P-039

USING G.I.S. TOOLS TO DEVELOP SPATIALIZED EMISSION INVENTORIES, DATABASE AND MAPS OF ATMOSPHERIC POLLUTANTS OVER THE FRENCH NORTH REGION.

FEVRE-NOLLET V., LEBEGUE P., MENDEZ M., DECLERCK L.

Physico-Chimie des Processus de Combustion et de l'Atmosphère - PC2A, Université Lille1, UMR CNRS 8522, Bat C11, 59655 VILLENEUVE D'ASCQ CEDEX, FRANCE

ABSTRACT

Development of atmospheric pollutants emission inventory is a critical step with regard to management of air quality at regional scale. The quality of input databases (socio economic, transport, industry …) and the time and space scales specify the inventory effectiveness. But quality often related to a large number of data that classical methodologies can hardly resolve. A specific methodology adapted to air quality model calculation have been developed. The tools used are PostgreSQL as DataBase which is the kernel of the software, the Geographic Information System (GIS) used is GRASS , finally the user interface is a web site using PHP within the PRADO framework, all are free softwares. The web site named POQAIR, was settled to provide emission maps and matrixes with various spatial and temporal scales. The inventory concerns a large range of pollutants such as SO2, NOx, NMVOC, CO2, CO, CH4, NH3, N2O, HCl, HF, Pb, Zn, Cd, Hg, dioxins (PCDDs) and Total Suspended Particles (TSP).

BACKGROUND AND OBJECTIVES

Since eighties, the spatialized emission inventories of atmospheric pollutants appeared. First, it was used for large spatial scale (GENEMIS, 1999). Later, the research on this subject matter focused on regional to local scale to provide for air quality modeling on big cities (François et al., 2005). The present work took place in the framework of the CERPA program (Cartographie de l'Exposition aux Risques des Populations aux Aérosols/Mapping Aerosols Risk Indices) and concerns the Nord-Pas de Calais region.

Regional air quality models need high resolution in time and space emission inventory. Our original inventory has been designed by the PC2A laboratory and the Ecole des Mines de Douai in 2004 (Martinet et al., 2005). In this inventory, the emission database has been constructed with spreadsheets and spatialized with the G.I.S. software ESRI ArcView8 . In order to refine time and space resolution, it was necessary to use new software with customized tools.

APPROACH AND METHODS

The general methodology consists of two stages. The first step is collecting emission data in a DataBase Management system (DBM). The second step deals with emission calculation and spatialization with G.I.S. Software. Three types of sources are considered: punctual, linear and surface-area sources. Punctual sources are used for big industries or power plant due to their high emissions with a possible three dimensions modelling. Linear sources are mostly applied to traffic, and surface sources are applied to almost all human activities.

The spatialized emission inventory is built from main databases such as the INSEE-SIRENE database contains economic information on companies and industries. AGRESTE (http://agreste.agriculture.gouv.fr) database reports information on agricultural surface-area and the livestock for each township. The transport database informs about the localization and the use of the roads, rail, waterway and air traffic. Each human activity is referenced to one or more SNAP (Selected Nomenclature for Atmospheric Pollution) code. Each SNAP code is related to a specific emission factor for specific chemical species. Knowing the emission factor and the annual production of human activities we can calculate the amount of annual emission by species and SNAP. Finally, all the calculated data can be integrated in the G.I.S. Software GRASS thanks to the BDCarto and GEORoute (www.ign.fr).

The most important problem is the great deal of data. Spreadsheets are a very bad solution to manage such quantity of information. For the calculation we have tested three technologies: Python, Java and SQL. Python and Java have similar efficiency and the shortest calculation time is obtained using pure SQL.

This architecture allows to generate maps and meshed data which are necessary to air quality models. The administrative district code referenced emissions are transformed into meshed data by a C++ program. This program uses the GRASS application to spatialize the data.

RESULTS

In this work, a code was developed to provide annual spatialized emission database with the appropriate input format for air quality models. It allows user to define the domain-grid which is framed on the GIS database, the code calculates for each mesh the township surface percentages. The emissions are attributed according to these percentages and normalized from the GIS-base to a grid-base system. When the selected domain is wider than our regional inventory, the grid is completed by European emission inventories data EMEP.

Conclusion and future plans

We developed a methodology using PostgreSQL, G.I.S. Grass and C++ code to produce spatialized emission inventories. Compared to Excel-Access solution, PostgreSQL efficiency permits a dynamic computational system. A web site POQAIR (poqair.univ-lille1.fr) was settled to provide data and maps. The POQAIR database concerns a large range of very toxic pollutants. So, this database will be an important tool for evaluation of risk impact and epidemiologic studies.

REFERENCES

François S., Grondin E., Fayet S., Ponche J.L., 2005. The Establishment of the atmospheric emission inventories of the ESCOMPTE program. Atmospheric Research, 74, pp 5-35.

GENEMIS,1999. Emission inventory database (EMEP-CORINAIR) for Europe for the year 1999, EUROTRAC-2. http://genemis.ier.uni-stuttgart.de/GENEMIS1999.pdf

Martinet Y., Wroblewski A., Kergomard C., Ponche J.L., Nollet V., 2005. Inventaires spatialisés de polluants atmosphériques : rôle et utilisation des systèmes d'information géographique. Revue Internationale de Géomatique, Vol. 15, n° 1, pp 63 – 80.