

The unprecedented heatwave of August 2022 brought about national wide O₃ pollution in China. This study targeted the heatwave month of August, 2022 in the air pollution basin SCB in Southwest China presenting the detailed investigation on the spatial disparity of O₃ pollution between two major urban areas Chongqing and Chengdu with pollution levels of O₃ in the western SCB (Chengdu) but relatively lower concentrations in the eastern basin (Chongqing). Meteorological and precursor factors were assessed with observation, modeling study and machine learning methods, spotlighting high temperatures, intensive solar radiation, and overnight accumulative pollutants as key contributors to O₃ concentration, revealing the important role of meteorology-induced natural emissions and meteorological changes. It is suggested to be accepted this paper for ACP publication in the ACP after the major revisions:

Major comments:

As mentioned in the discussions, if the cross-regional transport predominantly influenced Chongqing (contributing ~80%), the local photochemical O₃ production contributed merely about 20 % to O₃ variations during August 2022 in Chongqing, where the prevailing southerly driven the transport of poor-O₃ air masses from the Yungui Plateau, because Chongqing is immediately adjacent to the Yungui Plateau in the south. Please give the detailed discussions and highlighted the results on the regional transport importance in the spatial disparity of O₃ pollution between Chongqing and Chengdu in the following respects of changing emission and meteorology:

- a) the lower O₃ in Chongqing was dominated by the the transport of poor-O₃ air masses from the Yungui Plateau with the less contribution of photochemical O₃ production from local and regional transported precursors.
- b) the cross-regional transport of O₃-precursors from the Yungui Plateau with low anthropogenic emissions and high natural emissions. It is possible to identify the local and non-local O₃-precursors with their relative contribution in Chongqing.
- c) the spatial disparity of O₃ pollution between Chongqing and Chengdu was decided by the changes in regional transport of O₃ and its precursors respectively with high and low contribution of non-local O₃-precursors to the two urban areas.
- d) Please compare the 33-yr (1990-2022) averages of air temperature, relative humidity, wind speed

and direction over August between Chengdu and Chengdu with the anomalies in August,2022. Please clarify that the anomalies of high air temperature and low relative humidity are connected with the strong-southerly-driven cross-regional transport of cool and dry air masses from the Yungui Plateau, which could suppress the photochemical O₃ production in Chongqing.

Specific comments:

- 1) Observational data showed that Chengdu experienced a consecutive 17-day period of O₃ exceedance, Did the extreme heatwave last the consecutive 17-day period in Chengdu? How long was the extreme heatwave in Chongqing? As the study targeted the month of August, 2022 (not a heatwave), please modify the title of manuscript for the study.
- 2) The first paragraph in sect. 1 Introduction is too long with the disorder presentation. Please restructure this paragraph in 2-3 paragraph.
- 3) Please mark the location of Tibetan Plateau and Yungui Plateau and indicate the meaning of color contours in Fig. 1a. Please change Fig. 1b with the 33-yr averages of air temperature over August between Chengdu and Chengdu with the anomalies in August over 1990-2022 based on the site observations.
- 4) Please carefully check the caption of Fig. 2 against the Figure, give a correct caption (vc, wind, averages over August 2022).
- 5) Fig. 1g presented the significant differences in RH. Please add the discussions on role of RH in the spatial disparity of O₃ pollution between Chongqing and Chengdu.
- 6) Please remove the discussions (lines 302-313) on the synoptic system. 200hPa and 500hPa are too high to discuss the stationary and unstable atmosphere for air quality change over the SCB.
- 7) Please thoroughly check the English presentations in the text and all the Figs. with the clear and captions.