

## **Effects of fossil fuel generated and total anthropogenic emission phase-out on public health and climate**

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Anthropogenic greenhouse gases and aerosols are associated with climate change and human health risks. We used a global model to estimate both the climate and public health outcomes attributable to fossil fuel use, indicating the potential benefits of a phase out. We show that it can avoid an excess mortality rate of 3.61 (2.96–4.21) million per year attributable to ambient air pollution worldwide. This could be up to 5.55 (4.52–6.52) million per year by additionally controlling non-fossil anthropogenic sources. Globally, fossil fuel related emissions account for about 65% of the excess mortality, and 70% of the climate cooling by anthropogenic aerosols. The chemical influence of air pollution on aeolian dust contributes significantly to the aerosol cooling effect. Because aerosols affect the hydrologic cycle, removing the anthropogenic emissions in the model increases rainfall by 10–70% over densely populated regions in India and 10–30% over northern China, and by 10–40% over Central America, West Africa and the drought-prone Sahel, supporting water and food security. Since aerosols mask the anthropogenic rise in global temperature, removing fossil fuel generated particles liberates  $0.51(+/-0.03)^{\circ}\text{C}$  and all pollution particles  $0.73(+/-0.03)^{\circ}\text{C}$  warming, reaching around  $2^{\circ}\text{C}$  over North America and Northeast Asia. The steep temperature increase from removing aerosols can be moderated to about  $0.36^{\circ}(+/-0.06)^{\circ}\text{C}$  by the simultaneous reduction of anthropogenic ozone and methane. In order to save millions of lives and restore aerosol-perturbed rainfall patterns, whilst limiting global warming to  $2^{\circ}\text{C}$ , a rapid phase-out of fossil fuel related emissions and major reductions of other anthropogenic sources are needed.