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Interactive comment on "LA Megacity: a High-Resolution Land-Atmosphere Modelling System for Urban CO_2 Emissions" *by* Sha Feng et al.

Anonymous Referee #2

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General Comments

'The paper of Feng et al. entitled 'LA Megacity: a high-resolution land-atmosphere modelling system for urban CO2 emissions' compares different model resolutions and emission maps to identify optimal configurations for simulating CO2 fields over a megacity. Although this concept of comparing different models or model configurations is not new, urban air quality poses some additional challenges that the authors try to address in this paper. Additionally, they pay attention to monitoring requirements and their new network design methodology can certainly prove useful, also to estimate footprints. However, I believe the authors could stress more the importance and novelty of their study in the context of recent studies, as the summary of current literature lacks

an overview of knowledge gaps/remaining challenges and how their study fits into this (except for the paragraph about studies that focused on LA). Other than that I thank the authors for their very nice work.

Specific comments

Why have the authors decided to use one-way nesting? What would be the advantage compared to two-way nesting and what are the consequences?

The authors have chosen to simulate a two-month period per day, rather than doing the whole period in one simulation. This requires re-initialisation of the concentration fields for each day. How do the authors ensure conservation of mass between the simulations? Could you show that this re-initialisation has no impact on the simulated mass fractions?

Could the authors clearly specify whether the temporal variations for both emission product are equal? If not, how do they differ and what would be the consequence for the comparison of the products?

The authors state that for the MYNN_UCM configuration the PBL height is better represented for d03 than for d02 and that this is also reflected by other configurations. However, it appears from figure 4 that for some configurations d02 is actually better during the afternoon. This requires some reflection in the text.

Are the biases shown in Figure 6 for the whole period, including night time? If so, how do the authors reach the conclusion that the dryness in the model causes a lower PBL height (Figure 4) in the afternoon, while the PBL height is actually higher a bit earlier during the day? I would like to see a clear explanation for this, as generally I would think that dryness would cause a higher PBL height.

Page 15, ln. 23-24: 'However, during daytime, with well-mixed conditions, the discrepancy between the WRF-Hestia and WRF-Vulcan runs becomes smaller.'; and similarly: Page 16, ln. 15-17: 'For the same reason, we show that FFCO2 emissions do not play

a dominant role around 1400 PST unless there are strong local signals...'. This is an interesting note. Usually, well-mixed daytime concentrations are sampled for inverse modelling, as these conditions are usually better represented by models. That leads to the question how well we could estimate posterior fluxes if a 40% increase in FFCO2 emissions only leads to an increase of less than 1% in the total CO2 concentration (which is a rough estimate from your Figure 8 at 1400 PST using both 1.3 km simulations). Could the authors digress a bit on the consequences of this note for inverse modelling?

Section 5 introduces a new network design method. Although mentioned before that this would be discussed, I would like to see a few sentences discussing the need for such new method and the limitations of other methods. Currently, this is only briefly mentioned in the discussion. Could the authors also make a recommendation on which method would be most suitable for future use?

Technical corrections

In Section 3.1 the authors list five criteria for profile selection. The difference between point 4 and 5 should be made more clear.

In Section 3.4, the third paragraph, the authors mention the temperature difference between Granada Hills and downtown LA in °F. I would suggest to use Kelvin to make comparison with the other temperature results in Kelvin easier.

In Section 5, please mention clearly whether you used any data selection or that all data was included for the correlation maps.

The discussion now starts with new results based on flask samples of radiocarbon. Please move this to the results section. Also I would suggest to introduce the use of radiocarbon earlier, as this not mentioned previously in the paper.

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