in the reference list). It would be good to reference the Global Protocol for Community-scale GHG Emissions (GPC) here, as this is the current standard for city-based GHG inventories in the policy world, used by both the C40 and GCoM (two organizations that are currently mentioned in the paper). See <https://ghgprotocol.org/greenhouse-gas-protocol-accounting-reporting-standard-cities>. The paragraph on page 29, lines 672-683, does an excellent job of describing the issues with traditional urban inventories and the benefit of the Hestia approach. Could a few aspects of this description appear in the introduction?

6. The data collection and processing effort involved in creating the Vulcan and Hestia datasets are impressive and well-described. The types of emissions that are included and excluded from the Vulcan dataset are detailed: the Vulcan dataset focuses on energy-related fossil fuel emissions, thereby missing greenhouse gas emissions related to non-fossil fuel activities, such as fugitive/evaporative emissions and direct industrial process emissions from activities such as steel production (however, the text specifies that emissions from cement production are included). It may be worth mentioning at this point that CH₄ and N₂O are not included (this is mentioned on p24, but could be mentioned earlier – for example, on p6 the inclusion of carbon monoxide is discussed, which could be a good place to put information about treatment of CH₄ and N₂O). Waste management is an important part of traditional city inventories, and the urban planning/policy-making crowd may want to know if emissions from waste decomposition/incineration are included/excluded from the dataset.

7. The analysis of spatial clustering and local emissions “hotspots” is very interesting and could potentially have direct policy/planning relevance. While not necessarily brand-new information (high traffic flow and congestion are likely well known), the addition of the emissions consequences could potentially open the door to new forms of carbon-related financing/policy mechanisms.

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8. Something that stands out in the abstract is the 10% difference in the model results and the planning authority's GHG inventory. However, in the paragraphs on p24, a bit more information is needed about the SCAG model to understand the comparison to Hestia and its relevance. SCAG is described as "a regional greenhouse gas emissions inventory for a base year period of 1990-2009 with projections out to the year 2035." Are these both direct emissions inventories? Does SCAG use a traditional accounting approach similar to the GPC or an approach closer to Hestia's methodology? Is the purpose of comparison for validation of Hestia, or to demonstrate the drawbacks in the SCAG inventory? A couple more lines about the SCAG methodology and the purpose of the comparison will help clarify.

9. In my opinion, the most important paragraph for policy makers is p30, lines 700-713. Policy makers/planner may be tempted to think, "We do these GHG inventories already, why should we look at this tool?" That paragraph directly answers the question of why an urban planner/policy maker should care about this work. I highly recommend bringing elements of this paragraph to the introduction and/or abstract. Perhaps a few lines in the introduction that are specifically directed at city planners and policy makers. I completely agree with the line, "The most important attribute of the Hestia-LA approach, therefore, is the potential it offers for targeting urban CO2 reduction policy more efficiently." This hook deserves an earlier appearance in the paper.

Technical Corrections

- As mentioned above, the two citations on p2, line 64, do not appear in the reference list - Typo in y-axis label of Figure 10b.

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