

Comment on acp-2021-1010

Anonymous Referee #1

Referee comment on "Measurement report: On the difference in aerosol hygroscopicity between high and low relative humidity conditions in the North China Plain" by Jingnan Shi et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-1010-RC1>, 2022

The manuscript by Shi et al. reports measurements of aerosol hygroscopicity under high and low relative humidity scenarios in the North China Plain. The results show that the kappa values are higher which mean more hygroscopic during high humidity episodes (HRH) than during low humidity episodes (LRH). This distinct difference was attributed to the different chemical composition of the particles under the two scenarios, particularly the O:C ratio, an indicative of the oxidation level. Hygroscopicity is an important aerosol property and hence understanding the influencing factors and the controlling processes is essential to mechanistic understanding the aerosol formation and the climate effects. The paper is well-prepared and can be publishable after the following issues are fully resolved.

- In section 4.2, the comparison of CCOA and OOA between the HRH and the LRH is qualitatively fine; however, it might be more accurate to consider the significant difference of the organic fraction between the two scenarios, for example, for CCOA, they become 59%*29% (0.17) vs 46%*6% (0.028) and for OOA, the values become closer, i.e., 59%*18% (0.11) vs 46%*41% (0.19).
- The description (lines 290-300 on p.11) of reaction mechanism for the two periods might need to be noted since there are no more evidences to dig out the formation mechanisms during the two periods. It seems they are just speculated in this case. Also, the average RH values for both periods should be given and compared to Sun et al. and Yu et al.'s studies. Similar notices should be given when describing Fig. 6e for the mechanisms (lines 327-329) in section 4.3.
- The title of section 4.4 needs to be modified to reflect its content. This section describes the correlation between the O/C ratio and the kappa value under the two scenarios. The current title is similar to that of section 4.2. In addition, is there a better way to describe the oxidation state (level) except for the O/C ratio?
- The following comments are rather minor:
 - Line 35 on p.2, "particles" should be deleted;
 - Line 68, "which" here is referred to chemical composition or ambient aerosols, it seems

ambiguous;

- Lines 78-79, "There also remain ... more hygroscopic", this is an ill sentence;
- Lines 89, "since decades"? You probably cannot say "since tens of years", right?
- Line 90, "leaded to a fast..."?
- Line 94, it is "showed" not "shown";
- Line 97, "extensive efforts to investigated the..."?
- Line 100, I think it is better not to use article before "different sources" here;
- Line 224, don't need "the experimental";
- Line 237, "this phenomenon" not "this phenomena";
- Line 269, "usually considered as mainly from...", as here is a pronoun so it needs an object;
- Line 288, "by" should be deleted;
- Line 343, "contribute" needs a "to" here;
- Line 379, it is better to change "has to be" to "was" here;
- Line 392, "marginally increase" should be "marginal increase" as increase is a noun here.