DEVELOPMENT OF AN ON-LINE HYBRID AIR QUALITY MODELING SYSTEM FOR THE CITY OF MILAN

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Summary
In this study we propose a complete hybrid on-line modelling chain for the evaluation of the air quality at urban scale, using the Eulerian model CAMx including an extension of the Plume in Grid (PiG) algorithm developed to treat the main streets as linear sources (Linear Plume in Grid, LPiG). A particular focus is placed on traffic emission sources by creating a bottom-up emission inventory for the traffic sector for the on-line hybrid model, starting from traffic simulations and fleet composition data specific for Milan. Preliminary results show that the proposed modelling chain is able to reproduce the spatial gradient of air pollutant at the intra-urban scale.

Introduction
The impact of road transport sector on air quality in urban environment is of great concern, especially when considering the new stricter WHO air quality guidelines. The off-line combination of an Eulerian model for background and a local model (Lagrangian or Gaussian), is a widely used approach to investigate air quality at intra-urban scale. The main limitations of these off-line techniques are usually related to the double counting of emissions and the inconsistency in chemistry processes between the large and local scale models. To resolve these issues, an on-line hybrid model consisting of the Eulerian model CAMx (Ramboll, 2020) with and an extension of the native Plume in Grid model (PiG), called Linear Plume in Grid (LPiG) was developed and applied over the city of Milan. A particular focus is posed on traffic emissions for the Milan urban area, where a bottom-up emission inventory has been developed.

Methodology and Results
We set up a system of two nested domains to simulate the air quality in Milan: the master grid covers the entire Italian peninsula with a resolution of 4km, while the nested domain has a resolution of 1km and a size of 70x70 km^2. In this latter, a finer grid with 50m resolution is then used to sample the sub-grid variability in pollutants concentrations due to road-links emissions. We developed a bottom-up traffic emission inventory for the city of Milan, starting from the results of traffic simulations provided by the Milan municipality environmental and mobility agency (Agenzia Mobilità Ambiente Territorio AMAT). Temporal profiles for speed and traffic volume, and the Milan specific fleet composition were also provided by AMAT. We coupled the traffic simulation with the bottom-up emission model High-Elective Resolution Modelling Emission System version 3 for Bottom-Up (Guevara et al., 2020). HERMESv3_BU uses the COPERT V methodology to estimate both exhaust and non-exhaust traffic emissions. Primary roads emissions are explicitly simulated as linear sources thanks to CAMx_LPiG, while the remaining ones are dumped onto the 1km Eulerian grid. New tools were developed to link the modelling chain allowing HERMESv3_BU to write emissions in the CAMX and LPiG format. Air quality results obtained with this emission framework were evaluated for the meteorological year 2017.

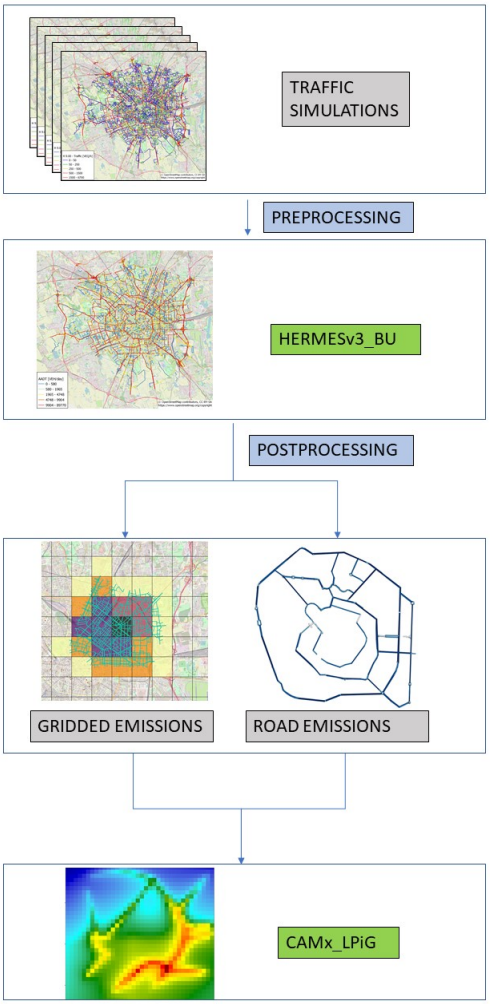

Fig.1 Graphical representation of the proposed hybrid modelling system

Conclusions
This work presents a complete modelling chain able to explicitly simulate the impact of road emission on air quality in urban areas, using an on-line hybrid air quality model, with an implementation for the city of Milan. The proposed methodology represents a flexible and reliable tool to evaluate air quality policies at urban scale, in line with the provisions of the European strategy emission reduction targets.

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