General comments

The manuscript "Chemical composition and droplet size distribution of cloud at the summit of Mount Tai, China" presents the measurement of chemical composition including pH and soluble ions of cloud water and physical properties of cloud droplet (number, size and liquid water content) in a mountain site for cloud events strongly influenced by anthropogenic emissions. It further investigates how the chemical composition and physical properties of clouds are influenced by aerosols (using $PM_{2.5}$ mass concentration a proxy) and how clouds affect aerosol concentrations. The authors found that the pH value was higher than 2007-2008 reported in a previous study for the same site, which was attributed to the increase of NH_4^+ and Ca^{2+}. The authors further found that when $PM_{2.5}$ was higher, the concentrations of soluble ions were higher and cloud droplets were smaller. Overall, the findings of this study are interesting and this study works an evaluable case study on the interaction of aerosol with clouds, especially for the cloud with strong influence of anthropogenic emissions. While the manuscript is mostly well written and fits the scope of ACP, I have some comments before it is published on ACP. These comments are mainly meant to clarify some discussions and improve the readability.

1. In the discussion of the interaction of aerosols with clouds, it is mainly the number of CCN that affects cloud microphysical properties, not the $PM_{2.5}$ mass concentration. Although the $PM_{2.5}$ mass concentration and CCN number concentration may correlate during the cloud events studied here, it is not necessarily true in many cases because particles contributing mostly to CCN number and $PM_{2.5}$ mass concentrations may differ in size ranges, depending on the particle size distribution. In this manuscript, $PM_{2.5}$ mass concentration was used a somewhat proxy for CCN. While the particle size distribution data are not available here, the authors need at minimum discuss the limit of using $PM_{2.5}$ here.
2. Some of the discussion or statement are not quantitative enough and need further clarification or supporting data.
   For example, in Pg 6 lines 2-11 on the relationship between PM2.5 level and LWC and cloud droplet size, instead of selecting a few cloud events with higher PM2.5 and qualitatively comparing the droplets sizes in these events, a quantitative way would be plot the droplet size versus PM2.5 level. Same principle applies for the effect of RH on droplet size explanation (low RH suppressing cloud droplets size). Since the effect of PM2.5 on droplet size is anyway discussed in Sect. 3.4, the authors could consider to merge this paragraph with the discussion of Sect. 3.4.
   Pg 6, lines 21-22, "…broadened the droplet size spectra…", it would be helpful to provide the standard deviation or geometric standard deviation of the droplet size distribution, because such broadening is not clear from Fig. 1 (the green color becoming wider does not necessarily mean broadening, which could be only due to increasing concentrations in all sizes).
   Pg 7, lines 16-19, about the origins of air mass, it would be helpful to add the information on this, such as back trajectory. And the wind directions in Fig. 1 did not show consistent directions except for panel D, in which winds are mainly from eastern sector.
   Pg 7, lines 22, "the TDIC was strongly correlated with the levels of PM2.5 and cloud acidity", it looks like to me that the correlation of TDIC with acidity is not that strong if TDIC were plotted agaist pH. Unlike TDIC, pH should not only depend on the PM2.5 concentration but

also chemical compositions of PM2.5, for example, whether there are more acidic or basic compounds.

Pg 8, lines 16-19, "the increase in the concentration of NH4+ from CE-Aug23#2 to CE-Aug23#3 was much higher than those of SO42- and NO3-," it would be helpful to provide the number of increase of NH_4^+, NO_3^-, and SO_4^{2-}. (Do you mean the molar concentrations here?)

3. In some discussion, not enough background information is available to understand the discussion. For example, in Pg 6, line 2 "High PM2.5 levels can lead to low LWC values, which can diminish the size of the cloud droplets", at this point, I had difficulty to understand this statement here without further explanation, for exampling, using the findings from literature. Also lines 9-10, "If the RH remains constant, each CCN shares less water vapor, which leads to lower LWC values and hinders the growth of cloud droplets.", I also had difficult time understanding why it is so.

Specific comments

1. Pg 2, line 10 "…more than 30% of the total annual sulfur depositionwas deposited as a result of cloud events (Shimadera et al., 2011).", for me, that does not seem to be relevant to the arguments before on the role of non-precipitation vs. precipitation clouds.
2. Pg 4, line 3, what is effective diameter exactly defined?
3. Pg 5, line 24, "…may be attributable to the increasing consumption of agricultural fertilization and soil acidification…", I suppose this only refers to NH_4^+ not Ca^{2+}. If so, please clarify.
4. Pg 5, line 32, "This diversity was a result of the characteristic formation…", the meaning of "characteristic formation" is vague.
5. Pg 6, lines 29-30, "It should be emphasized that although the levels of PM2.5 decreased from event A to event D, there were no significant changes in the CDSD properties." What does "CDSD properties" mean? I suppose the droplet size (ED) is also a CDSD property. If so, it is affected by PM2.5 level as discussed in Sect. 3.4 and Fig. 4 and would contradict the statement here.
6. Pg 7, Sect 3.2.3, why do the two types of cloud behave differently? Because of the origin of air mass?
7. Pg 7, line 27, "CCN, especially particulate matters, are likely to be the main source of ions and acid-causing components in cloud water." I suggest to omit "especially particulate matters" because it seems to indicate that some CCNs are not particulate matters.
8. Pg 7, line 28, "… the transmission and variation…"
9. I suggest authors to further polish the languages.
10. Fig.1d, the RH is flat. Is it constantly at 100%?
11. Fig. 5, how are the values of size Dp (Dp=6.0 for high PM2.5 level and Dp=13.0 for low PM2.5 level and so on) and ion content obtained? Please clarify.

Technical comments

1. Pg 2 line 6 "…taking place multiphase chemical reactions", maybe "…multiphase chemical reactions taking place" is better.

2. Pg 3, line 17, add comma after “conductivity” and “formaldehyde” (and omit the “and” after).
3. Pg 7, line 27, “…acid-causing components…” does not sound the right wording. Please re-phrase.
4. Pg 7, line 28, “… the transmission and variation…”, “transmission” does sound right, maybe “partitioning” or “exchange”.
5. Pg 8, line 7, “The above results demonstrate that cloud water is a dominant sink”, by “dominant” I guess that authors meant important since they did not compare with other sinks.
6. Pg 8, lines 11-14, the author emphasize the importance of dilution effect of cloud water. However, based on strong correlation of PM2.5 and TDIC regardless of the LWC level, does the correlation suggest that the dilution effect throughout all these cloud events are similar and therefore not crucial?
7. Pg 8 line 21, “….were the main hygroscopic compounds.”, add “hygroscopic compounds’ of what? PM2.5?
8. Pg 8 line 31, “… Nd varied with the same PM2.5 level”, change “with” to “at”.