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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Exploring nonlinear associations between atmospheric new-particle formation and ambient variables: an information theoretic approach" *by* Martha A. Zaidan et al.

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Point-to-point response to referee 2:

We thank the reviewers for their encouraging and positive comments. The original comments (requiring a response) are shown in boldface. Our responses will be intercalated and the final manuscript will be revised accordingly.

Reviewer comments:

1 I recommend that some modifications need to be done for the introduction. The introduction has too many paragraphs. The fourth, fifth and sixth paragraph can

be merged. In those paragraphs, the authors only cite Hyvonen et al., (2005) paper but take lots of sentences to describe their methods. I recommend that some other references (or methods) should be cited here and it's better to use only 1 or 2 sentences to summarize their methods. Moreover, comparing with other methods, in the introduction the authors need to explain why the information theoretic approach is better or more suitable method to analyze the atmospheric data related to NPF.

Thanks for your suggestion, we will merge and simplify the paragraphs. As you suggested, we will also add extra explanation related to that, including Mikkonen et al. (2006, 2011), whom have used discriminant analysis and multivariate non- linear mixed effects model, to analyse key factors contributing to the NPF and growth of formed particles, respectively. In addition to that, we already mentioned briefly the drawbacks of previous methods, where we said that MI will be used to overcome those issues.

2 As the authors introduce a new method to analyze the long-term atmospheric data, in the MS text the advantages and disadvantages of this method compared to common methods should be discussed in detail. An additional section and figure would be better for this discussion.

The common practice for finding correlation between atmospheric variables is through linear correlation, analysing it via scatter plot and histogram. We have discussed how MI can be advantageous in dealing with long-term atmospheric data in section 4.2. A result via scatter plot and histogram that contains the most important atmospheric variables in atmospheric process is also shown. In that case, we demonstrate that although the common methods are typically efficient in finding correlation, but through that case study, there are few cases where the common method may not always be suitable.

Specific comments:

Page 4, Line 26: You don't need to mention Weber et al.'s proxy if they are not used in your paper.

We will remove this as suggested.

Page 5, Line 16 17: The instructions about figure are not needed here.
Yes, we explained this in the Figure 7's caption already. We will remove the redundant entry as suggested.

Page 10, Line 14: Is the water concentration similar with the relative humidity? You can give some hypothesis based on chamber studies from references.
There is one notable difference between these two: water vapor concentration usually increases with the rise of ambient temperature (T) because warmer air can simply hold more water. So that quantity is much higher during summer than winter. Relative Humidity (RH) is scaled to the maximum water content of the air, so it does not care about seasonal variation of T. On the other hand, RH varies a lot diurnally (because T does and the water vapor concentration is more constant over a diurnal cycle).

Page10, Line 27 28 29: I would say that the correlation with O3 is also related to the formation of OH and H2SO4.
Thanks for your explanation. We will add and incorporate this into our result explanation.

Figure 1 'Hyytiala station' need to be changed into 'SMEAR II station'
We will change it.

Figure 7 The plots of nucleation, Aitken and accumulation in the left panel are not needed in this kind of figure. You can define those in the MS text. Please add the labels for y-axis and colorbar.
We will do this as you suggested.

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