Instantaneous Road Traffic Emissions Modelling System for cities

Reporting

Project Information

IRTEMS

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Project website

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Project closed

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Periodic Reporting for period 2 - IRTEMS (Instantaneous Road Traffic Emissions Modelling System for cities)

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Summary of the context and overall objectives of the project

In recent years, there has been a growing concern for the environment and a rush in a multitude of sectors to research and develop new ways to improve sustainability in a wide range of sectors. One sector of high importance is that concerned with road traffic in cities, where emissions produce severe effects on citizens' health and the environment. New emerging technologies in transport are arriving

and a change in urban mobility paradigm has begun. Over recent years, significant progress has been made in reducing emissions of key air pollutants from the transport sector. However, this sector is still one of the main contributors to urban air pollution in Europe and some traffic-related air quality problems remain in urban areas worldwide. Non-compliance with European air quality standards is often linked to traffic-related highly polluted microenvironments (hot-spots) that require local intervention in addition to city-scale plans and measures. This poses a unique opportunity to develop innovative tools needed to tackle urban air pollution.
To accurately understand the high concentrations of pollutants that occur in certain urban areas and their influence on the actual exposure of the population, it is necessary to estimate the contribution of road traffic to atmospheric emissions in great detail. Emission models are often used for this purpose can help us to understand traffic emissions processes and how to improve air quality in our cities.
With this in mind, the EU-funded project IRTEMS has helped to wider the knowledge on the development of high-resolution road-traffic-emission-modelling system that can be applied at city scale. During the action, research has focused on the implementation of instantaneous road transport emission modelling system with high resolution at city scale. A 2-year stay in the USA with experts on measuring and modelling emissions was successfully completed and a 1-year returning phase to the EU was carried out in an emission and air quality modelling reference group. Collaborations with enterprises of the transport sector and other research organizations with expertise on instantaneous traffic emission models were done through the action. This aspect reinforced the strong inter/multidisciplinary of the project to develop a powerful simulation system and to provide solutions involving different aspects to generate important impact on society.
This project was a career opportunity that has helped to generate new research lines. All the research results and knowledge generated during the project is openly accessible through scientific publications and several dissemination activities for different target audiences. This helped to involve different sectors on the research activities from the EU, increasing the interest of a wider part of the society, in this case, by contributing to a better air quality in accordance with the targets of the European climate action plan through the analysis of traffic emissions.
In conclusion, this action has contributed to significantly progress on the scientific knowledge about road transport emission models and their application for microscale studies at city-scale and has set the basics for the development of a future tool to provide accurate citywide emission results.

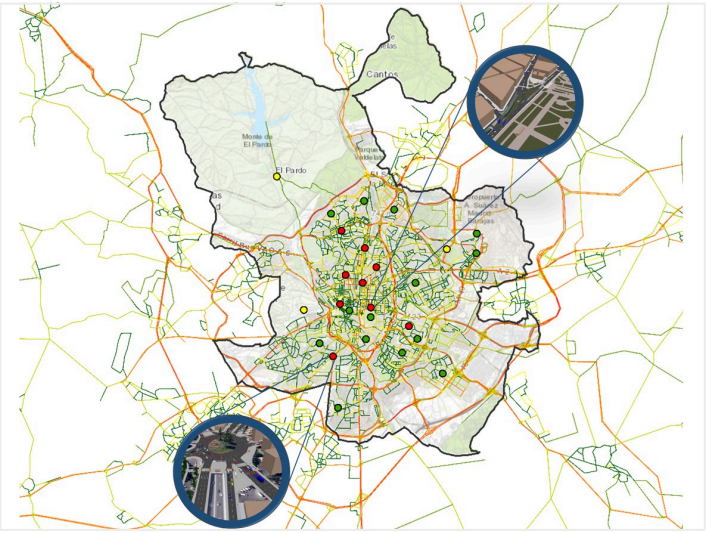
Work performed from the beginning of the project to the end of the period covered by the report and main results achieved so far

The project has contributed to the knowledge on how to reduce road traffic emissions providing scientific outcomes for accurate answers on traffic emission generation and possible reduction mechanisms.
During the first two years of the project different model approaches were analyzed. The models can produce similar high resolution emissions outcomes when the key factors are correctly considered. The key factors identified in this analysis were engine power and load for each vehicle class in addition to detailed driving patterns for the emission estimation. This analysis demonstrates the importance of an accurate definition of the model parameters for a specific vehicle fleet so that the modules selected during the project need to consider the specific information of the vehicle fleet.

Estimation of segment average emission rates by means of a microscale emission model has been demonstrated for a set of 232 vehicles considered representative from a fleet. This methodology was useful to identify microscale emission hotspots locations at high spatial resolution. Microscale model US EPA MOVES was evaluated in comparison to measurements. The main outcome was a high model precision and accuracy, up to 77% and 95% respectively across pollutants, at locating hotspots and non-hotspots according to measurements. These high values indicate that the model is performing well and has a high level of agreement with the measurements pointing out the potential of this tools for emission hotspots analyses.
Input requirements for modelling the microscale spatial distribution of emission hotspots has been analyzed in order to demonstrate a method to create segmented trajectory data files for input to an emissions model. MOVES model input requirements for modelling the microscale spatial distribution of emission hotspots has been applied to estimate second-by-second (1 Hz) vehicle activity used by microscale vehicle tailpipe emissions models to support estimation of on-road emission rates at high spatial resolution.
IRTEMS project was analyzed to identify and create a portfolio of R&I project results, to improve existing exploitation strategy, provide support and guidance for Intellectual Property Rights, and Development a Business Plan so that the pathway to be ready for the exploitation of the future tool is prepared.
During the timeframe of the action, all the activities have been disseminated targeting different audiences such as throughout scientific conferences and workshops, teaching activities, social media, and also on bars through Pint of Science festival to bring the science to all kind of audiences.

Progress beyond the state of the art and expected potential impact (including the socio-economic impact and the wider societal implications of the project so far)

There are several methods and approaches that are useful for different scales of analysis. To understand the spatial and temporal distribution of the emissions, typically, regional traffic emission models are used for the compilation of urban inventories and usually those are the most detailed data available at city scale. This level of detail is not enough to understand the high pollutant concentrations that occur on specific urban highly polluted microenvironments (hotspots). To accurately understand the influence of these very local high concentrations on the real exposure of the population, there is a need to estimate the contribution of road traffic to atmospheric emissions at city level but in great detail. For that, an integrated multi-scale approach is needed which is a crucial step to analyze potential air pollution abatement measures in cities.
This project has progressed to set the basis for a useful modelling system to analyze road traffic emissions at city scale with great detail. IRTEMS has improved the possibilities to understand the real implication and to analyze the potential of local abatement measures by analyzing opportunities to estimate the contribution of road traffic to atmospheric emissions at the city level and in great detail. This is an essential resource for local and central governments that are exploring different strategies to tackle the impacts of air pollution in urban areas. IRTEMS project has contributed to improve our knowledge in this key field.



City scale traffic emission simulation with high resolution for areas of interest

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