

## Response to Reviewer #1:

### General comments:

The authors addressed all reviewer comments. The article can be published as is. However, after checking the reviews, I have identified 3 minor technical fixes.

Response:

We appreciated reviewer's positive feedback and suggestions. The point-to-point responses to the reviewer's comments are listed below.

1. Line 249-250. A reference is needed for "The influence of vertical transport of the PBL air mass is much weaker at ZSF than at lower altitudes..." I suggest Collaud-Cohen et al., Atmos. Chemistry. Phys., 18, 12289–12313 (doi:10.5194/acp-18-12289-2018, 2018)

Response:

Thanks for the suggestion. We have added the reference Collaud-Cohen et al. (2018) in the main text and the reference list.

Collaud-Coen, M., Andrews, E., Aliaga, D., Andrade, M., Angelov, H., Bukowiecki, N., Ealo, M., Fialho, P., Flentje, H., Hallar, A. G., Hooda, R., Kalapov, I., Krejci, R., Lin, N. H., Marinoni, A., Ming, J., Nguyen, N. A., Pandolfi, M., Pont, V., Ries, L., Rodríguez, S., Schauer, G., Sellegri, K., Sharma, S., Sun, J., Tunved, P., Velasquez, P., and Ruffieux, D.: Identification of topographic features influencing aerosol observations at high altitude stations, Atmos. Chem. Phys., 18, 12289-12313, doi: 10.5194/acp-18-12289-2018, 2018.

2. Caption to Figure 8: please, replace "red and black dash line indicate..." with "red and black dashed lines indicate..."

Response:

Thanks. We have corrected the caption of Fig.8 as:

“Figure 8: Scatter plot of NPF starting time (solar time) on different days of year. Black solid lines denote the mean seasonal starting time, the red and black dashed line indicate the sunrise and sunset time, respectively.”

3. Figures S5 and S6 were added following the reviewer's recommendations; however, these figures are not referred to in the text. Please add a reference to these figures in section 2.2 or in the results section. It is worth highlighting the fine distribution of PNSD for non-events in LTR and LWE; Is there any explanation for this?

Response:

Thanks for the comment. The reference to the Fig.S5 and S6 have been added in Sect. 3.2 and 4.1.1.

The fine distribution of PNSD on non-event for site LTR and LWE shows different influences of traffic emission at the two sites. We have compared the traffic influence at LTR and LWE and added discussion in Sect. 3.2 as follows.

- Revision in Sect. 3.2 Growth and formation rates

“The site-to-site difference in anthropogenic influences can be clearly seen from the mean PNSD on non-event days, as shown in Fig.S5 and S6 in the supplementary material. Similarly, the CS values were generally higher in the area with stronger anthropogenic emissions, and the lowest at high Alpine site ZSF. . . . As shown in Fig.S6 (a3) and (b3), the particle number concentration lower than 50 nm at LTR was higher than that at LWE. One of our previous studies showed that the particle number concentration in traffic related size range  $N_{10-30}$  and  $N_{30-200}$  were 10 % and 17 % higher, respectively at LTR and LWE (Sun et al., 2009), indicating higher gaseous precursor concentration and thus stronger anthropogenic influence at LTR.”

- Revision in Sect. 4.1.1 Nucleation strength factor

“...In addition, the mean PNSD on NPF and non-event days for each GUAN site in Fig.S6 can clearly depict this site-to-site difference in NSF. The influence of anthropogenic emissions on UFP gradually decreased from urban background to high Alpine site, leading to clearer background atmosphere for regional background and mountainous area. Hence, the contribution of NPF on UFP were more pronounced in these site categories.”