COMPARING SOURCE ORIENTED AND RECEPTOR ORIENTED SOURCE APPORTIONMENT RESULTS OVER THE MILAN AREA IN LIFE-REMY PROJECT

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Summary

The LIFE-REMY (Reducing Emission Modelling uncertainty, https://liferemy.eu/) project, launched in May 2021, investigates the impact of uncertainty in pollutants emission and air dispersion models that could negatively affect air quality assessment and plans. A particular focus of the project is the modelling of emission and formation processes, involving primary and secondary particulate generation as well as the comparison of source apportionment modelling techniques, which allow an accurate quantification of key emission sources. In this work only the Milan area case study set up is presented and a first example of results based on source oriented models is shown.

Introduction

The quantitative and reliable assessment of the role of the different sources with respect to pollution levels (source apportionment, SA) represents a key prerequisite in order to reduce uncertainty in air quality modelling driven by emissions. In this view, the comparison of SA results, particularly when based on different and independent methods (e.g. Receptor vs Source oriented models) can provide informative outcomes.

Methodology and Results

The SMOKE-WRF-CAMx modelling system is applied over the Milan area (Northern Italy) by means of two computational domains, with the larger domain covering the whole Italy at 4 km resolution, while the innermost one, centred over the city of Milan, covers an area of 70x70 km^2 at 1 km resolution (Agresti et al, 2020). Simulations are performed over two periods: a baseline simulation covering the whole 2017 and COVID-19 simulation focused on February-April 2020. SA with source oriented method is performed by means of the CAMx model able to evaluate both source "impacts" through the usual Brute Force (BF) method and source "contributions", by means of the embedded PSAT tool (Yarwood et al. 2004) for PM and related precursors. SA analysis with Receptor oriented approach will be carried out by means of PMF (EPA PMF version 5) and focused only on urban background site (Milano Pascal) and one rural site (Milano Schivenoglia), the chemical dataset includes metals, ions sugar and OC/EC.

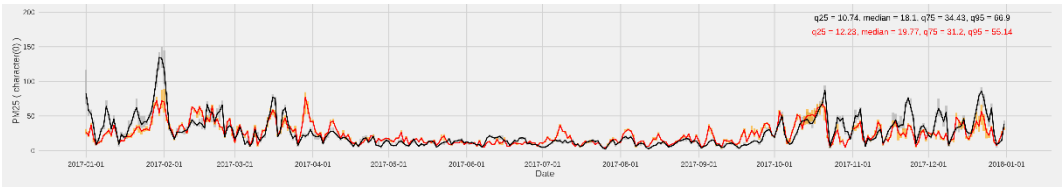

Fig.1 Modelled (red) and observed (black) $PM_{2.5}$ daily concentrations at 11 air quality stations for 2017 over the Milan domain.

Fig. 1 shows an example of CAMx model performance evaluation for $PM_{2.5}$ over the Milan domain for 2017 case study, pointing out that CAMx is able to reproduce observed trends, except for few winter peaks. SA analysis will be then performed to investigate the influence of the uncertainty in emission estimates on modelled concentration and observed discrepancies.

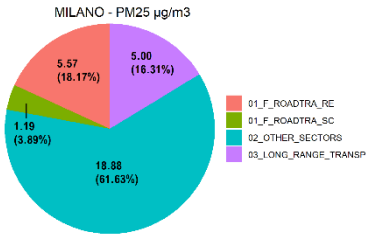

Fig.2 Source contribution results obtained by CAMX for COVID 19 case study over the city of Milan

Fig. 2 shows an example of source contribution results from CAMx for $PM_{2.5}$ in Milan for COVID-19 simulation and focused on traffic sector. Particularly the pie chart quantifies, among others, the contribution of the "removed" road transport emissions (ROADTRA_RE, 5.57 µg/m^3), with respect to the remaining emission (ROADTRA_SC, 1.19 µg/m^3) and all other sectors. This result can be then compared with the corresponding source "impact", computed by CAMx through BF approach for further discussion on the comparability between SA methods. Finally, CAMx results will be compared against RMs results, derived from measured PM composition data, in order to evaluate the reliability of the modelled source contributions and reduce possible uncertainty in emission estimate.

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References

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