Low-Cost Air Quality Sensor Network in Munich

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As the number of official monitoring stations for measuring urban air pollutants such as nitrogen oxides (NOx), particulate matter (PM) or ozone (O₃) in most cities is quite small, it is difficult to determine the real human exposure to those pollutants. Therefore, several groups have established spatially higher resolved monitoring networks using low-cost sensors to create a finer concentration map [1-3].

We are currently establishing a low-cost, but high-accuracy network in Munich to measure the concentrations of NOx, PM, O₃, CO and additional environmental parameters. For that, we developed a compact stand-alone sensor systems that requires low power, automatically measures the respective parameters every minute and sends the data to our server. There the raw data is transferred into concentration values by applying the respective sensitivity function for each sensor. These functions are determined by calibration measurements prior to the distribution of the sensors.

In contrast to the other existing networks, we will apply a recurring calibration method using a mobile high precision calibration unit (reference sensor) and machine learning algorithms. The results will be used to update the sensitivity function of each single sensor twice a week. With the help of this approach, we will be able to create a calibrated real-time concentration map of air pollutants in Munich.

[1] Bigi et al.: Performance of NO, NO₂ low cost sensors and three calibration approaches within a real world application, Atmos. Meas. Tech., 11, 3717–3735, 2018

[2] Popoola et al., “Use of networks of low cost air quality sensors to quantify air quality in urban settings,” Atmos. Environ., 194, 58–70, 2018