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Comment on acp-2021-709

Anonymous Referee #3

Referee comment on "Meteorology impact on $PM_{2.5}$ change over a receptor region in the regional transport of air pollutants: observational study of recent emission reductions in central China" by Xiaoyun Sun et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-709-RC2, 2021

This study investigates the relative contribution from meteorological effect and emission changes to PM2.5 variation over the Twain-Hu Basin (THB) based on the Kolmogorov–Zurbenko (KZ) filtering of long-term air quality measurement data. It is indicated that the reduction in anthropogenic emissions was the primary cause for the long-term decline in PM2.5 concentrations and the meteorological changes moderated the PM2.5 variations in the THB. However, in terms of novelty and broad interest, this work still needs to be improved. Besides, there could be great uncertainties associated with the multiple linear regression and KZ filtering method, but the authors have not validated the method and touched on the uncertainties in the conclusion. Here list some of my main concerns.

There are many parameters used in KZ filtering and multiple linear regression. The justification and validation of the selection of them should be provided. I think the changes in data coverage or the parameter selection would largely influence the final quantitative estimation of contributions, which is suggested to be elaborated.

Another issue is the estimation of the effects of NO2 and SO2 emission reductions on PM2.5 change trends based on long-term (ð□□□LT) and emission-related long-term (ð□□□emiss) components of PM2.5, SO2 and NO2. The long-term changes in PM2.5 are also caused by the emission variation of primary components like black and organic carbon, in addition to the chemical transformation of gaseous precursors. The difference in the emission of different primary pollutants may also lead to modifications in Klt/Kemis of PM2.5. How was this impact/bias included and quantified in the present work?

Minor comments

Figure 9: Why did the contribution rates of meteorological variations show great spatial disparities at a small scale, i.e., EZ, HG and HS. It seems not very likely that the variation in synoptic weather or meteorological conditions has such a large heterogeneity at such a small spatial scale.