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Tasks description of WP3

T3.1. Characterization of urban dispersion using advanced observations-based methodologies and modelling.

This task will lead to a methodology to improve urban aerosol particle emissions (D3.1) combining in-situ measurements and novel modelling tools (Large-Eddy Simulation LES, data assimilation, bottom-up emission models, AQ and dispersion modelling). The task links to ICOS methods. Eddy covariance measurements of aerosol fluxes from the urban surface to the atmosphere (from T1.3) and high-resolution modelling will be combined to quantify the spatial and temporal dynamics of urban emission fluxes and thus improve the emission data products using PALM LES and SILAM models. The technique will be developed in Helsinki and tested in Paris. The street-network model MUNICH, evaluated against PALM, will be used to simulate the dispersion processes between the urban surface and ABL and upscale to city level. Long-term (T1.1), NRT (T4.2) and SA (T1.2) results of aerosol particle measurements will be used to constrain emission estimates at the road-link level and improve their spatial characterization over an entire pilot city (Barcelona) using the bottom-up HERMESv3 emission model and observations, machine learning, and data assimilation techniques. HERMESv3 will also be used to feed the consistency between bottom-up and top-down methodologies over cities conducted in T3.2, in relation with the Guidance for upscaling (T5.5). A system now used in CAMS84 for the comparison between model and CAMS21b and IAGOS vertical observations over regional areas, will be extended to urban environments on the new data streams (from T1.3) and will also create a link with satellite observations in city environments. The joint analysis of background and urban areas will allow LRT apportionment in T3.3. The developments are instrumental to the service proposed in T5.3.

T3.2. Enhancing quality and completeness of emissions inventories.

This task will identify gaps in emissions and provide sectoral information for a variety of gas and particulate pollutants at spatio-temporal scales relevant to urban areas, using better integration with observations (from WP1, ACTRIS, IAGOS, and ESA-Copernicus space-borne observations). Novel inventories for focus pollutants and precursors (including PM, BC, nanoparticles, VOCs, NOx, NH3 and metals) for specific sectors of interest identified in WPs 1-2 (e.g., road transport non-exhaust particles) will be constructed with a consistent methodology, which will be used for systematic evaluation of emission inventories (WP4). Gridded emissions will be provided at a resolution of 6x6 km2 for Europe and with increasing accuracy over cities of interest in 1x1 km2 with a GIS-based approach, which explicitly handles line and point sources by different disaggregation proxies, including Copernicus services. The consistency between local city inventories from fine-scale emission estimates (T3.1) with the regional inventory (T3.2) will be assessed. The developed methodologies (D3.2) and emissions (D3.3) will

be implemented in T3.3-T3.4, used in specific pilot studies (SP2) and in the roadmap for upscaling (SP3).

T3.3. Extending AQ modelling to health and policy relevant indicators down to urban scale.

This task will enhance selected chemistry-transport models (CTMs), PM Comprehensive AQ Model with eXtensions for Ultra-Fine (PMCAMx_UF), CHIMERE, EMEP, LOTOS- EUROS, SILAM) to quantify source contributions to conventional and novel AQ health metrics (nanoparticles, OP). The CTMs will be combined with urban observational data (of atmospheric concentrations and 3D profiling and remote sensing, T1.3 and T4.5) to improve modelling scale, vertical information, chemical and microphysical modules for the simulation of nanoparticles (T4.2), PM chemical composition, and VOCs. The improved CTMs will capture source contributions of activity sectors and from local sources and long-range transport of PM and nanoparticles. Several modelling strategies are already developed in the CAMS Policy Service models: sensitivity simulations, tagging and surrogate modelling and will be confronted to source apportionment products (T1.2). By combining this sectoral information with indicators of OP (T2.2) and the new information on heavy metal emission from non-exhaust traffic (T3.2), more relevant diagnostics for the health-harmful air pollution indicators such as OP will be proposed. Maps of source-specific information on health relevant air pollution indicators at high resolution (1x1 km2) over specific urban areas and over the remaining European regions will be produced (D3.4). The improved modelling tools will be used in T3.4 and implemented in specific pilot tests-demonstrations (SP2) and in the roadmap for upscaling (SP3).

T3.4. Implement novel AQ indicators in tools supporting policy decision making to improve citizen health.

This task will test a pilot system that can be used to assess efficiency of policy measures at different scales (city, national, EU), building on the new emission inventories (T3.2) and the improved modelling (T3.3) using the novel (ROS, SA information, nanoparticles) and AQ indicators. The models will cover a range of scales starting from regional and reaching out to urban areas. Several strategies will be used to quantify the local vs. non-local contribution to city AQ, incl. Particulate SA technology and the novel “local fraction” methodology available in the EMEP MSC-W model.

The models will be run for the European domain for a period of several years covering different meteorological and emissions conditions. These will simulate the changes in novel AQ indicators and SA resulting from specific local (WP4), national and EU policies will be assessed by comparing the model results to the SA data (from WP1), historic SA data and other observational data available (e.g. from European Environment Information and Observation Network (D3.5). The information on SA at 1 km resolution will be further nested over the pilots (T4.3) at higher resolution in local scale models to refine the guidance for upscaling advanced PM exposure indicators in T5.5. The subgrid variability (< 1 km) will be reflected through the provision of sensitivity metrics to be

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defined (M3.5), that will provide variability range in the source specific 1 x 1 km^2 maps for population exposure studies (WP2).

T3.5. WP3 synergy to support SPs 2 and 3 for modelling novel health and policy relevant indicators and emission inventories.

This task will integrate knowledge from T3.1-3.4, will make a critical analysis and synthesis of the methodologies used and the results on reconciling emission estimates at various scales, of the efficacy of the techniques used for SA evaluation in models, elaborate to what extent developed methodologies can be generalised and exploited to support health impact studies (WP2), to support pilot demonstrations (WP4) as well as to assess the tools developed in WP3 that are suitable for feeding a service-oriented modelling framework (WP5). A pan-European report on modelling health indicators, variability, sources and uncertainty and needs to support policy implementation and pilot demonstrations-tests in SP2 (WP4), and the definition of the roadmap for interoperable services in SP3 will be delivered (D3.6).

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