Responses to Reviewers:

Reviewer 2:

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 manuscript examines the effect of model horizontal resolution on calculated distribution of O3, CO and NOx, through its influence on simulated meteorological fields and transport, emissions and nonlinear photochemistry, in the MCMA using WRF-chem, and examines the effect of each factor on pollutant simulation. This is a very interesting topic in chemical transport modeling that has not been addressed in-depth before. This paper attempts to tackle this topic in a systematic way. However, the quality of this paper would notch up a level if (1) the grid resolution design (table 2) is improved, and (2) the simulation extends to include more days or episodes.

According to the reviewer's comments, more model simulations are performed to get some insight of the impact of model resolution on the simulated ozone and its precursors in different days. The result (shown in the attached figure) suggests that the result is very similar between different day simulations. Thus, in the revised paper, we include the context regarding the simulation resulted from different days, but did not include the extra figures. The more detailed response to reviewer's comments is as follows.

Specific comments

1) The resolution scheme in Tab 2 appears to be quite simplistic. In my opinion, the 24km resolution can be ignored, since in such a case the MCMA urban area, where most RAMA stations for comparison reside, contain only 4-5 pixels, which is not suitable for simulating urban pollutants. Instead I would suggest adding more resolution combinations so that more rigorous explorations can be made of the effect of the three factors induced by the model resolution on the chemical performance.

In the study, we show that when both the model and emission resolution are 24 km, the simulation of chemical oxidants is significantly lower than the measured result. By contrast, we change the model resolution to 6 km and keep the emission resolution (24 km), and compare the two model simulations. The comparison shows that even we still use 24 km resolution for the emissions, the simulation is considerably improved. Thus, this model simulation set up provide useful information regarding the impact of model grid and emission resolution on simulation of ozone and its precursors in large urban area, and should be remained in the paper.

2) The results are based on one-day simulations. To make the conclusion general and representative, multi-day or multi- episode simulations are needed.

In response to the reviewer's comments, we made additional simulations (see attached figure). The result shows that the simulation in different days provides similar result (comparing the attached paper to Figure 6) for the impact of model grid on simulation of ozone and its precursors in large urban area. In the revised paper, we include the context regarding the simulation resulted from different days, but did not include the extra figures.

3) It is not clear to me whether there is an objective standard in defining the threshold and optimal resolutions. For example, according to Fig 11, the 6-km resolution case yields the best overall performance (considering O3, CO and NOx together); but for O3 alone the 12-km resolution case has the best performance. This leads to the classic question–does model get the right result for the right reason? This suggests that it needs to be cautious when coming to define the threshold and optimal resolutions.

In the revised paper, we add Table 3 (evaluation of model performance table, suggested by Reviewer 3). In the table, we evaluate the performance of the simulations with different resolutions by considering model mean and model variability). The threshold and optimal resolutions are determined by the overall model performances, including performances for different chemical species (CO, NOx and O3), and also the calculated mean and variability.

4) Including a table for chemical performance statistics would be helpful in defining the resolutions raised in the previous comment.

This is also suggested by Reviewer 3. In the revised paper, we add Table 3 (model performance table) to better evaluate the model simulation.

5) It would be valuable to include a table of meteorological performance and how does it translate into chemical performance in the cross-resolution examinations (like Run#4 and 5 in Tab 2). I would anticipate that it assists to answer the classic question in Comment #3.

Table 3 includes both chemical and meteorological performances.

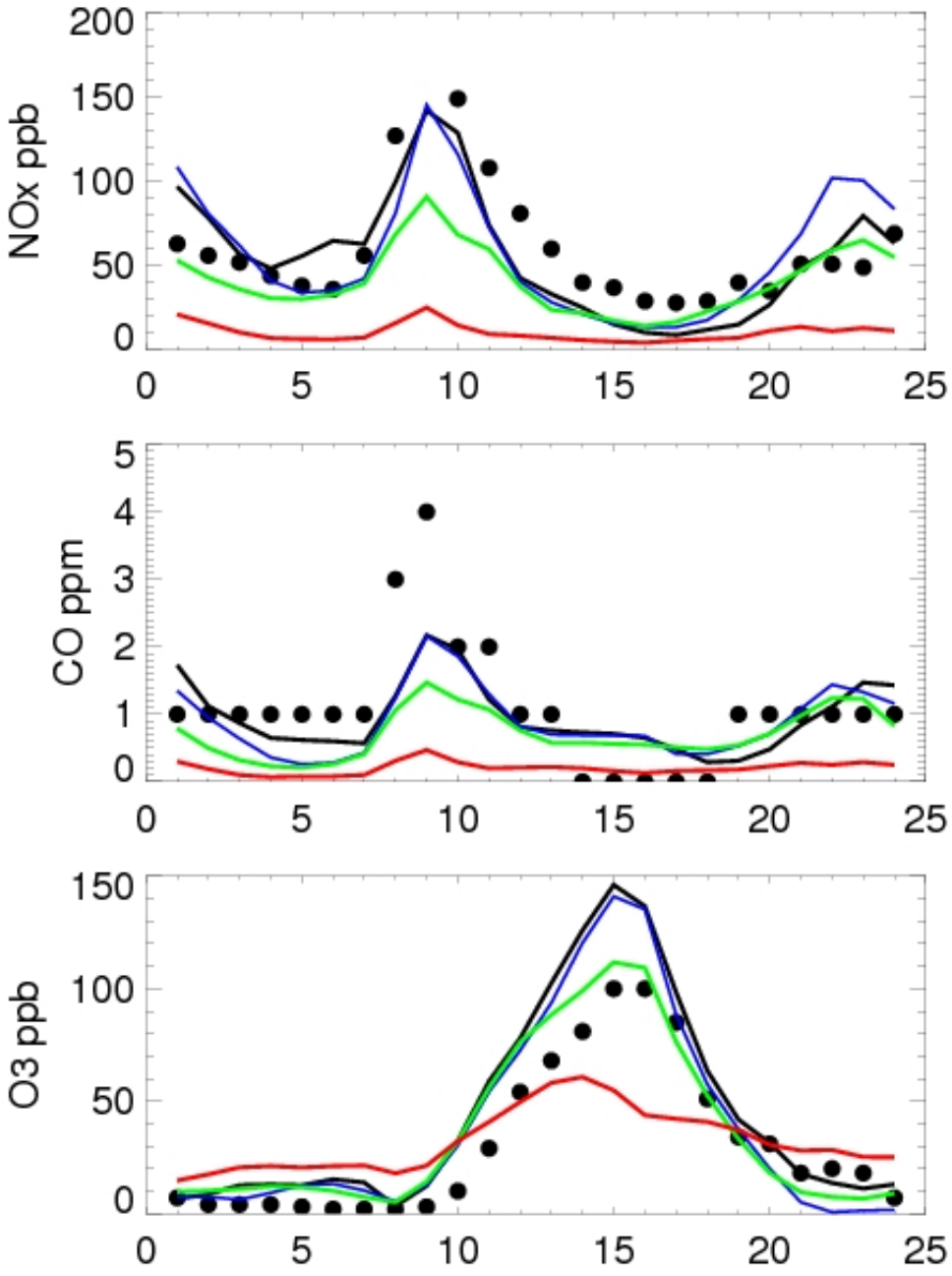
6) The paper examines the optimal resolution toward the coarse end; an equally important question is toward the opposite end. Can authors add discussions on how the model performance would change if the resolution gets higher, and discuss whether there would be an optimal resolution toward the fine end (like 1km or higher)?

The purpose to find the optimal resolution is primarily to minimize computer burden when apply a regional model to study air pollutants in large cities. In this case, increase resolution of computer is beyond the scope of this purpose.

Technical

Some languages need to be furnished.

The English is substantially polished in the revised paper.



Attached figure for the result of March 29, 2006 in Mexico City.