

## Responses to Reviewers:

### Reviewer 3:

We thank the reviewer for the careful reading of the manuscript and constructive comments. We have revised the manuscript following their suggestions as is described below.

#### General comments

.....This is a valuable result (although it isn't included in the abstract) since it provides a concept that generalizes the results of the paper and that could be tested in other urban settings. The paper should be published since there is interest and concern about grid resolutions to use for model applications and this paper provides some useful information and methods for investigation of this question. However, the paper requires revision in several ways prior to final publication.

Thanks for the good suggestion by this reviewer. We add the statement that **“This study suggests that the ratio of the city range to threshold resolution is 6 to 1, and this ratio can be considered as a threshold model resolution for other cities in general”** in the abstract of the revised paper.

First, the relative effects of the three key issues were assessed in terms of model performance, but the model performance was only judged in a semi-quantitative way. Table 1 (which is isn't needed) should be replaced with a comprehensive table of model performance measures for each of the individual model runs and this should include measures of model bias and absolute error for both meteorological performance and chemical species performance. Performance for peak concentrations should also be included. Given these performance measures, it might be interesting to graph a performance measure vs grid resolution to help visualize the effects of grid size.

In the revised paper, we add a performance table (Table 3) to provide a quantitative analysis of the result. In Table 3, we show the calculated and measured mean, minimum, and maximum values at different resolutions. The bias of the model result is also analyzed and is shown in Table 3. This evaluation gives more insights regarding the performance of the model. For example, the mean value shows the model averaged bias, and the maximum value comparison indicates the bias in the model variability in different resolutions. The later comparison is a new analysis and provides useful information in evaluation of the model. In response to the reviewer's comments, we also re-plot Figure 11. In the new figure, we not only compare calculated mean value to measured result, and also make the comparison between calculated and measured variability of the concentrations of ozone and its precursors.

The real key to success with this type of paper is the development of a generalization concept that others might use in different settings. In this regard, the ratio of urban size to grid size is a useful starting place. The authors might also consider measures of the

intrinsic variability of urban properties as a yardstick for required grid resolution. For example, how does the variability in emission density or population compare to grid size. If population is relatively uniform over large areas, then we might assume that emission inventories do not need to be developed at high resolution. Is this correct? What about variability in terrain height and how does that relate to meteorology? Are there differences in the variability for different ozone precursors and how does this relate to the photochemical effects investigated in the paper?

In the paper, we have designed model by changing (a) both model and emission resolution, (b) model grid only, and (c) emission resolution only (see Table 2). The study suggests that the ratio between city boundary and model resolution cannot be less than 6:1, which can be used as a criteria to test regional model in other large cities. The model study also suggests that the meteorological (model grid) resolution is more sensitive to the calculated ozone and its precursors than the emission resolution in large cities. This result provide an important information that with a relative high resolution of model grids, simulation obtained by a regional dynamical/chemical model with a coarse resolution of emissions can still provide a reasonable performance in large cities.

### **Editorial revisions**

For example, the title should have a colon instead of a semi-colon. The various maps should be rescaled to show urban Mexico City in more detail and not the whole model domain since much of the domain is blank. The caption for Figure 1 is somewhat confusing and may include some mis-wording. There are no units indicated in Figure 2. In Figure 11, the ozone results need to be indicated for day and night.

All these suggested editorial revisions are made in the revised paper. All suggestions regarding the figures are re-plotted (Figures 7 and 9). The units in Figures 2 and 11 are added. In addition, we carefully read through the paper, and the English of the paper is considerably improved.