RI-URBANS

INNOVATION – extended

- **Developing near real-time source apportionment for non-refractory particulate matter (PM) speciation (ACSM) and black carbon (BC).**

  State-of-the-art tools with this objective require data compilation and offline analysis of results in such a way that long after the PM speciation and BC measurements data on source contribution is obtained.

  Progress beyond the state of the art: We intend here to develop a highly innovative tool that captures online ACSM data on ions and constituents of organic aerosols, together with BC measured with different wavelengths (to distinguish biomass burning from diesel BC), and jointly evaluate these for source contributions (biomass burning, road traffic, secondary organic aerosols, cooking aerosols, secondary inorganic aerosols). Thus, in this way, NRT information on the origins of PM pollution can be provided to the AQ managers.

- **Near real-time data access to nanoparticle size distribution**

  Source apportionment data on particle number size distribution is stored and evaluated long after the measurement itself.

  Progress beyond the state of the art: Here we propose an innovative tool able to provide NRT information of size distributions for number concentrations that can inform AQ managers on the NRT levels of nanoparticles and also provide some information on the possible origins based on the size distribution.

- **Source apportionment of nanoparticles**

  Source apportionment of nanoparticles has been provided using cluster analysis, Positive Matrix Factorisation (PMF) and ratios with BC, but all these methods have relevant limitations (Rivas et al., 2020).

  Progress beyond the state of the art: Here we intend to provide a harmonised protocol to quantitatively obtain source contributions to ambient concentrations of nanoparticles in urban areas. Innovation in elaborating this advanced protocol is expected by combining approaches and tracers (other pollutants) to better apportion contributions.

- **Evaluating the impact of air pollution in health**

  Innovation will also be created in evaluating health effects of air pollution. On the one hand, we will evaluate, in a harmonised way using epidemiological tools, the effects of air pollution using novel AQ metrics and source contributions, including those for

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nanoparticles. On the other hand, we will innovate by comparing the oxidative potential with PM speciation (online and offline) and in epidemiologically evaluating the short-term effects of oxidative potential using long time series data. Relating oxidative potential with actual mortality and morbidity will provide very health-relevant information for AQ policies. Thus, the ambition here is not only to develop innovative tools for health effect analysis but also to apply them to novel AQ metrics.

- **Mapping nanoparticles concentrations using mobile units**

  Innovation is also present in mapping nanoparticles concentrations using mobile units with instrumentation to measure these and other complementary pollutants.

  Progress beyond the state of the art: Measurements using electric vehicles or bicycles equipped with mid-cost sensors, such as a combination of sensors for nanoparticles, BC, NO2 and PM, coupled with urban scale modelling, and citizens' science measurements with low-cost sensors calibrated by RI-URBANS, will produce an innovative way of mapping nanoparticle concentrations at the urban scale and of profoundly analysing their origin.

- **Offline and online measurements of oxidative potential to trace toxicological patterns**

  Both offline and innovative online measurements of oxidative potential to trace toxicological patterns will be also implemented and compared with online PM chemistry. Innovative online oxidative potential measurements (indicative of potential toxic effects by tracing the consumption of antioxidants caused by a given pollutant, PM component or source contribution).

  Progress beyond the state of the art: Oxidative potential is usually measured offline, but this is limited by the fact that micro-PM components continue to be oxidised after sampling, which inhibits accurate determination of the oxidative potential. Comparison of online PM speciation and the derived source contributions will shed light on the true associations between these parameters.

- **Linking highly advanced vertical atmospheric measurements with urban air quality services and modelling tools**

  There is a need to assimilate relevant vertical atmospheric measurements in AQ management. By having NRT information of the planetary boundary layer or the load of pollutants in atmospheric layers over the city/region, AQ management can be enhanced.

  Progress beyond the state of the art: We will provide information to AQMNs of these patterns and supply them to AQ management and modelling tools to increase their capacities and accuracy, including producing more reliable forecasts. There is also innovation in modelling and mapping novel health relevant indicators as nanoparticles and ROS and their source attribution.

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Moreover, RI-URBANS will create **new opportunities for the private sector** by offering the development of **innovative tools in the pilot studies**, where both the companies producing these advanced instruments, software or modelling tools and the scientific-technical evaluation of results will offer a unique testing laboratory to show the potential for AQ applications. Furthermore, the need for new equipment to measure AQ metrics, the mobile measurements, the citizen observatories using smart sensors and urban modelling, among others, will generate opportunities for local SMEs to innovate in this field.

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