We thank the reviewer for a set of very comprehensive comments. We have used a combination of measurements and model calculations to evaluate how these issues could impact the overall results of the paper. Our detailed responses for each comment are listed below, along with the changes made to the manuscript to make these findings clear to readers. Our responses to the comments are presented in blue. The comments are shown in black.

1. Clearly this research is very relevant to policymakers for the development of emission control strategies to improve air quality. This study is not the first to develop and apply mobile smog chambers to air quality measurements at specific sites. For example, Mobile Smog Chamber, https://www.psi.ch/en/lac/mobile-smog-chamber; Kaltsonoudis et al., A portable dual-smog-chamber system for atmospheric aerosol field studies, Atmos. Meas. Tech., 12, 2733–2743, 2019. I believe that there was even a commercial chamber, about the size of a soccer ball, that was marketed to directly measure NO_x and VOC limitation by an Australian company (I apologize for not being able to find a reference). My point is that the authors should include a couple of paragraphs summarizing previous mobile chambers and discuss how their new system is an improvement.

The original manuscript only has 2 sentences talking about the previous study about transportable smog chamber. As requested, we have searched for additional studies that use transportable smog chambers. A more thorough discussion has been added to the Introduction section in the revised manuscript.

"Mobile smog chambers bridge the gap between laboratory studies and the real atmosphere. Past studies have designed mobile smog chambers to measure the aging of secondary pollutants (i.e., O_3, SOA) from certain emission source (Howard et al., 2008, 2010; Li et al., 2019; Platt et al., 2013; Presto et al., 2011). It is difficult to evaluate sensitivity of secondary pollutants formed from multiple sources using a single smog chamber. Recently, a mobile dual smog chamber system has been used to directly measure the SOA formation in ambient air (Jorga et al., 2020; Kaltsonoudis et al., 2019). Our smog chamber system consists of three chambers designed to simultaneously analyze the non-linear response of O_3 formation to NO_x and VOC perturbations. The automated valve and sampling system also allows long-term remote field measurements to evaluate the seasonal trends in O_3 sensitivity."

2. The TROPOMI measurements are especially interesting in that they indicate how important biogenic emissions may be in California. I commend the authors for including both Figure 9 and Figure 10. Examination of Figure 9 seems to suggest that the $HCHO/NO_2$ ratio in the most populated regions, the San Francisco Bay Area and Los Angeles South Coast Air Basin (SoCAB), do not have a strong seasonal dependence while Figure 10 makes it clear that they have some. It might be good if the authors expanded their discussion of the relative and rather strong seasonal differences in the $HCHO/NO_2$ ratio between different sites in California.

Figure 9 is the TROPOMI $HCHO/NO_2$ map for California. Figure 10 is the monthly averaged TROPOMI $HCHO/NO_2$ averaged for each air basin. We expand Figure 10 below to show the monthly variation of $HCHO/NO_2$ for different cities in SOCAB. The paragraph discussing this revised Figure has been updated in Section 3.3 of the revised manuscript.

"The seasonal variation of O_3 sensitivity can be observed over the entire state of California using the TROPOMI $HCHO/NO_2$. Figure 10a shows how the O_3 sensitivity seasonal pattern differs among different air basins. The air basins with the highest populations have suppressed seasonal variation of O_3 sensitivity because of the higher anthropogenic NO_x emissions. The difference in the seasonal variation of O_3 sensitivity can also be observed within air basins. Figure 10b illustrates the TROPOMI $HCHO/NO_2$ monthly variation for different cities in SoCAB between February to October, 2020. The cities inside/around the LA urban core have $HCHO/NO_2 < 4.6$ throughout the entire year with a weak seasonal variation. This might be caused by reduced BVOC emissions in the urban center. The remote areas (darker colors in Figure 10b) have greater seasonal variation and higher peak $HCHO/NO_2$. The sharp increase of $HCHO/NO_2$ in summer leads to a shift in O_3 sensitivity from the NO_x-saturated regime to the NO_x-limited regime in the cities further away from the urban core. Due to the different seasonal variation of $HCHO/NO_2$ at different sites, the NO_x-saturated region around the urban core will shrink in the summer and expand in the winter. Figure SX shows this seasonal pattern of O_3 sensitivity regime distribution in Los Angeles as an example."

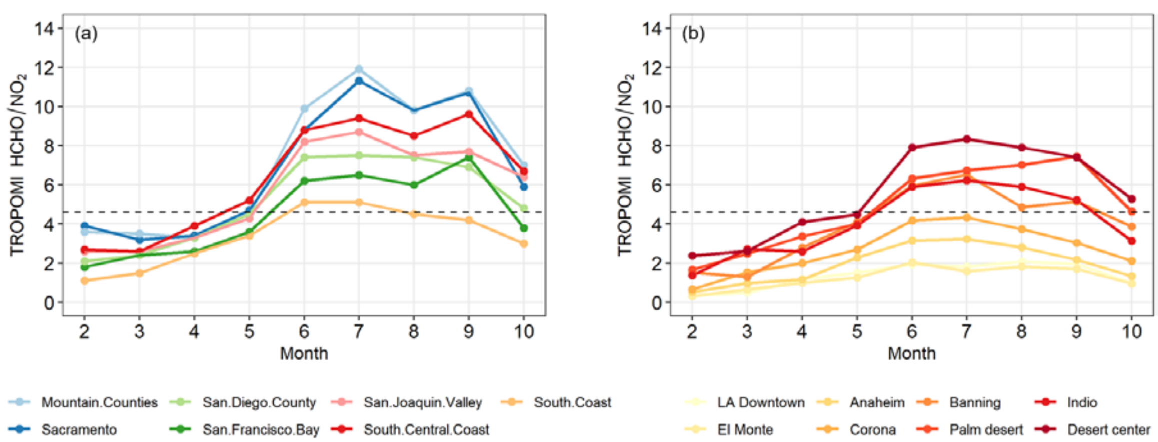

Figure 10. Monthly variation of TROPOMI HCHO/NO2 in different air basins (left panel) and in different cities in South Coast Air Basin (SoCAB) (right panel). The darker colors in the right panel indicate increasing distance from the urban center of Los Angeles.

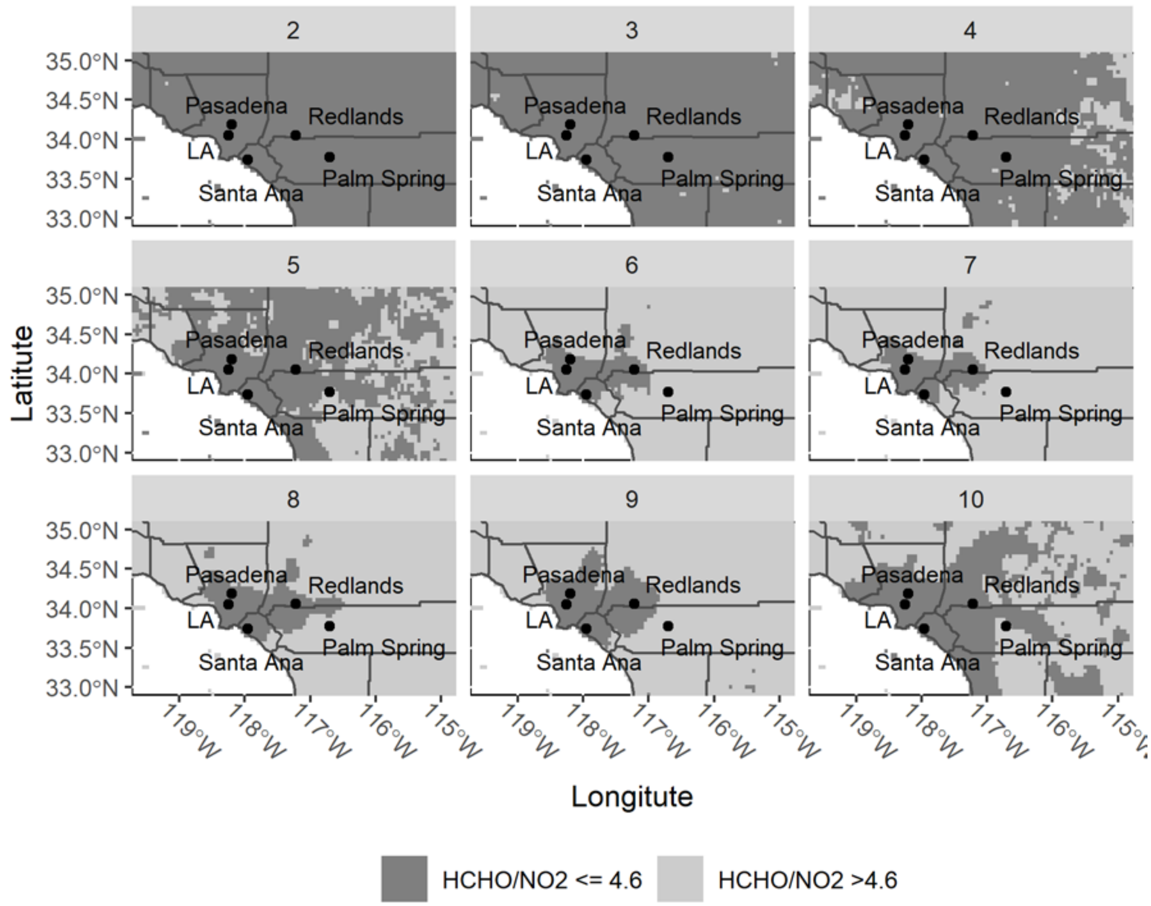

Figure SX. Spatial distribution of O_3 sensitivity regime based on TROPOMI satellite (HCHO/NO2) ratios in Los Angeles for April – October 2020. Light area is in NO_x-limited regime ($HCHO/NO_2$ > 4.6), dark area is in NO_x-saturated regime ($HCHO/NO_2$ <= 4.6)

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