

# Determination of the spatial distribution and vertical profiles of UFP and other pollutants in an urban area

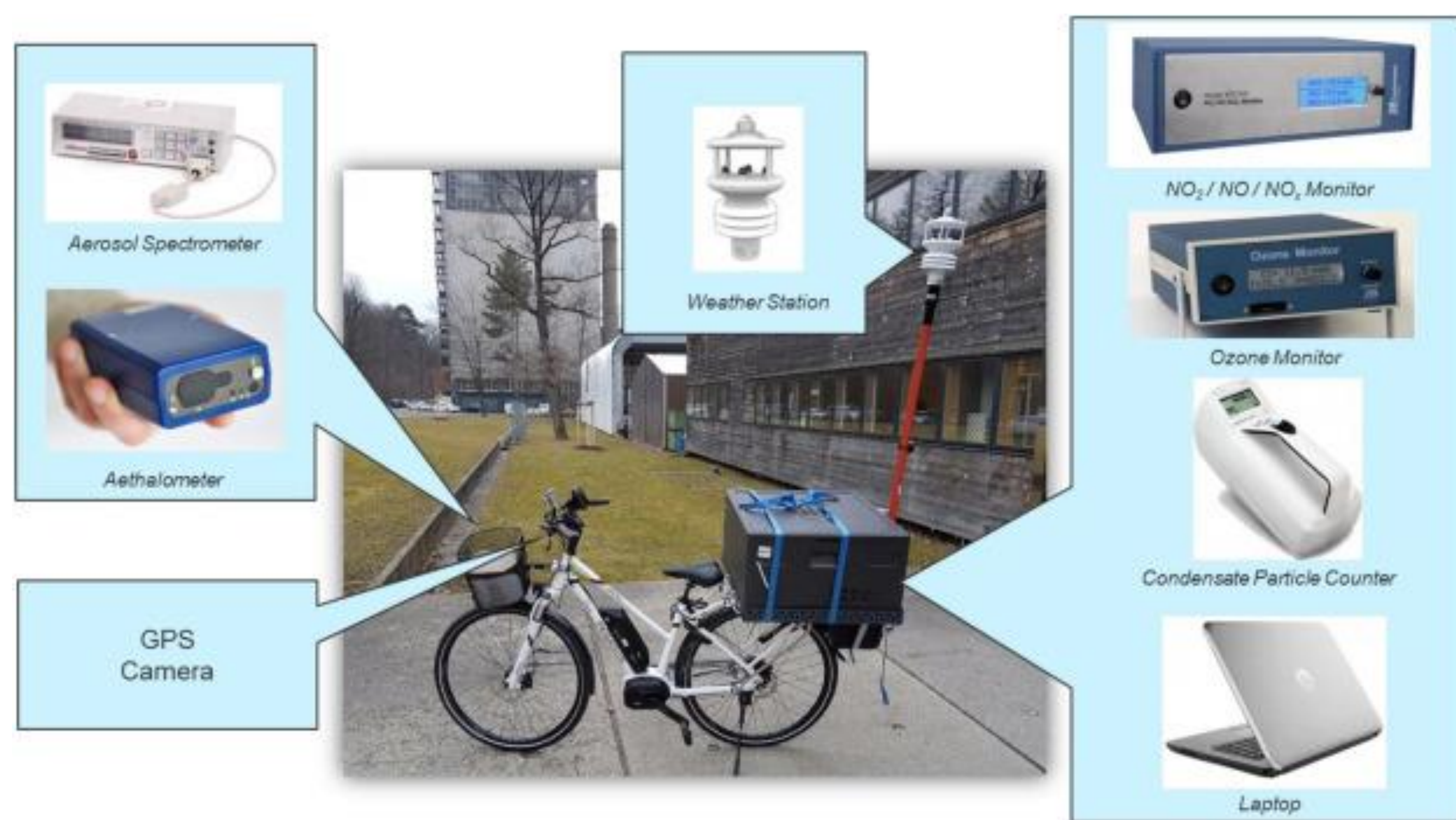
## Introduction

Air quality measurements in Stuttgart are performed under the project Urban Climate Under Change [UC]<sup>2</sup>

Bicycle measurements provide the spatial distribution of meteorological parameters and air pollutants including UFP, while the balloon measurements provide the vertical profiles of the same parameters

## Mobile measurements using bicycle

- The mobile measurements were carried out during summer and winter period of 2018
- As part of the quality assurance of the measured data, the gas devices were calibrated regularly using a gas phase titration system
- PM, UFP and BC measurement devices were compared in advance with calibrated devices and also with the stationary monitoring stations

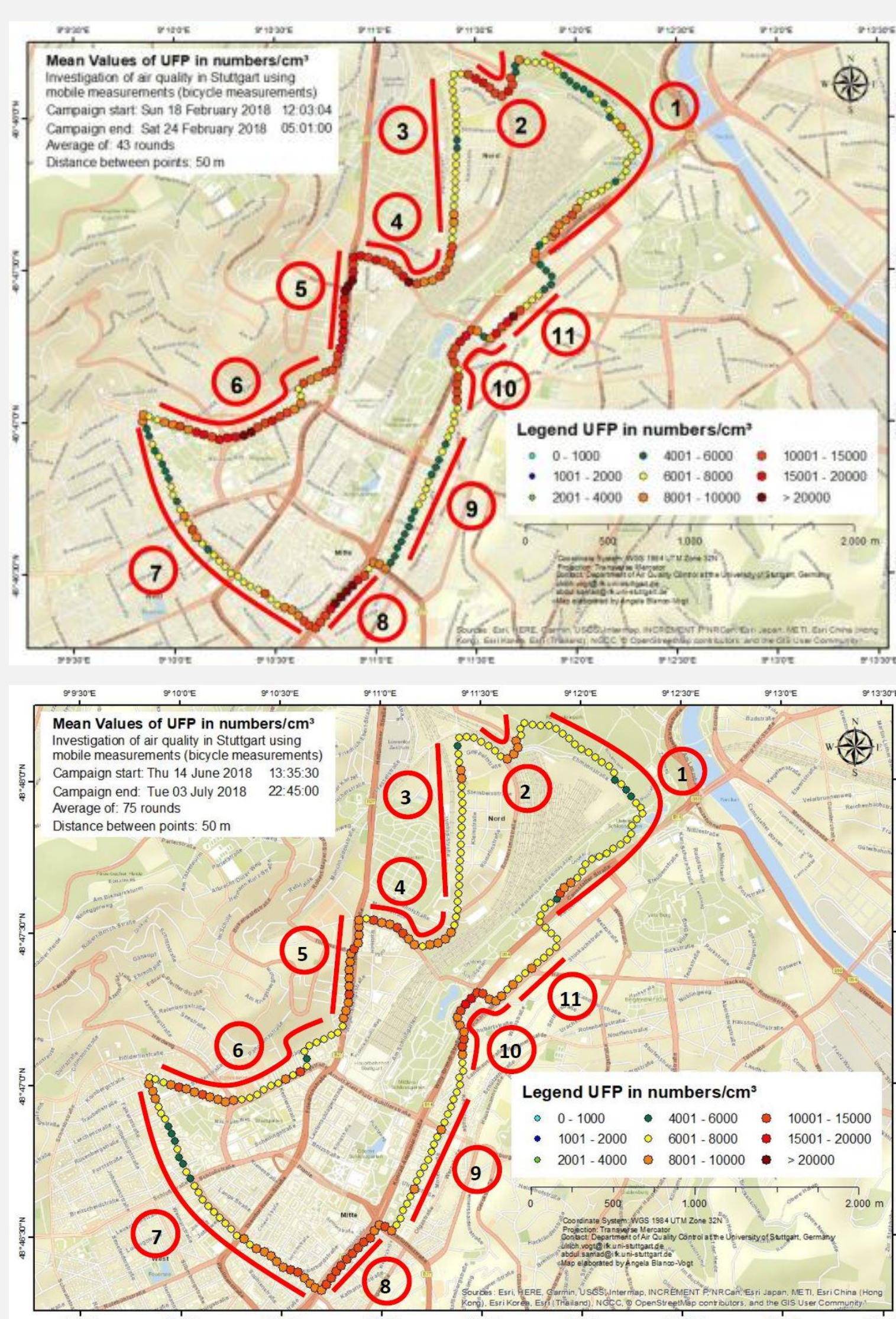


## Results

The whole route is divided in 50 m sections and the values are averaged and shown by one circle on the route. The results show the following:

- Lower UFP concentrations during the summer measurement campaign compared to the winter measurement campaign
- Higher UFP concentrations in the study area alongside the main roads with heavy traffic
- Variation in the UFP concentrations by factors such as location, traffic volumes, weather conditions, etc.
- Relatively high UFP concentrations around the well-known measurement site Stuttgart "Am Neckartor"

Segment	Description
1	Park
2	Area between park and main street (Construction area)
3	Residential area with low traffic
4	Area between main street and federal highway B27 (Construction area)
5	Federal highway B27
6	Main road linked with the federal highway B27
7	The road from west to south while covering the city center until it reaches the federal highway B14
8	Federal highway B14
9	The road parallel to the federal highway B14
10	Am Neckartor on the federal highway B14 where the LUBW monitoring station is located
11	The main road parallel to the federal highway B14



## Vertical measurements using tethered balloon

- Balloon measurements provide vertical profiles of air pollutants and meteorological parameters

### Instrumentation of the balloon:

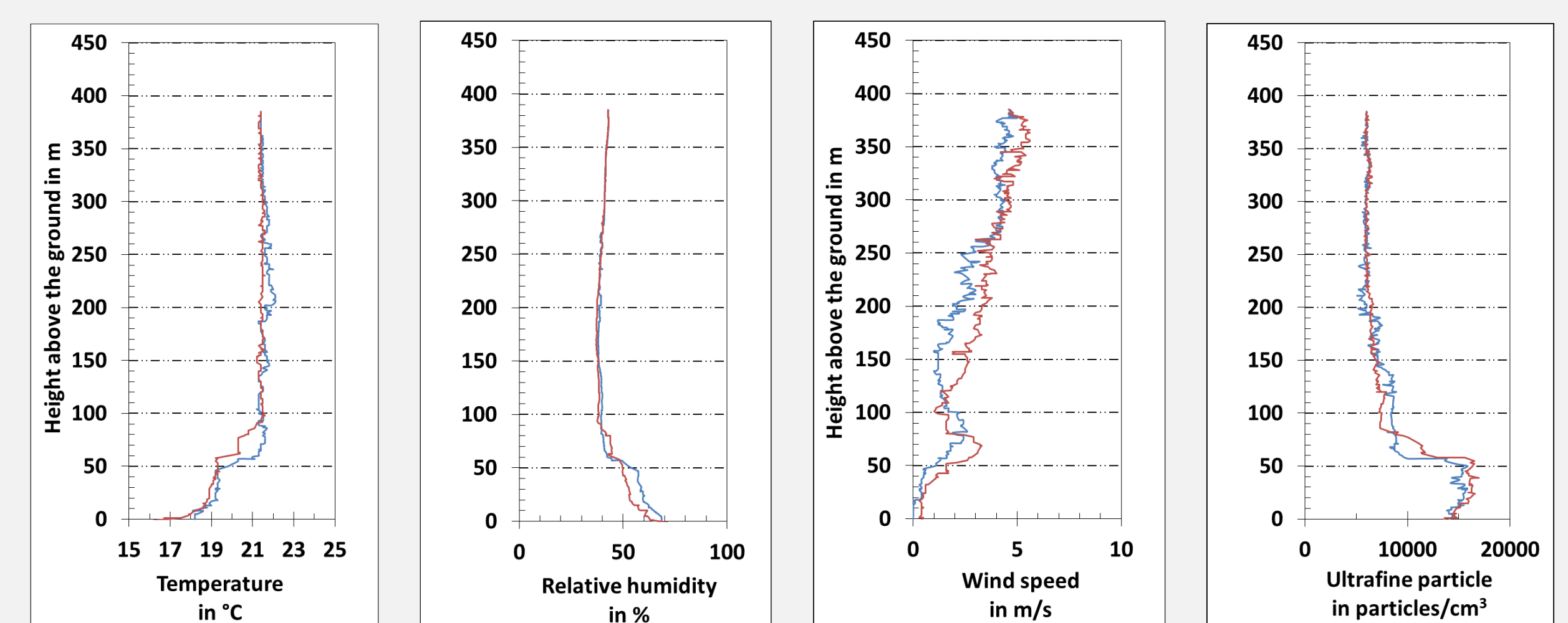
- Meteorology: Wind speed, wind direction, temperature, relative humidity, air pressure
- Gas pollutants measured: O<sub>3</sub>, NO, NO<sub>2</sub>, NO<sub>x</sub>
- Particles measured: Ultrafine particles, PM and black carbon



## Results

The blue line shows the values during ascent and the red line during descent. The results show the following:

- Temperature inversion at around 50 m above ground
- Lower wind speeds closer to the ground due to obstacles
- Relatively higher UFP concentrations near the ground up to the inversion layer



## Conclusions

- Bicycle measurements: Higher UFP concentration in the winter campaign as compared to the summer campaign. Local traffic contributing more than 50% to pollutant concentrations. Highest pollutant concentrations at the notorious hotspot Stuttgart "Am Neckartor"
- Balloon measurements: Temperature inversion during the night causing higher UFP concentration near the ground up to the inversion layer. Stable atmosphere during the inversion period.

