

AirSensor v1.0: Enhancements to the open-source R package to enable deep understanding of the long-term performance and reliability of PurpleAir sensors

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ABSTRACT

As low-cost air quality sensors become more widely utilized, more tools and methods are needed to help users access/process sensor data, identify poorly performing sensors, and analyze/visualize sensor data. Free and open-source software (FOSS) packages developed for use on FOSS data science platforms are well-suited to support this need by offering replicable and shareable tools that can be adapted to meet a user or project's specific needs. This paper describes enhancements to the FOSS AirSensor R package (version 1.0) and the DataViewer web application (version 1.0.1) that have been developed to support data access, processing, analysis, and visualization for the PurpleAir PA-II sensor. This paper also demonstrates how these enhancements may be used to track and assess the health of air sensors in real-time or for large historical datasets. The dataset used for this analysis was collected during a multi-year project (with sensors deployed from October 2017 to October 2020) involving the distribution of approximately 400 PA-II sensors across 14 communities in southern, central, and northern California. Applying the tools in the AirSensor package revealed a dramatic variability in sensor performance, mainly driven by seasonal trends or particulate matter source type. These results also indicate that this sensor can provide useful data for at least three years with little evidence of substantial or consistent drift. Further, high agreement was observed between co-located sensors deployed at different times, indicating that it may be reasonable to compare data from old and new PA-II sensors. In addition to assessing the long-term performance and reliability of the PA-II sensor, this analysis serves as a model for how data from large sensor networks may be effectively processed, evaluated, interpreted, and communicated.

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