

1 Response to Reviewer #1

We thank the reviewer for taking the time to review our paper and for the constructive comments.

(1.1) [...] Nonetheless, there are serious problems with the physics the authors have achieved a mathematical definition of mixing state not a physical one. If discussions of physical entropy and the second law are omitted, the paper is fine. [...]

We agree with the reviewer that it is important to distinguish the thermodynamic and the information-theoretic definition of entropy. To improve this aspect of our paper, we followed the reviewer's suggestion and made the following changes:

- *In the introduction, page 3, line 24, changed the sentence to: "In this paper we present the first quantitative measure of aerosol mixing state, the mixing state index χ , based on diversity measures derived from the **information-theoretic** entropy of the chemical species distribution among particles."*
- *In the introduction, page 3, line 26, added "using information-theoretic entropy measures". The sentence now reads: "The measurement of species diversity and distribution using information-theoretic entropy measures has a long history in many scientific fields."*
- *We removed the sentence at the end of section 2 (page 7): "The case of a coagulating population represents a closed system as the total mass is conserved. Hence, according to the second law of thermodynamics, the total entropy of the system $H = \sum \mu_i H_i$ has to increase, which translates to an increase in D_α and the mixing state index χ ."*
- *We added sentence on intensive/extensive quantities at the end of section 2 (page 7, lines 7–11): "The population mixing results (Table 5 and Theorem 3) show that the diversities and entropies are intensive quantities. For example, doubling the size of particle i leaves H_i unchanged, and doubling the population leaves H_α unchanged. Extensive versions of these quantities can be defined by mass-weighting, so that the total mass-extensive entropy is $H = \sum_i \mu_i H_i$, for example."*