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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Intermittent turbulence contributes to vertical diffusion of $PM_{2.5}$ in the North China Plain" *by* Wei Wei et al.

Anonymous Referee #3

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Normally, intermittent turbulence is associated with the stable boundary layer (SBL). That is, turbulence strength varies when the background stratification is generally stable. When the stratification is totally wiped out by strong turbulent mixing for a relatively long period, the relatively strong turbulent mixing is not considered as part of a time series of intermittent turbulent mixing anymore. In this study, a period of strong turbulent mixing occurred at the end of all the three cases and each of them lasted for nearly a day. If the authors think the strong turbulent mixing period in each case is part of the time series of intermittent turbulence, this is definitely not what intermittent turbulence in the traditional definition.

Physically, intermittent turbulent mixing in the SBL can be generated by intermittent strengthening wind shear, which can be associated with low level jets (LLJs) as pointed

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Discussion paper

by the authors in the paper. However, this mechanism is not new; Banta et al. (2003, JAS; 2006, QJ; 2007 JAS) have investigated relationships between LLJs and turbulent mixing extensively.

In addition, from the title of the paper, it seems that the authors would address the role of intermittent turbulent mixing to the vertical dispersion (not diffusion, diffusion is for molecular movements) of PM2.5. However, the observation indicates that the intermittent turbulent mixing during the high PM2.5 period is not strong enough to disperse PM2.5 and the significant reduction of PM2.5 is observed at the end of each event when strong mixing arrives. Then what is the significance of intermittent turbulence during the stable period? What is the significance of the new intermittent turbulence index introduced here in comparison with simple parameters such as wind speed if wind shear is the key physical process for dispersing PM2.5?

Furthermore, because the stable boundary layer is known to be associated with weak winds when wind direction variations can be significant, how does wind advection contribute to the temporal variation of PM2.5 besides vertical dispersion of PM2.5 by turbulent mixing? Where is the high PM2.5 source?

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