Responses to Editor and Referee's comments

First of all, we would like to thank the Editor and Referee for their comments and suggestions, which improved greatly the presentations and interpretations in our revised manuscript. In the revised article, we have addressed all comments and suggestions from the Editor and Referee. Our point-by-point responses to the Referee's comments are outlined below. The Referee's original comments are shown in italics and our responses are given in normal fonts.

Referee #1

Comments:

This paper reported that the modeled decline in surface ozone levels appears closely linked to a regional wetting trend in northwestern China, in line with observations. Increased precipitation enhances the removal of ozone precursors and ozone itself through wet deposition and promotes cloud cover, which reduces photochemical ozone production by limiting sunlight. Additionally, higher humidity and wetter conditions can alter atmospheric chemistry, leading to lower ozone formation rates. Together, these factors contribute significantly to the reduction in surface ozone concentrations in northwestern China. Authors conducted extensive model sensitivity simulations to highlight falling ozone concentrations induced by rising humidity in this part of China. The results are convincing and the paper is publishable in the ACP after addressing following comments.

Response: We thank the Referee's positive and encouraging comments, which help us to improve this article considerably.

1. Figure 1 captions indicate the figure illustrates O_3 attribution (fraction) between the two scenarios (S1 and S3), but the figure does not show such attribution. I would understand here you mean "difference" in Fig. 1c. You can add such the attribution figure as the fraction between Fig. 1a and 1b in revised Fig. 1, which could help readers understand further the effect of meteorology on O_3 trend.

Response: Following the Reviewer's comment, we have added a new Fig. 1c in Figure 1.

2. Figure 2c and line 261-262, does SAT trend in scenario 2 (S2) differ from baseline scenario S1? Unless you turned on feedback simulations in WRF-Chem, SAT trends between S1 and S2 should not differ each other.

Response: In the WRF-Chem simulation, we explicitly activated both aerosol feedback mechanisms (include the direct and indirect effects) and nudging option, please refer to lines 107-111.

3. There are several objectively analyzed ozone databases providing global and China's gridded daily O_3 concentrations, such as MERRA-2. Authors may compare their modeled O_3 trend under baseline scenario (S1) with these datasets, thereby further verifying their model results.

Response: Given some key uncertainties in O_3 concentrations near the surface in MERRA-2, particularly before 2004 (Wargan et al., 2017), MERRA-2 data was not used to compare with our modeled data. Instead, following the Reviewer's suggestion, we compared our simulated summer O_3 concentration trend (Fig. 1a) with CAMS (Copernicus Atmosphere Monitoring Service) global reanalysis (EAC4) archived O_3 date. The results show good agreements of O_3 trends in Eastern China but CAMS reanalysis yielded negative O_3 trends in a vast region of Northwestern China, except for Gansu and Shaanxi. This seems inconsistent with the background O_3 trend measured in Waliguan Global Atmospheric Background Station (36°17'N, 100°54'E), located in Qinghai Province, Northwestern China, where measured daily O_3 concentrations from 1998-2014 show a positive slope of 0.0007, implying an increasing trend. To avoid confusion, we did not present CAMS O_3 trends across China.

Reference:

Wargan, K., Labow, G., Frith, S., Pawson, S., Livesey, N., and Partyka, G.: Evaluation of the Ozone Fields in NASA's MERRA-2 Reanalysis, J. Clim., 30, 2961–2988, https://doi.org/10.1175/JCLI-D-16-0699.1, 2017.