Characterizing impact of air pollution on human health
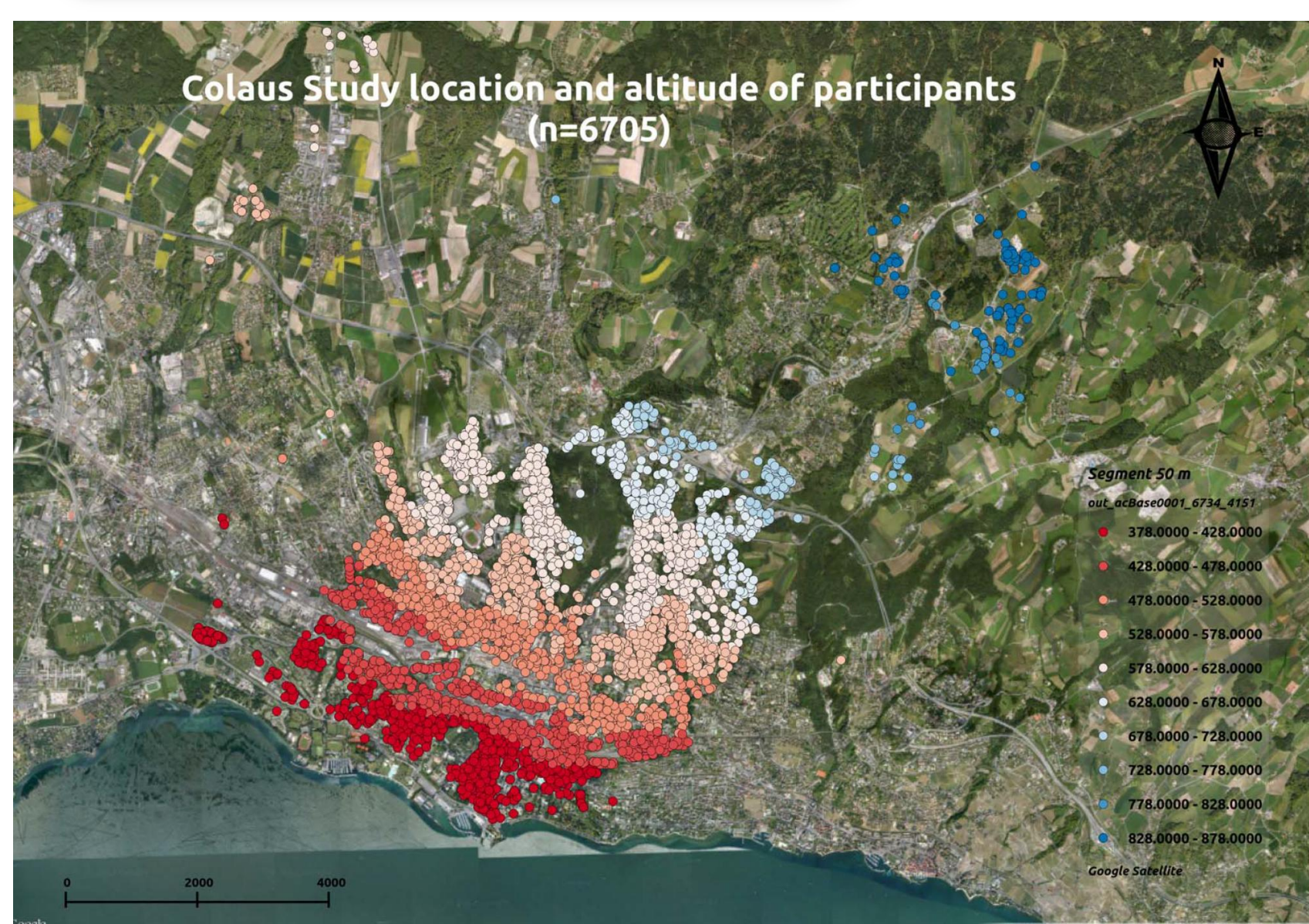
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[1] Institute of Social and Preventive Medicine (IUMSP), Lausanne University Hospital (CHUV), Route de la Corniche 10, 1010 Lausanne, Switzerland
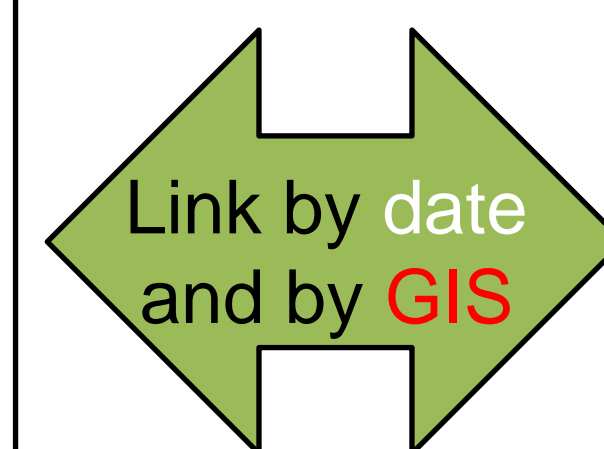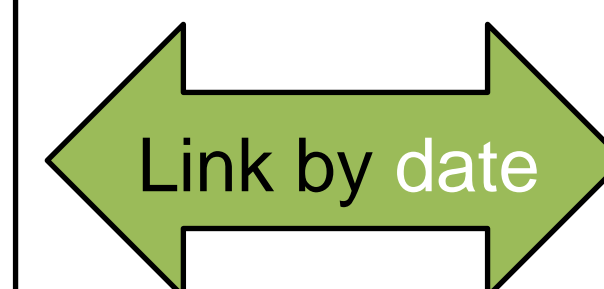
[2] Institute for Work and Health (IST), Route de la Corniche 2, 1066 Epalinges, Switzerland

[3] IOM Singapore Pte. Ltd., 30 Raffles Place, #17-08 Chevron House, Singapore, 048622

IUMSP   CHUV   ist   Unil UNIL | Université de Lausanne   IOM

CoLaus

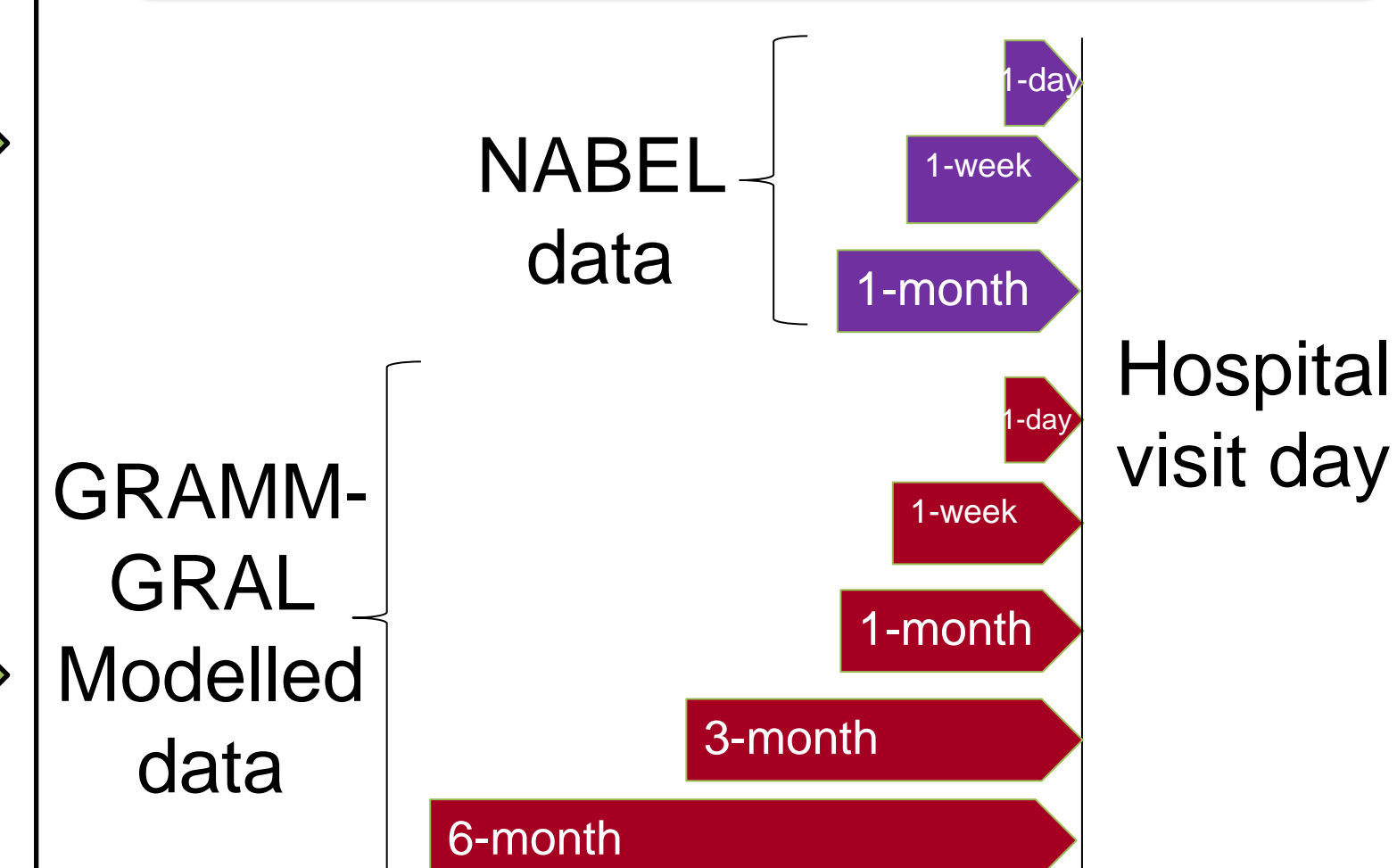CoLaus Study location and altitude of participants (n=6705)

- Population-based study, including participants aged 35 to 75 years in Lausanne
  - ❖ CoLaus 1 (N=6184, 2003-2006)
  - ❖ CoLaus 2 (N=5069, 2009-2012)
  - ❖ CoLaus 3 is ongoing since 2014

- Inflammatory markers including:
  - ❖ high-sensitive C-reactive protein (hs-CRP)
  - ❖ interleukin 1-beta (IL-1β)
  - ❖ interleukin 6 (IL-6)
  - ❖ tumor-necrosis-factor alpha (TNF-α)

Link by date

Link by date and by GIS

Exposure data

GRAMM model covers 4x4 km in Lausanne

NABEL data — 1-day, 1-week, 1-month

GRAMM-GRAL Modelled data — 1-day, 1-week, 1-month, 3-month, 6-month

Hospital visit day

Preliminary results

- Spatial modeling provides larger exposure gradients, which allows studying health effects of longer term health effects (several months)
- Available modeling data was applied to 5113 subjects in CoLaus 1, and 4176 subjects in CoLaus 2.
- Associations between PM10 and inflammatory markers were strongest for the 6-month prior to visit day for IL-1β and IL-6.

CoLaus 1

CoLaus 2
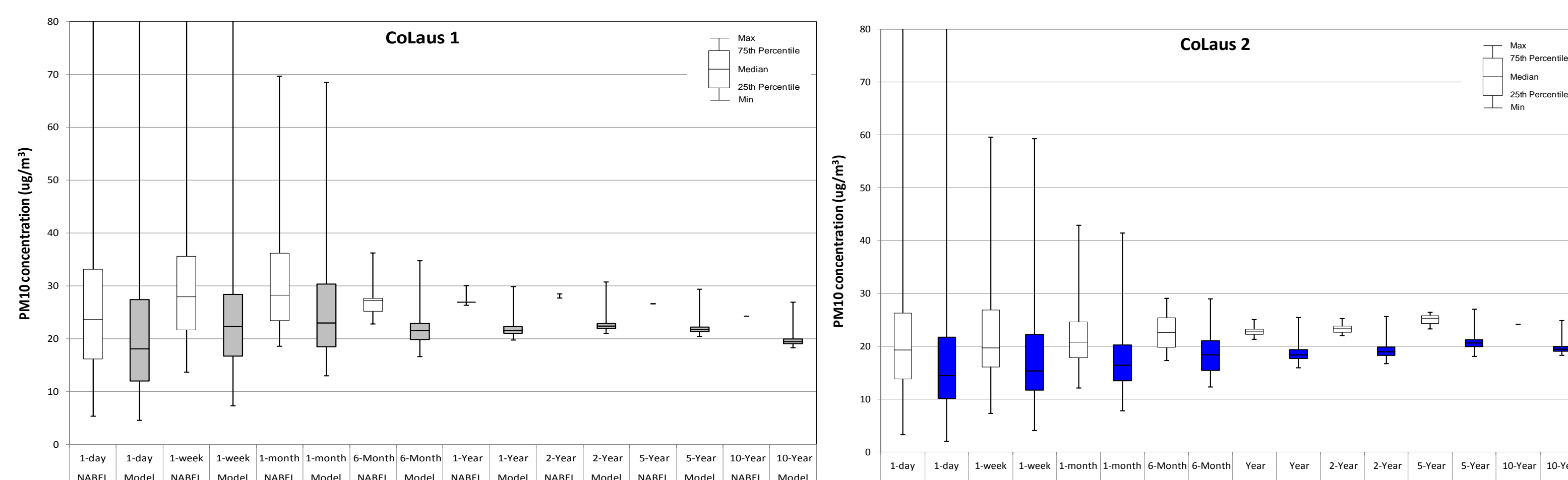
Comparison of exposure estimates and gradients provided by a single central site monitoring station (empty boxes) and by spatial GRAMM-GRAL modelling (filled boxes) for the two different study periods.
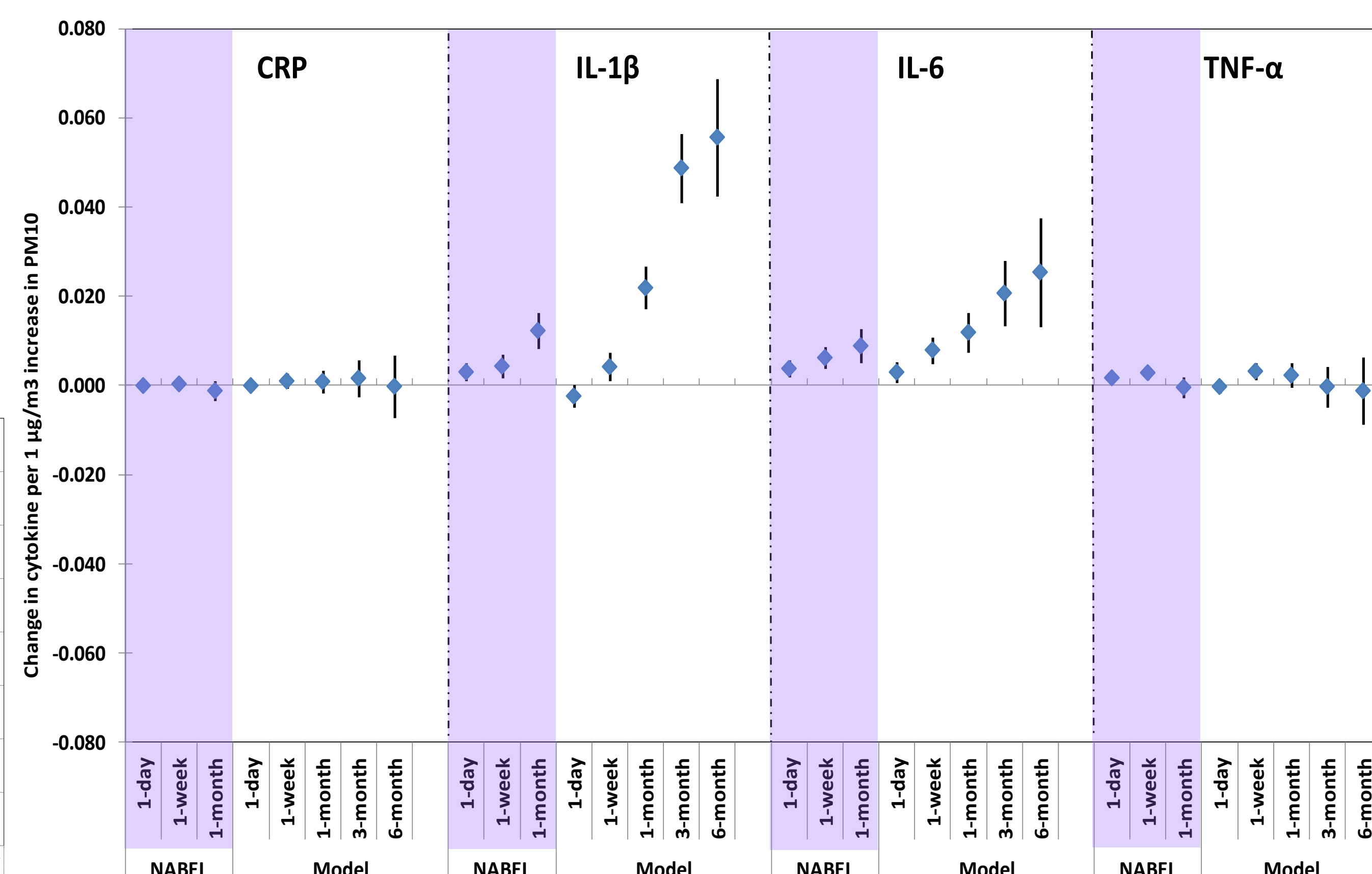
Association of different exposure durations with inflammatory markers by linear mixed models, adjusting for age, gender, BMI, smoking, alcohol, diabetes, hypertension, pressure, temperature and season.

Pilot study

- 25 participants
- Each measured once per seasons
- 100 daily (24h) recordings
- Progress: 80%
- Finish by July 2016

Physical Activity
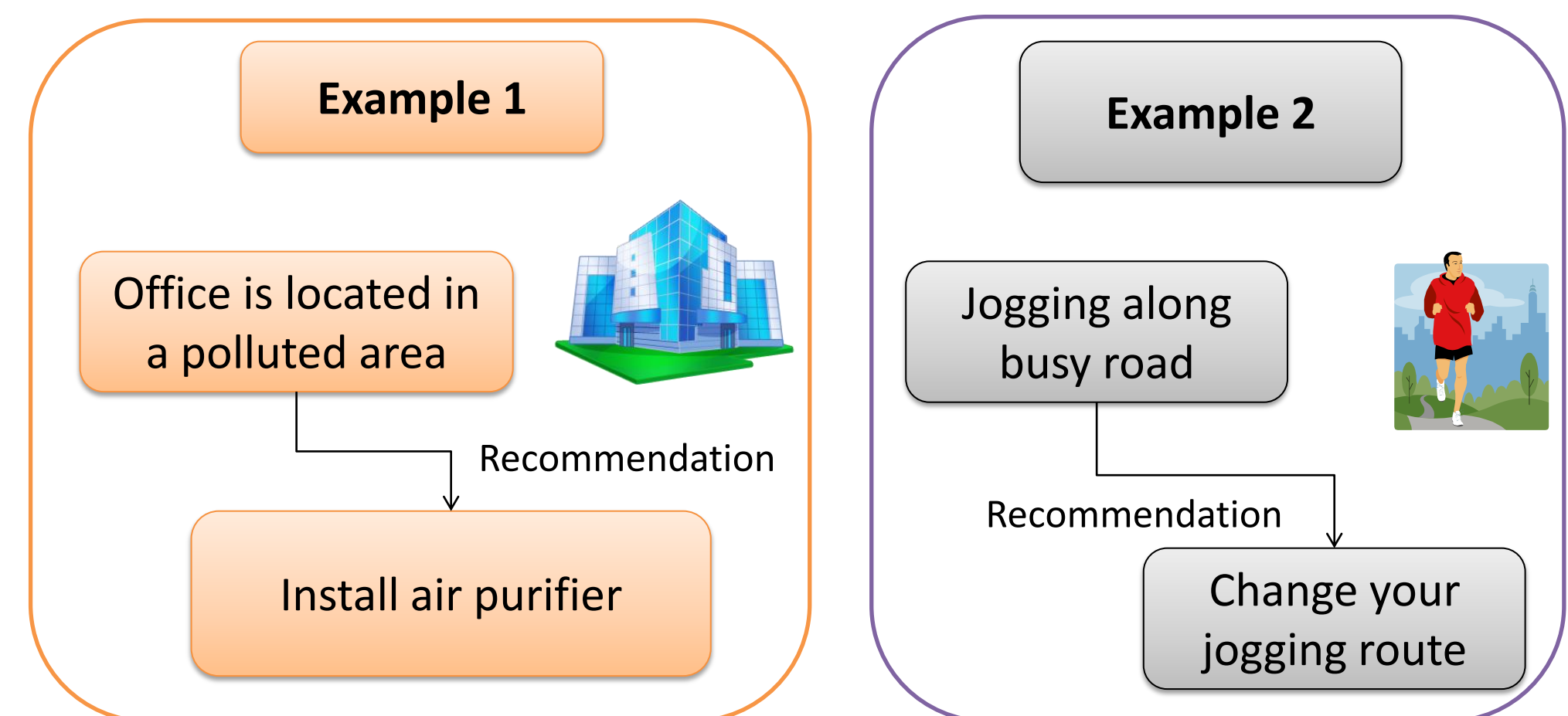

GPS

PM2.5

CO

Ultrafine particles

Noise

- **Example: one subject's daily exposure on 04 June 2015**

Activity Diary

Time	Activity	
•09:45-10:07	Walking	🚶
•10:07-10:24	Transport	
•10:24-10:37	Walking	🚶
•10:37-12:08	Shopping	
•12:08-12:40	Transport	
•12:40-13:20	Walking	🚶
•13:20-13:45	Indoor	
•13:45-14:55	Transport	
•14:55-16:30	Indoor	
•16:30-17:45	Walking	🚶
•17:45-18:20	Walking	🚶
•18:20-18:36	Outdoor	
•18:36-19:08	Walking	🚶
•19:08-	Indoor	
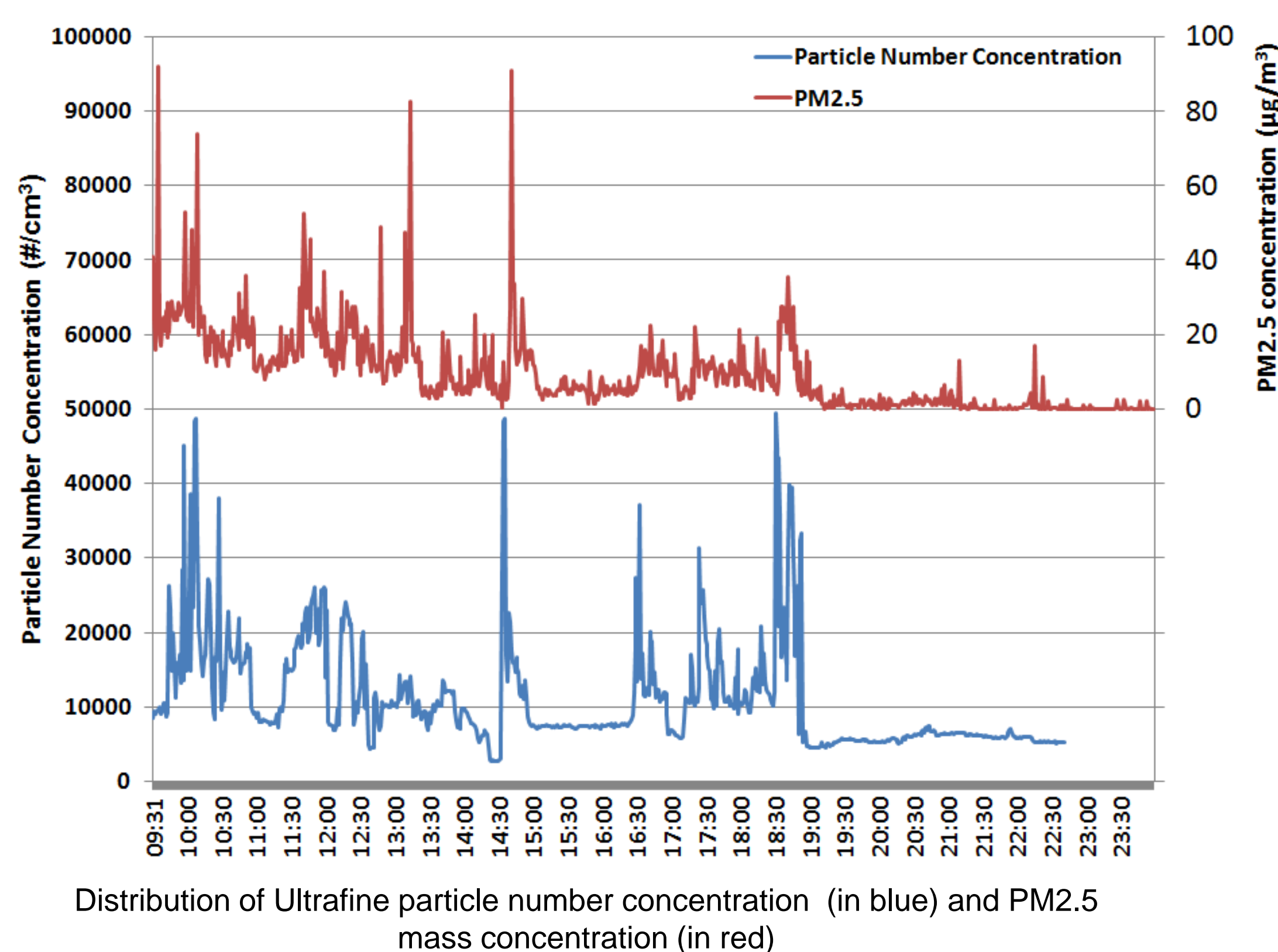
Distribution of Ultrafine particle number concentration (in blue) and PM2.5 mass concentration (in red)

Personalized recommendation

Example 1

Office is located in a polluted area

Recommendation

Install air purifier

Example 2

Jogging along busy road

Recommendation

Change your jogging route

Next steps

- Further investigate how different PM10 exposure time windows influence kidney function

- Include concentration map from bus measurements in the health analysis

- Complete pilot study and analyze the results