

Interactive comment on “Meteorology-driven variability of air pollution (PM1) revealed with explainable machine learning” by Roland Stirnberg et al.

Anonymous Referee #1

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The research work employs field measurements of Particulate Matter smaller than 1 μm in diameter (PM1), routine meteorology data and propose a machine learning framework in air-pollution forecasting. The authors address the significant challenge of Interpretability in machine learning using the SHapley Additive exPlanation (SHAP) regression values.

A general comment is related to the aim of the proposed work. Although the role of meteorology on PM concentrations is well studied, the paper proposes a novel method/tool of explainable machine learning in atmospheric sciences. The results support the use of explainable machine learning as a statistical modeling framework in operational air

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quality forecasting. The authors comment on this in the conclusion section but could highlight the ability of the proposed framework earlier in the manuscript. While the results of the study are of local interest the proposed modelling framework has a high replication potential in areas with limited PM₁ field measurements and therefore has a general implication in atmospheric science.

Some concern is related to the use of meteorological data for the period of July to mid-November 2016. It is useful to include some descriptive statistical analysis of the meteorological data for all sites in order to compare and highlight the suitability of using meteorological data from the Paris Charles de Gaulle Airport. Furthermore, the locations of all measurement sites should be included in the map of the area of study and use more appropriate location mark labels.

The authors could provide some descriptive statistical analysis of the PM₁ field measurements. This analysis could provide thresholds of high-pollution events in the region (e.g. similar to the >95 percentiles used in the paper). The overall ability of the proposed framework could be also evaluated using exceedances forecast verification metrics (e.g. Probability of Detection, False Alarm Ratio etc.) for certain PM₁ thresholds. This analysis could be complementary to the analysis of high-pollution case-studies and role of meteorological conditions of high-pollution events.

The paper presentation and structure is clear and supports the discussion of the results. The authors give proper credit to earlier published work and discuss their findings appropriately. The figures in the manuscript support the discussion of the results. In Figures 9 and 10 the color-bar of the PM₁ composition could be misleading. It is advised to change to avoid confusion with the feature contributions color scales.

The authors should also check of consistency of abbreviations throughout the manuscript. For example, Mixed-layer height (MLH) in some figures is abbreviated as BLH.

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