Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., referee comment RC3
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Comment on acp-2020-1302

Anonymous Referee #3

Referee comment on "Unexpected enhancement of ozone exposure and health risks during National Day in China" by Peng Wang et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2020-1302-RC3, 2021

The paper investigates the causes of increase in surface ozone concentration in China during the Chinese National Day Holidays (CNDH) in 2018. The authors used CMAQ model to simulation O3 production during three periods of pre, during, and after (CNDH). The result shows that the increased O3 values during CNDH are due to increase in precursor emissions and also regional transport. The impact of enhanced O3 during CNDH on public health and mortality rate in major cities in China.

The paper is well-written and fits to scope of ACP. However, it needs some clarifications on the changes in the anthropogenic emissions in the three periods. If no changes were made to the anthropogenic emission inventory to reflected the changes in emissions due to the national holiday how are you attributing the changes in O3 to this event? The relative contribution of biogenic vs. anthropogenic emissions needs to be discussed further in the paper. It may play an important role in the variation in O3 concentrations and it is totally dismissed. Please see the comment sections for the details.

General comments:

- What does regional transport mean in the scale of your study? All the paper on regional transport in China that are cited in the introduction discuss one region in China and the impact of transport from a region to another hence "regional transport". Specifically, I am referring to P3, L61 where you stated the rapid increase of O3 throughout China is attributed partly to regional transport. What does this mean if the transport is between subregions in your domain?

- Section 2.1: Please note in the main text that October emission is industry and residential sectors are higher than September emissions. The monthly variation in emission inventory (between September and October) can play a role in variations in O3 concentrations and it is not discussed in the paper.

- Section 2.1: I am not familiar with MEIC inventory, does it have a diurnal or monthly variation? Please provide more information.

- Section 2.1: This is my main questions to the authors: Is the anthropogenic emission different during CNHD? If no then how are you attributing changes in emission as one the reasons for enhanced O3. If yes then please provide more information about the changes.

- Section 2.1: PRE-CNDH and CNDH periods have 6 days and AFT-CNDH is 23days. Is there a specific reason for this? This makes your statistical comparisons (for example in fig 1) not fair because you are including more days in one of the periods compared to

others.

- Figure 1. Can you add model values to plots a and b to show if model captured the variation in the MDA8 O3?

- Figure 1. Can you show on one of the maps where each the regions in plot (a) are? Why AFT-CNDH in east China is so much lower than PRE-CNDH?

- P6 – section 3.2: Having a discussion on changes in O3 production regime in valuable. However, I suggest starting this section by discussing the differences between emissions. This way you can better distinguish between uncertainties in emissions and in the uncertainties in simulation of O3 production process.

Having a figure that shows the differences between NOx and VOC emissions (in different periods within your simulation) as one the main figures will be very helpful.

- P8 – Discussion on changes in transportation emission.

I think making these changes in transportation sector emission and running another simulation can reflect the actual changes that occur in the emissions during the national holiday. Without considering these changes the conclusion seems weak and incomplete to me. I'm not suggesting to add a real time vehicle emission inventory. You can simply increase the emission from transportation sector by factor of 2.2 during the national holiday and study the impact on O3 values.

Specific comments:

P4 – L83. It is not clear to me if or how much the anthropogenic emission has changed on CNDH days. Also having September and October months in the simulation, probably biogenic emission changes as well. Please be more specific about changes in emissions during the simulation period.

P4 – L100-107. I suggest briefly explain which benchmarks you used for meteorology and O3 performance in this paragraph.

P6 – L158. In south China…

Are you referring to model or obs values? Please clarify.

P6 – L 159. In contrast…

What is the reason for this?

P6-L160. High O3_NOx…

What is a high O3_NOx and O3_VOC level? Also in Fig 2 b and c can you use same range for O3_NOx and O3_VOC? And perhaps a better color bar? The values of O3_NOx in south China during CNDH are not readable.

P8 – L183 – Fig S4:

This is the part that confuses me the most. Is the increase of NOx (and AVOC) emission in Oct due to the national holiday or it is for the whole month? If it's for the whole month how are you attributing it to the national holiday (only from Oct 1-7)?

The differences between e and f (if it shows biogenic VOC emissions) is a natural occurring event and not related to changes in anthropogenic activities. How much of the changes in ozone can be attributed to this? I would like to see BVOC emission maps for PRE-CNDH as well given the highest temperature occurred in PRE-CNDH. Can this justify lower O3 values in AFT-CNDH that we see in Fig 1?

Can you provide difference plots for AVOC and BVOS plots? Also, why different time frames are considered for BVOC plots?

P9 – L 221: Fig S11 and Fig S12. this is not correct.