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Reply on CC1

Youwen Sun et al.

Author comment on "The drivers and health risks of unexpected surface ozone enhancements over the Sichuan Basin, China, in 2020" by Youwen Sun et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-664-AC1>, 2021

Thanks very much for your comments and your detailed explanations in the email (not shown in the community comments) regarding the usage of potential vorticity (PV), which help us to avoid a controversial deduction in the revision.

We have quantified the aggregate meteorological influence and the aggregate anthropogenic influence on the unexpected surface ozone enhancements over the SCB with the GEOS-Chem-XGBoost method. It is no doubt that the unexpected surface ozone enhancements over the SCB is induced by meteorology anomaly. However, the GEOS-Chem-XGBoost method cannot separate the influence of each individual meteorological or anthropogenic factor. As a result, we compare the differences in many meteorological or anthropogenic factors between 2020 and 2019 over the SCB and surrounding regions to probe qualitatively each individual influence. In previous version, we attempted to use the potential vorticity (PV) at the planetary boundary layer height (PBLH) as a tracer to evaluate the stratosphere-to-troposphere transport. We have very little sense regarding how much difference in PVU at the PBLH can be called large or small, which resulted in a controversial deduction. After reading the references that you listed at the end of the comments as well as your explanations in the email, we give up to use the PV at the PBLH as a tracer to evaluate the stratosphere-to-troposphere transport and removed all PV related content and discussions in the revised version. As a result, all your concerns mentioned above are gone. Since we only performed very few analysis for the PV in the study, all revisions are minor.

Instead, we have compared and analyzed the difference in vertical transport velocity at the PBLH between 2020 and 2019. We concluded that there is no strong evidence for the change in the horizontal transport from other regions (Figure 5(b)) and the vertical transport from the free troposphere to the surface (Figure 6 (a)) over the SCB in May-June 2020 vs. 2019 (Lefohn et al., 2012; Škerlak et al., 2014; Stohl et al., 2003; Wirth and Egger, 1999; Wang et al., 2019; Wang et al., 2020).

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