Implications of RCP emissions on future PM2.5 air quality and direct radiative forcing over China

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A panoramic view of the Beijing Olympic Park Zone, taken from HD cameras placed at the 280-meter platform of the 325-meter high meteorological observation tower of the Institute of Atmospheric Physics, Chinese Academy Sciences on Nov. 17, 2016. Credit: Institute of Atmospheric Physics, Chinese

With rapid industrialization and urbanization over the past decades, China has experienced widespread air pollution induced by fine particulate matter with a diameter of 2.5 μm or less ($PM_{2.5}$). To protect human health and meet the newly implemented annual $PM_{2.5}$ target (less than 35 μg m^{-3}), great efforts are needed to reduce emissions effectively. It is, therefore, essential to understand how future $PM_{2.5}$ concentrations are affected by changes in anthropogenic emissions.

By using a global chemical transport and future emission scenarios (the representative concentration pathways, RCPs), researchers from Institute of Atmospheric Physics and their co-authors, projected that by 2030 wintertime (summertime) $PM_{2.5}$ concentrations averaged over Beijing-Tianjin-Hebei, Yangtze River Delta, Pearl River Delta, and Sichuan Basin will be 49-56 (31-40), 40-50 (23-29), 22-27 (8-11), and 56-68 (19-24) μg m^{-3}, respectively, with the ranges of $PM_{2.5}$ concentrations obtained on the basis of the four RCPs.

"In consideration of annual $PM_{2.5}$ target, controlling $PM_{2.5}$ pollution in Beijing-Tianjin-Hebei and Sichuan Basin will be challenging." said Hong Liao, who is the corresponding author of the research published in *Journal of Geophysical Research: Atmospheres*. "In these two regions, it will take at least two decades to achieve the annual $PM_{2.5}$ target under the RCP2.6, RCP4.5, and RCP8.5 scenarios, and $PM_{2.5}$ concentrations will keep increasing under RCP6.0."

In the meantime of improving air quality, policymakers are suggested considering the impacts on climate induced by decreases in aerosol concentrations, as experienced in the US and Europe. The IPCC has estimated that the global mean surface temperature exhibited a warming

of 0.85°C (0.65-1.06°C) from 1880 to 2012, and the associated radiative forcings by greenhouse gases and aerosols were +2.83 and +0.90 W m^{-2}, respectively. "Thus, the predicted positive aerosol direct radiative forcing of 0.7-1.9 W m^{-2} over eastern China (20°-45°N, 100°-125°E) in 2050 relative to 2000 under all RCPs except for RCP6.0 have important implications for regional climate." said Liao.

"There is a long way to go to mitigate future $PM_{2.5}$ pollution in China based on the emission scenarios." Concluded Liao. "At the same time, the consequent warming from reduced aerosols is also significant and inevitable."

The study has been published in *Journal of Geophysical Research: Atmospheres*.

More information: Ke Li et al, Implications of RCP emissions on future PMair quality and direct radiative forcing over China, *Journal of Geophysical Research: Atmospheres* (2016). DOI: 10.1002/2016JD025623

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