Milestone M28 (M4.12)
Pilot studies finished in 9 cities

RI-URBANS

Research Infrastructures Services Reinforcing Air Quality Monitoring Capacities in European Urban & Industrial AreaS (GA n. 101036245)

By

UHEL, UoB, NOA, CSIC, CNR, INOE, EMPA, FMI, KNMI, CNRS & PSI

25/10/2024

RI-URBANS (www.RIURBANS.eu) is supported by the European Commission under the Horizon 2020 – Research and Innovation Framework Programme, H2020-GD-2020, Grant Agreement number: 101036245

Milestone M28 (M4.12): Pilot studies finished in 9 cities

Authors: Tuukka Petäjä (UHEL), Katrianne Lehtipalo (UHEL), David Beddows (UoB), Eleni Liakakou (NOA), Andrés Alastuey (CSIC), Angela Marinoni (CNR), Jeni Vasilescu (INOE), Christoph Hueglin (EMPA), Hilkka Timonen (FMI), Arnoud Apituley (KNMI), Jean-Eudes Petit (CNRS), Kaspar Daellenbach (PSI) & Karine Sartelet (CNRS)

Work package (WP)	WP4 Pilot implementations for testing and demonstrating services
Milestone	M37 (M4.12)
Lead beneficiary	UHEL
Means of verification	Confirmation from pilot leaders and submission of milestone report
Estimated delivery deadline	M37 (31/10/2024)
Actual delivery deadline	25/10/2024
Version	Final
Reviewed by	WP4 leaders
Accepted by	RI-URBANS Project Coordination Team
Comments	This document summarises the RI-URBANS pilot activities and confirms their finalisation in 9 pilot cities. We give brief samples of each pilots, which will be elaborated in the Task specific summary reports in deliverables.

RI-URBANS (www.RIURBANS.eu) is supported by the European Commission under the Horizon 2020 – Research and Innovation Framework Programme, H2020-GD-2020, Grant Agreement number: 101036245

Table of Contents

RI-URBANS (www.RIURBANS.eu) is supported by the European Commission under the Horizon 2020 – Research and Innovation Framework Programme, H2020-GD-2020, Grant Agreement number: 101036245

1. About this document

This document summarises the RI-URBANS pilot activities and confirms their finalisation in 9 pilot cities. We give brief examples of each pilots, which will be elaborated in the Task specific summary reports in deliverables as follows:

- Task 4.1: D24 (D4.3) Summary: Source apportionment pilots, sustainability and associated benefits.
- Task 4.2: D26 (D4.5) Summary: Nanoparticle aerosol pilots, sustainability, associated benefits for AQMNs and AQ policy.
- Task 4.3: D28 (D4.7) Summary: Mapping procedures, sustainability and applicability for upscaling.
- Task 4.4: D29 (D4.8) Summary: health effects of novel AQ metrics, source contributions: epidemiology.
- Task 4.4: D30 (D4.9) Summary: OP of PM, PM components and PM source contributions.
- Task 4.4: D31 (D4.10) Summary: novel health effect indicator pilots, sustainability, associated benefits.
- Task 4.5: D33 (D4.12) Summary of AQ hotspot pilots, sustainability and associated benefits.

The final synthesis of the WP4 is provided in D34 (D4.13) Synthesis of RI-URBANS pilot actions, sustainability and importance on upscaling.

This is a public document, available in the RI-URBANS website (https://riurbans.eu/work-package-4/#milestones-wp4). The document will be distributed to all RI-URBANS partners for their use and submitted to the European Commission as an RI-URBANS milestone M28 (M4.12).

2. RI-URBANS pilots

WP4 tests and demonstrates solutions and tools for advanced urban Air Quality monitoring systems and provides novel data regarding aerosol sources, aerosol number concentrations and size distributions, develops air quality mapping and explores the connections between the novel air quality parameters and health indicators in the selected pilot cities. The work includes analysis of air quality parameters around emission hotspots as well. According to the Description of Work, the pilots were classified into 5 pilot actions (Table 1), where originally a total of 9 different cities participated in the demonstration activities. The pilot cities were Athens (ATH), Barcelona (BCN), Birmingham (BIRM), Bucharest (BUC), Helsinki (HEL), Milano-Bologna (MIL), Paris (PAR), Rotterdam-Amsterdam (ROT) and Zurich (ZUR). The aim was to include at least 3 cities in each pilot action.

During the project, few of the pilot actions expanded into follower cities providing additional confirmation of pilot concepts. See Table 1 for updated contributions.

RI-URBANS (www.RIURBANS.eu) is supported by the European Commission under the Horizon 2020 – Research and Innovation Framework Programme, H2020-GD-2020, Grant Agreement number: 101036245

Table 1. *RI-URBANS pilots and participating cities. X indicates planned pilot contribution and F indicates a follower-activity.*

Pilot - Task City	ATH	BCN	BIRM	BUC	HEL	MIL	PAR	ROT	ZUR
P1 - T4.1 - NRT aerosols	X	F		F	X	X	X		X
P2 - T4.2 - NRT nanoparticles		X	X		X + F				F
P3 - T4.3 - Urban fine scale mapping	X		X	X	F		X	X	
P4 - T4.4 - Novel health indicators	X	X					F		X
P5 - T4.5 - Pollution hotspots				X	F	X		X	

2.1 Near-real time aerosol source apportionment of carbonaceous aerosols

Pilot activity regarding near-real time provision of aerosol source apportionment in WP 4 has been concluded. Description of pilots and confirmation of the end / continuation are described below for each of the pilot cities separately.

ATH: In Athens, near-real time (NRT) data transfer for the AE33 aethalometer and the ToF-ACSM (Time of Flight Aerosol Chemical Speciation Monitor) was established at Demokritos urban background station (DEM-Athens). The data acquisition software developed by the IFT Institute in Leipzig is continuously used for the AE33. AE33 data are formatted as EBAS hourly level0 files and are submitted to the Lille University database in France and NILU database in Norway. The Autolycos software was installed at the ToF-ACSM in January 2023, and was running until May 2024, except for a period between May and August 2023, when the instrument was out of operation. NRT source apportionment (SA) of carbonaceous aerosols was established and running during the whole 2023. In addition, monthly organic PMF source apportionment (SA) was taking place manually for comparison purposes with the NRT SA. Furthermore, in Athens, NRT measurements were also conducted by means of a Q-ACSM (Quadrupole-ACSM) and an AE33 at the urban background Thissio Air Quality Monitoring Supersite in the centre of Athens city, on behalf of NOA since 01/2023. Manual source apportionment was held for both Q-ACSM and AE33 data and compared with the real time results on a monthly basis until 07/2023 as after that the Q-ACSM was out of order.

BCN: Barcelona is a follower city in this Task. NRT data transfer for the AE33 and Q-ACSM was established at Barcelona supersite (Palau Reial, BCN) in January 2023. For AE33, the data acquisition software developed by the IFT Institute in Leipzig was used. The real time exportation and source apportionment software tools were installed for the Q-ACSM in January 2023 and have been running with a few interruptions due to instrument malfunctioning. NRT source apportionment (SA) of carbonaceous aerosols has been performed throughout 2023 complemented with a monthly-based intercomparison with manual PMF. Moreover, rolling PMF has been conducted for ACSM data for the entire pilot year. Currently, after the pilot phase, the NRT data exportation and source apportionment is still ongoing.

BUC: Bucharest is a follower city in this Task. In Bucharest, we contributed to the NRT aerosol source apportionment of carbonaceous aerosols as a follower city. ACSM and AE33 data from the RADO-Bucharest ACTRIS site were delivered NRT to several servers and databases (InfluxDB, Nextcloud, EBAS) since 2022. The NRT-SA for AE33 and ACSM data was centralised during the pilot year, 2023. Manual speciation has been conducted on a monthly basis for the data collected during the pilot phase, as well as comparison with NRT-SA results. Moreover, rolling PMF has been conducted for the entire pilot year. BUC continues to submit NRT data after the pilot period in RI-URBANS.

RI-URBANS (www.RIURBANS.eu) is supported by the European Commission under the Horizon 2020 – Research and Innovation Framework Programme, H2020-GD-2020, Grant Agreement number: 101036245

HEL: In Helsinki the ACSM and AE33 measurements were conducted in the Mäkelänkatu Supersite, situated in the traffic environment. The data was automatically submitted to a centralised server using tools provided by the project. Manual PMF was conducted on a monthly basis during the pilot phase and seasonal as well as rolling PMF were conducted after the pilot year for the ACSM dataset. The NRT-SA and monthly offline PMF results were compared during the pilot year in order to refine the NRT-SA process.

MIL: In Milano a full year campaign has been conducted, since January 19th 2023 till March 21st 2024, with Aethalometer AE-33 and ToF-ACSM. We also contributed to the NRT aerosol source apportionment of carbonaceous aerosols as a follower city. The NRT-SA for AE33 and ACSM data was centralised during the pilot year, 2023. Additional measurements were performed at the same time: VOCs, with a VOCUS-PTR-MS, particle number size distribution (PNSD, NAIS + SMPS), NOx, greenhouse cases (CO_2, CH_4, H_2O, with a Picarro). All the data are formatted as EBAS hourly level2 files and are submitted to NILU Homeless data portal database in Norway. NRT source apportionment (SA) of carbonaceous aerosols was established and running during the whole 2023. In addition, the monthly organic PMF SA was taking place manually and compared with the NRT-SA.

The same instrumental setup (AE-33 and Q-ACSM) was run in Bologna (January 1st - December 31 2023) and is still ongoing. Bologna, located in the eastern more agricultural part of the region participated in the pilot as the second city of the Po Valley. NRT data were regularly submitted for both cities.

PAR: ACSM and AE33 measurements were performed in Paris at three different sites representative of different pollution background conditions: Paris-Chatelet (urban), Paris-BPEst (traffic) and SIRTA (suburban). Tools necessary for data transfer to the centralised server were installed in 2022 and have continuously run throughout the pilot year 2023. Manual monthly PMF have been performed at all sites during the pilot year in order to evaluate the consistency of NRT outputs. In addition, manual rolling PMF has been carried out.

ZUR: NRT data transfer for aerosol absorption (AE33) was established in spring 2023 at the urban background supersite Zurich-Kaserne using the software tools provided by the project. Offline source apportionment is carried out at regular intervals, implementation of NRT-SA of AE33 data is pending. The measurements and NRT data transfer will be continued beyond the pilot phase of RI-URBANS. A Q-ACSM was operated in parallel at the Zurich-Kaserne station from July 2022 to July 2023. Starting in January 2023, the NRT-data were exported using the dedicated tool developed by the ACMCC during the pilot year. NRT-Source apportionment was performed until February, after which it was stopped due to instrument/software failures. Additionally, manual PMF on a monthly basis as well as Rolling PMF on organic aerosol were conducted for comparison throughout the pilot phase.

2.2 Near-real time provision of nanoparticle-PNSD data

Pilot activity regarding near-real time provision of PNSD data in WP4 has been concluded. However, as the data pipeline has been established from the observation sites and the ACTRIS Data Centre, all data providers continue to submit NRT data as part of their normal operations. Each pilot city action is summarised shortly below.

BCN: Barcelona supersite (Palau Reial, BCN) contributing to the NRT data delivery of PNSD is a reference for AQ management authorities and AQ research in Spain. This urban background site is located within the grounds of the Institute of Environmental Assessment (IDAEA), in the NW of Barcelona near Diagonal Avenue, one of the city's main roads. It is operated by CSIC in collaboration with the Catalan Government (GENCAT). BCN supersite continues to submit NRT size distribution data after the pilot period in RI-URBANS.

BIRM: The Birmingham Air Quality Site (BAQS) is an urban background site which is one of three the Natural Environment Research Council (NERC) funded supersites in the UK, the other two being at Manchester Piccadilly and London Honor Oak Park sports ground. The Birmingham facility is located within a self-contained cabin within a small green space within the grounds of the University of Birmingham (UoB) which itself is surrounded by green

RI-URBANS (www.RIURBANS.eu) is supported by the European Commission under the Horizon 2020 – Research and Innovation Framework Programme, H2020-GD-2020, Grant Agreement number: 101036245

space residential and campus facilities, located circa 4 km SW of the busy city centre. As an outworking of Task 4.2, BIRM expects to continue to collect NRT PNSD measurements beyond the RI-URBANS Pilot period.

HEL: In Helsinki we conduct PNSD measurements at two observation sites. Both are located ca. 4 km from the Helsinki city centre. Mäkelänkatu site is an urban traffic site operated by the Helsinki Regional Air Quality Authority (HSY), while SMEAR-III is an urban background site operated jointly by the University of Helsinki (UHEL) and the Finnish Meteorological Institute (FMI). Here the SMEAR III is considered as the primary pilot while the Mäkelänkatu observation site is a follower. Both SMEAR III and Mäkelänkatu site continue to submit NRT size distribution data beyond the pilot period in RI-URBANS.

ZUR: Zurich is a follower city in this Task. PNSD measurements are conducted at the urban background site Zurich-Kaserne. A measurement system that fully complies with ACTRIS requirements has been in operation since May 2023. NRT data submission to the ACTRIS Data Centre is in progress but has not yet been completed. The PSND measurements in ZUR and transmission of NRT data are embedded in the regulatory air quality monitoring network NABEL and will be continued beyond the pilot period of RI-URBANS.

2.3 Urban fine scale mapping including innovative modelling, monitoring, and crowdsourcing

Pilot activity regarding urban fine scale mapping with innovative modelling, monitoring, and crowdsourcing WP4 has been concluded. Description of pilots and confirmation of the end / continuation are described below for each of the pilot cities separately.

ATH. Regional-scale modelling was performed for number concentrations (Aktypis et al. 2023, 2024), and multi-scale modelling down to the street scale was performed (Myriokefalitakis et al. 2024) and compared to measurements for $PM_{2.5}$ and NO_2, using deterministic modelling (regional chemistry transport model coupled to Gaussian model).

BIRM. In Birmingham, two mixed fixed site/mobile campaigns were carried out. This used a combination of 5 fixed measuring spots (with the involvement of citizens of the local community) and data collected using mobile (either walking or cycling) setups. The data collected were used for:

- Air quality assessment at street level and high spatial density.
- Prediction of air quality conditions when data is not available using machine learning techniques.
- Variation of the sources of air pollution affecting different parts of the study area, using the mobile measurements.

Furthermore, the high spatial resolution numerical model (10x10m) has been extended to include ultrafine particles (UFP), in addition to PM2.5, PM10 and NO_2. Traffic reduction modelling scenarios have been conducted to investigate air quality changes due to traffic reductions. This allowed initial assessment of the variability of air pollution in the Birmingham area (Zhong et al. 2023, 2024).

BUC: In Bucharest, the work included data analysis of the mobile campaigns, highlighting variability in air pollutant concentrations and their spatial features between the warm and cold conditions. Two mobile campaigns were conducted in summer 2022 and winter 2023 using UFP, PMx and gaseous sensors. Mobile data for 100KM route were implemented in the ESCAPE Land Use Regression models together with PyLUR tool and QGIS to illustrate the variability of air pollutant concentrations within the city. The model outputs were compared with measurements from fixed stations. Computed maps highlighted PM and gaseous spatial features between the warm and cold conditions in BUC. The outcome of the model implementation in BUC and concentration maps assessments is submitted for publication in a peer-reviewed journal (Talianu et al.,2024).

RI-URBANS (www.RIURBANS.eu) is supported by the European Commission under the Horizon 2020 – Research and Innovation Framework Programme, H2020-GD-2020, Grant Agreement number: 101036245

HEL: Helsinki is a follower city in this Task. In joint activities of UHEL, FMI and Helsinki Regional Air Quality Authority (HSY), we performed a mapping action in the Kumpula Science Campus with a network of small Black Carbon sensors during summer 2022. The results lead into a Bachelor thesis of Tapio Elomaa and the synthesis is reported in a peer-reviewed paper by Elomaa et al. (2024). Further mapping activities were performed in summer 2024 with Condensation Particle Counters, Black Carbon sensors and cost-effective air quality sensors onboard a bicycle. We explored the variability of concentrations within Helsinki and linked the mobile measurements to high quality air quality monitoring data by including SMEAR III and Mäkelänkatu supersites in the bike routes.

PAR: Two experimental campaigns were carried out during the summer 2022 using fixed measurements at different station types, such as background and traffic sites, aiming to characterise the PM composition, as well as eBC and UFP (Maison et al. 2024, Park et al. 2024, DiAntonio et al. 2024). Measurements of PNSD from a previous measurement campaign (MEGAPOLI, 2009) were also used to evaluate the modelling of the number concentrations (Sartelet et al. 2022). Measurements from the campaigns were used to evaluate the multi-scale modelling down to the street scale. The simulated concentrations of equivalent black carbon (eBC), number concentration of UFP, PM2.5 and NO_2 compare well to measurements (Maison et al. 2024, Park et al. 2024). Better model/measurement comparison statistics are obtained using bottom-up inventory with correction of the traffic flow with traffic counts than with the top-down inventory (Park et al. 2024). Multi-scale modelling down to the street scale is performed for all pollutants with advanced chemical schemes to represent secondary organic aerosol concentrations (Sartelet et al. 2024).

ROT: Mobile monitoring campaigns have been designed and implemented with the UU’s Airview car in November - December 2022 (six weeks of driving, nearly every day). UFP, eBC and NO_2 at many streets, including downtown, neighbourhoods and industrial-influenced areas and the large harbour. Measurements were completed in December 2022 and January 2023 with help from UU subcontractor DCMR. Besides the car measurements, mobile eBC measurements were collected with 38 In BIRM: PM10, PM2.5, PM1 and UFP were measured using both walking and bicycling as a means of mobility. In BUC: Several summer and winter campaigns were carried out using mobile measurements without citizens’ involvement. UFP, PMx and gaseous pollutants were measured. In May 2023 a second campaign on the same streets was carried out. We further designed and implemented a mobile monitoring campaign with cyclists. In practice we recruited employees of the ROT metro area based DCMR and the municipality to make urban air quality monitoring and mapping while biking in the region. Data from previous campaigns were processed to do descriptive mapping of urban air quality within the Rotterdam area. In May - July 2023 also a second car-based mobile monitoring campaign was conducted. The data from this and the winter 2022 campaign were analysed, linked with GIS predictor data. Empirical models were developed and by linking with wind direction data, the impact of area sources (port, heavy industry, airport) was analysed.

In each pilot city, concentrations were mapped, with methodologies based on either mobile measurements or deterministic modelling. To characterise the air pollution variability in the pilot cities, concentrations were mapped in each city for a winter and a summer period, and the concentration differences between these two periods were compared. Furthermore, the variability of concentrations for each pilot city was quantified using the normalised standard deviation (NSD). The NSD gives information about the variability of the local-scale concentrations. The work in Task 4.3 continues towards a summary of results of the different pilot cities.

RI-URBANS (www.RIURBANS.eu) is supported by the European Commission under the Horizon 2020 – Research and Innovation Framework Programme, H2020-GD-2020, Grant Agreement number: 101036245

2.4 Novel health indicators of nanoparticles and PM components and source contributions

Pilot activity regarding novel health indicators of nanoparticles and PM components and source contributions in WP 4 has been concluded. Description of pilots and confirmation of the end / continuation are described below for each of the pilot cities separately.

ATH: The Thissio Air Quality Monitoring Supersite is located on the top of the hill of Nymphs at the National Observatory of Athens around 50m above the mean city level. It is an urban background station close to the city centre which receives aerosols both from urban and regional sources. Surrounding the area is a pedestrian zone, while there is no major road within a 500m radius.

BCN: The Barcelona Palau Reial urban background monitoring site is located within the grounds of the IDAEA - CSIC in northwest Barcelona, 200 m from one of the main traffic avenues of the city (Diagonal Avenue, traffic density of 90 000 vehicles per working day). The main source of atmospheric PM is road traffic, although contributions from industry, regional secondary atmospheric pollutants, construction, and shipping are also relevant.

PAR: Paris is a follower city in this Task. In addition to the planned pilots, the study was extended to Paris (PAR). The Paris Les Halles urban background station, located in the centre of Paris, was selected. The station is in a public park (Jardins des Halles) adjacent to the infrastructure of the local public transportation network Châtelet Les Halles. The surrounding area is a typical urban neighbourhood with residential and commercial activities.

ZUR: The Zurich Kaserne urban background monitoring site is in a courtyard park in the centre of Zurich part of the Swiss National Monitoring Network (NABEL). The surrounding area is dominated by residential buildings and small businesses. While the station is not directly affected by major roads, local traffic is present. The station receives aerosols both from regional and local/urban sources.

New and available long-time series of PNSD of UFP, PM offline and online speciation and eBC, were collected at the pilot sites to develop and test improved evaluation of health effects in epidemiologic time series studies. New 24h filter samples were collected at **ATH**, **BCN** and **PAR** during the 1yr period in 2022-2023. For **ZUR**, samples already collected in 2018-2019 were used. Filter samples from the 4 sites were chemically analysed following the same methodology. Source apportionment for PM as well as for selected subcomponents (e.g. novel air quality metric eBC) was performed.

Oxidative Potential (OP) was measured over the course of 1 year for each location. The new time series of pollutants (UFP and PM sources) were used to evaluate the drivers of PM's OP. Results will be presented in D30 (D4.9).

Mortality and hospital admission datasets for these cities with time series of UFP, PM components and OP, have been collected. Epidemiological evaluation of the selected novel metric and their source contributions is ongoing and will be presented in D29 (D4.8).

2.5 Pollution hotspots

Pilot activity regarding pollution hotspots in WP 4 has been concluded. Description of pilots and confirmation of the end / continuation are described below for each of the pilot cities separately.

BUC: In Bucharest, we contributed to pollution hot-spot activities and set up a temporary observational site (June to November 2022) for in-situ and remote sensing observations in a highly polluted area near the CET Vest power plant. Additionally, the permanent reference site, RADO-Bucharest, located about 10 km southwest of the study area performed measurements of aerosol and clouds, gas remote sensing and solar radiation. Moreover, in winter 2023, the campaign focused on near-surface measurements using mobile measurements in a dense residential area close to the hotspot. Assessment of aerosol properties particularities at the temporary site in the city centre and ACTRIS permanent site had been conducted, showing higher exposure to fine particles of the temporary site in BUC

RI-URBANS (www.RIURBANS.eu) is supported by the European Commission under the Horizon 2020 – Research and Innovation Framework Programme, H2020-GD-2020, Grant Agreement number: 101036245

during cold periods. Campaign data analysis highlighting power plant influence on residential area air quality is submitted for publication in a peer-reviewed journal ("How does the location of power plants impact air quality in the urban area of Bucharest?").

HEL: Helsinki was a follower city in this Task. In Helsinki, we contributed to pollution hot-spot activities with joint effort by UHEL, FMI and HSY. The actions included two measurement campaigns in the vicinity of road traffic, where we explored spatial-temporal variability of novel air pollutant concentrations and gradients. The campaign for the winter period is submitted for publication (Teinilä et al. 2024) whereas the measurements near Turunväylä highway are being analysed now. This campaign included gradient measurements with variable distances from the highway with and without a noise barrier. The results are being compared against large eddy simulations (Koohandaz et al. 2024, in preparation).

MIL: Milano was a follower city in this Task. In Milano, we contributed to pollution hot-spot activities with a mobile station from CNR-ISAC, installed for this purpose in the vicinity of Milano Linate, that can be considered a large emissions source, including both a medium-sized airport and a crossroad of heavy traffic roads, such as Viale Forlanini and the near ring road. The exposure estimates in the Linate hotspot have been studied by using targeted fixed-sites measurements and mobile measurements, possibly to be coupled with modelling, of several reference pollutants. The pollutants addressed are the number concentration and size distribution of UFP, particles' optical properties, mass concentrations of PM2.5, PM10, eBC, and NOx. The concentrations measured in Linate and the concentrations variability are compared with the urban background site of Milano Pascal. Moreover, an exercise of Urban Air Quality mapping has been performed by using opportunistic measurements with volunteer citizens/workers. Four field campaigns (one per season) were carried out by mapping eBC on a surface of 25 square km, from the centre to the suburbs.

ROT: In the Rotterdam metropolitan area, the harbour as well as the inland rural area, intensive observations were made in September 2022. These observations were used to map fine scale concentrations around hot spots (industrial, harbour, traffic, airport), as well as vertical profiling observations of aerosols and wind in the outskirts of the city (Slufter), the harbour area (Geulhaven), two locations within the city centre (DCMR and downtown), the regional airport (Rotterdam-The Hague Airport) and at the Cabauw Atmospheric Research Station in the rural area that is generally downwind of the city. Mobile observations were used throughout the metropolitan area. Additionally, experimental airborne remote sensing mapping NO_2 concentrations over the urban area and the harbour were deployed on several flights to learn the applicability for the study of air pollution hot spots. For public outreach a citizen science bike route was used for mapping the concentrations of NO_2 and eBC close to road and waterway traffic arteries and away from the main routes. Additional data, but less intensive, was collected in May-June 2024, covering different seasonal and meteorological conditions. The observations are used to test and improve the regional and the Eddy resolving models.

3. Summary

As indicated in the sections above, all pilots in RI-URBANS are concluded. The summaries of the individual pilots will be reported in task-specific summary deliverables.

RI-URBANS (www.RIURBANS.eu) is supported by the European Commission under the Horizon 2020 – Research and Innovation Framework Programme, H2020-GD-2020, Grant Agreement number: 101036245

4. References

Aktypis A., Kaltsonoudis C., Skyllakou K., Matrali A., Vasilakopoulou C.N., Florou K., Pandis S.N. (2023): Infrequent new particle formation in a coastal Mediterranean city during the summer, Atmos. Environ., 302, 119732. https://doi.org/10.1016/j.atmosenv.2023.119732

Aktypis, A., Kaltsonoudis, C., Patoulias, D., Kalkavouras, P., Matrali, A., Vasilakopoulou, C. N., Kostenidou, E., Florou, K., Kalivitis, N., Bougiatioti, A., Eleftheriadis, K., Vratolis, S., Gini, M. I., Kouras, A., Samara, C., Lazaridis, M., Chatoutsidou, S.-E., Mihalopoulos, N., and Pandis, S. N. (2024): Significant spatial gradients in new particle formation frequency in Greece during summer, Atmos. Chem. Phys., 24, 65–84, https://doi.org/10.5194/acp-24-65-2024

Di Antonio, L., Beekmann, M., Siour, G., Michoud, V., Cantrell, C., Bauville, A., Bergé, A., Cazaunau, M., Chevaillier, S., Cirtog, M., de Brito, J. F., Formenti, P., Gaimoz, C., Garret, O., Gratien, A., Gros, V., Haeffelin, M., Hawkins, L. N., Kotthaus, S., Noyalet, G., Pereira, D., Petit, J.-E., Pronovost, E. D., Riffault, V., Yu, C., Foret, G., Doussin, J.-F., and Di Biagio, C.: Modelling of atmospheric variability of gas and aerosols during the ACROSS campaign 2022 in the greater Paris area: evaluation of the meteorology, dynamics and chemistry, EGUsphere [preprint], https://doi.org/10.5194/egusphere-2024-2175

Elomaa, T., Luoma, K., Harni, S., Virkkula, A., Timonen, H., and Petäjä, T. (2024) Applicability of small-scale black carbon sensors to explore high resolution spatial variability of ambient black carbon, Aerosol Research Discuss. [preprint], https://doi.org/10.5194/ar-2024-12.

Koohandaz et al. (2024) Whether noise barriers can provide a better air quality or not (in preparation).

Maison A, Lugon L, Park S-J, Boissard C, Faucheux A, Gros V, Kalalian C, Kim Y, Leymarie J, Petit J-E, Roustan Y, Sanchez O, Squarcioni A, Valari M, Viatte C, Vigneron J, Tuzet A, Sartelet K. (2024): Contrasting effects of urban trees on air quality: from the aerodynamic effects in streets to impacts of biogenic emissions in cities. Sci. Tot. Environ., 946, 174116. https://doi.org/10.1016/j.scitotenv.2024.174116

Myriokefalitakis, S., Karl, M., Weiss, K. A., Karagiannis, D., Athanasopoulou, E., Kakouri, A., Bougiatioti, A., Liakakou, E., Stavroulas, I., Papangelis, G., Grivas, G., Paraskevopoulou, D., Speyer, O., Mihalopoulos, N., and Gerasopoulos, E.: Analysis of secondary inorganic aerosols over the greater Athens area using the EPISODE–CityChem source dispersion and photochemistry model, Atmos. Chem. Phys., 24, 7815–7835, https://doi.org/10.5194/acp-24-7815-2024

Park S.-J., Lugon L, Jacquot O, Kim Y, Baudic A, D'Anna B, Di Antonio L, Di Biagio C, Dugay F, Favez O, Ghersi V, Gratien A, Kammer J, Petit J-E, Riva M, Sanchez O, Valari M, Vigneron J, and Sartelet K. (2024): Population exposure to outdoor NO_2, black carbon, particle mass, and number concentrations over Paris with multi-scale modelling down to the street scale, submitted to Atmos. Chem. Phys., EGUsphere [preprint], https://doi.org/10.5194/egusphere-2024-2120.

Sartelet, K., Kim, Y., Couvidat, F., Merkel, M., Petäjä, T., Sciare, J., and Wiedensohler, A. (2022): Influence of emission size distribution and nucleation on number concentrations over Greater Paris, Atmos. Chem. Phys., 22, 8579–8596, https://doi.org/10.5194/acp-22-8579-2022.

Sartelet K, Wang Z, Lannuque V, Iyer S, Couvidat F and Sarica T (2024): Modelling molecular composition of SOA from toluene photo-oxidation at urban and street scales. Environ. Sci. Atmos., 2024, Advance, https://doi.org/10.1039/D4EA00049H

RI-URBANS (www.RIURBANS.eu) is supported by the European Commission under the Horizon 2020 – Research and Innovation Framework Programme, H2020-GD-2020, Grant Agreement number: 101036245

Talianu C., Vasilescu J., Nicolae D., Ilie A., Dandocsi A., Nemuc A., and Belegante L. (2024): High-resolution air quality maps for Bucharest using Mixed-Effects Modeling Framework, egusphere-2024-2930.

Teinilä, K., Saarikoski, S., Lintusaari, H., Lepistö, T., Marjanen, P., Aurela, M., Hellén, H., Tykkä, T., Lampimäki, M., Lampilahti, J., Barreira, L., Mäkelä, T., Kangas, L., Hatakka, J., Harni, S., Kuula, J., Niemi, J.V., Portin, H., Yli-Ojanperä, J., Niemelä, V., Jäppi, M., Lehtipalo, K., Vanhanen, J., Pirjola, L., Manninen, H.E., Petäjä, T., Rönkkö, T. and Timonen, H. (2024) Wintertime aerosol characterization at an urban traffic site in Helsinki, Finland (submitted).

Zhong, J., Harrison, R. H., Bloss, W. J., Visschedijk, A. and Gon H. D. V. (2023): Modelling the dispersion of particle number concentrations in the West Midlands, UK using the ADMS-Urban model. Environ. Int., 181, 108273. https://doi.org/10.1016/j.envint.2023.108273.

Zhong, J., Stocker, J., Cai, X., Harrison, R. H., & Bloss, W. J., (2024): Street-scale air quality modelling over the West Midlands, United Kingdom: Effect of idealised traffic reduction scenarios. Urban Climate, 55, 101961. https://doi.org/10.1016/j.uclim.2024.101961.

RI-URBANS (www.RIURBANS.eu) is supported by the European Commission under the Horizon 2020 – Research and Innovation Framework Programme, H2020-GD-2020, Grant Agreement number: 101036245