

Valuing the External Costs of PM10 Pollution at Regional Level

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The project has been developed with ARPA Lombardia (the regional environmental agency) in 2005-06 to support the decisions about traffic restrictions and domestic heating improvements by evaluating the expected reduction of external costs of air pollution.

The PM10 External Costs System covers the entire Lombardy region (more than 1500 municipalities and 8 million inhabitants) and is dedicated to local authorities as well as to technical staff of various offices in the local government. Its structure is shown in Figure 1 where ovals stands for the user's main choices.

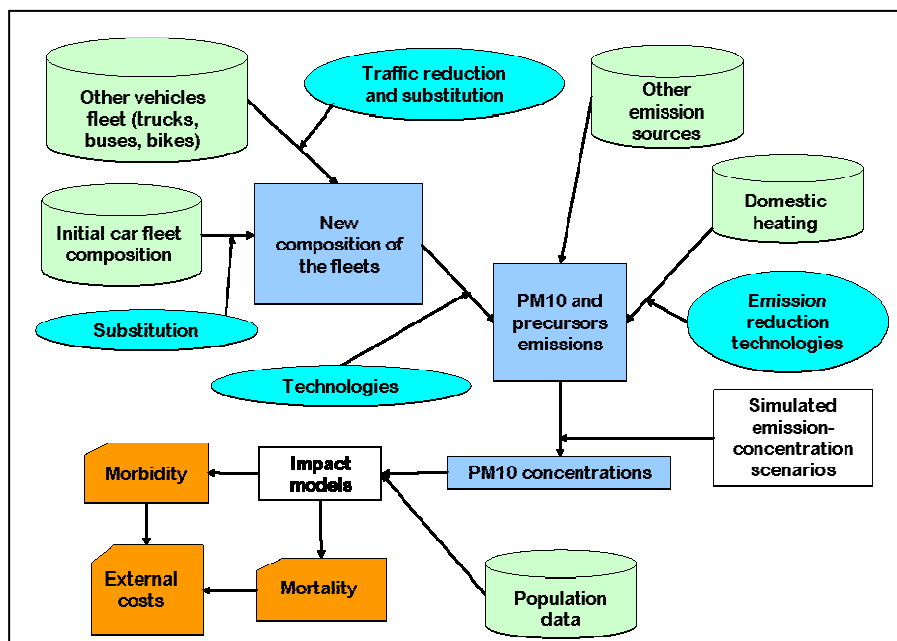


Figure 1. Structure of the PM10 External Costs System of the Lombardy region.

The software follows the ideas proposed by the EU ExternE project (www.externe.info), a long run research effort to evaluate the economic impact of air polluting activities in Europe.

The major problem in dealing with PM10 is that the majority of it is secondary pollution and its concentration is above the standard for most of the year in many crowded areas of the region.

The logical flow of the system starts from scenario hypotheses about the composition of the vehicle fleet and the domestic heating systems, computes the emissions, converts emissions into mean concentrations, then computes the impacts of such concentrations to human morbidity and mortality, and finally transforms these values into external costs.

The main source of data for the project is the regional emission inventory INEMAR, which contains emission values for many pollutants for each municipality and is periodically updated. The second most important source is the National Institute of Statistics (www.istat.it) from which all the population characteristics (numbers, age distribution, health conditions,...) have been extracted. Other smaller tables refer to the COPERT III vehicle emissions and ExternE exposure indexes and cost evaluation.

Various spreadsheets are used to perform each step of the evaluation procedure: based on the user's scenario assumptions, the new vehicle and heating emissions are evaluated, they are distributed among the 1500 municipalities and added to the other non-regulated sources to obtain a user emission scenario. This is translated into concentrations using a nearest neighbor method in another

sheet where the input and output of different runs of the off-line simulation model are stored. The metric used is a standardized distance of PM10 and precursor (SO₂, NO_x, NH₃) emissions defined by the user from the scenario simulated with the off-line model. Combining estimated concentration values with the distribution of population (classes and activities) and exposure indexes, another sheet computes health effects for each municipality and finally external costs are evaluated. The plots of several aggregated variables are presented in the output sheet, together with the possibility of selecting them for a detailed spatial representation as shown in Figure 2.

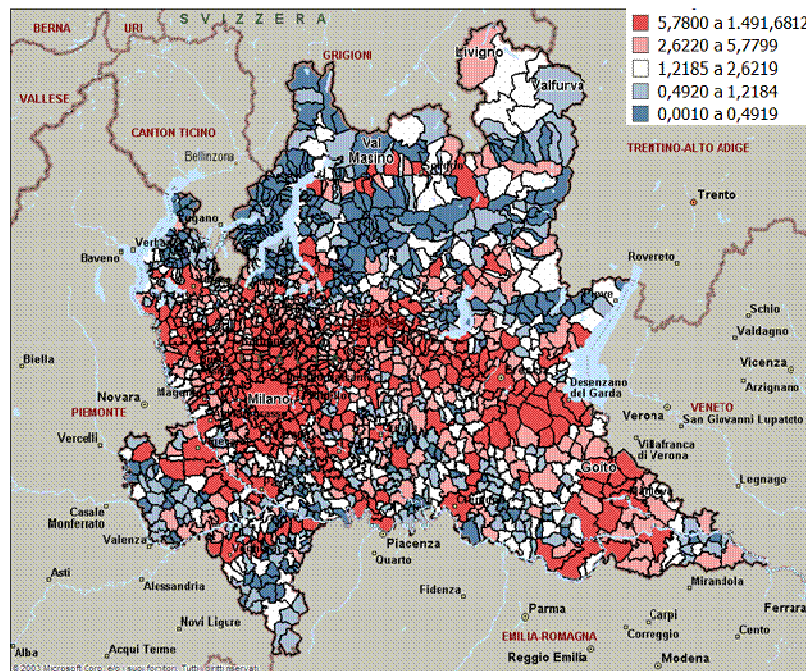


Figure 2. Direct visualization of spatial variables: primary PM10 traffic emissions.

The AriaRegional model suite (www.aria-net.it), used off-line to compute the mean annual concentrations following a given emission pattern, is based on a sophisticated eulerian three-dimensional model, derived from STEM. It requires a hourly description of emission values and chemical speciation, of the regional meteorology as well as of the boundary conditions. This means that each simulation requires a considerable effort and several hours (or even days) of computer time.

It has been run for a limited number of emission conditions, but the suggested approach allows to freely add new outputs to improve the precision whenever they are available.

A hypertext works as a help file for using the software, contains all the original documents from which parameters and functions have been extracted, and a searchable data and results dictionary. This allows to find out among the several tens of thousands of numbers managed by the system those of interest and possibly modify them or use them for additional graphic output. Presently, there are no plans for general distribution to the public.