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Loss of Life Expectancy related to temporal evolution of PM2.5 considered within energy scenarios in Europe

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Fine particulates: a major pollutant for human health

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

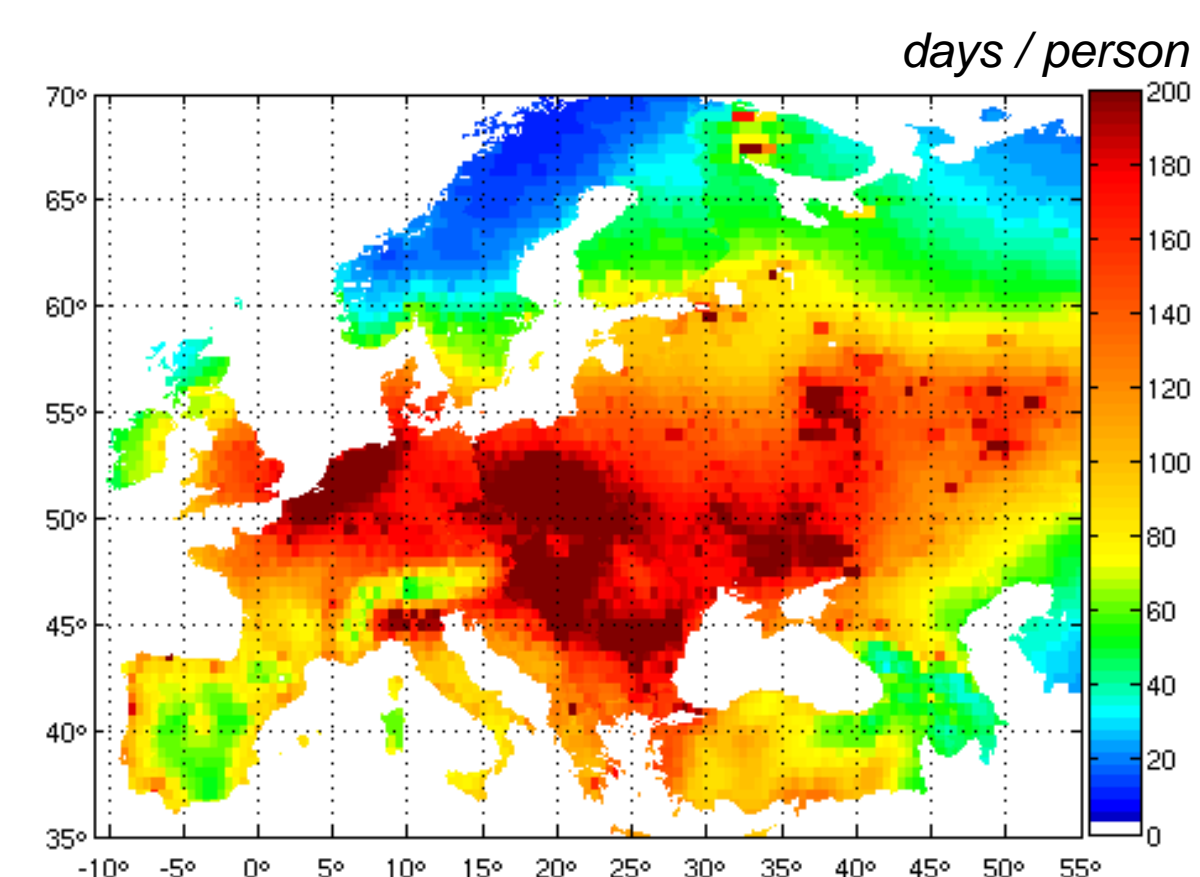
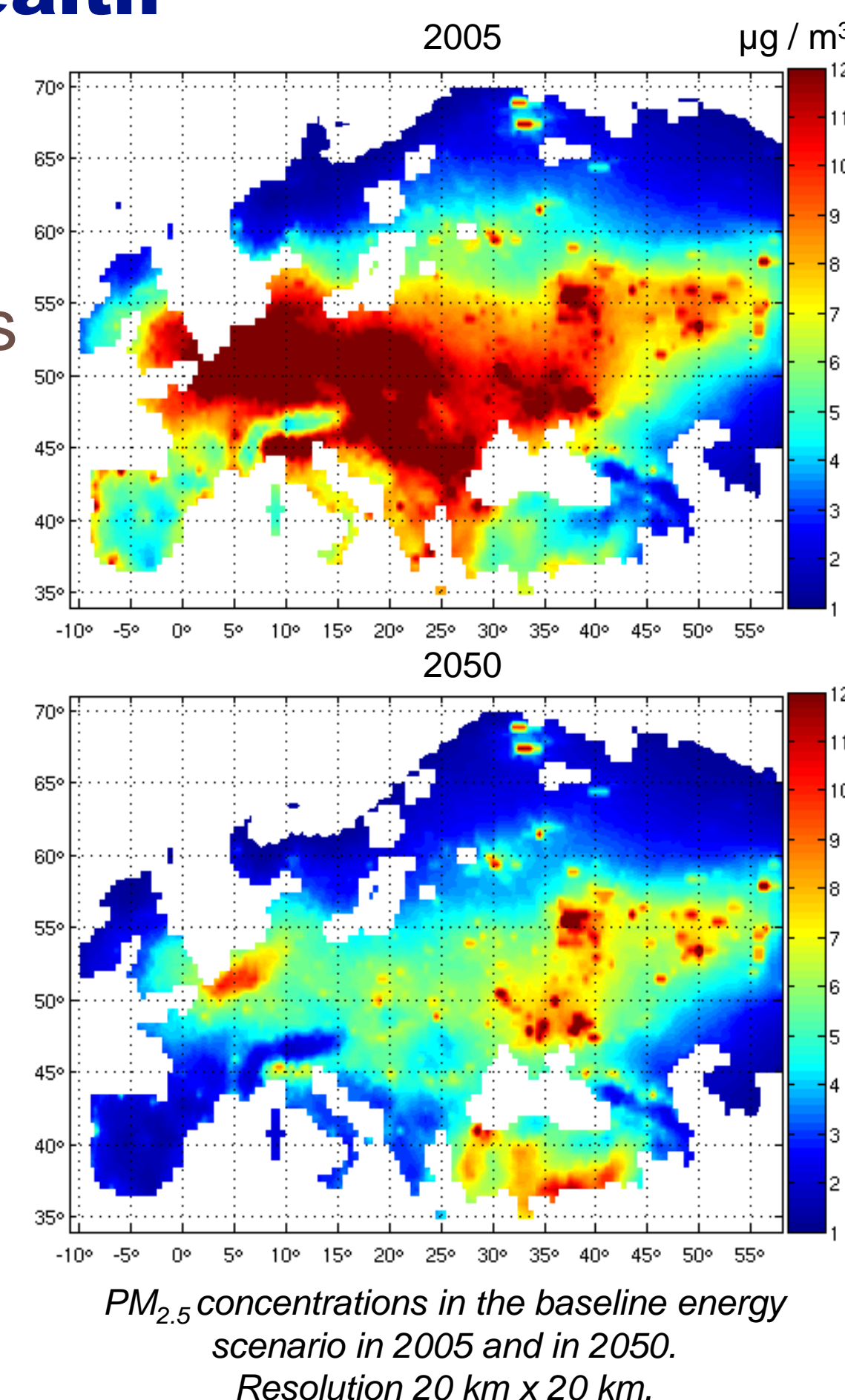


Loss of Life Expectancy: a key indicator to compare impacts from energy scenarios

- 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.



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.

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