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Testing of eight particulate matter sensors in the lab

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To understand and model urban air quality, high-quality measurements at abundant locations are desirable. This is one of the reasons why the use of sensors to measure air quality has increased substantially over the last decade. The low-cost of most sensors makes it possible to set up a sensor network with multiple locations. However, the data obtained from sensors are not always reliable and therefore one should be careful processing, analyzing and using the data.
The LIFE project VAQUUMS (Various assessment of air quality measurement methods and their policy support) aims to develop a supporting framework for local and regional air-quality monitoring networks to standardize and facilitate the uptake of flexible monitoring systems. To do so, among other actions, air-quality sensors are tested both in a lab set-up as well as in field campaigns.
In this study, we focus on the results of the Particulate Matter (PM) sensors obtained in the lab at TNO in Petten (the Netherlands). In these lab tests, 8 types of sensors were tested in three-fold (which were Alphasense OPC-N2, DYLOS 1700 AQM, Honeywell HPMA115S0, Nova fitness SDS011, PLANTOWER PMS 7003, Shinyei PPD42NJ, Shinyei PPD60PV-T2, and Winsen ZH03A). The test took place in a climatized exposure box. Both fine and course aerosols were generated with different PM-concentrations. Thus, during the lab tests, temperature, relative humidity, PM-concentration and particle size are varied. A FIDAS (fine dust aerosol spectrometer) which measures PM1, PM2.5 and PM10 is used as a reference, as well as an EPC (Environmental particle counter) to measure the amount of ultra-fine particles. The results indicate whether or not the sensors manage to measure the PM concentration correctly and how much they are influenced by temperature and humidity. These results will also show if the sensor data needs to be corrected for temperature or/and relative humidity and what the lower detections limit of the sensors are. First results indicate that not all sensors respond the same to a change in PM-concentrations. As some sensors are influenced by the relative humidity, correcting for this dependence will improve the data quality of the PM sensors.