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Tasks description of WP4

T4.1. Near-real time aerosol source apportionment of carbonaceous aerosols.

This task will employ the source apportionment tool (from T1.2) for the ACSM (organics, sulphate, nitrate, ammonium and chloride) and multiwavelength aethalometer (BC) data. Expected outputs: tracers and contributions of primary sources such as traffic, wood burning, and cooking (depending on measurement site); quantification of the SOA fraction; automatic transfer of data (organic aerosols matrices and aethalometer BC concentrations) to ACTRIS DC. These will be reported on a monthly basis by the pilot cities (D4.1) to allow uniform view on the sources of aerosol particles across European urban environments. In addition to online source apportionment, each city will perform it also manually for QC purposes (D4.2). The pilots will be performed at supersites in Helsinki, Paris (ACTRIS-SIRTA, Les Halles AirParif and BPEst AirParif), Athens (Agia Paraskevi and Thissio), Zurich (Zurich-Kaserne), Milan and Bologna (Po Valley Basin). D4.3 is a synthesis of the results and benefits the NRT source apportionment for the AQMN networks in Europe.

T4.2. Near-real time provision of nanoparticle-PNSD data.

This task provides PNSD from the urban supersites and ensures their compliance with PNSD ACTRIS requirements to foster harmonisation. The instrument setups will be checked with regards to their performance, sampling protocols, best practices, sample drying, instrument maintenance, size classification and standard operating procedures based on the operational ACTRIS standardised NRT data provision tool for sub-micron PNSD developed in Copernicus project CAMS-21a. We apply this ST to the existing urban PNSD systems from different cities in Europe, harmonizing measurements and providing NRT-data (D4.4) to the end-users enabling contrasting data analysis between city environments and background sites. The NRT-PNSD-STs tool will be deployed at the Barcelona and Birmingham urban background supersites and Helsinki road-side supersite. The sites are a showcase for the AQMNs for the benefits of nanoparticle measurements (D4.5) and can be included as part of ACTRIS network depending on national support.

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T4.3. Urban fine scale mapping including innovative modelling, monitoring, and crowdsourcing.

This task will take advantage of developed STs (from WP1-3) for the European urban areas to describe the variability of outdoor exposure of nanoparticles and other pollutants using modelling tools, mobile measurements of nanoparticles, BC and PM mid-cost sensors, novel dispersion measurements, and the participation of networks of citizens and new innovative instruments by SMEs (D4.6). To reproduce high pollutant concentrations in the streets, hourly maps are required for summer and winter at spatial scales <100 m (D4.7). In Rotterdam, mobile monitoring for streets will be performed using a car combined with measurements by cyclists or pedestrians with portable instruments for nanoparticles and BC. A key input is vertical gradients using remote sensing, building on regional background measurements. In Bucharest, in-situ mobile measurements of nanoparticles, BC, PM2.5 and gaseous compounds (NO2, SO2, O3) will be performed. Seasonal campaigns will be organized to measure around the ring road, and main traffic roads inside the city. In Birmingham, an ADMS numerical model will be developed in which street-scale dispersion will give an ultimate resolution of 10x10 m, validated using data from a dense local sensor network supplemented with citizen monitoring for PM2.5, BC, NO2 and nanoparticles. In Paris, mapping will be provided using two modelling approaches; ADMS with data assimilation for NO2, PM10, BC, and multi-scale modelling with the street model MUNICH for NO2, PM2.5, PM10, nanoparticles, BC, inorganic and organic aerosols. The potential of vertical gradients to improve AQ mapping will be estimated. The approaches for fine scale mapping will be evaluated for their potential for upscaling and sustainable implementation in cities (D4.7).

T4.4. Novel health indicators of nanoparticles and PM components and source contributions.

We aim at validating measurement techniques and approaches to assess health effects by complementing existing AQ policies with measures directly targeting novel AQ metrics and health-relevant emission sources. The work relies on the source apportionment (WP1), health and AQ analyses (WP2) and modelling (WP3) STs. Different temporal resolutions will be used for all health indicators, from hours to daily averages. First, we will perform an epidemiological evaluation of the health effects of the novel AQ metrics (D4.8). We take advantage of available long time series of PNSD of nanoparticles, PM offline and online speciation and BC to evaluate their health short-term effects and compare these against the source contributions for both nanoparticles and PM. Second, we will evaluate the OP of PM components and source contributions (D4.9) from novel pilot city data in order to evaluate long-term variations. Chemical analyses will be available offline and online to compare OP with PM components. This pilot will use guidance of T4.2 for PNSD measurements. The wide spatial coverage (Athens, Barcelona, Zurich) will help assess the impact of PM, OP, and nanoparticles sources that are abundant only in some regions in Europe. The long-term assessments will be complemented with real-time assessment of temporally sparse sources and

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aging of fresh emissions on PM's OP. The final product is a summary of novel health indicators, their sustainability and benefits for the AQMNs and AQ policies (D4.10).

T4.5. Pollution hotspots.

This task focuses on quantifying emission sources and concentrations in and near urban areas with intense traffic and/or industrial activities, and to identify the contribution of these hot spots to air pollutant exposure. With WP1 data, this task will assess the regional background with novel observations within and near the hot spot areas. The data will be linked through regional and high-resolution modelling (WP3). Initial results from the pollution hotspots are depicted in D4.11. In Rotterdam, mobile monitoring will be done using a car measuring nanoparticles, BC, NO2, PM2.5 and CO2, in addition to a network of stationary citizen NO2 and PM2.5 sensor measurements. The work includes participation of SMEs with innovative instrumentations. Remote sensing techniques will be applied and the IAGOS aircraft measurements (Schiphol airport) will provide an important input. Models and observations will be compared to demonstrate the ability for upscaling in other cities. In Milan, an urban pollution map will be created with special attention to heavy traffic roads, while in Bologna focus will be on the airport (<4 km away). Mapping will be carried out with mobile sensors for gases, PM and BC. A comparison of measurements with urban scale LUR and DALES models and microscale chemical transport models will be made. Bucharest will set up an observation site in a highly polluted area around power plants, using in-situ and remote sensing observations near the pollution source and at the background reference site to quantify nanoparticles, PM2.5 and reactive trace gases (NO2, SO2, O3). Measurements will also include mini-DOAS, ceilometer and a scanning LIDAR. A summary of the pilot activities will be provided addressing their sustainability and local/regional benefits for the AQMNs (D4.12).

T4.6. Synthesis of the pilot studies (M24-M44).

This task will deliver an integration of WP4 results to support the roadmap for interoperable services concerning AQ enhanced observations modelling, health effects, urban mapping of nanoparticles, hotspots, participation of SMEs and other relevant issues. We will perform a strategic analysis to link AQMNs and European RIs (ACTRIS, ICOS, IAGOS) as well as nationally operated urban AQ supersites. We will provide a coherent summary of the piloted actions and their benefits to the local AQMNs (D4.13), which will support the roadmap for STs upscaling in WP5.

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