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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Using different assumptions of aerosol mixing state and chemical composition to predict CCN concentrations based on filed measurement in Beijing" *by* Jingye Ren et al.

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I am having a signiïňĄcant difïňĄculty to comprehend the deïňĄnitions of the mixing states in section 3.2. Some of the described mixing state assumptions make no sense. For instance, it is not clear how an external mixture with size-resolved chemical composition could be possible (assumption 4) because in an "external mixture" different chemical components belong to different particles, independently of their size. The composition of particles cannot change with size if there is only one chemical in each type of particles. Perhaps this is not what the authors meant, leaving the reader to

guess.

Re: regarding to the comments of Referee 1, we would like to clarify them as follows, In the external mixture assumption, each particle consists of a single species (sulfate, or nitrate, or organics. . ..). The volume fraction of total particles in a size bin for each chemical species is size-dependent. Note that here the assumption of "size-resolved chemical composition" refers to that the fraction of total particles for each chemical is different in different size bin. For example, for externally mixed particles with 60 nm, if the total particle number is 100, of which 65 are organics, 15 are sulfate, 12 are nitrate and 8 are ammonium, and each particle is composed by one chemical. But for particles with 200 nm, if the total particle number is 80, of which 45 are organics, 15 are sulfate, 10 are nitrate and 10 are ammonium. At this case, the fraction of each component varies with particle size. The particles are thus with size-resolved chemical composition as we stated in the manuscript. When predicting CCN, the fraction information multiplying by particle number size distribution is used to derive the final CCN of each component.

There are a number of other places in the manuscript, where the terminology is poorly deïňĄned. For instance, when talking about volume fractions, do the authors refer to the composition of a single particle or the volume fraction of particles in a size bin? How are assumptions 2 and 4 different? The audience and reviewers should not second guess what the authors tried to say. The deïňĄnitions of mixing state assumptions need to be supported with mathematical equations and schematic drawings.

Re: As we addressed previously, for an external mixture assumption, the volume fraction refers to the each chemical fraction of total particles in a size bin; and for internal mixture, it refers to the composition of a single particle. Assumption 2 (internal mixture with size-resolved chemical composition, IS) means the particles in each size bin is internal mixed, and the chemical composition of each single particle is size-dependence. Assumption 4 (external mixture with size-resolved chemical composition, ES) means that the particles in each size bin are externally mixed, and the volume fraction of to-

tal particles for each chemical component in a size bin is different at different size. We agree and appreciate the reviewer's comments on that the methodology is needed to be clearly presented. Further revision will be made in a revised version of the manuscript.

While this might be an interesting and important study, currently I see no point trying to decipher the results until the methodology is clearly presented. I suggest that the manuscript is returned back, encouraging the authors to revise and resubmit.

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