Health impact assessment of air pollution beyond urban areas: protocol for a pilot study in two french regions

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Background

The health effects of air pollution are well documented. Several studies have established causal relationships between short and long-term exposure to air pollution, morbidity and mortality. As the individual risk from air pollution is relatively low while the whole population is exposed, health impact assessments (HIAs) help getting a clearer vision of the public health impact of air pollution [1].

At the European level, HIAs in urban areas have been useful to raise awareness on the health impacts of air pollution and to foster dialogue and exchange of know-how between environment and health professionals [2]. In France, HIAs in urban areas have been largely used with the same benefits. Recently, with the development of fine spatial-scale air quality models and geographic information systems, stakeholders are empowered to perform HIAs on a broader area, the regional scale.

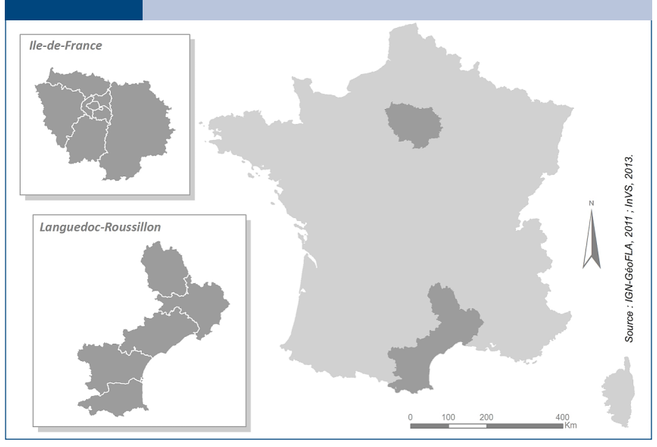
Aims

The main objectives of the pilot study are to:

- conduct an air-pollution HIA at the regional level in two French regions, Ile-de-France (IDF) and Languedoc-Roussillon (LR), contrasted in terms of geography, demography, urbanization and air pollution sources, using routinely available modeled spatialized air-pollution levels (figure 1);
- evaluate the added value of the results for stakeholders in order to extend the method to other regions.

Within this pilot study, this poster presents the main differences between the two selected regions in terms of air pollution levels and the influence of the model grid resolution on HIA results.

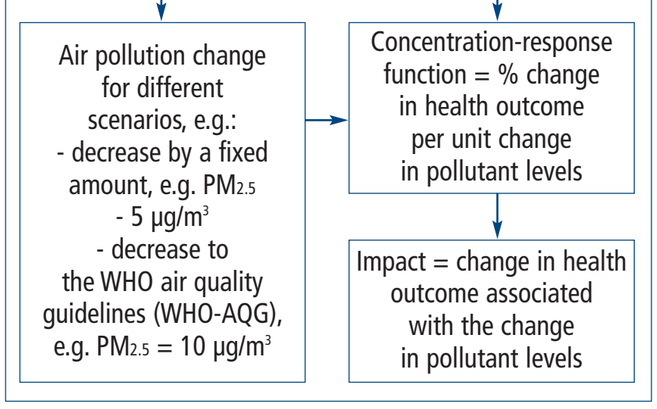
FIGURE 1 — French regions involved in the study



Methods

The method used for HIA in the present study is an extension of the classical method used for HIAs in urban areas [2]. It is summarized in figure 2.

FIGURE 2 — Basis of the HIA method for air pollution



In the absence of CRFs specific of rural or industrial areas, the pilot study evaluates the long-term impact of ozone and $PM_{2.5}$ on mortality using CRFs reported by the ACS cohort study.

Mortality data by age and cause for each "commune" (~district) are provided by the CepiDc-Inserm for the period 2008-2010.

Population data by age are provided by Insee between 2008 and 2010.

In LR, O_3 and $PM_{2.5}$ annual mean levels were available only on a 10 x 10 km grid (Ineris – PREV'AIR). In IDF, O_3 was available on a 10 x 10 km grid, and $PM_{2.5}$ were available on a 10 x 10 km, 25 x 25 m and 50 x 50 m grids (Ineris – PREV'AIR, AirParif).

Since in France policies are implemented at the commune levels, and for communication purposes, it was chosen to present the results by commune.

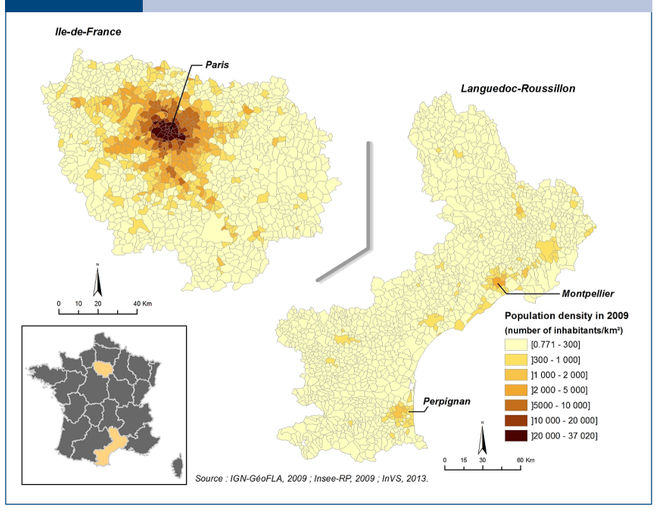
Preliminary results

IDF is the most populated region of France, population density decreasing from very high in the center (Paris area) to the rural outer parts. LR is the southernmost region of mainland France and includes two main urban areas, Montpellier and Perpignan (table 1 and figure 3).

TABLE 1 — Contrasts between the two regions involved in the study

Region	Main characteristics	Strenghts	Drawbacks
Ile-de-France	Highly urbanised center (Paris and suburbs: 21,196 inhab/km²) PM sources: Tertiary 40% Traffic 25% Industry 22% $PM_{2.5}$ annual mean ~18 µg/m³	Several air pollution models available Already involved in regional HIA (AC-HIA project)	IDF is not representative of other regions Large infra-urban air-pollution variation within Paris
Languedoc-Roussillon	Rural region, large influence of the agriculture and industrial sources 95 inhab/km² PM sources: Agriculture 35% Industry 30% Traffic 22% Seaside and mountain influences $PM_{2.5}$ annual mean ~15 µg/m³	Representative of most of the French regions	Few air pollution models available

FIGURE 3 — Population density in Ile-de-France and Languedoc-Roussillon regions in 2009



Ozone concentrations are much larger in LR, due to favorable climatic conditions (figure 4), while PM is a more important issue in IDF (figure 5). Within IDF, ozone concentrations are higher in the rural areas, whereas PM concentrations are higher in urban areas.

Despite large differences at the commune level between assessed PM exposures based on the 10 km and the 50 m grid (figures 5 and 6), the HIAs results are of the same magnitude when considering the whole region. For instance, compliance with WHO-AQG would delay 2,745 [950:4,809] deaths in IDF using 10 km grid resolution, and 2,856 [985:5,027] using 50 m one. This may be related to the fact that exposure levels in the central densely populated part of the region (which accounts for the larger part of the health impacts) are less affected by the choice in spatial resolution. However, based on differences in assessed exposure levels (see figures 5 and 6) larger differences in HIA results are expected when considering a single commune especially for semi-rural communes in Ile-de-France.

FIGURE 4 — Mean values for ozone in µg/m³ in 2008-2010 in Ile-de-France and Languedoc-Roussillon regions by commune with Ineris data

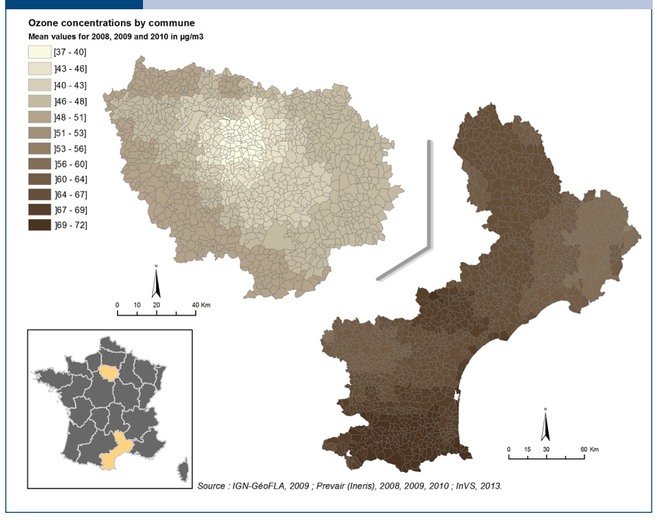


FIGURE 5 — Mean values for $PM_{2.5}$ in µg/m³ in 2008-2010 in Ile-de-France and Languedoc-Roussillon regions by commune with Ineris data

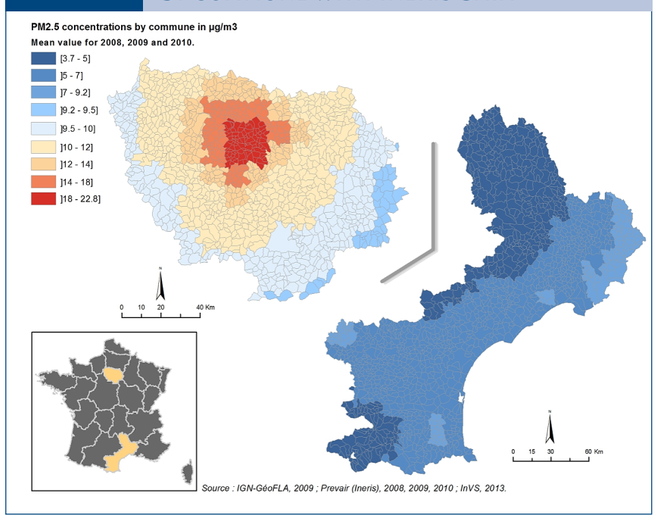
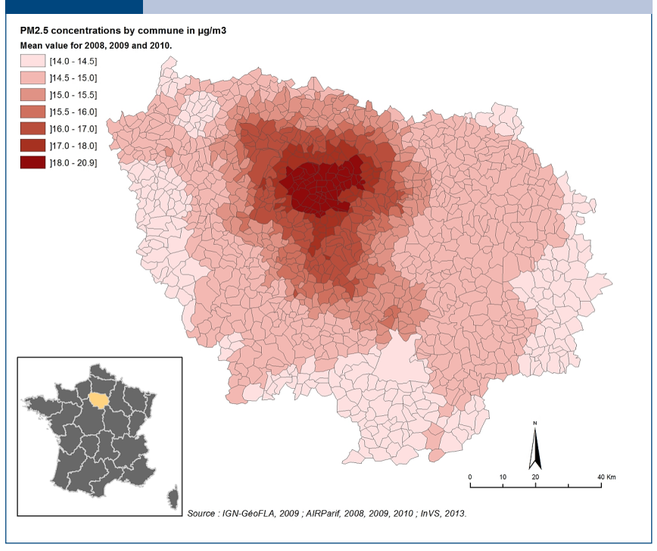


FIGURE 6 — Mean values for $PM_{2.5}$ in µg/m³ in 2008-2010 in Ile-de-France by commune with AirParif data



Conclusions

Spatialized HIAs may provide an objective estimate of the health impacts of improvements in air quality at a small geographical scale, and may be more easily used by decision makers for planning and implementing measures aiming to protect public health more effectively. However, their feasibility is limited by the availability of air pollution data at an appropriate spatial scale.

What is more, the transferability of urban AP CRFs to an industrial or agricultural context should be further discussed by the epi community.

Detailed HIA findings in these two French regions will be carefully interpreted for and clearly communicated to the local decision makers by the beginning of 2014.

References:

[1] Medina S, Ballester F, Chanel O, Declercq C, Pascal M. Quantifying the health impacts of outdoor air pollution: useful estimations for public health action. J Epidemiol Community Health. 2013 Jun;67(6):480-3.

[2] Pascal M, Corso M, Chanel O, Declercq C, Badaloni C, Cesaroni G. *et al.* Assessing the public health impacts of urban air pollution in 25 European cities: results of the Aphekom project. Sci Total Environ. 2013 Apr 1;449:390-400.

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