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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Convective uplift of pollution from the Sichuan basin into the Asian monsoon anticyclone during the StratoClim aircraft campaign" *by* Keun-Ok Lee et al.

Anonymous Referee #2

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Lee et al. studies the convective transport of pollutants from Sichuan basin to Asian Monsoon Anticyclone (AMA) region during one convective event on Aug.7 of 2017. Lee et al. (2020) uses a cloud-chemistry model (Meso-NH) and observational data from the StratoClim, IAGOS and satellites. Lee et al. shows in section 3 that the model reasonably reproduced observed concentrations of some chemical tracers including ozone and CO compared during the Aug.7 convective event. Lee et al. demonstrates using the model that the convection quickly transports CO from boundary layer to 18 km and contributes to 0.5% of CO in the 10-20 km layer for 2 days. Besides, Lee et al. shows that India contributes more than China to the CO in AMA and the Chinese portion is significantly contributed by Sichuan basin. In general, I think the paper reports

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an important transport pathway from Sichuan basin to AMA, which is constrained by the StratoClim datasets. However, some concerns are needed to be addressed before publication.

From Figure3, we know that the Aug.7 convective event is reproduced well by the model. In terms of the long-term Chinese/Indian contributions (e.g. 10-day averages in Figure 12), any information to show that the clouds/convections are reasonably simulated during the 10-day period?

For the CNTL and other sensitivity simulations, are the multiple convections similar amount those runs (including the starting time, base height, BT, LWC etc)? I am asking this question because we are talking about 0.5% of anomalies due to Sichuan Aug.7 event. Can we tell the number (i.e. contribution fraction) you derived are statistically significant?

I am concerned by the analysis on aerosol (POA and BC) and Figure 11. What is the parameterization scheme of the convective removal? Does the secondary activation of aerosols (e.g. Grell and Freitas et al., 2014, ACP; Wang et al., 2013, GMD; Yu et al., 2019, GRL) considered in this study? Convection can quickly remove aerosols in-cloud, which results in fast (in log-scale) decay of aerosols From Figure 8, seems modeled POA and BC can be transported from BC to UT without much loss, which seems not right to me. (note, unlike insoluble species CO in your Figure 8, aerosol even BC and POA can be internal mixed and activated).

Minor concerns:

For Meso-NH CNTL run, what are the initial conditions for clouds? Are aerosols activated to CCN in Meso-NH, which can influence the cloud droplet number? Since this study heavily relies on the parameterizations of the convections (which shows pretty nice agreement in Figure 3), more information on the aerosol-cloud interaction schemes are needed in the method section.

Figure 6, the colored circles are extremely difficult to find. Might consider using circles with black boundaries.

Figure 12 caption, AMA region? Altitude info is missing.

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