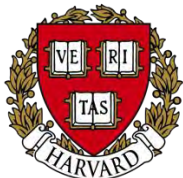


# Global premature mortality due to exposure to air pollution from fossil fuel combustion

K. Vohra, A. Vodonos, J. Schwartz, E. A. Marais, M. P. Sulprizio, L. J. Mickley,  
<https://doi.org/10.1016/j.envres.2021.110754>



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GLOBAL FUND

# PM<sub>2.5</sub> from Burning Fossil Fuels

PM<sub>2.5</sub> precursors emitted from a range of activities that combust fossil fuels

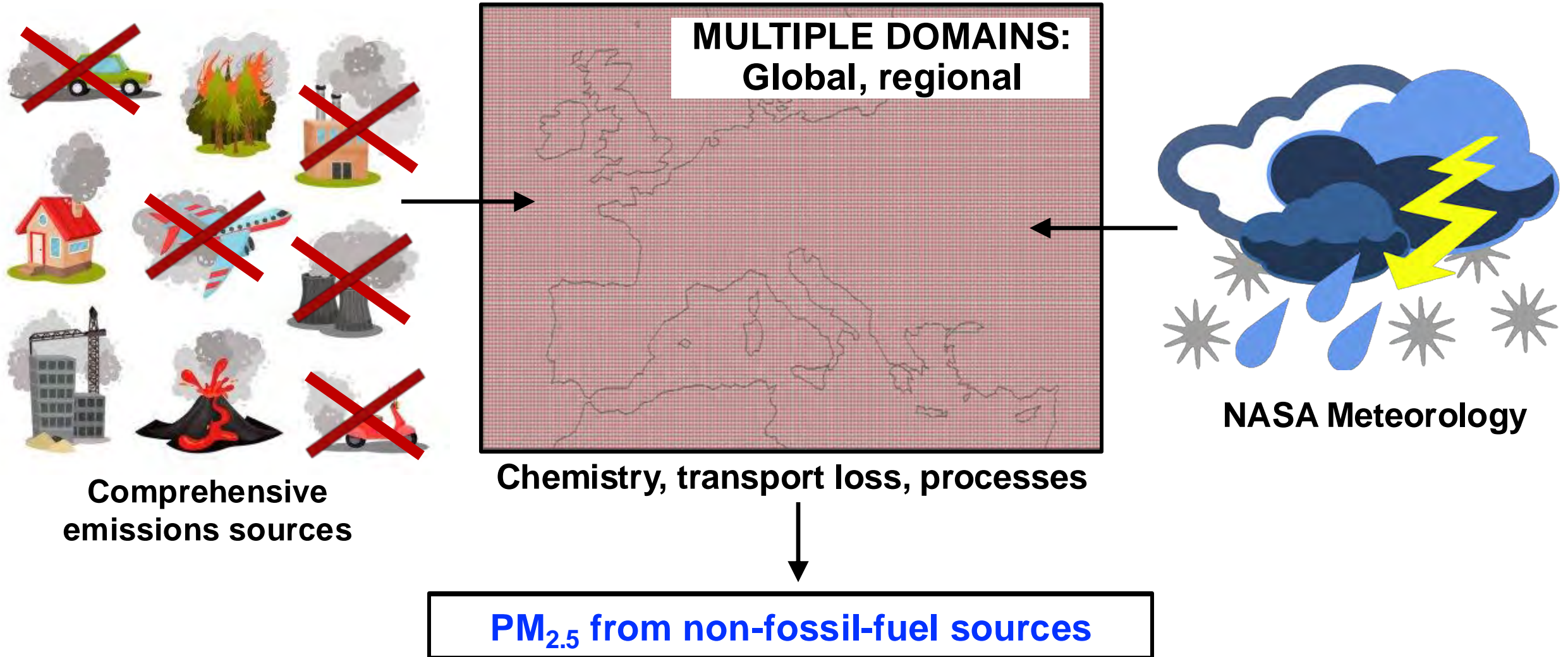
Combustion for transport, industry, energy generation, and domestic heating, lighting and cooking





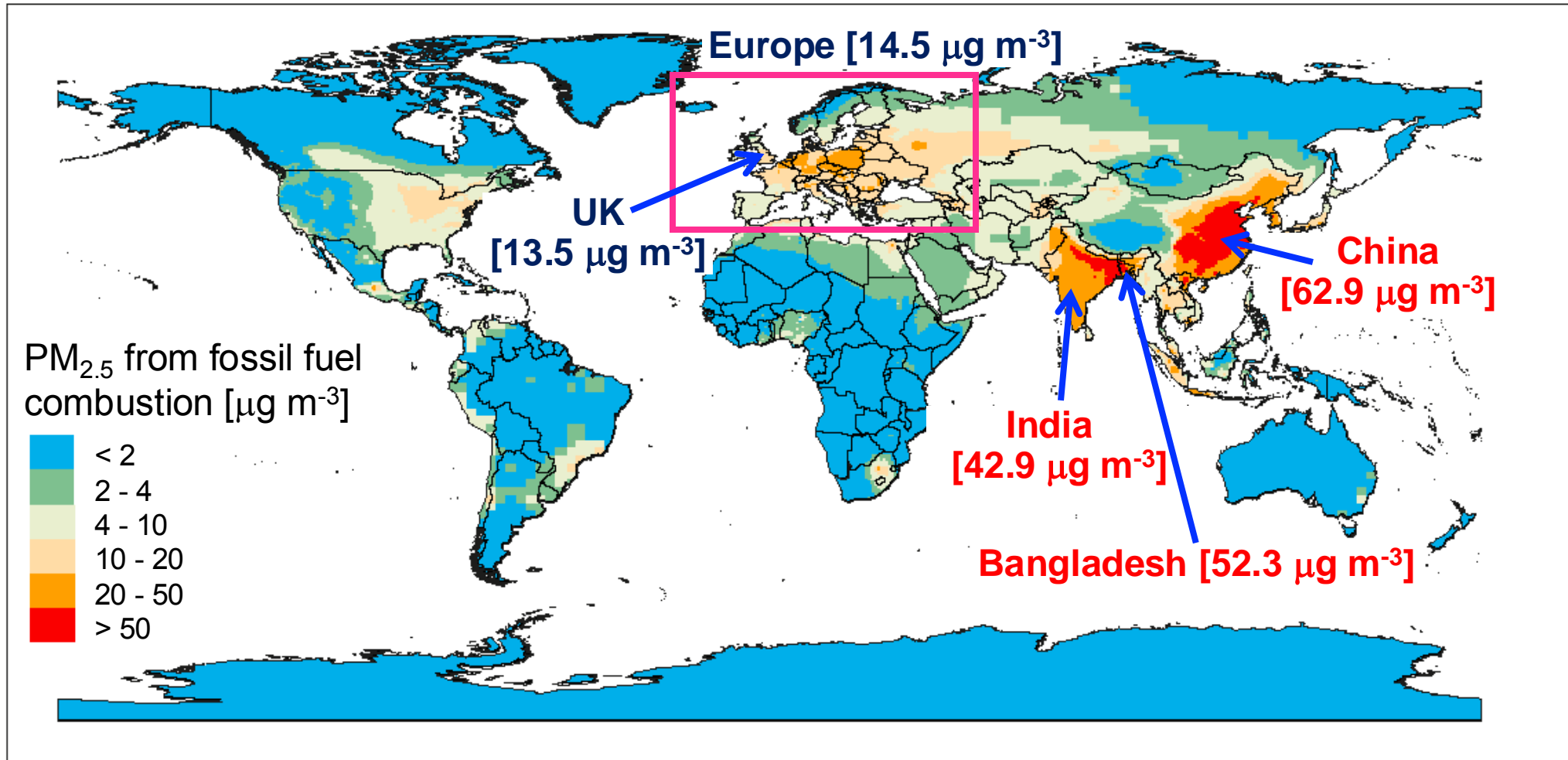
# Simulate Surface PM<sub>2.5</sub> with GEOS-Chem

3D Atmospheric Chemistry Transport Model



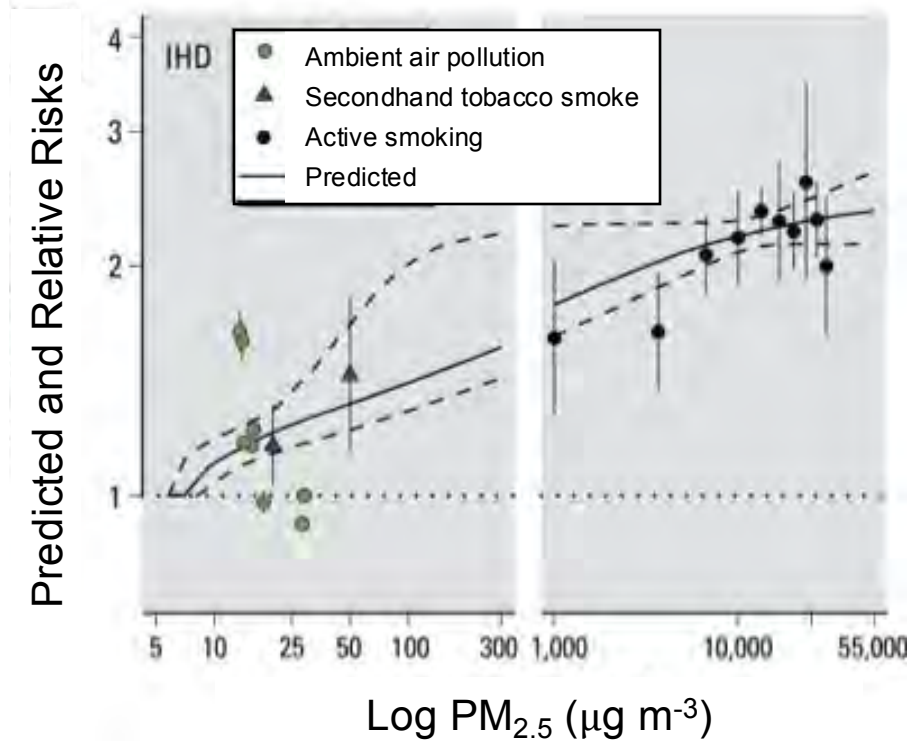
# GEOS-Chem Estimate of Fossil Fuel PM<sub>2.5</sub>

Difference between model simulations with and without fossil fuel PM<sub>2.5</sub>



# Standard and Widely used Risk Assessment Models

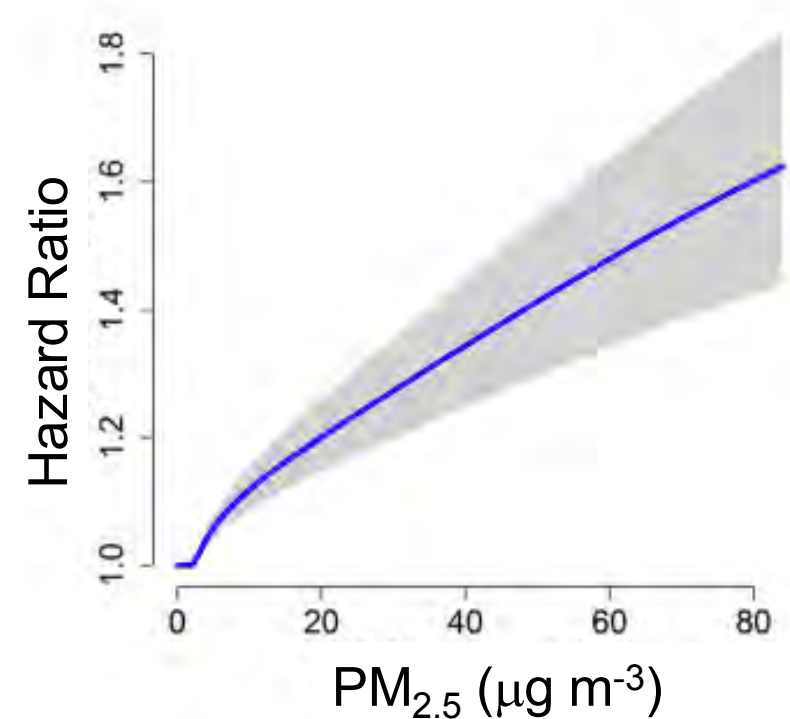
## Integrated Exposure-Response (IER)



[Burnett et al., 2014]

Data includes active and passive smoking to address outdoor PM<sub>2.5</sub> > 40  $\mu\text{g m}^{-3}$

## Global Exposure Mortality Model (GEMM)

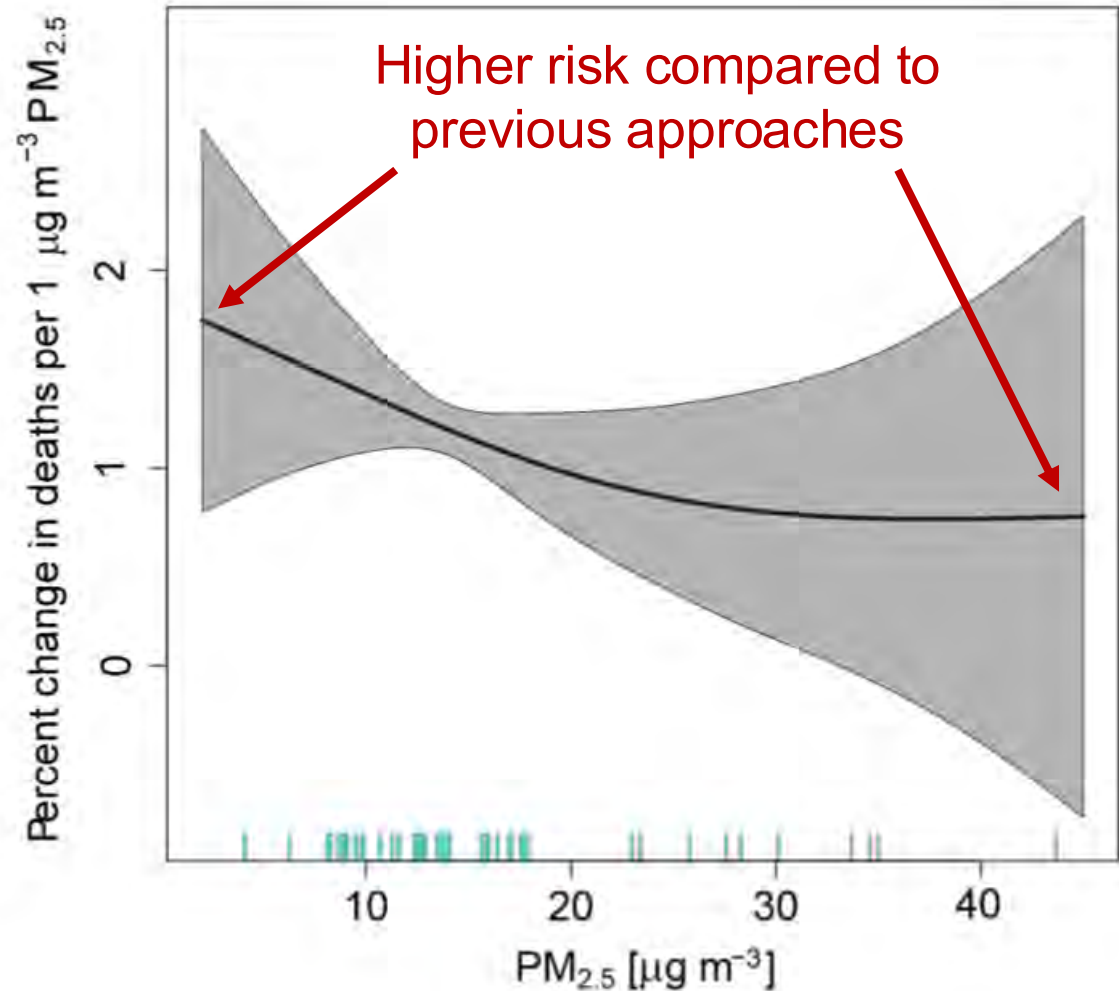


[Burnett et al., 2018]

41 cohort studies and model constrained using 4 parameters

# Updated Risk Assessment Model used in our Study

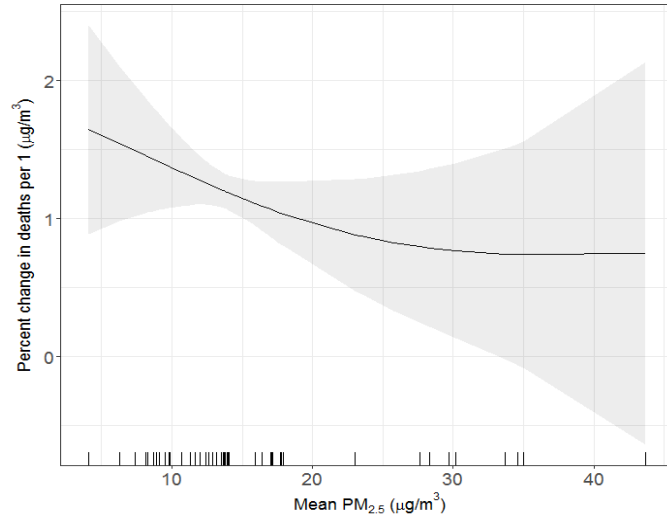
- Flexible shape of concentration-response function
- More cohort studies, and wider concentration and age range than previous approaches
- Includes death from all-causes



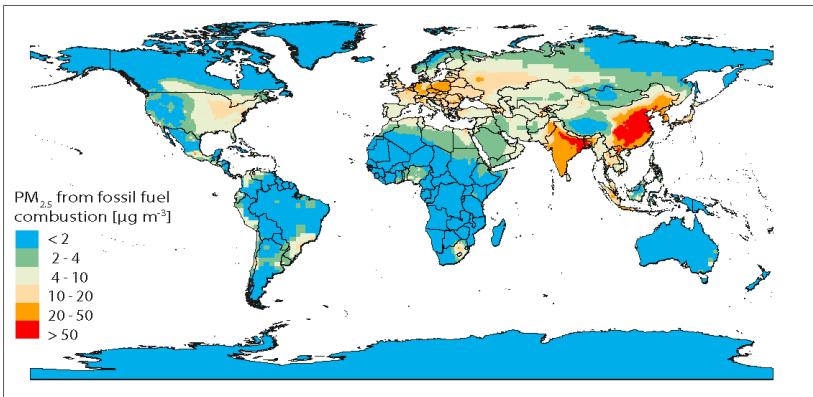
[Vodonos et al., 2018]



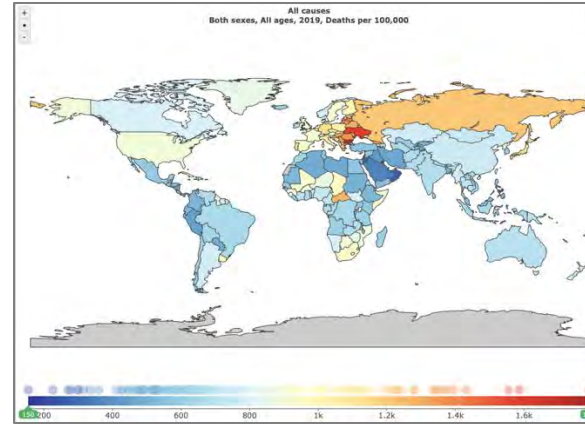
# Approach used to Calculate Health Impact



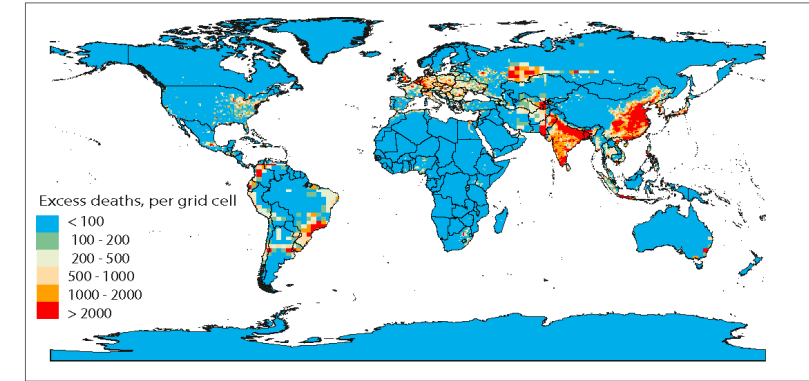
Meta-analysis concentration-response function from cohort studies



Fossil-fuel PM<sub>2.5</sub> from GEOS-Chem



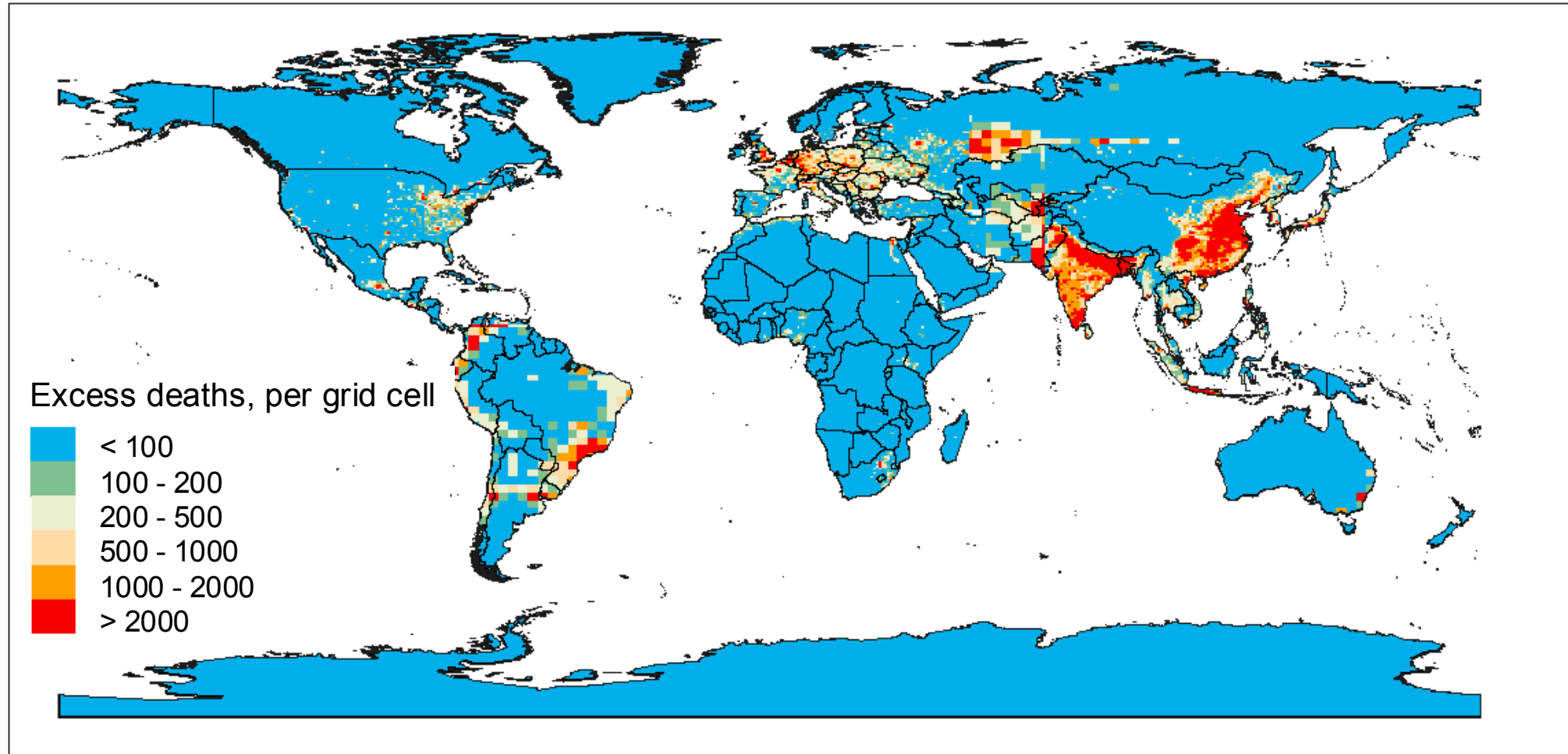
Baseline mortality from Global Burden of Disease



Global premature mortality

We use the derived fossil-fuel PM<sub>2.5</sub> with baseline mortality in the meta-analysis concentration-response function to estimate global premature mortality

# Global Premature Mortality from Fossil Fuel combustion



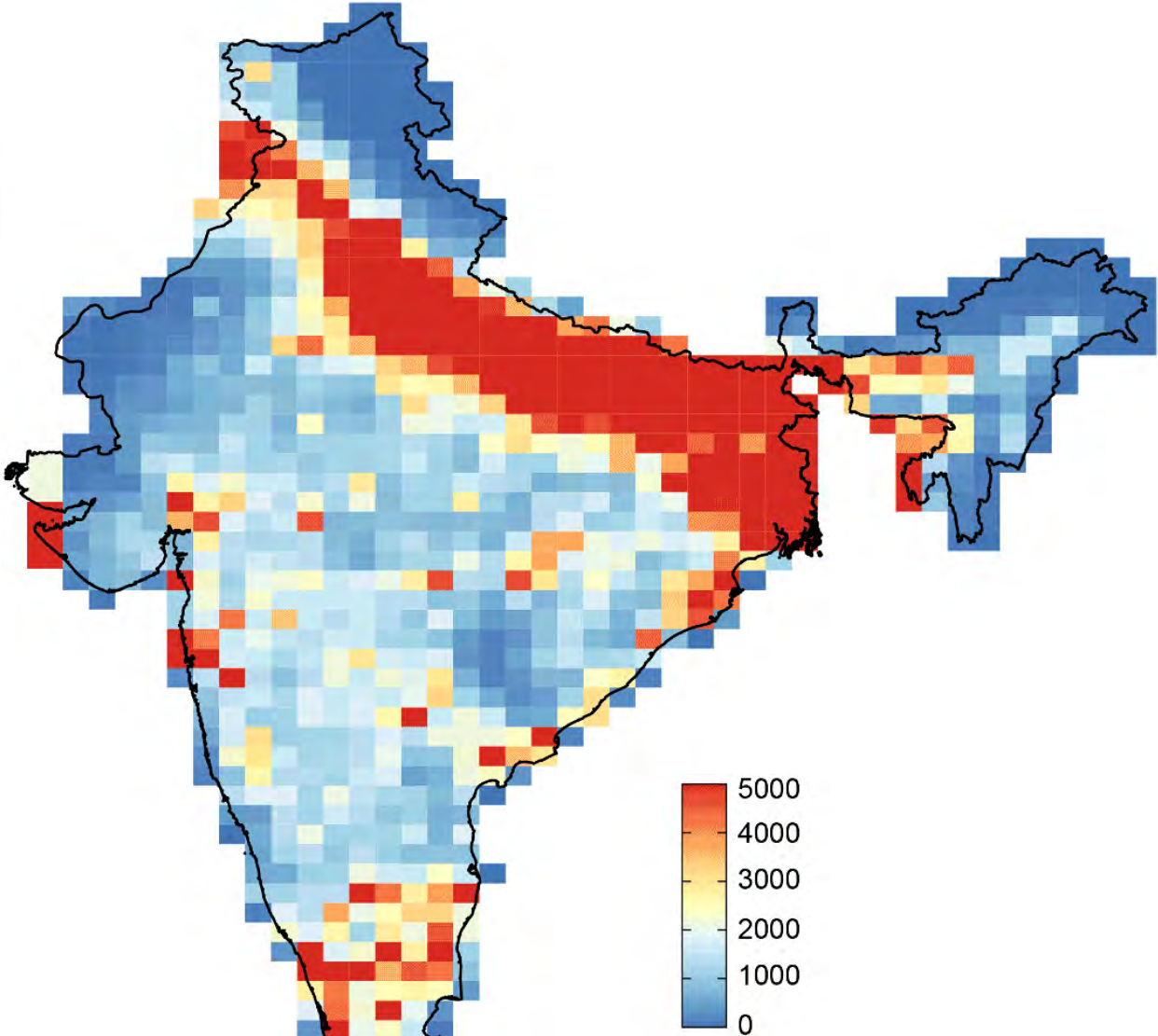
**10.2 million** adult (14+ years) premature deaths attributed to fossil-fuel  $PM_{2.5}$  in 2012  
[-47 million, 17 million]

GEMM CRF: 6.7 [95% CI: 5.3-7.9] million adult (25+ years) premature deaths



# Regional Premature Mortality from Fossil Fuel Combustion

**India**  
**2,500,000**



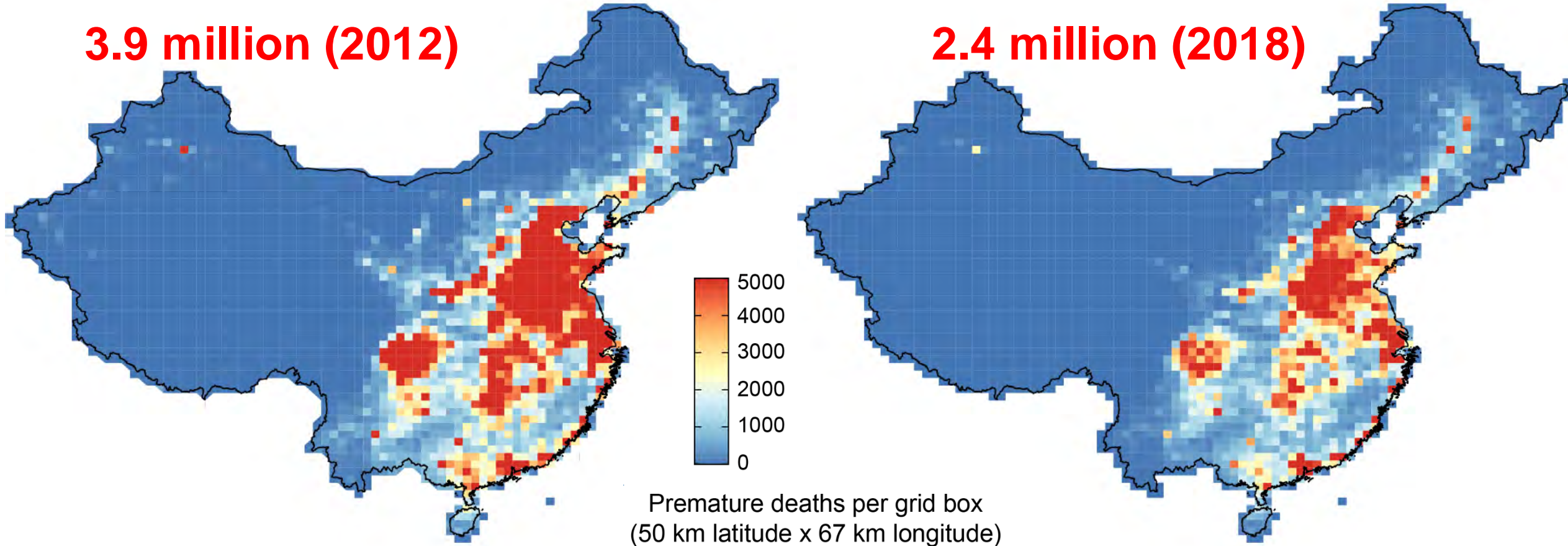
Premature deaths per grid box  
(50 km latitude x 67 km longitude)

# Policies Help Mitigate Premature Deaths

## China

**3.9 million (2012)**

**2.4 million (2018)**



**1.5 million fewer deaths in 2018 than 2012 due to policy-driven decline in PM<sub>2.5</sub> pollution in China**

# Resources Related to the Publication

## **The Conversation pieces on health and air quality:**

<https://theconversation.com/ditching-fossil-fuels-will-have-immediate-health-benefits-for-millions-world-leaders-must-seize-the-chance-171015>

<https://theconversation.com/air-pollution-in-fast-growing-african-cities-presents-a-risk-of-premature-death-183944>

## **Datasets derived using GEOS-Chem:**

Global premature mortality from fossil fuel air pollution: <https://doi.org/10.5522/04/14595714>

## **Visualization of results on Tableau dashboard:**

[https://public.tableau.com/app/profile/karn.vohra/viz/Globalmortalitylinkedtoairpollutionfromfossilfuelcombustion/Global\\_mortality\\_fossil-fuelPM2\\_5](https://public.tableau.com/app/profile/karn.vohra/viz/Globalmortalitylinkedtoairpollutionfromfossilfuelcombustion/Global_mortality_fossil-fuelPM2_5)

<https://public.tableau.com/app/profile/karn.vohra/viz/Trendsinairqualityinfast-growingtropicalcities/Dashboard1>