Chinese emissions reductions deliver reduced PM2.5-caused mortality across China during 2015-2017

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Air pollution is a serious environmental issue and leading contributor to the disease burden in China. Following severe air pollution episodes during the 2012-2013 winter, the Chinese government has prioritised efforts to reduce $PM_{2.5}$ emissions, and established a national monitoring network to record air quality trends. Rapid reductions in fine particulate matter ($PM_{2.5}$) concentrations and increased ozone concentrations have occurred across China, during 2015 to 2017. We used measurements of particulate matter with a diameter < 2.5 μm ($PM_{2.5}$) and Ozone (O_3) from >1000 stations across China combined with similar datasets from Hong Kong and Taiwan to calculate trends in $PM_{2.5}$, Nitrogen Dioxide, Sulphur Dioxide and O_3 across the greater China region during 2015-2019. We then use the Weather Research and Forecasting model coupled with Chemistry (WRF-Chem) regional air quality simulations, to explore the drivers and impacts of observed trends. Using annually varying emissions from the Multi-resolution Emission Inventory for China, we simulate air quality across China during 2015-2017, and calculate a median $PM_{2.5}$ trends of -3.9 μg m^{-3} year^{-1}. The measured nationwide median $PM_{2.5}$ trend of -3.4 μg m^{-3} year^{-}. With anthropogenic emissions fixed at 2015-levels, the simulated trend was much weaker (-0.6 μg m^{-3} year^{-1}), demonstrating interannual variability in meteorology played a minor role in the observed $PM_{2.5}$ trend. The model simulated increased ozone concentrations in line with the measurements, but underestimated the magnitude of the observed absolute trend by a factor of 2. We combined simulated trends in $PM_{2.5}$ concentrations with an exposure-response function to estimate that reductions in $PM_{2.5}$ concentrations over this period have reduced $PM_{2.5}$-attribrutable premature morality across China by 150 000 deaths year^{-1}.