Interactive comment on "Air Stagnations for China (1985–2014): Climatological Mean Features and Trends" by Qianqian Huang et al.

Anonymous Referee #1

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General comments:

This manuscript presents very intriguing results with regard to the current status and positive trend of air stagnation in China during the previous 30 years. The analysis method is sounding and structure is well organized. This work certainly fit the scope of ACP. Overall, the results obtained here gain additional insight into how meteorology modulates the air pollution that is blanket across China. However, traditional, the atmospheric stability is characterized by thermodynamic metrics, such as PLAM developed by Yang et al. ACP 2016, which has been demonstrated to sufficiently reflect the real air pollution condition at most regions of China. The stagnation index (SI) was improved in this study by taking the terrain into account, which is composed of three components, but by nature it is quite different metric for characterize the atmospheric stability highly associated with air pollution. As such, more discussions are required,

as detailed in the following comments. Therefore, I recommend this work be published in ACP after the following concerns have been adequately addressed.

Specific comments:

1. The seasonality of stagnation index (SI) with maximum in summer but minima in winter reported here seems contrary to the actual air pollution. For example, a large amount of previous studies (e.g., Cao et al., JGR 2007; Guo et al., AE 2009; He et al., AE 2011) have shown that seasonal variation of aerosol concentrations is significant in China, characterized by highest concentration in the winter and lowest in the summer. More interestingly, Guo et al. (2009) revealed more complicated seasonality of aerosol concentrations based on 11 PM observations sites. Therefore, the appropriate discussion concerning how the SI connects with aerosol pollution on the monthly scale is needed, given the easy availability nowadays. In other words, I would like to see the scatter plots of Stagnation days versus PM2.5 or PM10, similar to the plot convention in Fig. 8. 2. Page 3, line 13-17: For each of the other radiosonde stations: it is better to clarify how many station, for example 8 other radiosonde stations? According to Guo et al., ACP 2016, there are 120 radiosonde stations across China, and actually only part of the whole radiosonde netword was used in this study. 3. Figure 1: The site outside of China like Blagovescensk, Vladivostok, and KingsPark should be plotted and marked. 4. Page 4, line 25: What kind of spatial interpolation methods have the authors applied? More details should be given, like the size of grid point for the maps. 5. Section 3.2:" During summer a weaker pressure gradient lingers over China, which results in weaker atmospheric circulations and more frequent stagnations." , i think at least one figure is needed to corroborate this argument, e.g., the pressure gradient difference between summer and annual mean.

Rerences: Cao et al., 2007.Spatial and seasonal distributions of carbonaceous aerosols over China. JGR, 112, D22. Guo, J.P., X. Zhang, H. Che, S. Gong, X. An, C.X. Cao, J. Guang, H. Zhang, Y.Q. Wang, X.C. Zhang, P. Zhao, X.W. Li: Correlation between PM Concentrations and Aerosol Optical Depth in Eastern China, Atmospheric

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