Loss of Life Expectancy related to temporal evolution of $PM_{2.5}$ considered within energy scenarios in Europe

23rd SETAC Europe Annual Meeting
12–16 May 2013, Glasgow, Scotland
http://glasgow.setac.eu
Glasgow 2013 SETAC Europe

TH150

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Fine particulates: a major pollutant for human health

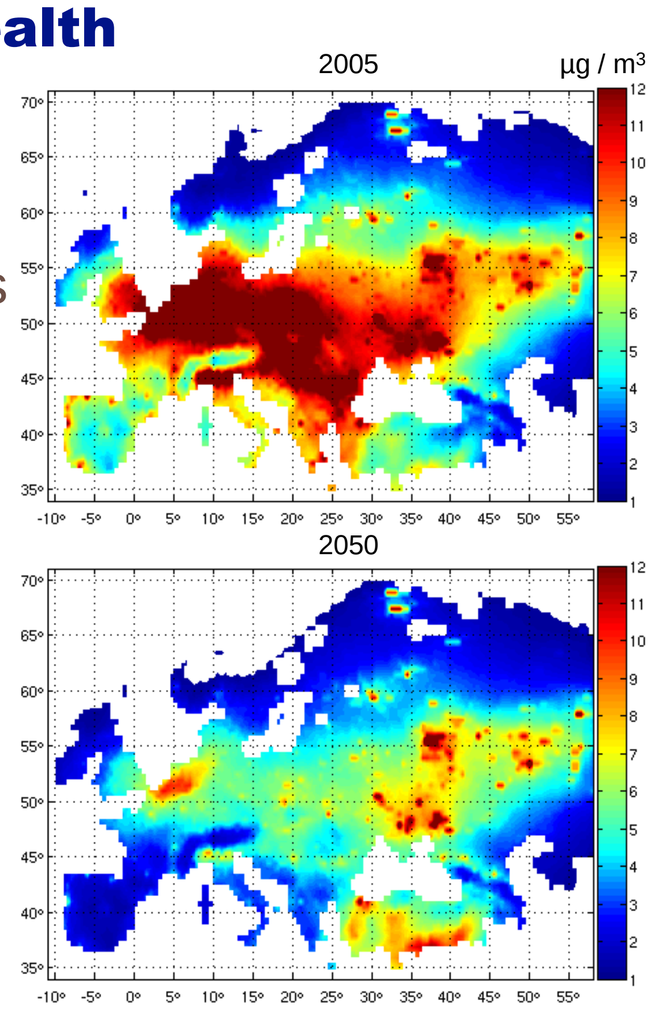
EnerGEO project: simulation of energy scenarios and impact assessment on environnement and human health: http://www.energeo-project.eu

Loss of Life Expectancy: a key indicator to compare impacts from energy scenarios

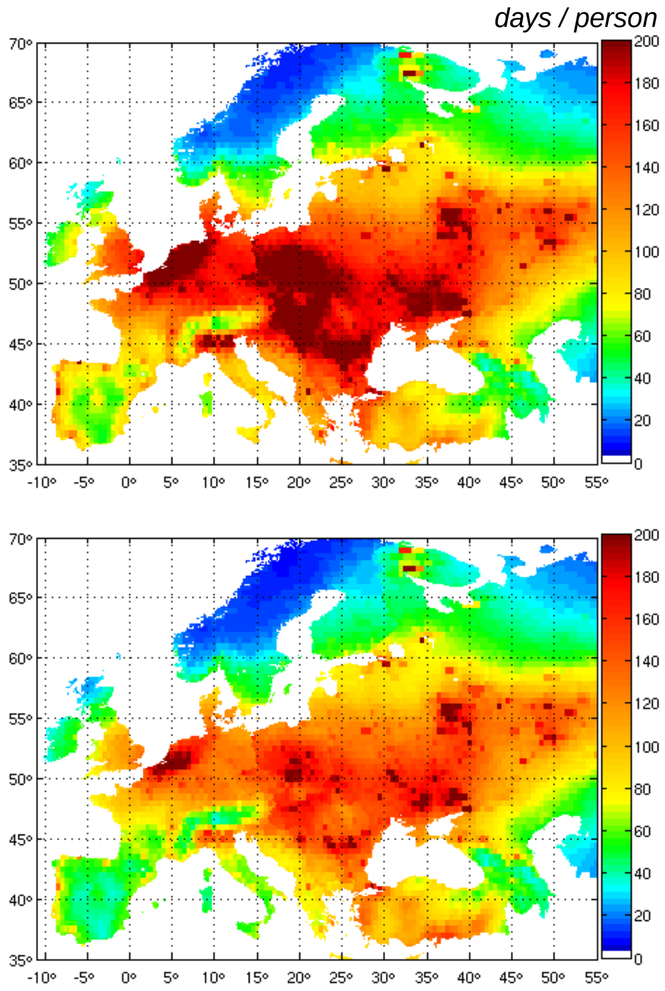
- Baseline scenario : current European legislation with the objective to reduce some pollutants and more specifically $PM_{2.5}$, fine particulates of 2.5 µm size.
- Evaluation of different electricity energy scenarios compared to the baseline, studying their impacts on life expectancy.
- **Static** standard evaluation: $PM_{2.5}$ concentration is considered constant during the exposed lifetime of the population.

Necessity to integrate the temporal dimension of scenarios

- Energy scenarios horizon : 2050.
- Important variation of $PM_{2.5}$ exposure during the population whole lifetime.
- Proposal of a **dynamic** method to compare scenarios accounting for their temporal dimension.



$PM_{2.5}$ concentrations in the baseline energy scenario in 2005 and in 2050. Resolution 20 km x 20 km.



Loss of life expectancy for the population older than 30 years in 2005, in the static approach (top) and dynamic one (bottom) for the baseline energy scenario. Resolution 20 km x 20 km.

Maps of impacts on human health

Data sources

- IIASA[1] for $PM_{2.5}$ concentration maps derived from GAINS model for the baseline scenario in years 2005, 2030, 2040 and 2050.
- United Nations[2] for the 5-years cohorts size and mortality rates per country, from 1950 to 2100. The population under concern is people older than 30 years in year 2005.
- SEDAC[3] for density maps of population in years 2005, 2010 and 2015.
- Pope (2002)[4] for the relative risk value for a population older than 30 years exposed to $PM_{2.5}$.

Accounting for the dynamic of the scenario

- Algorithm based on the approach recommended by the « *Task Force on Health* »[5] and IIASA[1] : loss of life expectancy is the difference between life expectancy calculated with $PM_{2.5}$ concentrations observed along the population lifetime, and life expectancy without exposure.
- Temporal interpolations of $PM_{2.5}$ concentrations performed in the scenarios (from 2005 to 2050) along the population lifetime.

Conclusions

- Significant difference in results of about 20% with lower impacts for the **dynamic** model which takes into account the temporal evolution of the pollutant concentrations.
- More realistic approach in the framework of scenarios comparison.
- Tables and maps for different energy scenarios available on line at the Platform of Integrated Assessment (PIA) of the European EnerGEO project : http://viewer.webservice-energy.org/energeo_pia/index.htm

[1] International Institute for Applied Systems Analysis, Austria. [2] United Nations, Department of Economic and Social Affairs, Population Division. The 2010 Revision of the World Population Prospects. [3] SEDAC : Socio Economic Data and Applications Center, center for International Earth Science Information Network (CIESIN), Columbia University. Gridded Population of the World (v3). [4] Pope, C. et al. 2002. Lung cancer, cardiopulmonary mortality, and long-term exposure to fine particulate air pollution. Jama-Journal of the American Medical Association, 287: 1132-1141. [5] TFH. 2003. Modelling and assessment of the health impact of particulate matter and ozone. EB.AIR/WG.1/2003/11, United Nations Economic Commission for Europe, Task Force on Health, Geneva.

The research leading to these results receives funding from European Community's Seventh Framework Programme (FP7, 2007-2013) under Grant Agreement Number 226364.

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