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Uncertainty evaluation for calibrating mobile sensors only using short collocation periods

High-grade measurement instruments as well as low-grade sensors are usually calibrated and/ or tested by means of comparison of their readings with indications of more accurate reference instruments during a period of time which is larger than the averaging time and reporting period of each of the involved instruments. As a consequence, classical uncertainty evaluation methods for assessing the calibration uncertainty explicitly or implicitly use this assumption.

However, mobile sensors for assessing the air quality, measuring, e.g., the PM- or the NO2-concentration in ambient air while mounted on a car or bike, may only be shortly collocated with an air quality station with reference instrumentation. The reporting rate of the reference station may be only 1 reading every 15 minutes or every hour, whereas the sensors may report a reading every minute or even faster, and, more importantly, the co-location time may only be in the order of 1 minute. Still, such short co-locations may provide valuable information with respect to the correct working of the sensor.

In this proposed contribution we will look at the uncertainty evaluation for such situations. We model the measurand (the quantity to be measured) by a Gaussian process and calculate the uncertainty of the difference between two reported values that are based on different average times. We apply the proposed method to datasets containing simulated and real measurement data.

Special/ Invited session

Classification

Mainly methodology

Keywords

mobile sensors, measurement uncertainty, calibration

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