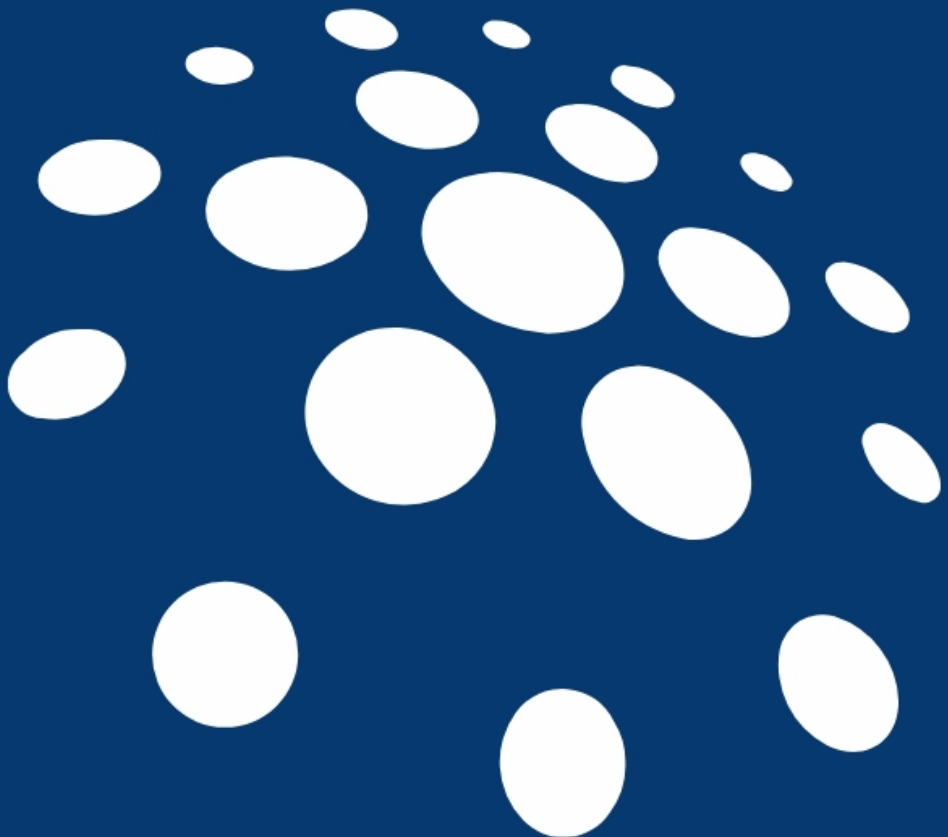


A decorative graphic on the left side of the slide consisting of numerous white circles and ovals of various sizes, some overlapping, arranged in a loose, organic pattern.

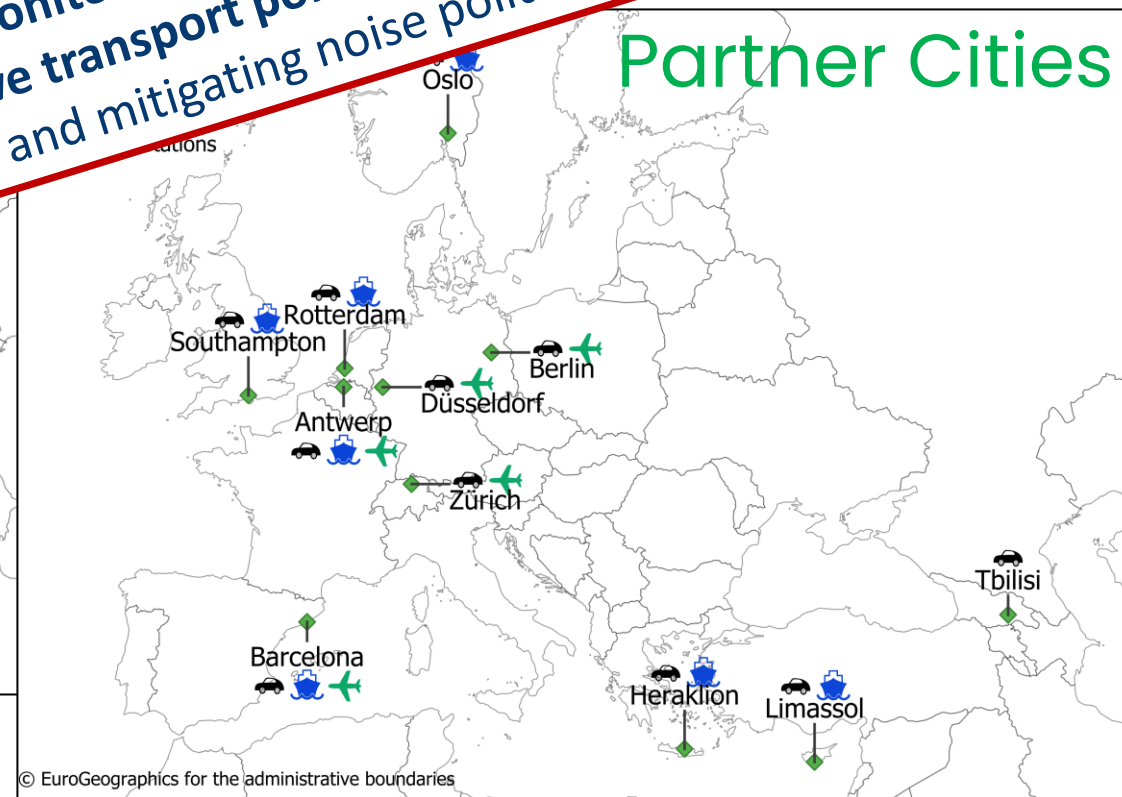
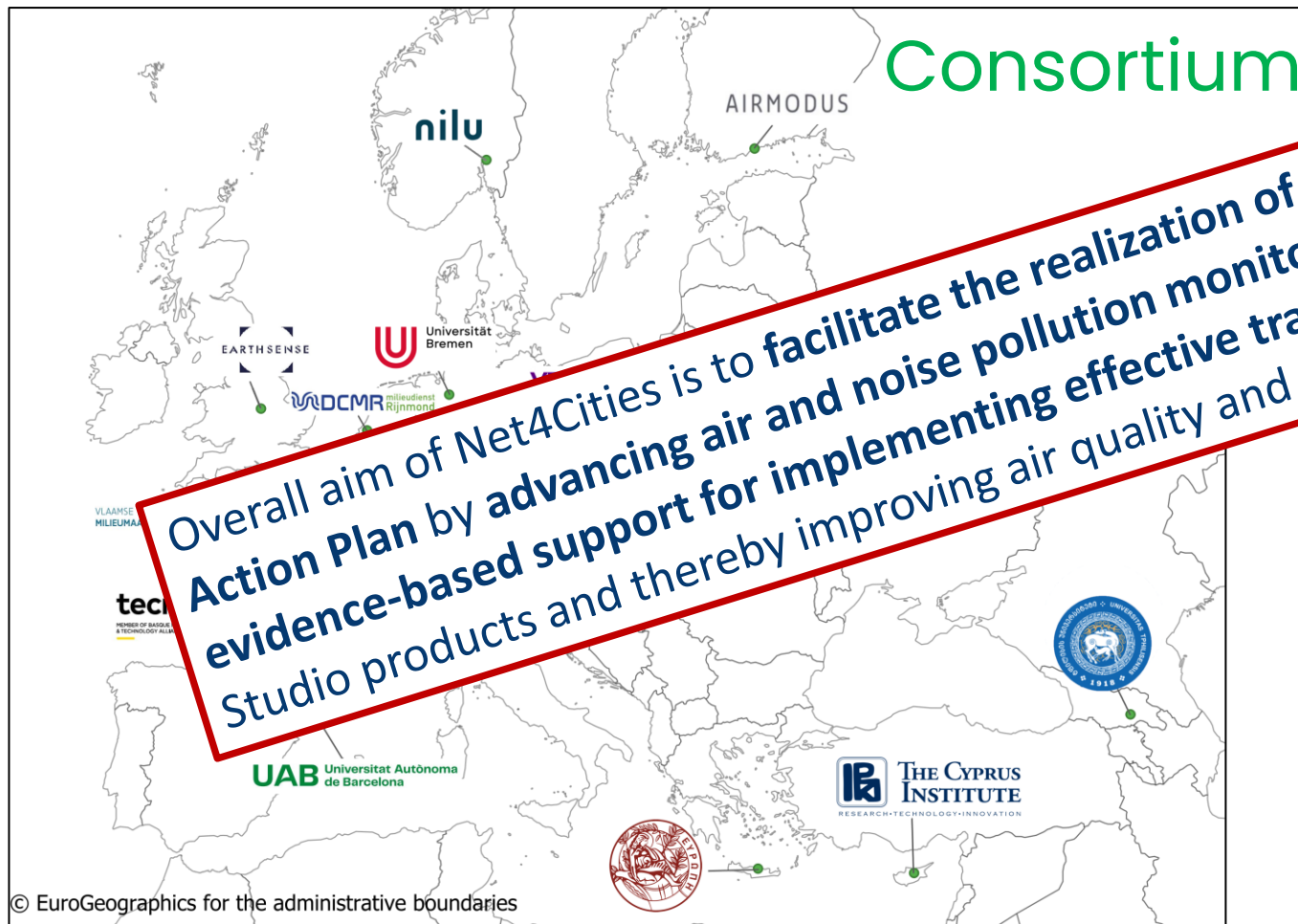
Real-time monitoring of transport-related air and noise pollution in European cities (Net4Cities): First overall AQ results

M. Van Poppel - VITO

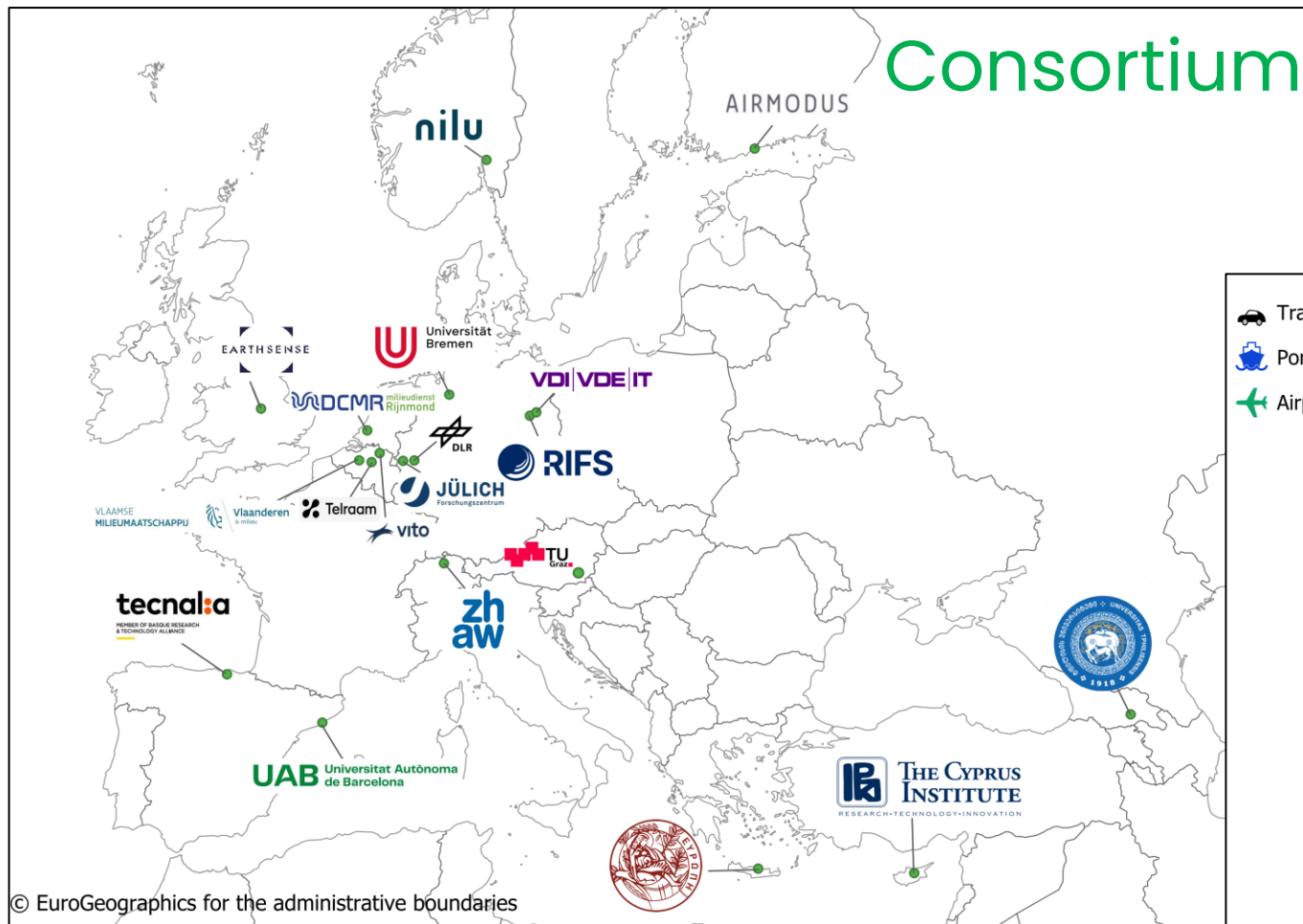
J. Peters, L. Vega Garcia, R. Wegener, M. G. Adam A. Pajunoja,
S. D. van Dusseldorp, M. Pikridas, J. Soares, M. Savadkoohi,
I. Aspuru Soloaga, and E. von Schneidemesser



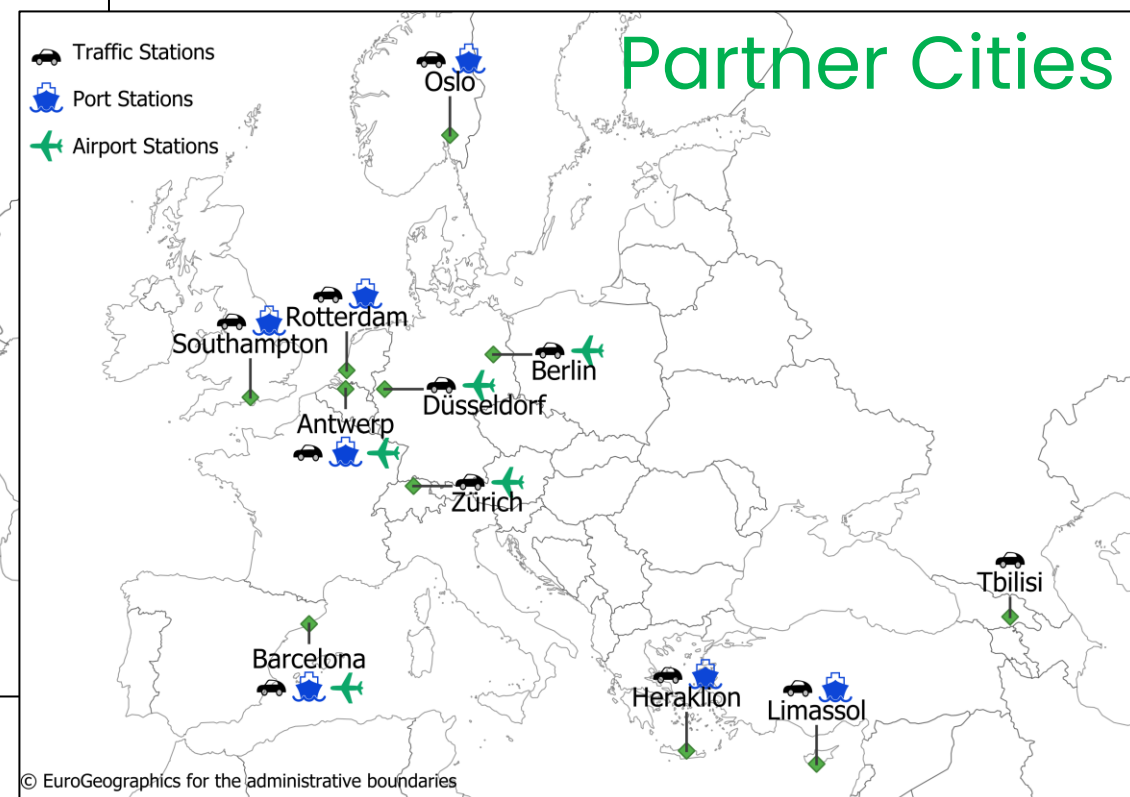
Funded by
the European Union



Real-Time Monitoring Networks and Transport Emissions for Tailored Zero Pollution Action Plans in European Cities

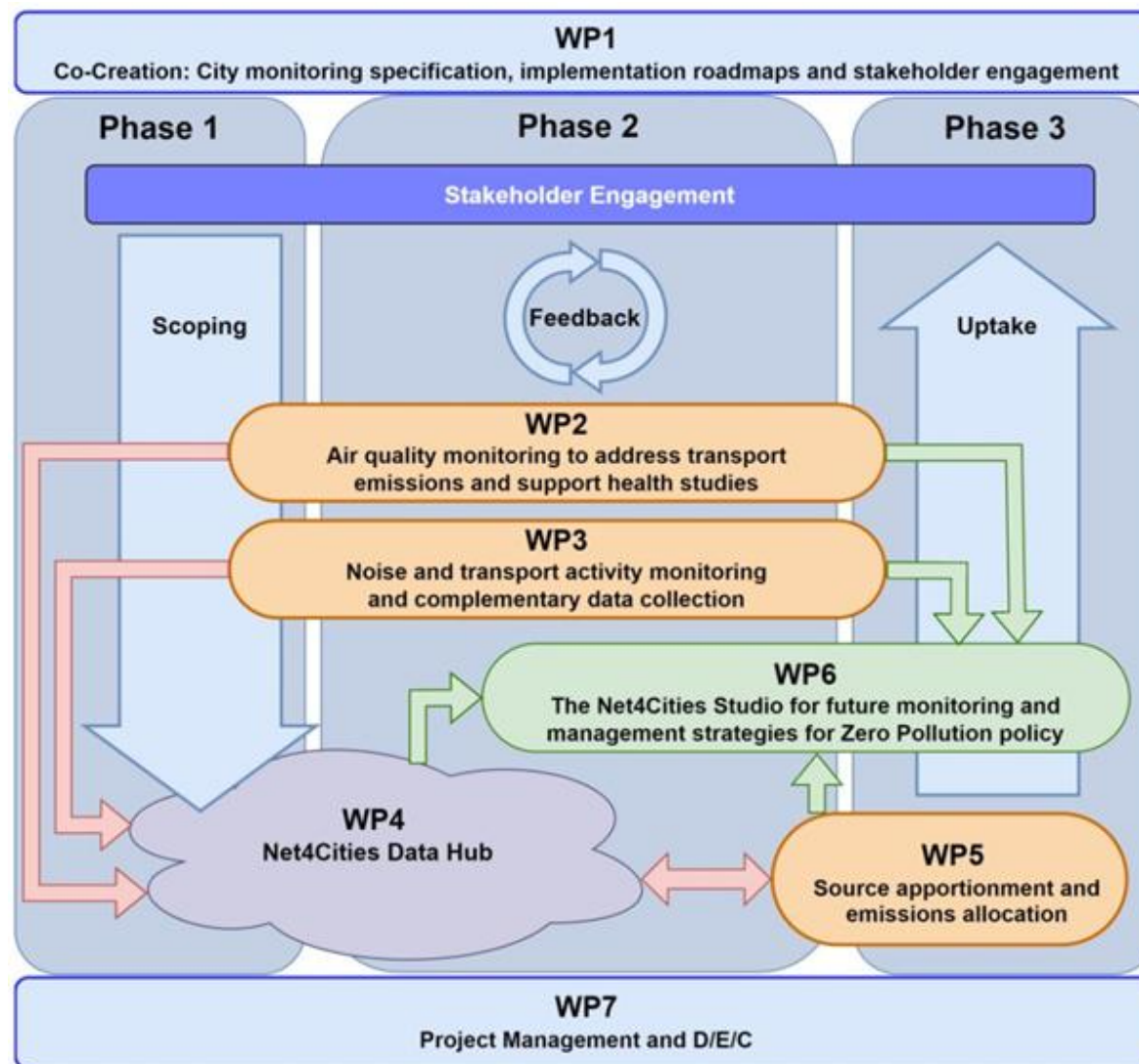


■ 2024 – 2027, 5 mil €



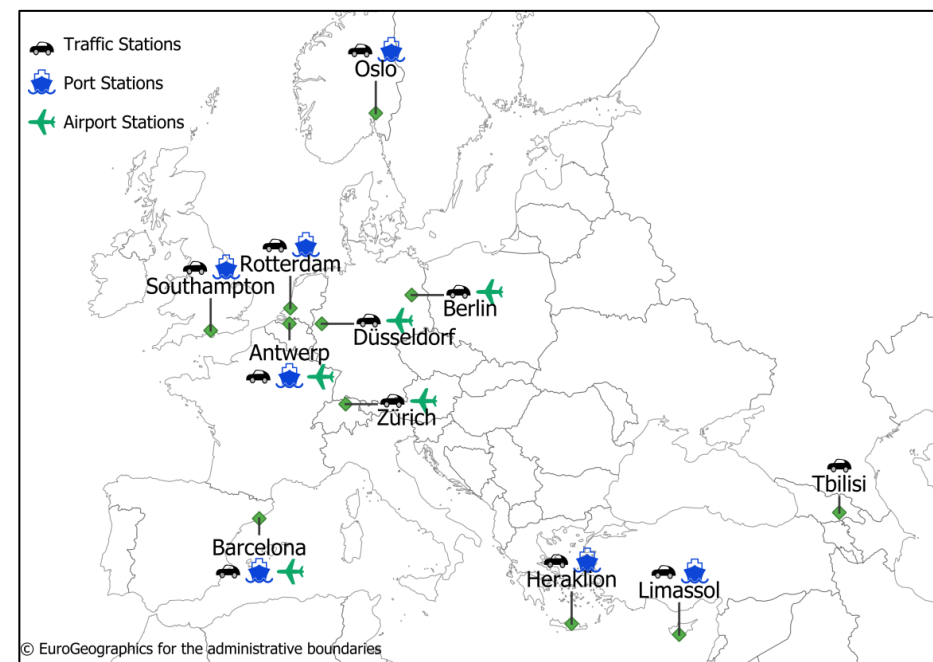
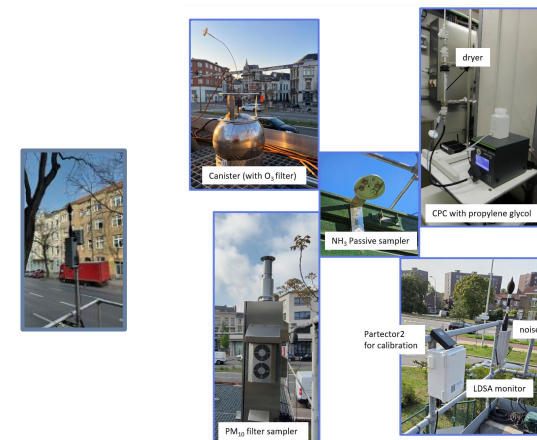
1. **Co-create** evidence-based, tailored policy solutions **for effective air and noise pollution reduction** plans.
2. **Advance monitoring networks** for transport-related **air** (exhaust and non-exhaust) and **noise** pollution – providing real-time information for policy, decision-support.
3. Generate **data on (emerging) pollutants and noise** in cities (from contrasting geographical and climatic locations with differing fleet compositions) to **support source apportionment and modelling applications** and the improvement of emissions inventories.
4. Consolidate in (urban and national level) databases integrated information from the monitoring and activity databases that enables **assessment of transport-related emissions and identification of non-compliant sources**, contributing to enforcement and the **reduction of health impacts**.
5. Create the Net4Cities Studio, including a variety of policy recommendations and guidance for e.g., **expanded monitoring network design**.

Net4Cities Work plan



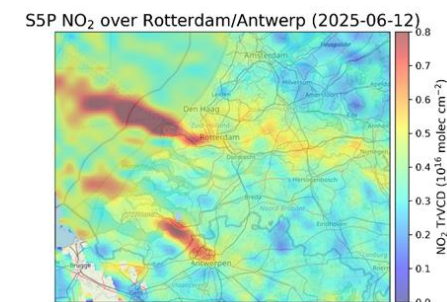
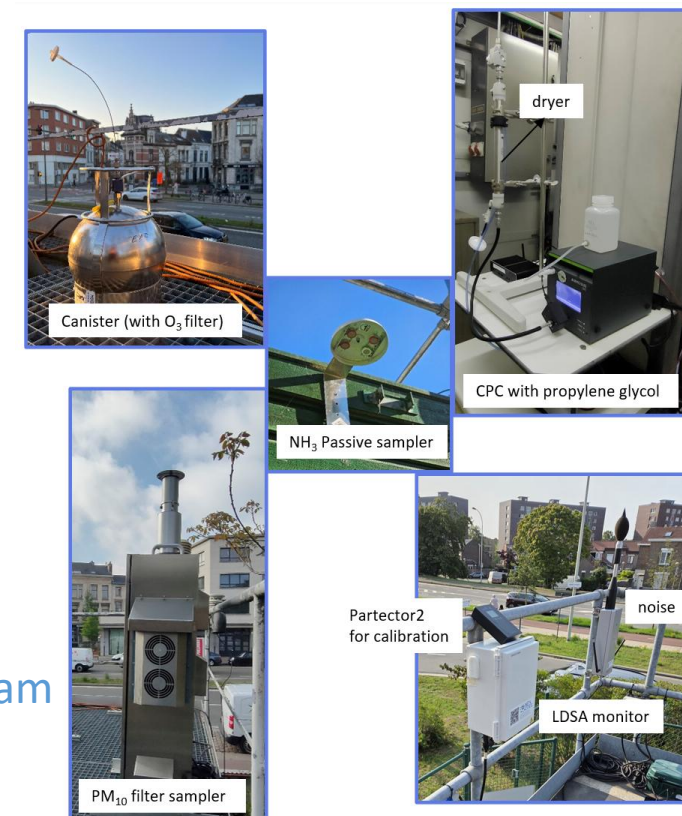
Advanced monitoring networks

- 11 partner cities (multiple locations in each city)
- Focus on **urban traffic** locations and around **ports** and **airports**
 - 6 airport sites
 - 6 port sites
 - 18 urban traffic sites
 - 2 rural and 1 urban background site
- > 2 years of (continuous) measurements
 - Air Quality (emerging pollutants), noise, traffic counts



Advanced AQ monitoring networks

- **Extending existing AQMN**
- **On-line measurements: > 2 years**
 - UFP (PNC, LDSA)
 - existing data of regulated pollutants $\text{PM}_{2.5}$, PM_{10} , NO_2 , NO , (if available CO , O_3 , benzene and SO_2)
 - existing data of BC (λ) -> see poster presentation H. Setia
 - at selected locations/periods: NH_3 , N_2O , trace metals (xACT) and organic PM speciation (ACSM)
- **Off-line measurements: 1 year**
 - NH_3 (passive samplers): monthly
 - Canisters (GHG and NMVOCs): 1day/month -> see poster presentation M. Adam
 - PM_{10} filter speciation (non-exhaust) at selected traffic locations: every 3th day
- **Targeted campaigns** for improved emission data and policy support
- **Remote sensing from space** to gap-fill ground-based in-situ monitoring data



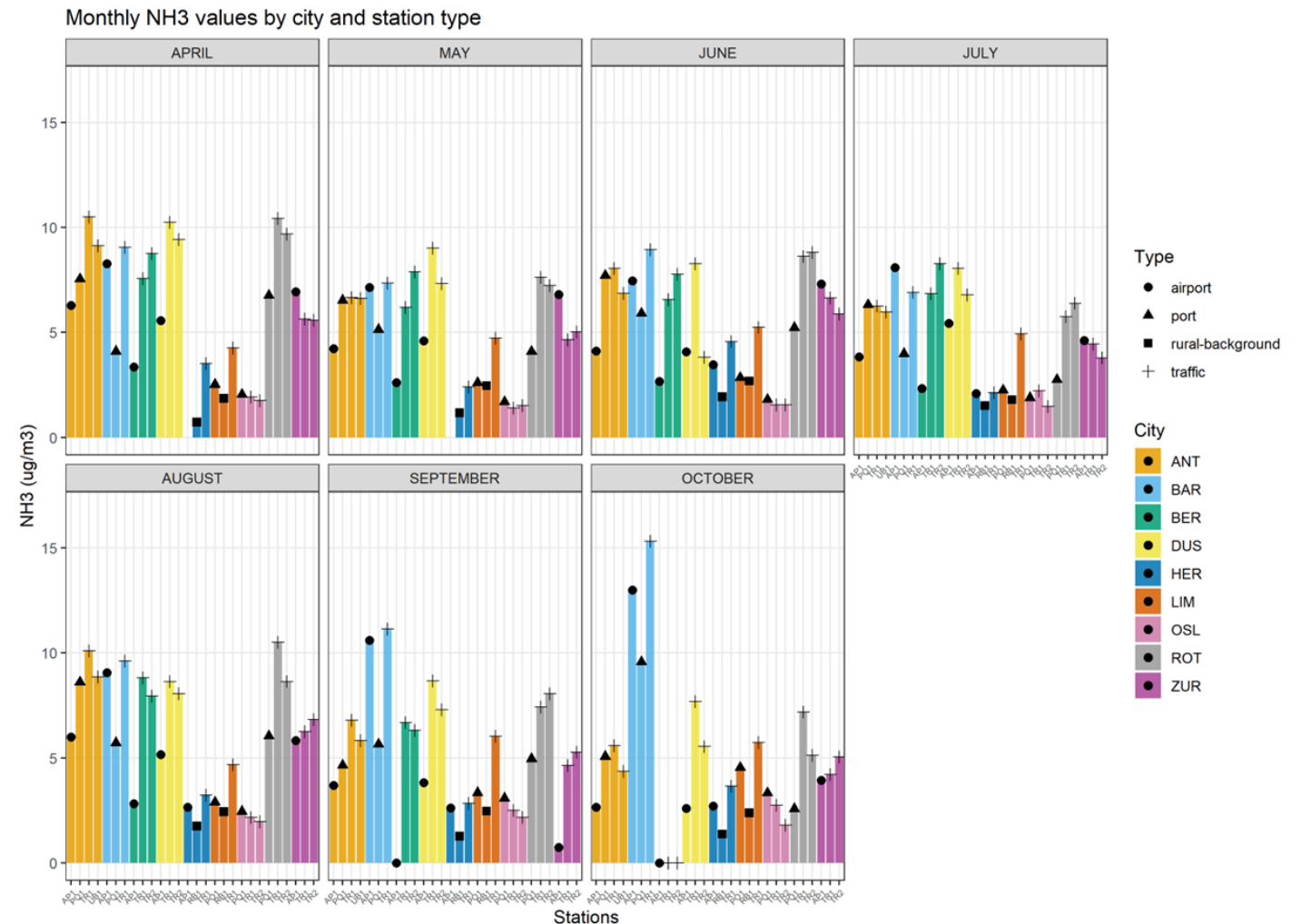
NH₃ measurements

- Passive sampler (EN 17346:2020)
 - Impregnated with oxalic acid
 - Analysis based on photometry (NILU)
- 1 sample per month (April 2025 – April 2026)
 - Same sampling periods in all cities!
- Sample analysis by NILU and deployment by local partner

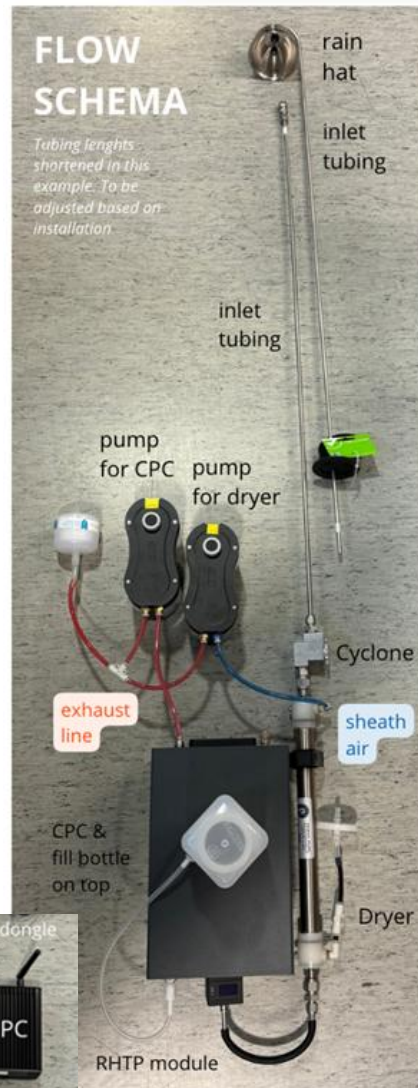


NH₃ Results (9 cities - April – October)

- The average value for **all samples**: $5.3 \pm 2.7 \mu\text{g}/\text{m}^3$ → these findings align with RI-URBANS assessments
- Heraklion, Limassol, and Oslo have the lowest values: $< 6 \mu\text{g}/\text{m}^3$
- For the other cities, values range from 3 to 15 $\mu\text{g}/\text{m}^3$
- Highest values observed in Antwerp, Barcelona, Düsseldorf, and Rotterdam
- Most stations show higher values in April and August
- Impact of station type

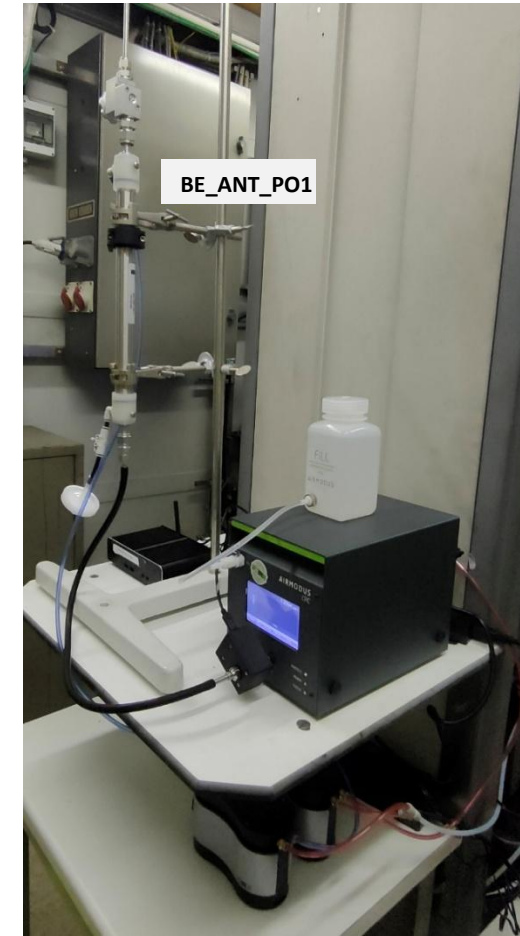


UFP (PNC): CPC



Specification net4cities

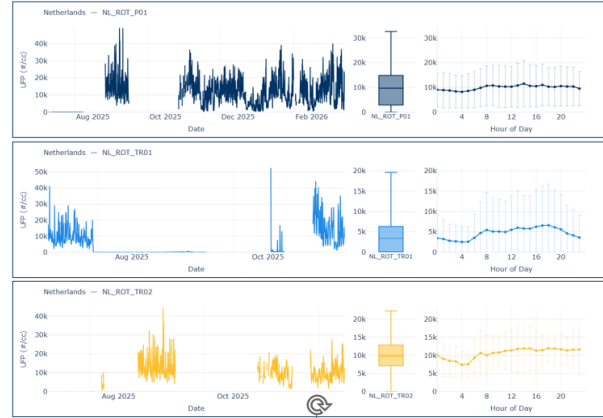
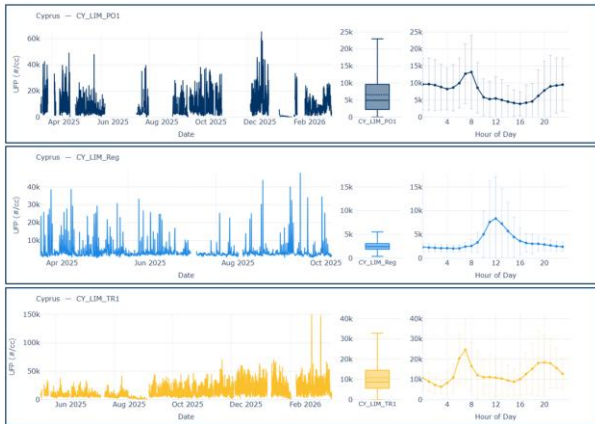
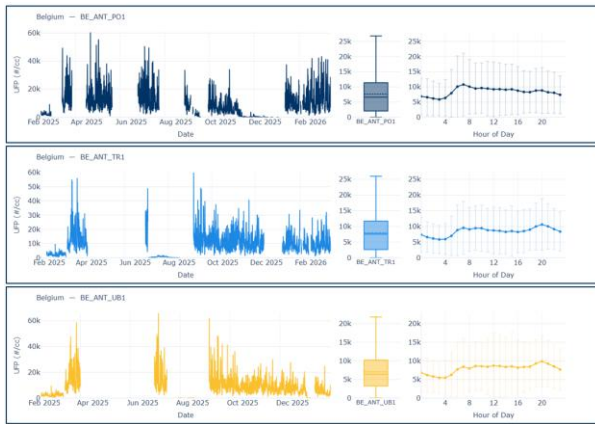
- CPC (Airmodus A30 - A20)
- Working fluid: butanol or propylene glycol
- Data freq: 1 Hz
- Size range:
10 nm (D50%) – 2500nm
- Concentrations:
0 – 500 000 #/cm³
- Installed in AQMS or T-controlled housing
- Data transfer: LTE 4G or local DAQ



UFP (PNC): CPC working fluids

- Airmodus A30 (propylene glycol) or A20 (butanol)
- Co-creation: selection of preferred liquid by cities - AQMN
 - Most cities and AQMN preferred propylene glycol – only two preferred butanol
 - Reason: harmful substance, smell, interference with other measurements (VOC, NOx)
- Observations/lessons learned so far
 - Butanol: reduction of butanol by using catalytic stripper (exhaust) and ventilation system (fill bottle); but still some issues in one of the stations
 - Very high concentrations can be observed with propylene glycol: e.g. Berlin peaks up to 400,000 particles/cm³
- propylene glycol is already CEN equivalent, ACTRIS approval is pending

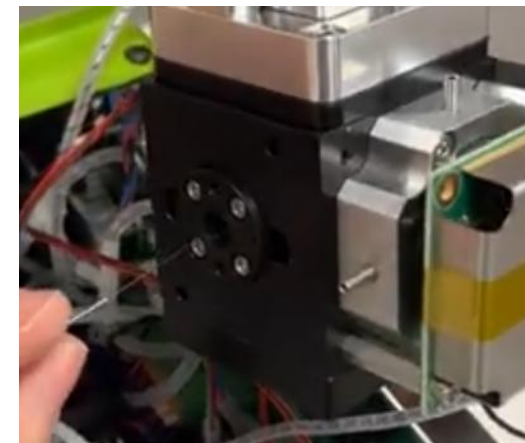
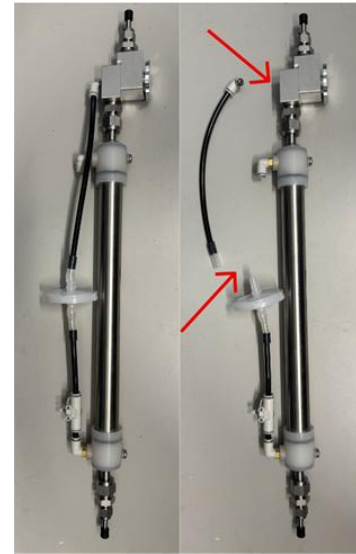
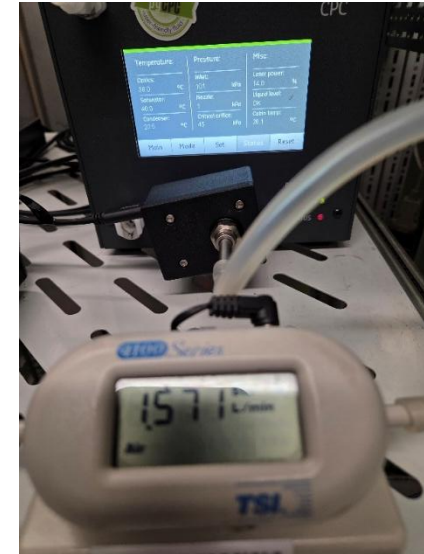
UFP(PNC)



- **24+** newly installed UFP sites!
 - 3 (Tbilisi, GE), 1 (Derby, UK), 1 (DUS) recently
- Data quality check and processing on-going
- Observations:
 - First year: data gaps, issues with installations,...
 - Differences between cities, type of locations within cities
- Data collection until April '27 and beyond...

UFP (PNC): lessons learned

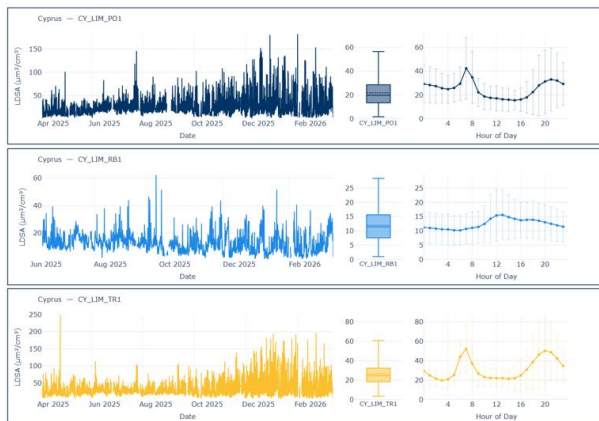
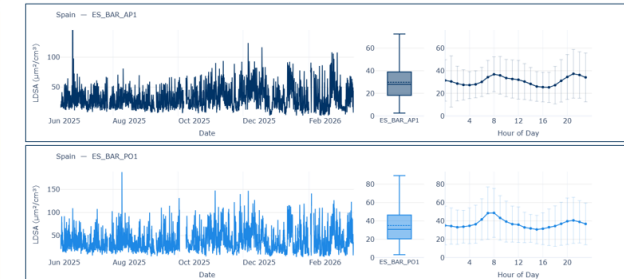
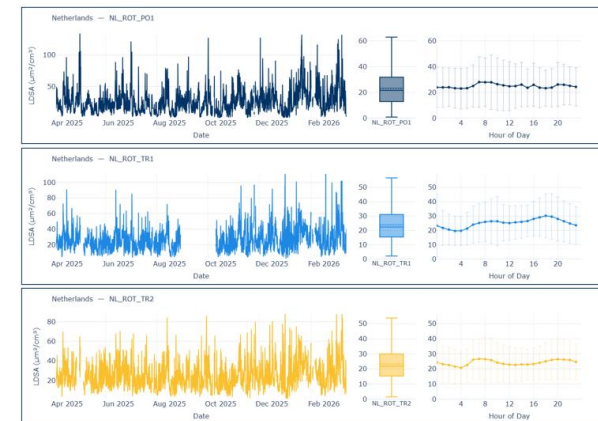
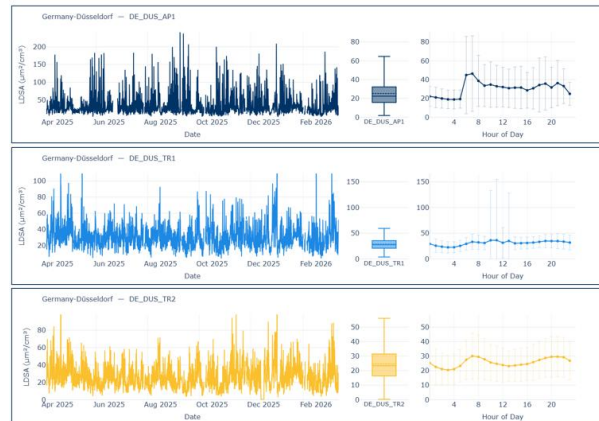
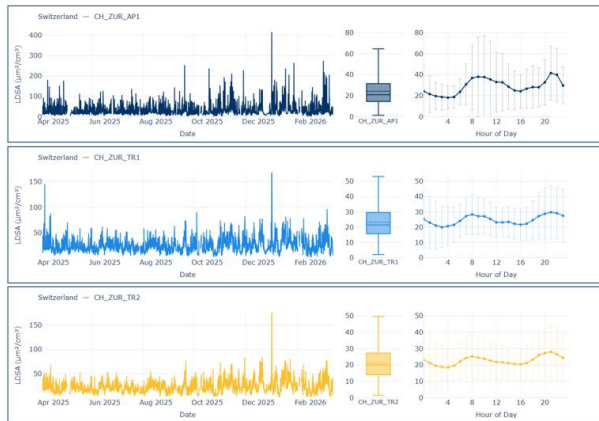
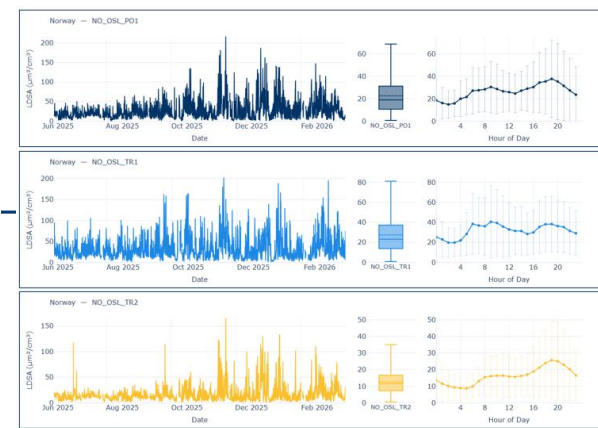
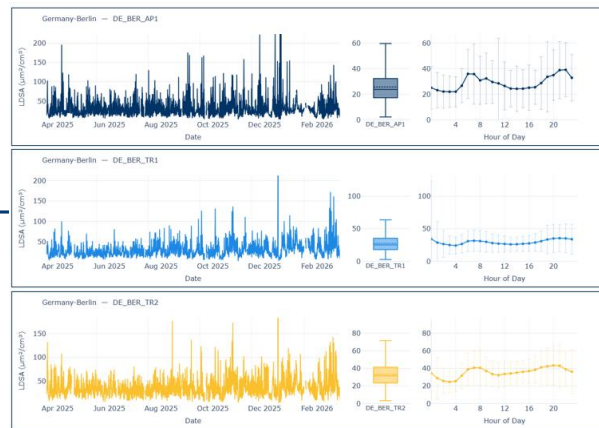
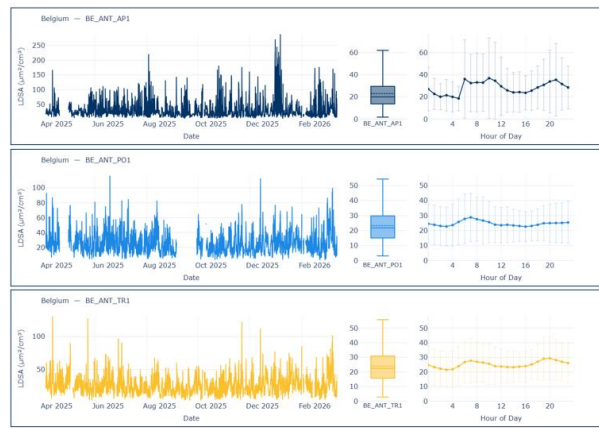
- Technical issues and improvements:
 - Revised laser required for the pg-version (higher power)
 - Adaption to the inlet system (higher flow) minimize particle losses (longer inlet)
 - Airflow bypass clogged (critical orifice/filter) and nozzle in optics clogged
 - => replacement of orifice and filter
 - => cleaning nozzle in optics: possible in field without need for re-calibration
 - => preventive: frequent flow checks, pulse diagnostics
 - => high concentrations in cities => additional dilutor is preferred!
 - Vacuum pump failure
 - => revision of pump at the site (repair kits)
 - Data transfer: problems with LTE 4G connection in well-insulated AQMS
- Operating errors => on-going training
- Adaption in set-up, maintenance frequency, training... will result in higher data capture for remaining period



LDSA measurements

- Lung deposited surface area (LDSA)
 - Epidemiological studies show strong association with health impacts
- Compact LDSA monitor (Naneos)
 - Lower-cost instruments: prototypes
 - Measurement of surface area via diffusion charging
 - Heated inlet
 - 24/7 operation
 - Build-in control Flow, T, RH
 - Wireless data transmission (SIM card)
- Data quality control through regular co-locations with handheld instrument (Partector 2 – Naneos) to check if service is needed (local partner)

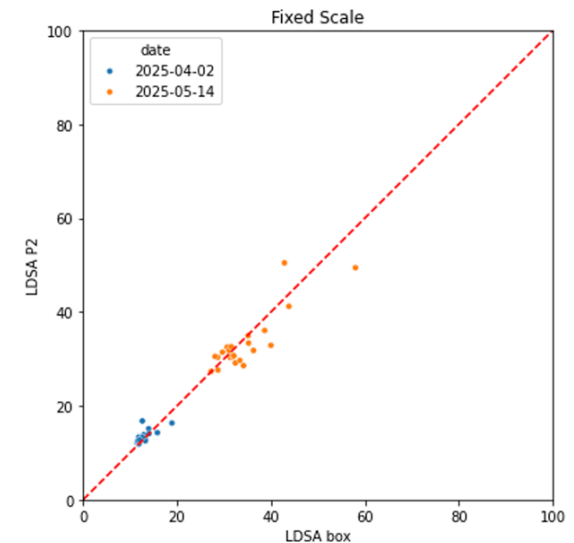




- 33 newly installed LDSA sites!
 - 7 recently (no data shown)
- Data quality check and processing on-going
- Observations:
 - First year: good performance, issues with installations,...
 - Differences between cities, type of locations within cities
- Data collection until April '27 and beyond...

LDSA: lessons learned

- Replacement of sensor (on-site) at the beginning of the campaign
- Data gaps were mainly related to local factors (e.g. power, maintenance) or remote firmware updates
- Quality control by co-location with Partector
 - Added value of regular co-locations: follow-up performance over time
 - Overall good results: no drift observed
- Delayed installations at sites in Southampton resulted in a valuable dataset: co-location of 3 instruments for almost one year (at one location)!
- Data capture continues for remaining period



Targeted campaigns

Monitoring ship emissions

Rotterdam (July – August 2025);
other campaigns planned



See poster presentation:
M. Adam "Urban transport-related emissions in
European cities: Insights from canister sampling
and mobile measurements in Net4Cities"
on Tuesday from 5-7pm

Impact of airport (Heraklion -> Kastelli)

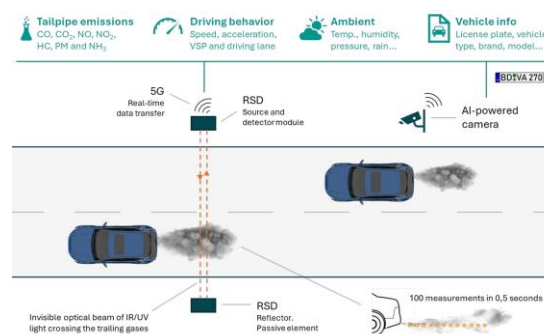
Heraklion
airport
9 MPPA
Kastelli
airport
>18 MPPA



Monitoring ammonia profiles at urban (traffic) site Antwerp (26/2/26 - ...)

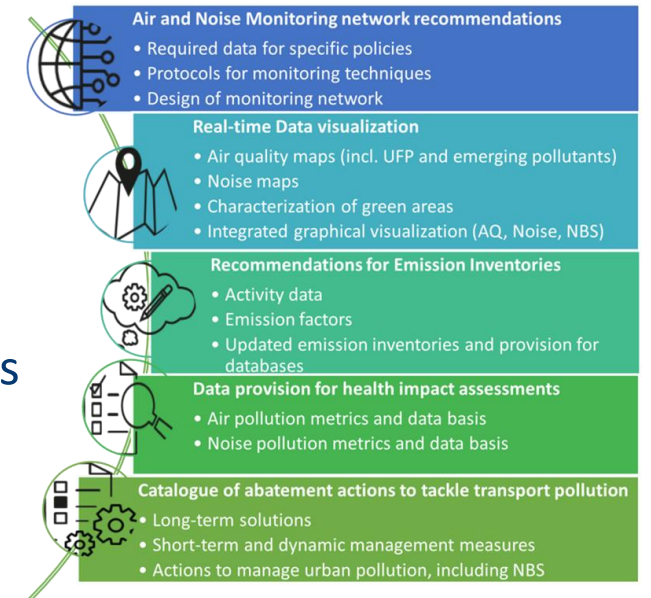


Monitoring vehicle emissions (Remote sensing and point sampling) In Antwerp, Berlin, Oslo, Warsaw (2026)



and more...
on-going work...

- Air Quality monitoring continued:
 - On-line monitoring of UFP (PNC, LDSA) on-going -> April '27 ... and beyond
 - Remote sensing and point sampling of vehicle emissions will start in May '26 (Antwerp, Warsaw, Berlin, Oslo)
 - Targeted campaigns: on-going
- Data processing and analysis:
 - Quality control of on-line data
 - Analysis of off-line data (one year): ammonia, canisters
 - Source apportionment (BC (λ), filter,...)
 - Combining AQ with traffic data, noise data and input for modelling
- Feedback to stakeholders (co-creation): report and stakeholder workshops
- Net4Cities Studio





Thank you!

Contact: martine.vanpoppel@vito.be

Net4Cities Webpage: <https://net4cities.eu/>

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