

# ***Interactive comment on “Large-eddy simulation of traffic-related air pollution at a very high-resolution in a mega-city: Evaluation against mobile sensors and insights for influencing factors” by Yanxu Zhang et al.***

## **Anonymous Referee #2**

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### General Comments

This paper presents high-resolution modeling of CO concentrations in a high population urban area and a model performance evaluation based on high time-resolution observations. The research in this paper is a solid scientific study that adds to the knowledge we have of the variability in air concentrations in large urban areas. Below I detail some specific comments that should be addressed by the authors as well as some technical corrections.

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## Specific Comments

-Lines 183-185: please provide more reasoning for your decision to use the minimum CO concentration from the nine air quality monitoring stations. Are any of these stations located away from traffic/industrial sources or upwind of the city? Are any of these truly representative of a background concentration?

-Figure 4: I can't understand this plot at all. Why are all of the modeled CO concentrations negative? Why don't the peaks in the yellow and orange lines match the stated geometric means of 0.17 and 0.28 mg/m<sup>3</sup>? What do the blue and red portions of the F(C) equation represent? If the black lines represent the total frequency of residential streets + highways, why is the black curve it so similar to the yellow curve with no obvious influence from the orange curve?

-Figure 5 and 221-225: please provide detailed information on the time resolution of the modeled and monitored data used in this plot and the stated statistics. From the methods section, it appears that the model has a time resolution of 6 s, but the taxi data have a resolution of 10 s. How were the data transformed to be of equal time interval?

-Lines 223-232: the uncertainty for both the modeled and measured CO concentrations are a large percentage of the calculated 0.90 and 0.92 mg/m<sup>3</sup> attributed to traffic sources. Combining this with my comment above that in-city monitoring sites may not be the best sources of background CO concentrations leads to the conclusion that the 40% attribution to traffic-related sources is very uncertain at best. I recommend adding further details on the uncertainty of this estimate.

## Technical Corrections

-Lines 48-50: please add a citation for this sentence. While the point being made is generally true (i.e., there are few sensors in most major cities), the specific numbers quoted in this sentence must be attributed to the correct location. Also, consider

changing the beginning of this sentence to, “For example, in [city], . . .”

-Line 67: please clarify that CALPUFF is a puff model, not a Gaussian model.

-Line 76: the word “dynamics” should be added between “fluid” and “models”.

-Figure 2: this figure is difficult to see and would be improved if it were higher resolution and/or a different color scheme.

-Figure 4: the legend is missing from this figure. Please include legend definitions for all three items plotted.

-Figure 6: panel Q needs to be clarified. Why is there a legend (mg/m<sup>3</sup>) on the right-hand side? Also, the explanation of the blue, red, and yellow bars does not make sense. R<sup>2</sup> values compare the model and station, so there cannot be separate R<sup>2</sup> values for the model and the station (i.e., the red and yellow bars).

-Figure 8 and associated text: are these ground-level concentrations or concentrations at 1.5 m (which would match the taxi data)?

-Figure 10. This plot would be improved by using actual concentrations rather than the natural log of concentrations. Using the natural log is not intuitive, as values <1 mg/m<sup>3</sup> are negative.

-Figure 11: “longitude” is misspelled. As with Figure 10, concentrations would be a more intuitive item to plot, compared to the natural log of concentrations.

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