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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Understanding meteorological influences on $PM_{2.5}$ concentrations across China: a temporal and spatial perspective" *by* Ziyue Chen et al.

Anonymous Referee #1

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Chen et al. present an interesting analysis of the spatial and temporal variation of the relationships of meteorology and PM2.5 over most of China. The cross convergent mapping analysis provides a unique method of understanding the causality of the relationships, which might otherwise be missed with typical correlation analysis. They highlight that the meteorological influence on PM2.5 varies widely by location and season, and that attempts to engineer favorable air quality meteorology should take these differences into account. The paper is well-written and relatively thorough, however it requires some additional explanations and detail. Thus I recommend publication following minor revision.

Page 2, lines 56-57: "Although quantitative contributions of different sources (e.g. coal burning and automobile exhaust) to airborne pollutants remain controversy" – It's not clear what you mean here with the "controversial" – politically or scientifically? If scientifically – the direct emissions and/or subsequent chemistry?

Page 4, section 2.1.1: How do you quality control the data and/or deal with missing data?

CCM method: How does the time lag parameter affect the results? The resolution of the map is mentioned but how does it affect the physical interpretation of the results? – Especially for those variables that may act on a shorter time scale.

Page 13, lines 295-296: This causality seems to be backwards: i.e., why would differences in PM levels cause differences in meteorological influences? What mechanism would cause this?

Page 14, lines 330-333: This sentence is very vague – can you be more specific?

Figure 2 and 3: I would suggest the background of concentrations be in a gray scale so the colored icons/wind roses stand out more. Also, how different would the maps be if the correlation coefficient were used instead? A statement or two would reinforce the argument for the use of CCM rather than correlation coefficient.

Page 20, lines 414-420: While higher relative humidity does lead to hygroscopic growth of aerosols, this is probably not evident in the observed concentrations since most measurements are taken at a constant relative humidity (e.g, 35% in US and Europe). Measurements in China may not do this, and if so, should be explicitly stated since this can have a major effect to aerosol mass depending on the composition of the aerosol.

Page 23, lines 515-535: This paragraph seems out of place with the rest of the section.

Page 23, line 525: I am not able to read Cheng et al. (2015), but I'm wondering what the model is using for predictors? If they are "static" models, isn't that just the mean state? I'm having a hard time understanding. If the argument is to use CCM instead of

correlations, an example (see above) would help to reinforce this.

Page 24, lines 562-566: How does the frequency of precipitation affect this statement? For example, if precipitation is rare in Beijing during winter, especially compared to the Yangtze River Basin.

Results/Discussion: Much of this review of meteorology-PM2.5 relationships in the discussion would probably be better suited in the introduction and in the results as it pertains to different locations within China. Many of the statements in the results are rather vague (e.g., page 14, line 330-333) and could be elaborated to include specific meteorological factors and specific locations.

Minor comments

Page 2, line 61: were correlated

Page 3, line 68: “fractions of three different sizes” of particulate matter

Page 4, lines 119-120: What does this sentence mean?

Page 12, line 288: Awkward wording

Page 20, line 426: Wikipedia is not an appropriate citation.

Page 20, line 427 and elsewhere: Check your usage of “by analogy” – you may be looking for a different phrase.

Page 20, line 433 and elsewhere: Check subject verb agreement, specifically for “PM2.5” and “concentration(s)”

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