



PM and Health

PM Emission Inventories Workshop
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PM and health

Content

- | What is PM
- | Health hazards of PM
- | Assessment of risk of PM
- | Conclusions

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PM and health

Size, composition and travel distance of PM

	Fine (<2.5 µm)		Coarse (>2.5 µm)
	Ultrafine (<0.1 µm)	Accumulation	
Composition	Sulphate EC, Metal compounds Organic compounds	Sulphate, Nitrate, Ammonium, H+, EC, compounds: organic, Pb, Cd, V, Ni, Cu, Zn, Mn, Fe, Particle- bound water	Dust, fly ash, crustal elements, sea salt, pollen; road, tire, brake pad wear debris
Travel distance	<1 to 10s km	100s to 1000s km	<1 to 10s km (100s to 1000s km in dust storms)

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Products of the «Systematic Review of health aspects of air quality in Europe», 2002/4

- | Health aspects of air pollution with particulate matter, ozone and nitrogen dioxide <http://www.euro.who.int/document/e79097.pdf>
- | Meta-analysis of time-series studies and panel studies of particulate matter (PM) and ozone (O3)
<http://www.euro.who.int/document/e82792.pdf>
- | Health aspects of air pollution – answers to follow-up questions from CAFE <http://www.euro.who.int/document/E82790.pdf>
- | The effects of air pollution on children's health and development: a review of the evidence
<http://www.euro.who.int/document/EEHC/execsum.pdf> (full report: Oct 2004)
- | Health aspects of air pollution
<http://www.euro.who.int/document/E83080.pdf>

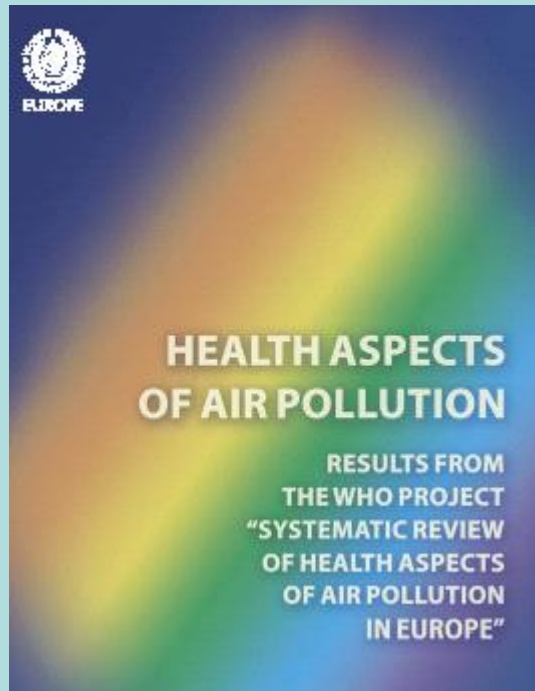
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PM and health

Products of the «Systematic Review of health aspects of air quality in Europe», 2002/4



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PM and health

Main results of the WHO systematic review on PM - I

- | The evidence on a causal relationship between PM exposure and several health endpoints (including mortality due to CV effects) has increased considerably in recent years
- | PM_{2,5} is an appropriate indicator to assess the effects of PM exposure on health, including mortality
- | However, there is evidence that coarse PM is also linked to some health effects
- | The long term exposure to fine PM may lead to a significant reduction in life expectancy (PM effects are not only ‚harvesting‘)

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PM and health

Main results of the WHO systematic review on PM - II

- | Some studies have clearly demonstrated the connection between improve air quality and improvements of population health
- | From a toxicological perspective, some PM constituents are of special concern:
 - | metals,
 - | organic compounds (such as PAH),
 - | ultrafine particles (< 100 nm) and
 - | endotoxins.
- | Critical sources include tailpipe emissions from vehicles, and other combustion related particles.
- | There is no apparent no-effect level

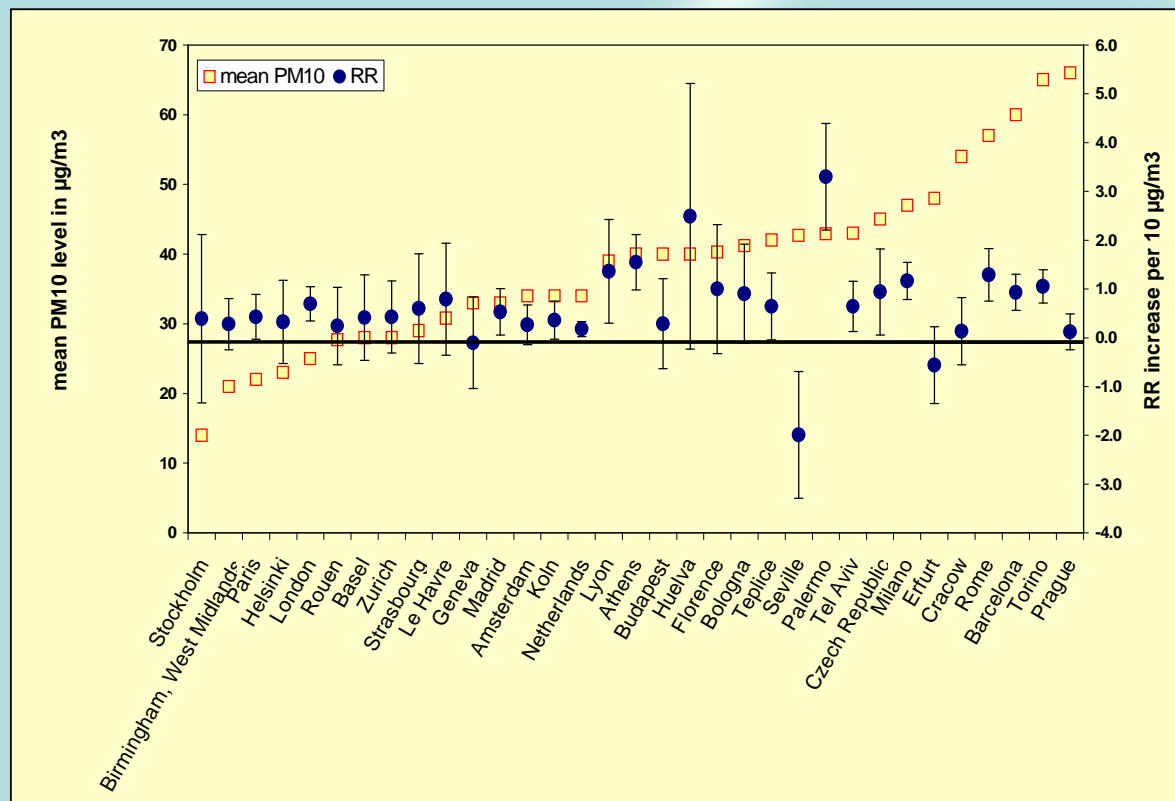
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Ranking of PM10 estimates for all-cause mortality by annual average levels of PM10



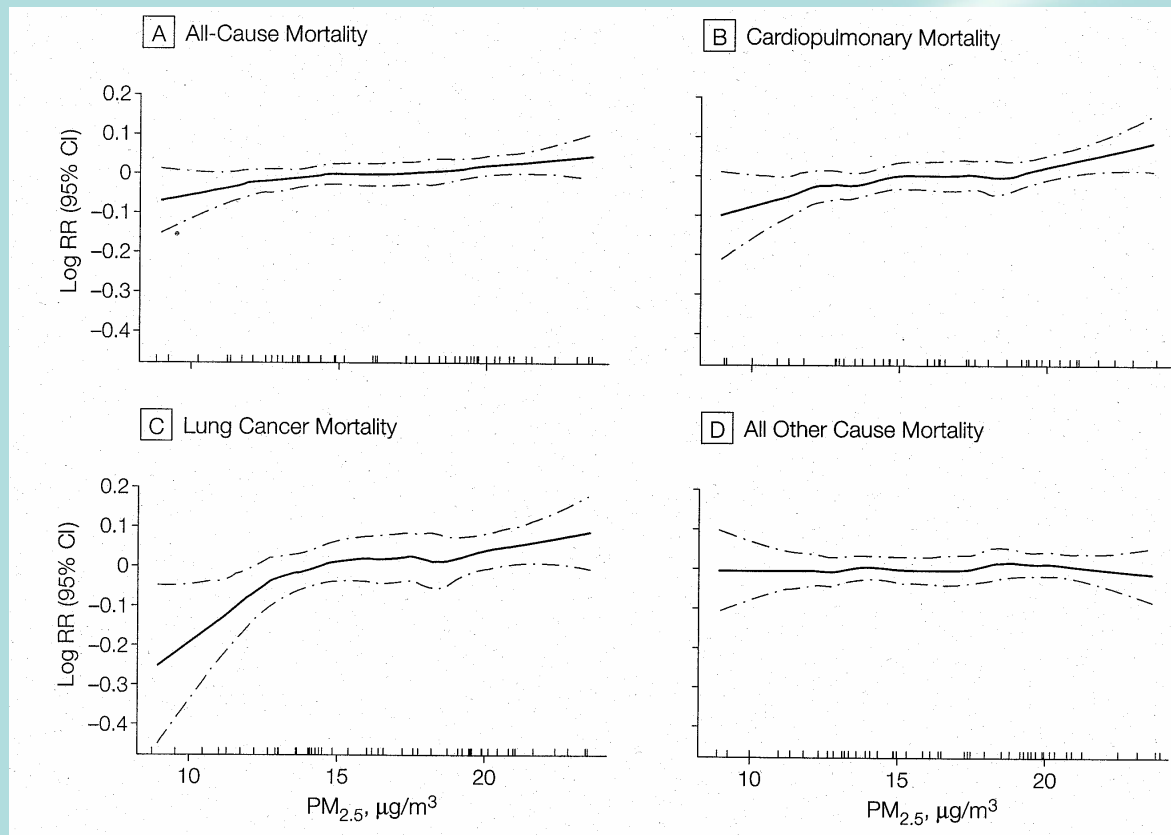
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Long term exposure to PM and risk of mortality in ACS cohort



Sources: Pope et al, JAMA 2002;

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PM and health

Long term exposure to PM and risk of mortality in ACS cohort

Cause of mortality	RR per 10 ug/m ³ PM _{2.5} *)	95% CI
All causes	1.06	1.02 – 1.11
Cardiopulmonary	1.09	1.03 – 1.16
Lung cancer	1.14	1.04 – 1.23
All other causes	1.01	0.95 – 1.06

Sources: Pope et al, JAMA 2002

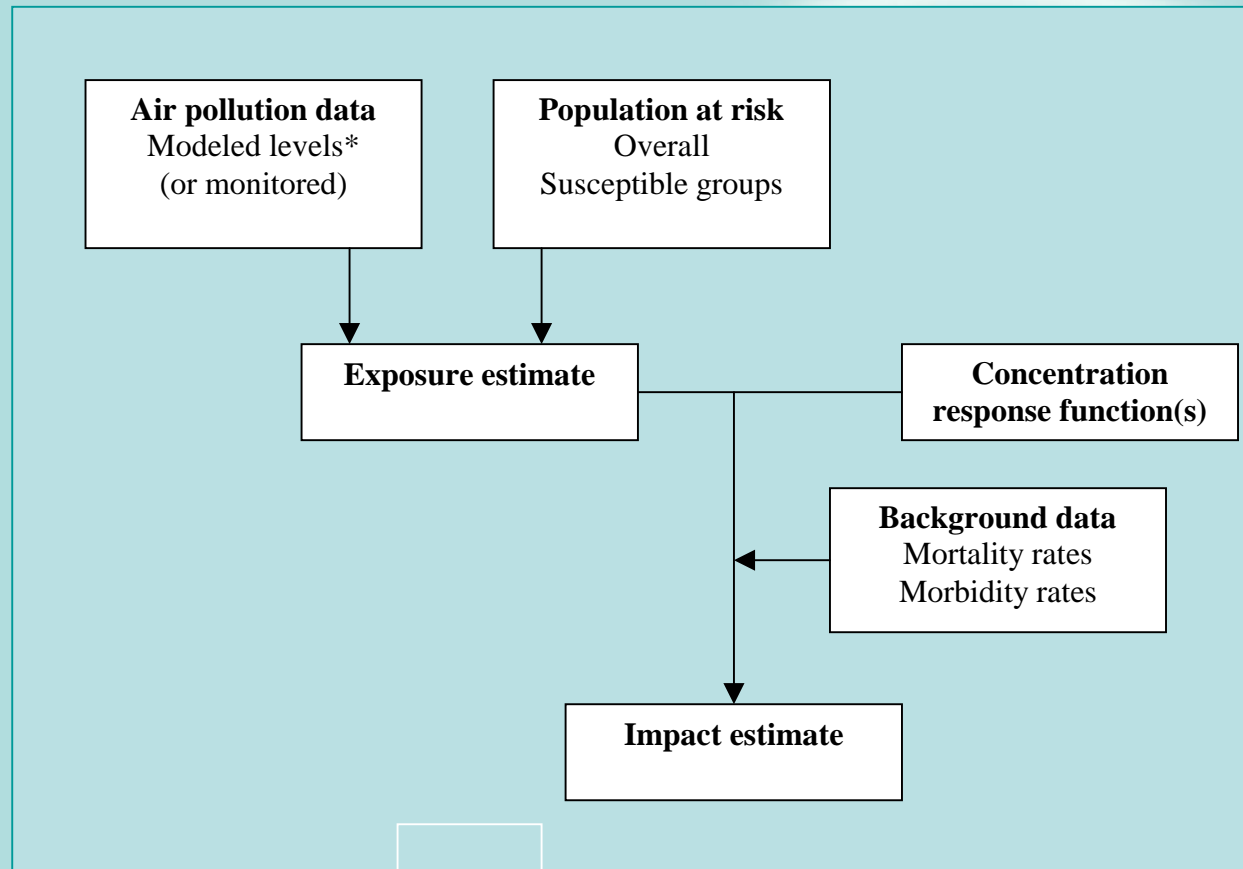
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Quantification of impacts



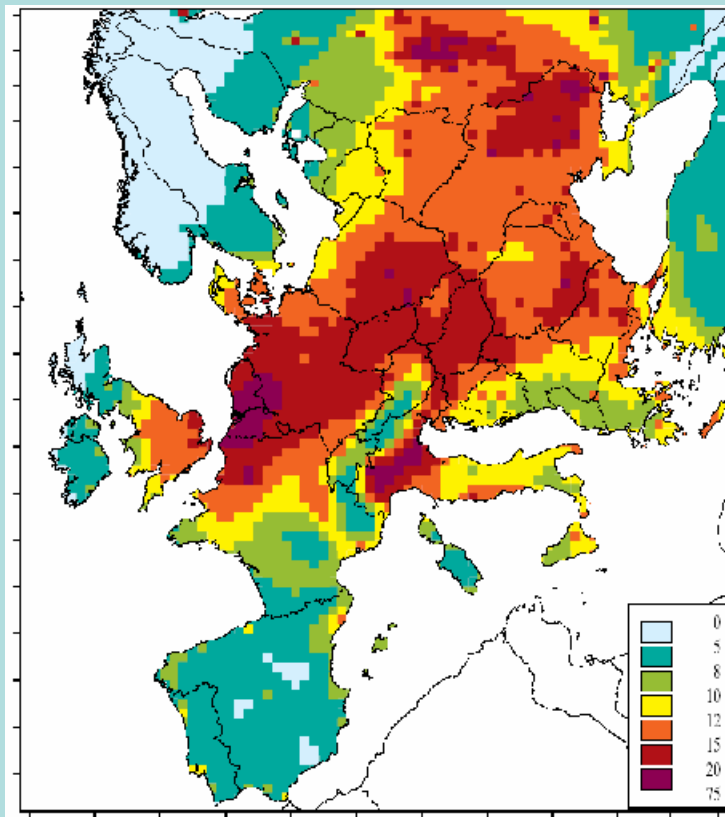
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Quantification of impacts – rural concentrations



Rural concentrations,
annual mean PM_{2.5} in µg/m³,
from known anthropogenic sources
excluding sec. org. aerosols
Emissions for 2000
Average meteorology for 1999 and
2003
Source: MSC-W

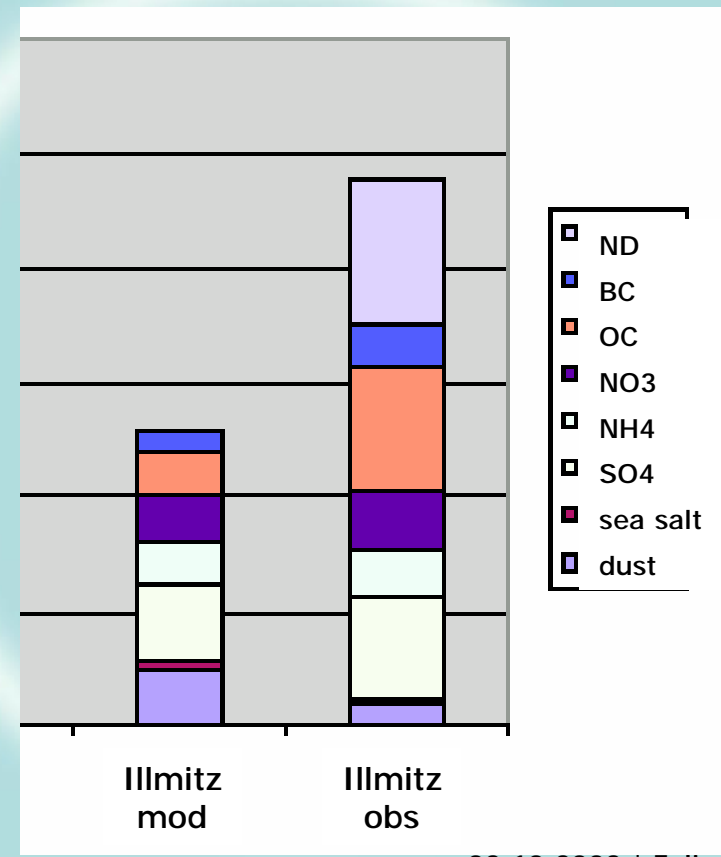
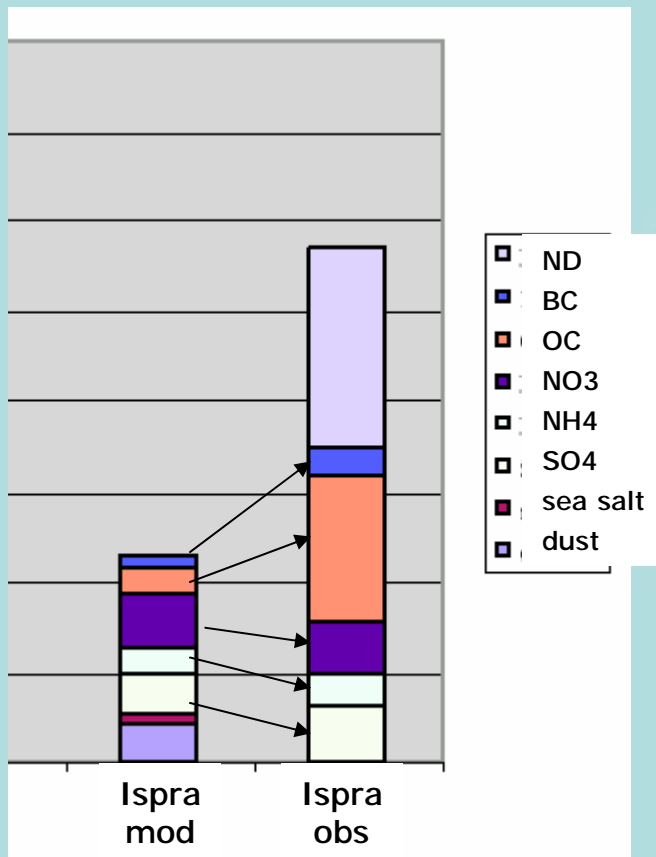
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Comparison of modelled versus measured concentrations



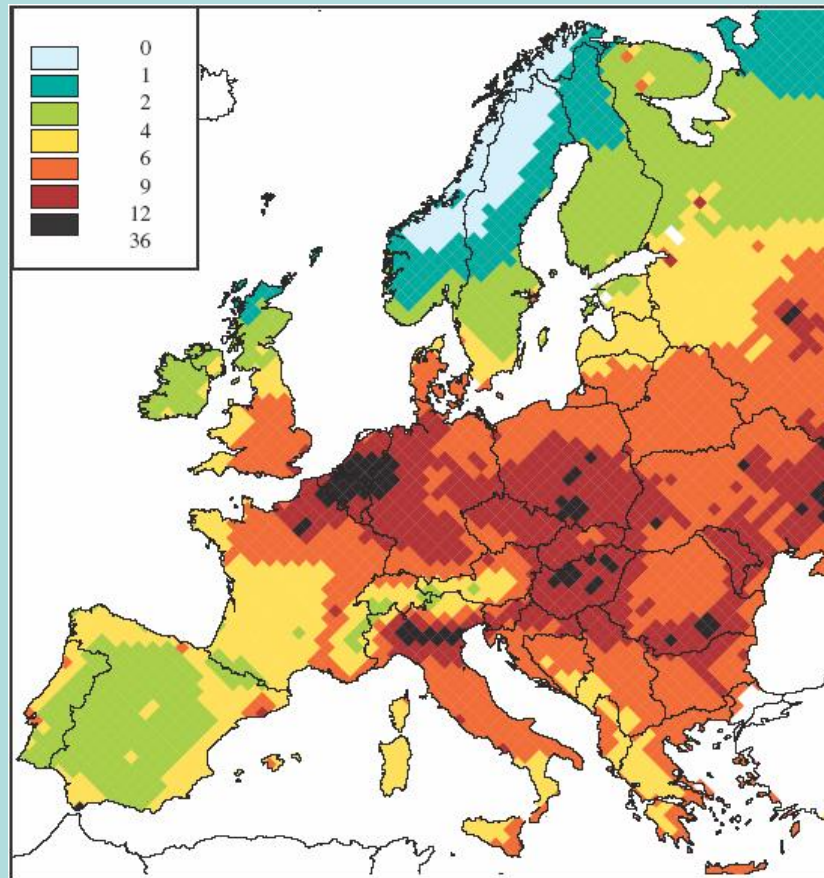
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Quantification of impacts – reduction in life expectancy



Reduction in life expectancy in months

Emissions for 2000

Average meteorology for 1999 and 2003

Source: IIASA

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Conclusions

- | Significant health impacts of long-term exposure (& short term peaks) of PM_{2.5}
- | Modelled and measured PM levels do not match as good as desirable: Missing processes; missing emissions??
- | Emissions & ambient monitoring: PM mass, size and speciation is desirable

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