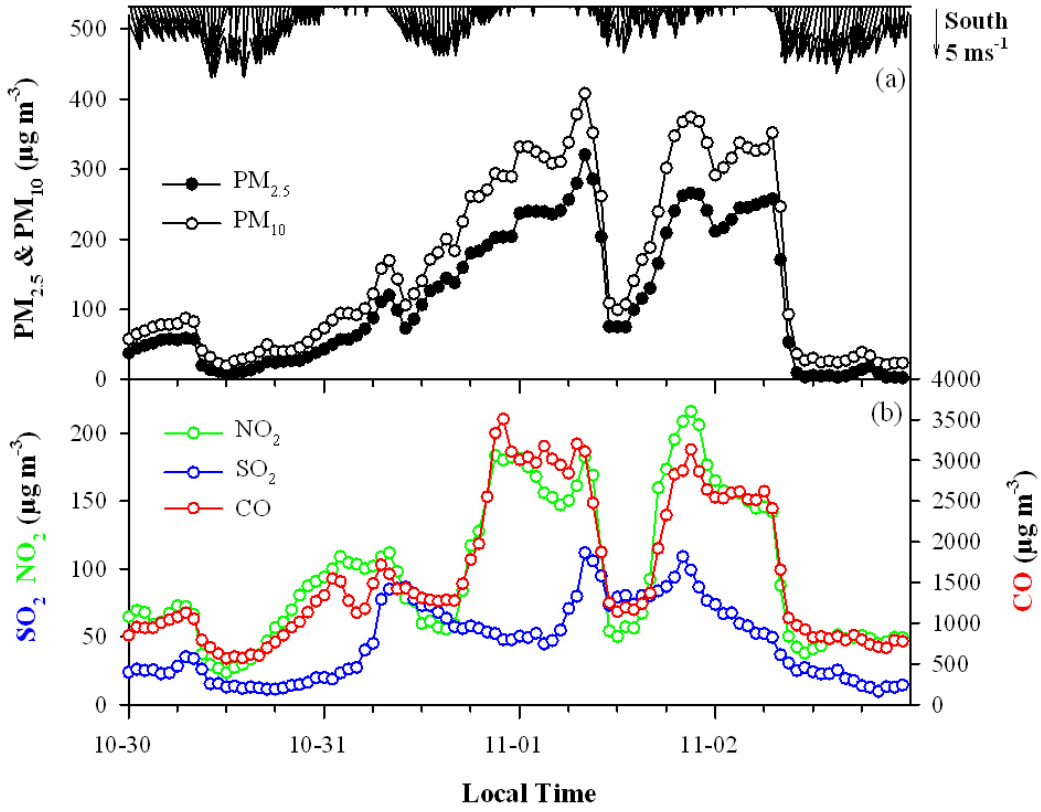
Response to Reviewers' Comments (#2)

This manuscript addressed a very important issue. The 2010 World Expo held in Shanghai provided a unique opportunity to analyze the effectiveness of human perturbed emission reduction on air quality. The conclusions of this manuscript have important implications for the future improvement of the air quality in Shanghai and other mega-cities around the world. The manuscript was well organized and presented. Therefore, the manuscript is suggested to be accepted by ACP with minor revisions documented below:

We appreciate the reviewer's comments on this manuscript and we do find it useful for the improvement of this manuscript. In the responses below, we have made the corresponding corrections following the comments point by point. Below are the responses to all the comments one by one. In the revised manuscript, we have highlighted the changes with red color.

1. I gave a comment that the author did not provide enough proves for the probable formation mechanism of some pollution episodes when reviewing the 1st version of the manuscript. I am afraid the author did not address it adequately in the discussion paper. For example, the author attributed the sharp increase of SIA concentrations during Oct 31 - Nov 1 to the rebound of air pollutant emissions as soon as the World Expo was announced closed, especially the sharp increase of vehicle emissions. The author tried to preclude the possibility of this heavy pollution controlled by unfavorable meteorological conditions by saying that the major meteorological parameters fluctuated little during the period from Oct 26 to Nov 1 (Page 3393, Line 6-16). However, we noticed that Shanghai experienced strong northerly wind during Oct 23 – Oct 29. In contrast, stagnant meteorological conditions dominated during Oct 30 – Nov 1, favoring the accumulation of air pollutants. I am not arguing that the sharp increase of PM is only attributed to the unfavorable meteorological conditions, but I think both the emissions and the meteorological conditions might contribute to the sharp increase. If you exclude the impact of meteorology, how do you explain the sharp decline of PM concentrations on Nov 2? It would be more convincing if the author could clarify the relative importance of emission increase and weather conditions.

Thanks for the comments and we agree with reviewer that the varied meteorological conditions did affect the variation of air pollutant concentrations. In the revised manuscript, we have added wind data to Figure 7 as shown below and made substantial revision on explaining the possible formation mechanism of this pollution episode. The role of meteorology on this pollution episode is now thoroughly discussed. Please refer to Line 341 - 366 in the revised manuscript for the revision.



Line 341 - 366:

The air quality in Shanghai during this period could be regarded as “good” and we believed that stringent control measures must be implemented to keep the air quality good. In addition, Shanghai experienced strong northerly winds from October 20 to 30 (Fig. 8a) and this also contributed to the better air quality. However, all the air pollutants drastically increased during the day (October 31) when the Expo was announced to be closed. Fig. 7 shows the diurnal variation of $PM_{2.5}$, PM_{10}, NO_2, CO, and SO_2 with hourly

wind profile from October 30 to November 2. No precipitation events were observed during this period. On October 30, the concentrations of all the air pollutants stayed at relatively low level. Strong wind was partly responsible for this. From 0:00 LST on October 31, $PM_{2.5}$ and PM_{10} concentrations gradually increased till the early morning of the next day. Although stronger winds appeared from around 9:00 to 20:00 LST on October 31, the concentrations of air pollutants didn't decrease while instead continued to increase, suggesting an increase of local emission. From 20:00 LST to the next morning, the atmosphere turned to be stagnant as indicated by the absence of winds. $PM_{2.5}$ and PM_{10} continued to rise and reached the extremely high concentrations of 320.8 and 407.8 μgm^{-3} at 8:00 LST of November 1. Afterwards, PM concentrations sharply decreased and reached troughs around the noon. The appearance of northeast and north winds evidently was beneficial for cleaning the air pollution. In addition, the elevated mixing layer at noon due to higher temperature could also dilute the emission. However, PM climbed up again and stayed at high levels till 7:00 LST on November 2. Afterwards, persistent northeast and north winds from the ocean helped cleanse the air pollutants again. Among these four days, insignificant differences of wind pattern, temperature, atmospheric pressure, relative humidity and dew point were observed. However, compared to the reference period of October 30, completely different diurnal patterns and concentrations of air pollutants in the following days were observed. Enhanced local emission was suggested to be mainly responsible for this tremendous rebound of all the air pollutants. This clearly indicated the lifting of short-term emission control measures (e.g. loose control on the vehicle flows, and allowance of high-duty vehicles into the city) took place right after the announcement of the closing of the Expo.

2. The organization of this manuscript is a little in disorder. The analysis of typical pollution episodes, the comparison between pre-Expo, Expo, and post-Expo, and the comparison between 2009 and 2010 are twisted together. In section 3.4, the author conducted a "comprehensive comparison" between 2009 and 2010, and some of the content in this section overlaps with the previous sections. I suggest the author reorganize some of the text. For example, the author might focus on the analysis of typical pollution episodes, and the comparison between pre-Expo, Expo, and post-Expo in section 3.1-3.3,

and compare 2009 with 2010 in section 3.4. It is the best if the abstract and conclusion parts are re-organized accordingly.

Thanks for the suggestion. In the revised manuscript, we have re-organized some paragraphs to make the organization of the manuscript more clearly. For example, Line 12 – 16 in Page 3380 from the original manuscript is now removed to Line 29 – 32 in the revised manuscript. Line 21 – 24 in Page 3380 from the original manuscript is now removed to Line 35 – 37 in the revised manuscript. Also, we have reorganized some parts of the conclusion to make it more logical and readable. Line 12 – 16 in Page 3402 from the original manuscript is now removed to Line 627 – 630 in the revised manuscript. Also, Line 28 in Page 3402 to Line 4 in Page 3403 from the original manuscript is rephrased and now removed to Line 629 – 637 in the revised manuscript.

3. In the abstract, key findings should be summarized in a manner which gives clearer conclusion on the effectiveness of the stringent temporary control measures during the World Expo, and derives significant policy implications.

Thanks for the suggestion. Now we added a sentence at the end of the abstract summarizing the findings in regard of the policy implication. Please refer to Line 43 – 46 in the revised manuscript for the changes: "This study demonstrated that stringent emission control measures aiming at mega-events in China could achieve positive benefits on improving the air quality in a short term. However, persistent efforts on curbing the anthropogenic emission remain a long way to go in the future."

4. Page 3382, Line 19, and Page 3405, Line 13-15, "Huang et al., 2012" should be "Huang et al., 2012c"?

Yes, now we have corrected this in the revised manuscript. Thanks for pointing out this.