




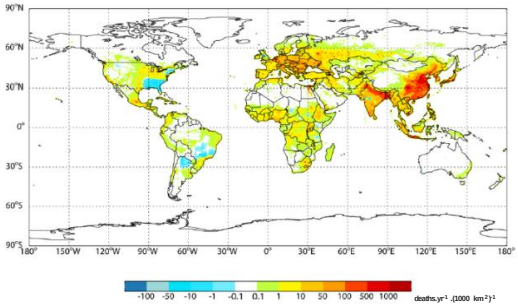

Global Premature Mortality due to Outdoor Air Pollution and the Contribution of Climate Change

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Abstract

Since the industrial revolution, anthropogenic outdoor air pollution has increased significantly. Ambient concentrations of air pollutants are affected both by emissions and by climate change. From a public health perspective, two pollutants of great concern are ozone and fine particulate matter ($PM_{2.5}$). In fact, many epidemiological studies have shown an association between exposure to these air pollutants and cardiopulmonary morbidity (e.g. asthma exacerbation) and mortality (e.g. death from cardiovascular and respiratory diseases as well as lung cancer). The present-day global burden of outdoor air pollution, and the effects of past climate change on global mortality via changes in air quality have been estimated. This seminar will report on the first study to use ozone and $PM_{2.5}$ concentrations from simulations with an ensemble of global chemistry-climate models. Changes in concentrations between preindustrial times and present-day were combined with present-day population and cause-specific baseline mortality rates and a concentration-response function. The effect of climate change on air quality was isolated by considering the difference between air pollutant concentrations from simulations with present-day emissions and climate and simulations with present-day emissions and preindustrial climate. From this data it was estimated that close to half a million premature respiratory deaths are associated globally and annually with anthropogenic ozone, while over 2 million deaths are due to anthropogenic $PM_{2.5}$-related cardiopulmonary diseases (93%) and lung cancer (7%). The effects of past climate change have an estimated small contribution of 1,500 (95% Confidence Interval, CI: -20,000 to 27,000) deaths per year due to ozone and 2,200 deaths (95% CI: -350,000 to 140,000) due to $PM_{2.5}$. The large CIs reflect the uncertainty in the concentration-response function and, particularly in the case of past climate change, the large variability among models. Forthcoming work will focus on estimating future premature mortality up to the end of the 21st century, considering four different scenarios, and estimating the potential contribution of future climate change.