

Comment on acp-2022-557

Anonymous Referee #1

Referee comment on "Composited analyses of the chemical and physical characteristics of co-polluted days by ozone and PM_{2.5} over 2013–2020 in the Beijing–Tianjin–Hebei region" by Huibin Dai et al., Atmos. Chem. Phys. Discuss.,
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In this manuscript the chemical and physical characteristics of O₃ (O₃SPD), PM_{2.5} (PM_{2.5}SPD) polluted days and O₃ and PM_{2.5} (O₃&PM_{2.5}PD) co-polluted days over BTH are investigated by using the 3-D global chemical transport model (GEOS-Chem). This manuscript is clearly written and well organized, and its conclusions are interesting.

- The simulated PM_{2.5} components including NO₃⁻, NH₄⁺, SO₄²⁻, BC, and OC are compared against observed PM_{2.5} concentrations, and the comparison shows that the simulated PM_{2.5} had a NMB of -26.9%. Even with the adjusted thresholds, percentages of observed polluted days for PM_{2.5}SPD shown in Figure c are lower than for O₃SPD and O₃&PM_{2.5}PD. Is the underestimation attributable to some missing primary aerosols?
- In the analysis two oxidation indicators (sulfur oxidation ratio and nitrogen oxidation ratio) are used, but not assessed. As observed SO₂ and NO₂ concentrations are available at CNEMC, model performance for SO₂ and NO₂ is suggested to be evaluated.
- Figure S5a shows the hourly variations of PBLH (m) averaged in all model-captured O₃SPD (blue), PM_{2.5}SPD (yellow), and O₃&PM_{2.5}PD (purple). Average PBLH at noon time for O₃SPD and O₃&PM_{2.5}PD is over 2000m, why are they so high? Figure S5b shows the daily anomaly of PBLH for O₃SPD and O₃&PM_{2.5}PD at night time exceeds -500m, while at noon time over 1000m. How does PBLH usually change over BTH?
- Figure S6 shows the vertical profile of SO₄²⁻ chemical production. Why is SO₄²⁻ chemical production larger at high levels than at low levels? Is it associated with cloud or high relative humidity? How is SO₂ concentration distributed vertically? How to understand the difference between O₃SPD and PM_{2.5}SPD?
- It is interesting to see Figure 8a that O₃ levels for O₃SPD are lower than for O₃&PM_{2.5}PD. Does it mean high PM_{2.5} leads to increase in O₃? Figure 8b also shows BC is well mixed vertically up to ~819h Pa. Is it an average for all selected days?