RESPONDS TO COMMENTS FROM REFEREE #1

First of all, we appreciate your very positive evaluation of our work. The responses of your specific comments/questions are outlined in detail below.

Specific comments:

(1) I am a little surprised by Figure 11 B and F. I would not have expected the condensation sink to increase over the last ~5 years even as the mode diameter decreases over this period. It will be helpful to have the barplots for N13-25, N25-100, and N100-800 in this figure.

Response: Thank you for catching that. As you said, low condensation sink and the meteorological factors like low RH and high solar radiation favor the NPF events (Boy and Kulmala, 2012). We updated the *CS* data and non-NPF events also were included in the revised Figure 11F, and $N_{13\text{-}25}$, $N_{25\text{-}100}$ and $N_{100\text{-}800}$ variations also were given in the figure. As it can be seen from Figure 11F, the mean condensation sink was between 0 and 0.01 s^{-1} with less fluctuation during the campaign. Shen et al. (2011) found that mean value of *CS* was 0.02 s^{-1} during NPF events in North China Plain, which was much higher than our results. Therefore, NPF events was less impacted by condensation sink during our campaign. The less varied $N_{100\text{-}800}$ during 2015-2019 as compared to that during 2012-2014 may be related to condensation of low volatile vapors which resulted in relatively high condensation sink. The above discussion and the revised Figure 11 will be added to the revised version of our manuscript.

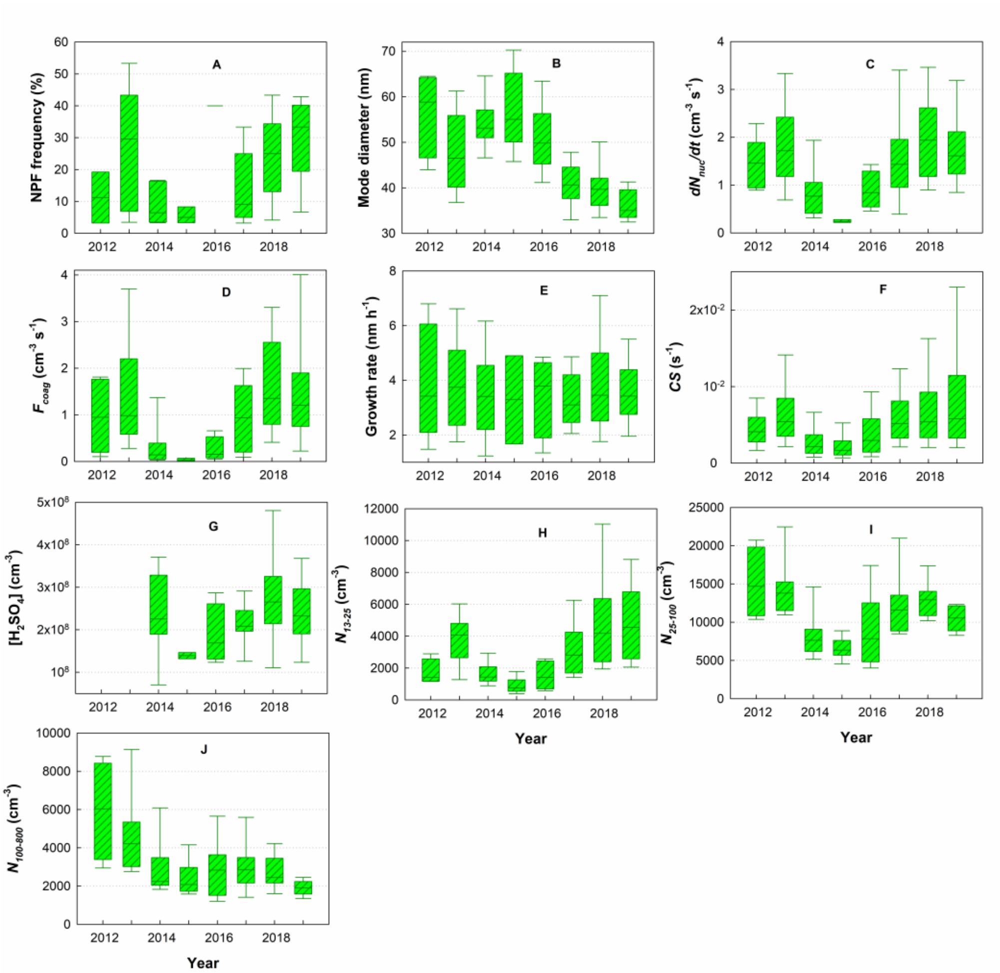

Figure 11: Inter-annual statistics of the trends of NPF frequency, mode diameter, formation (dN_{nuc}/dt, F_{coag}) and growth rates, *CS* and H_2SO_4 proxy and number concentrations in the three bins (N_{13-25}, N_{25-100}, $N_{100-800}$) during the campaign. The lines inside the box denotes the median slope, the two whiskers and the top and bottom of the box denote the 5th, 95th, 75th and 25th percentiles.

(2) The condensation sink values and discussion should be incorporated in the cluster analysis (specifically in Table 2).

Response: Thank you for your suggestions, which will largely improve the manuscript. The condensation sink values were incorporated in the cluster analysis (see also the below Table 2). The condensation sink ranged from 2.12×10^{-3} s^{-1} for Cluster F to 1.38×10^{-2} s^{-1} for Cluster B during the campaign. The *CS* values for Clusters B and F, representing new particle formation and growth events, were much higher than that for other clusters, but they was even lower than *CS* during NPF events in North China Plain (0.02 s^{-1}, Shen et al., 2011). Therefore, the large PNSD discrepancy among the clusters may be less influenced by condensation sink during the measurement campaign. *CS* may be not a key factor modulating occurrence of NPF events at urban Lanzhou in west China, and NPF was mainly affected by meteorological variables and coagulation effects. The above discussion and the revised Table 2 will be included in the revised version of our manuscript.

Table 2. Mean values of particle number in the three modes (N_{13-25}, N_{25-100}, and $N_{100-800}$), AOD, the concentrations of six criteria air pollutants ($PM_{2.5}$, PM_{10}, O_3, SO_2, NO_2, and CO) and condensation sink (*CS*) for each Cluster.

Cluster	N_{13-25}	N_{25-100}	$N_{100-800}$	**AOD**	$PM_{2.5}$	PM_{10}	O_3	SO_2	NO_2	**CO**	***CS***
Units	cm^{-3}	cm^{-3}	cm^{-3}	—	μg m^{-3}	μg m^{-3}	μg m^{-3}	μg m^{-3}	μg m^{-3}	mg m^{-3}	10^{-3} s^{-1}
A	1263.2	12156.5	3973.9	0.54	54.85	135.73	25.98	26.91	64.57	2.91	3.64
B	10370.4	9969.8	1504.7	0.39	31.42	86.53	92.77	13.56	40.67	2.73	13.8
C	2616.7	9071.8	2890.5	0.49	48.89	116.10	41.37	21.42	55.12	2.65	4.42
D	2010.0	11931.4	2301.6	0.55	43.92	124.13	46.28	16.85	57.68	2.33	5.33
E	4245.2	10806.9	1592.6	0.45	35.26	106.31	82.86	12.60	44.44	1.71	7.88
F	757.2	9492.2	5139.3	0.60	71.24	130.98	24.14	35.95	66.07	2.98	2.12

Reference

Boy, M. and Kulmala, M.: Nucleation events in the continental boundary layer: Influence of physical and meteorological parameters, Atmos. Chem. Phys., 2, 1–16, doi:10.5194/acp-2-1-2002, 2002.

Shen, X. J., Sun, J. Y., Zhang, Y. M., Wehner, B., Nowak, A., Tuch, T., Zhang, X. C., Wang, T. T., Zhou, H. G., Zhang, X. L., Dong, F., Birmili, W., and Wiedensohler, A.: First long-term study of particle number size distributions and new particle formation events of regional aerosol in the North China Plain, Atmospheric Chemistry and Physics, 11, 1565–1580, 2011.