# Mobile Measurements to Investigate the Spatial Distribution from Different Airpollutants in Duesseldorf during Summer

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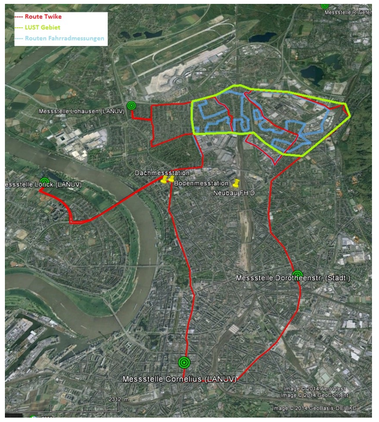
## INTRODUCTION

This poster presents an extract from results, which were gained in line of an interdisciplinary research project "**L**iveable and environment-friendly **U**rban **SiT**e (**LUST**)". The project is a collaborative between the faculties of architecture, mechanical and process engineering, as well as cultural and social science at the Duesseldorf University of Applied Sciences. The aim is to develop in a multi-disciplinary manner holistic, new concepts for a liveable and environmentally friendly city. Therefore the Laboratory for Environmental Measurement Techniques investigates the spatial distribution from different air-pollutants with mobile measurements e.g. bicycles equipped with an optical aerosol spectrometer (blue track). To better verify the results from the measurements and to determine the spatial air-pollution load situation additional, the measurement were extended almost over the whole urban area from Dusseldorf (red track) and were performed with an electronic powered vehicle (Twike). Beside the advantage of the Twike as an emission-free vehicle, it offers a big space for additional measurement systems for different kind of pollutants. So the Twike is an excellent platform for investigate airpollutants over a wide range. Furthermore it has a special mounting for an isokinetic inlet.

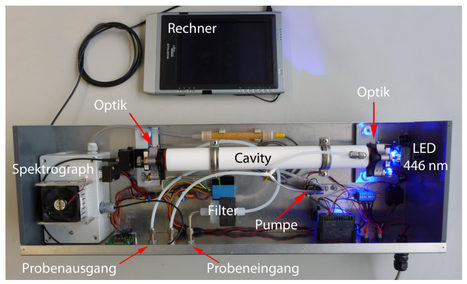



## MEASUREMENT EQUIPMENT

### Nitrogendioxide $NO_2$

### [IUP, Heidelberg]

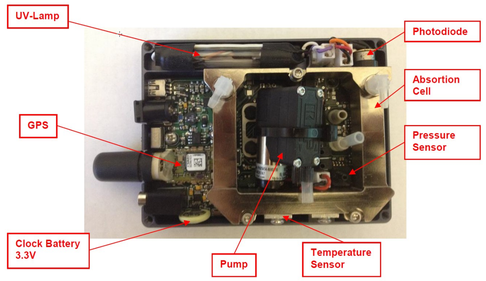
- Cavity UV DOAS
- Time resolution of 3-4 seconds
- Resolution 0,1 ppb
- LED Light source at 446 nm
- Cavity-Cell ca. 40 cm with an optical light path ~ 1,8 km
- Ocean Optics USB 2000+ spectrometer
- Integrated cooling and heating system
- Calibrated with a reference device from Environment S.A (Model AC 31)




### Ozone $O_3$

### [2B Technologies, Boulder]

- UV absorption
- LED light source at 254 nm
- Time resolution 10 seconds
- Detection limit 4 ppb
- Linearity 4 ppb – 10 ppm
- U-form absorption Cell
- Dimensions 10,2 * 7,6 * 3,8 cm
- Weight 0,34 kg

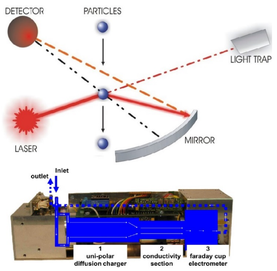



### Fine- and Ultrafineparticles

### [Grimm Aerosoltechnik GmbH, Ainring]

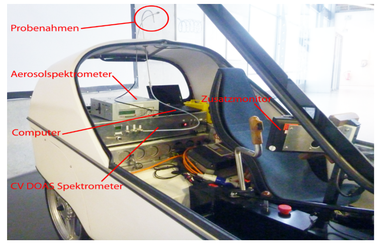
- **OPC**
- classifies particles in 31 channels (0,25 µm -32 µm)
- Time resolution of 6 seconds
- Calibrated with polystyrene latex spheres (PSL)
- Calculation mass concentration [µg/m³]

- **Nanocheck**
- Counts Ultrafineparticles
- Range from 25 – 300 nm
- Time resolution 10 seconds



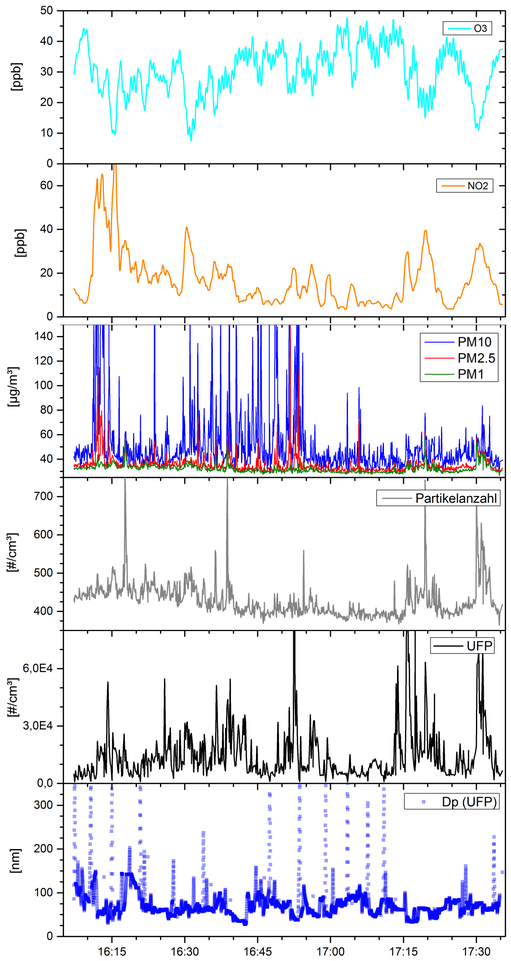

### Technical Details Twike

- Speed 85 km/h
- Maximum range 120 km
- Empty load 240 kg
- Payload 210 kg

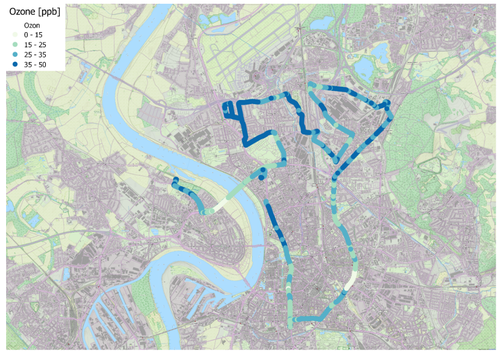



# RESULTS

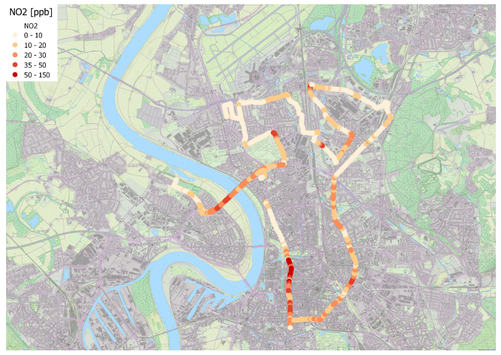
The following graphs show an exemplary situation of the spatial distribution during a measurement. The measurement took place at the 4th of September 2014 at afternoon during the rush hour with strong traffic. The weather this day was sunny without any clouds, temperatures around 22 °C and a calm and steady wind with maximum 2 m/s from southerly directions.



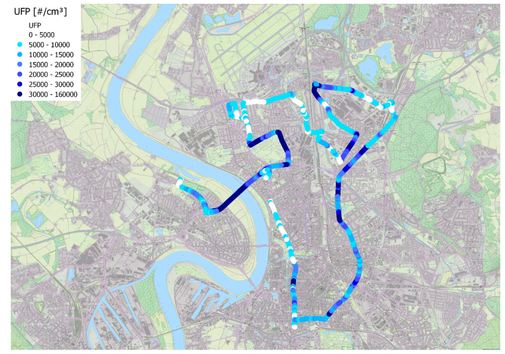

## Ozone ($O_3$)



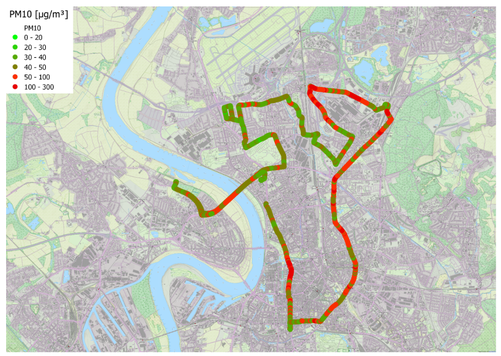

## Nitrogendioxid ($NO_2$)



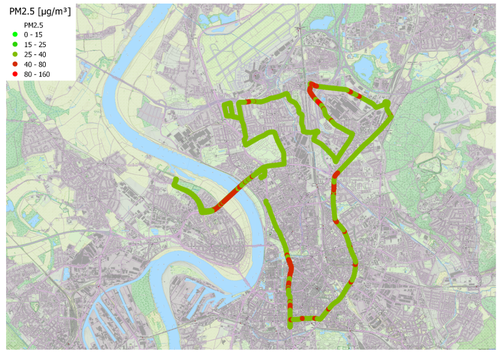

## Ultrafineparticles



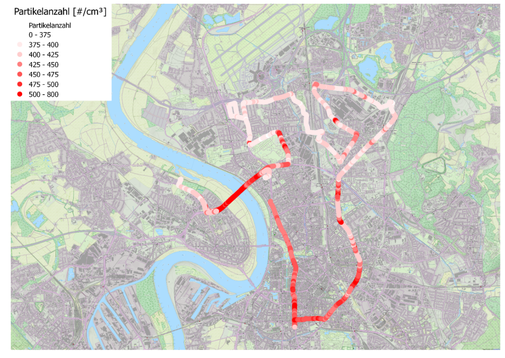

## PM10




## PM2.5




## Particle-counts




## CONCLUSION

Due to the intensive solar radiation on this day, the ozone concentration increases significantly. The measurement station “Lörick”, which is an urban background station and is operated by LANUV monitored at afternoon maximum concentration for ozone around 80 ppb. The increased concentrations were measured as well by the measurement from FH D all over the urban area of Duesseldorf. The data clearly establish the opposing trend between ozone and nitrogen dioxide. The measurement took place during the rush hour with a strong volume of traffic. Thus the $NO_2$ concentration rise clearly on the main roads (e.g. Corneliusstraße, Theodor-Heuss-Brücke, Lastring, etc.) which leads to a direct reduction of ozone. Maximum $NO_2$ concentration this day measured stationary at “Corneliusstraße” were around 120 ppb. The emissions from traffic can also be seen in the data from the aerosol spectrometer for PM10 and the particle counts as well as from the Nanocheck for the ultrafineparticles. Especially the ultrafineparticles are an indicator for combustion gases, where on the other hand the PM10 values aren´t directly related. PM10 peaks are mostly produced through re-suspended particles, abrasion from brakes or tires or even from dirty road cover.

## CONTACT

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