



Testing and evaluation of low-cost sensors for fine particulate matter PM10 and PM2.5

Konradin Weber, Tim Kramer, Christian Fischer, Tobias Pohl, Malte Schulenberg, Georg Heweling, and Christoph Böhlke

Laboratory for Environmental Measurement Techniques, Duesseldorf University of Applied Sciences, Muensterstr. 146, 40476 Duesseldorf, Germany

It is well known from medical studies that fine particulate matter has adverse effects to human health. However, exceeding of limit values for fine particulate matter PM10 and PM2.5 is still a problem in major German cities. Therefore, fine particulate matter is monitored in Germany by environmental state agencies at fixed stations with certified instruments. These certified instruments are able to deliver reliable and high quality results. However, because of the costs of these certified instruments and the maintenance efforts, only few measurements stations are placed in the cities at places, which are regarded as representative for the air pollution. On the other hand, it is of interest to know the concentration of fine particulate matter in areas and at places, which are not covered by the fixed measurement stations of the environmental state agencies.

In this situation citizen science projects started in Germany using low cost sensors for fine particulate matter. In principle, with these low cost sensors citizens could measure fine particulate matter at places and in situations of their interests.

However, at that point the question of reliability of the low cost sensor data arises. Therefore the Duesseldorf University of Applied Sciences (HSD) in Germany started a project for the testing and evaluation of low-cost sensors. For this reason 20 low-cost sensor units have been built up based on the SDS 011 sensor of Nova Fitness Inc. within the Laboratory for Environmental Measurement Techniques at HSD. The sensor measurement data can be transferred into a network and can be visualized on a digital map.

This testing and evaluation at HSD of the low-cost sensors comprised:

- Short term and long term comparison studies within the laboratory and at different urban sites with a certified wide range aerosol measurement system (Grimm WRAS).
- Short term and long term comparison studies within the laboratory and at different urban sites with mid-cost sensors (Alphasense AN2).
- Intercomparison testing and evaluation of sensors of the same production charge.
- Intercomparison testing and evaluation of sensors of different production charges.
- Testing and evaluation of the sensors at different meteorological conditions.

The results of this testing and evaluation will be presented at the conference. Moreover, the potential of additional applications for low-cost sensors, e.g. for mobile measurements (multicopter UAS, bicycles, pedestrians) or for the validation of air pollution models, will be discussed.