HIGH RESOLUTION MAPS OF ANNUAL NO_X AND NO_2 CONCENTRATIONS IN AN INFLUENCED RURAL AREA USING A DETERMINISTIC MODELLING METHOD

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The application of Directive 1999/30/EC on Ambient Air Quality Assessment and Management requires the assessment of air quality all over the territory included rural areas, which are poorly covered by monitoring stations. Our aim is to demonstrate the competitivity of modelling in front of geostatistics[1] approach on annual average air pollution mapping under a low influenced rural area. We used a deterministic model to map annual NO_x and NO_2 concentrations in a 66 x 66 km² mainly rural area, but influenced by both outer distant sources like the Parisian conurbation, and local inner sources like motorways.

Simulations were performed with the 3D transport Eulerian model TRANSCHIM[2]. Concentrations data of CHIMERE[3] continental and vertical profiles of ARPEGE[4] provided respectively the boundary conditions and the meteorological data. We used two types of annual NO_x emissions inventories: (1) a local inventory at 1x1 km² resolution; (2) the large scale EMEP inventory.

At first the model was calibrated in NO_2 and NO_x with two 14 days NO_2 passive sampling measurement campaigns. The spatial correlations r for the first campaign (43 sampling sites) and the second campaign (77 sampling sites) were respectively 0,73 and 0,64. The fractional bias for NO_x and NO_2 were respectively +0,142 and +0,183 (first campaign); +0,062 and +0,090 (second campaign).

Although the enormous increases in computing power have made the use of sequential computing easier for calculation of long-term average concentrations however the models become more and more complex, thus more CPU time consuming [5,6]. So the statistical approach is also useful. It is based on the calculation of a few scenarios. This is the reason why we have compared the two different approaches : an annual sequential calculation using tri-hourly sequential boundary concentrations and meteorological data, and annual statistical calculations classifying meteorological data and boundary concentrations.

The two methods gave similar annual concentrations (the 180h CPU time for the sequential computing on one Linux PC can be bring down to 18h with the statistical approach), whose comparison with measurements showed compatible agreement with the quality objective fixed at 30 % by the Directive on annual NO_x and NO_2 concentrations modelling.

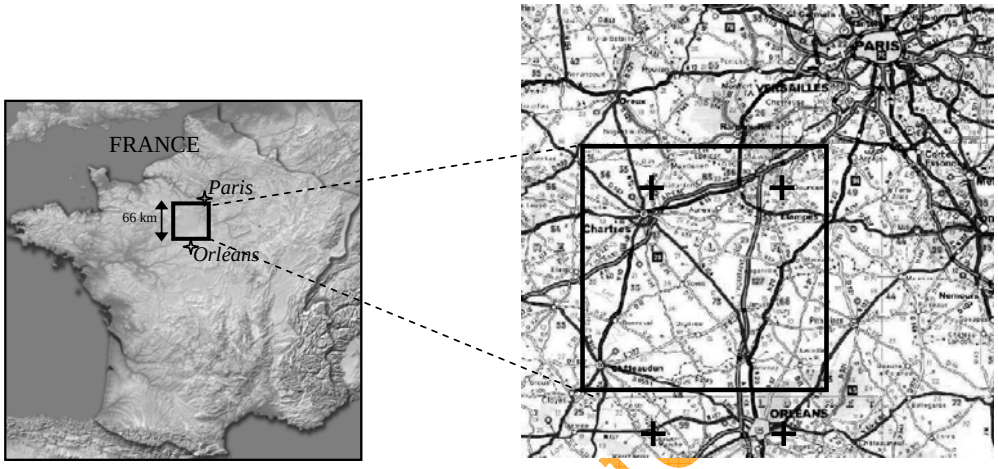

Figure 1: The calculated domain. The four symbols localise the sites providing the meteorological and boundary concentrations data.

REFERENCES

[1] *Stedman J.R. and Bush T., 2000. Mapping of nitrogen dioxide and PM10 in the UK for Article 5 Assessment. AEAT/ENV/R0707, December 2000.*
[2] *UMR 6614 CORIA www.coria.fr*
[3] *http://euler.lmd.polytechnique.fr/chimere*
[4] *Météo-France*
[5] *GLOREAM, 2000. Annual Report. http://www2.dmu.dk/AtmosphericEnvironment/gloream/AnnRep00_final.pdf*
[6] *COST Action 710, 1998. Final Report. http://www2.dmu.dk/AtmosphericEnvironment/cost/FinalRep.htm*