Performance evaluation of MOMA (MOment MAtching) – a remote network calibration technique for $PM_{2.5}$ and PM_{10} sensors

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ABSTRACT

We evaluate the potential of using a previously developed remote calibration framework we name MOMA (MOment MAtching) to improve the data quality in particulate matter (PM) sensors deployed in hierarchical networks. MOMA assumes that a network of reference instruments can be used as "proxies" to calibrate the sensors given that the probability distribution over time of the data at the proxy site is similar to that at a sensor site. We use the reference network to test the suitability of proxies selected based on distance versus proxies selected based on land use similarity. The performance of MOMA for PM sensors is tested with sensors co-located with reference instruments across three Southern Californian regions, representing a range of land uses, topography and meteorology, and calibrated against a distant proxy reference. We compare two calibration approaches: one where calibration parameters get calculated and applied at monthly intervals and one which uses a drift detection framework for calibration. We demonstrate that MOMA improves the accuracy of the data when compared against the co-located reference data. The improvement was more visible for PM_{10} and when using the drift detection approach. We also highlight that sensor drift was associated with variations in particle composition rather than instrumental factors, explaining the better performance of the drift detection approach if wind conditions and associated PM sources varied within a month.

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