Atmospheric
Chemistry
and Physics
Discussions

Interactive comment on "Decreasing Trends of Particle Number and Black Carbon Mass Concentrations at 16 Observational Sites in Germany from 2009 to 2018" *by* Jia Sun et al.

Anonymous Referee #2

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The paper presents a valuable dataset and analyses long-term trends of PNC and BC across Germany. The topic is within the scope of ACP, but in my opinion the scientific question does not have to be only how is it changing but why is that as well. Some of the presented conclusions could be better supported by data. For example, if the driver of the PNC and BC decrease is expected to be an emission decrease, could this be compared to any reported emission data? Or any mitigation strategies results? Comparison of the trends with such data would be an added value to the manuscript. Quite some information on BC has been already published in a more detailed paper by Kutzner et al, with more stations and longer dataset. It would be good to include an explanation on what this manuscript brings in addition to the already published results?

The methods and data quality are mostly appropriate with some exceptions. The number of evaluated stations is changing during the text. Why there are stations with no or non-analysed data? If LWE is not evaluated, why is it included in the text? If LAN and Raunheim stations are used for some analyses, why have not these been used from the beginning? At L278, 5 parameters at 16 sites makes 80 trends, why only 77 of them was evaluated? For the PNC data description, the uncertainty of the PNC measurements could be discussed in the text a bit more, (L164 etc.) and compared to the presented trends. In the 5.1 Section, a mean value of meteorological parameters is used for all stations. Would not it be better to have at least three different averages for the different types of stations? It would be difficult to compare one T and RH value for Alpine site, city etc. (L416) Also the 5.2 section needs more detailed methodology description. Why 15 clusters were used, what data were used for trajectory calculation? And mainly, why the analyses have not been done for the whole period? No changes in the period 2009-2014 do not automatically mean there will be no changes in 2009-2018 as well (L444). Also it is not described what is the difference between for example A1 and A2 cluster?

Minor comments: The manuscript would definitely profit from a native speaker check, there are multiple not very usual English phrases – L60 early regions (first?), L343 declined emissions => decreased?, L493+506 downward trend => decreasing trend?, L330+331 LENGTH of the time series - sometimes a verb is missing (L277 monthly median time series WERE USED?, L282 only MEL SHOWS increase?) or mismatched (L355 there is no difference can be seen between, L440 shown => showed?), there is a superfluous use of commas, for example as "it should be noted that, three sites... L300, L312,335 etc", and also some minor typos, for example L316 concentrations are in consistent, L321, Po Valey, one large industrial district.

In the equation description in 2.3.2 and 2.3.3. sections, the symbols are not clearly described, so it is quite difficult to follow the methodology. For example, Eq. 3 does not say what the 2 pi t or 4 pi t means etc. on the other end, it is not necessary to show

how a general vector or matrix looks like, L219 to 221 (with vector missing the C). If the description would be less technical and more explaining what is what, it would be easier to follow. Similarly, the theta in Eq. 9 is not explained at all, and although I know how the signum function works, I cannot recognize it in the eq?

-L363+368 eBC instead of BC?

-L72-73 sentence does not fit either to the preceding or the following sentences

-What does it mean "dataset is sufficient for true slopes"? L336

-L366 higher reduction rate is observed when human activities are more intensive?

-Why is the N10-30 described as "influenced by NPF" called young Aitken and not nucleation as usual?

-Number of references at some sections is redundant, for example 8 references stating non-parametric test are used for trend analysis? L183

-L398 do you expect the biogenic emissions in summer to have a trend? If not, they should not mask the anthropogenic trend?

-L526 the a) explanation does not explain anything, it just repeats the previous sentence?

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