Modelling Population Exposure to Traffic-related Air Pollution in Complex Urban Systems

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With the urgent need to reduce the high levels of air pollution observed in cities, ambitious traffic policies have been established by many European countries. However, debates still surround these measures, highlighting the need to investigate cost-effective means to assess their benefits on human health. Therefore, due to the complexity imposed by a city as an urban system, solutions to the grand challenges we face in cities must therefore be developed by a comprehensive approach, involving an understanding of complex interactions between different components of the system.

Our ongoing research aims to respond to this need seeking a decision-support tool for urban transport and air quality management, in particular to support local authorities in the promotion of "healthy transport policies". For this purpose, an integrated approach is being developed at urban scale to quantify how the changes associated with alternative traffic measures will affect population exposure to traffic-related air pollution, by combining transport-emission-dispersion-exposure models within an integrated modelling framework.

In order to achieve the defined goal, the main objectives of our current work are focused on evaluating the effectiveness of different traffic measures in terms of emission reductions and air quality improvements and their spatial distribution. The numerical system implemented is based on three modelling tools: (i) the macroscopic traffic flow model VISUM; (ii) the new road traffic emissions and energy consumption model QTraffic; and (iii) the air quality dispersion model AUSTAL2000. The modelling tools were linked and tested on the city of Coimbra.

By adopting an integrated modelling approach, the current work stresses the need to assess the overall role of road transport impacts within cities to evaluate the sustainability of urban mobility policies, focusing on the complex interactions between different aspects of the city, from the source to the receptor.

Keywords: transport planning; road traffic emissions; urban air quality; numerical modelling.