

Machine Learning in Earth System Science: An overview of meteorological normalisation

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Introduction

- Meteorological normalisation is a framework which enables a data user to control for changes in meteorology/weather over time in an air quality time series
- The technique uses the random forest ensemble machine learning algorithm^[1]
- An R package, **rmweather** has been accepted by CRAN which contains the tool set required for others to conduct this analysis^[2]
- The random forest models for Swiss PM₁₀ suggested interesting atmospheric processes^[3]
- The technique is useful for intervention exploration^[4]

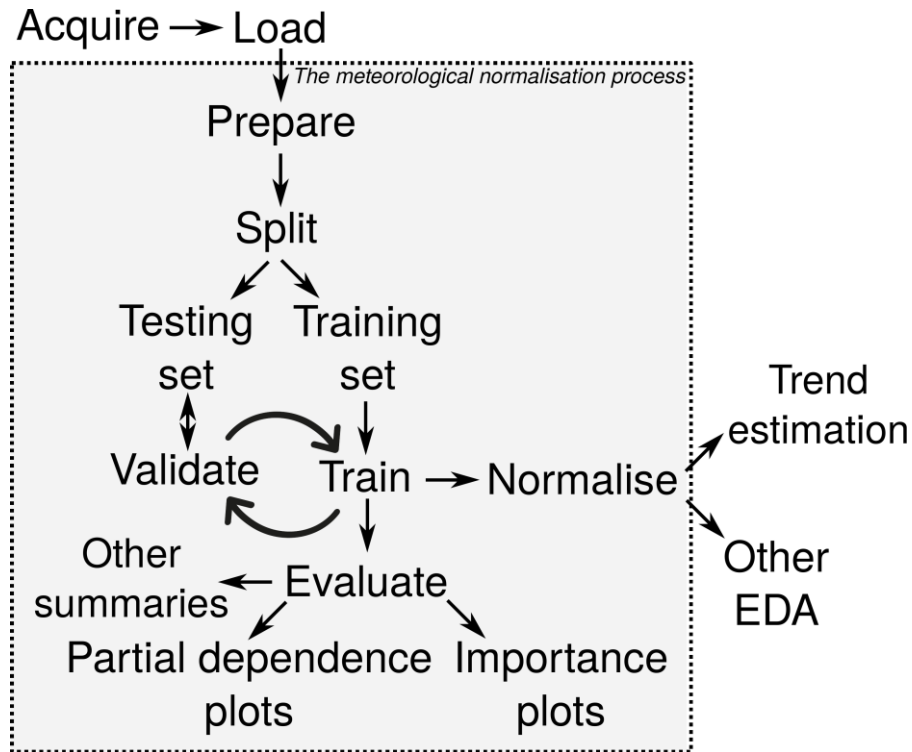


Figure 1. Conceptual diagram of the meteorological normalisation procedure.

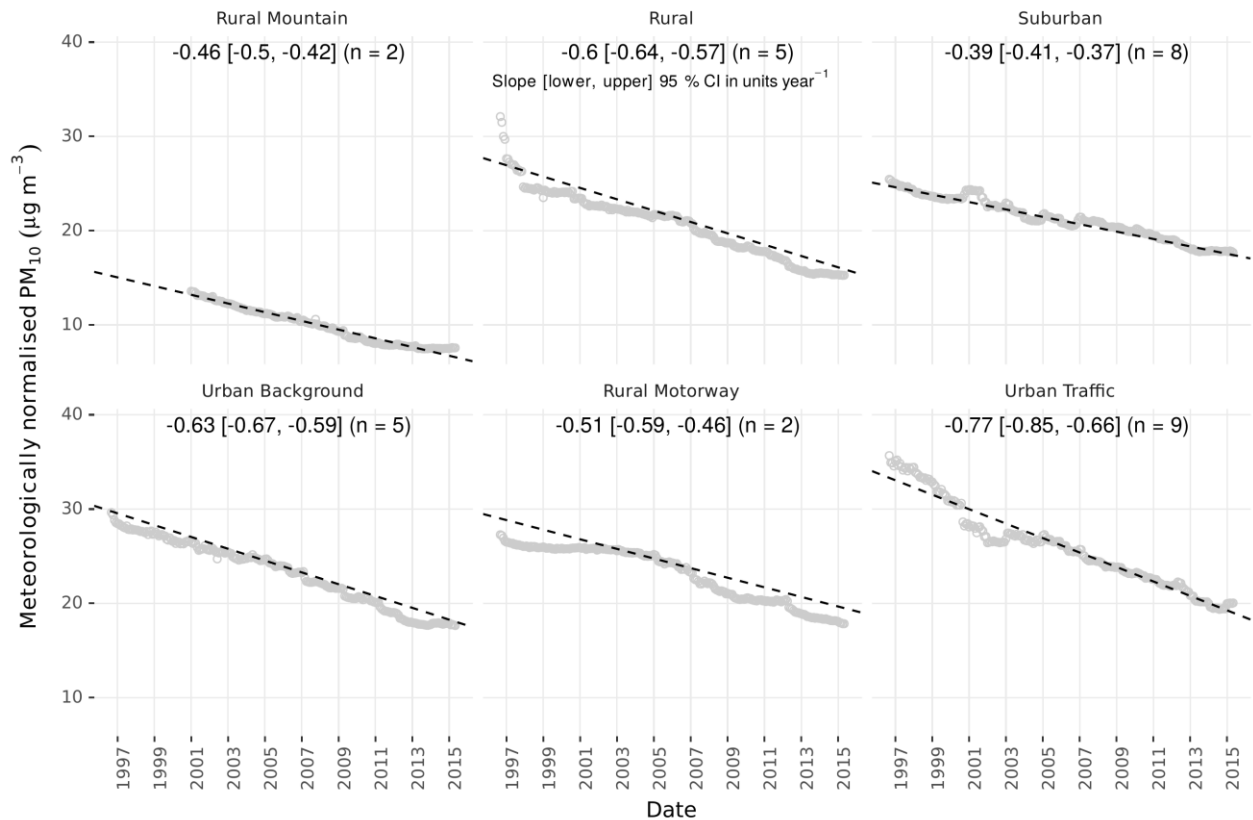


Figure 2. Meteorologically normalised trends for Swiss PM₁₀.

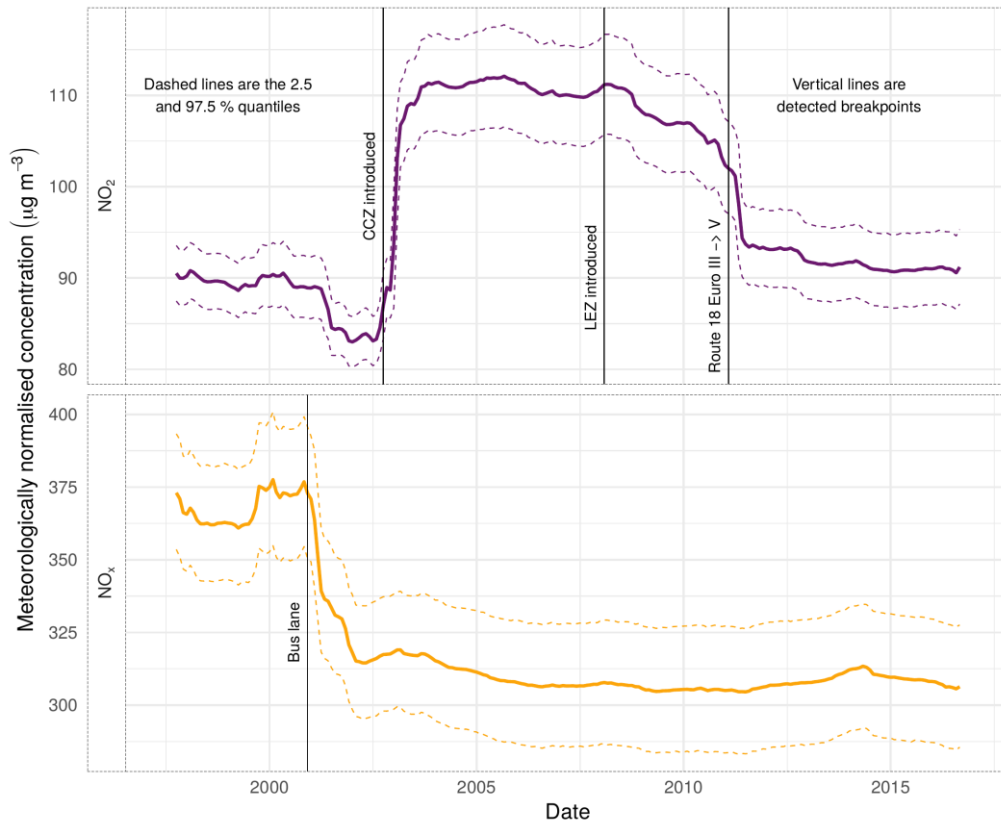


Figure 3. Meteorologically normalised trends of NO₂ and NO_x at London Marylebone Road between 1997 and 2016.

Final notes

- For examples and full discussion of this work, see references [3, 4]
- A poster is available for viewing at this conference
- A workshop is being held at this conference so the application of the technique and code development can occur with support

References

[1] Breiman, L. (2001). Random forests. *Machine Learning*, 45, 5--32.
<https://link.springer.com/article/10.1023/A:1010933404324>

[2] Grange, S. K. **rmweather**: Tools to Conduct Meteorological Normalisation on Air Quality Data. R package.
<https://github.com/skgrange/rmweather>

[3] Grange, S. K., Carslaw, D. C., Lewis, A. C., Boleti, E., and Hueglin, C. (2018). Random forest meteorological normalisation models for Swiss PM₁₀ trend analysis. *Atmospheric Chemistry and Physics* 18.9, 6223-6239.
<https://doi.org/10.5194/acp-18-6223-2018>

[4] Grange, S. K., & Carslaw, D. C. (2019). Using meteorological normalisation to detect interventions in air quality time series. *Science of the Total Environment*, 653, 578--588.
<https://doi.org/10.1016/j.scitotenv.2018.10.344>



The online location of this presentation