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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Random forest meteorological normalisation models for Swiss PM_{10} trend analysis" *by* Stuart K. Grange et al.

Anonymous Referee #1

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The paper describes a meteorological normalisation technique applied to time series of daily PM10 concentrations collected in 31 monitoring sites in Switzerland in the period 1997-2016. The technique is based on the Random-Forest (RF) model using various meteorological parameters (wind speed and direction, boundary layer height, weather pattern, etc.) as explanatory variables. Applying the proposed algorithm the meteorological effect on PM10 concentrations is removed and changes over time can be explained solely due to changes in emissions or chemistry. Also, RF presents the advantage of exploring the effect of each of the explanatory variables on controlling PM10 concentrations in relation to relevant physical and chemical processes through partial dependence plots.

The paper is well-written and relevant to the air quality community (and also to other

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disciplines using time series).

Few comments that I would like to be addressed/discussed before final publication:

1. The authors found that PM10 concentrations in Switzerland decreased between 1997 and 2016 but the discussion about the rate of change is a bit vague. Authors point that similar trend rates were reported in Barmpadinos et al. (2011) between 1991 and 2008. I would expect greater decreasing trends in PM10 in light with recent technology developments in controlling PM emissions from diesel vehicles for instance.

2. What is the role of wood burning emissions in trends in PM10 concentrations in Switzerland? Does the authors have any estimate of the rate of use of wood burners in rural / urban areas? Do you think that wood burning emissions might have an effect on trends in PM10 in suburban areas?

3. Rural mountain sites are the ones that the RF model explained less variance (R2 < 63% based on Fig. 3). Might the low R2 score explain the difference in trend observed using normalised time series vs. non-normalised in Figure 6? The narrower confidence interval of the trends estimated based on normalised time series is due to the removal of variability but it does not inform about the "accuracy" of the trend value (i.e. the real trend value).

4. What it would be a good "R2" threshold to be confident that the RF model is reproducing "enough" variability of the original time series?

5. Is there any other advantage of using normalised time series to calculate trends than just obtaining more robust trend estimators? Based on Figure 6, trends estimates using normalised and non-normalised time series are the same within confidence intervals but the computational cost is higher. Might normalised time series be useful to explore step-changes in the time series and related to specific policy interventions?

6. Partial dependence plots. What is the advantage of using these plots rather than build them using the "raw" data?

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