



Expanding atmospheric acid deposition in China from the 1990s to the 2010s

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Atmospheric acid deposition is considered a global environmental issue. China has been experiencing serious acid deposition, which is anticipated to be more serious with the country's economic development and increasing consumption of fossil fuels in recent decades. By collecting nationwide data on pH and concentrations of sulfate (SO_4^{2-}) and nitrate (NO_3^-) in precipitation between 1980 and 2014 in China, we explored the spatiotemporal variations of precipitation acid deposition (bulk deposition) and their influencing factors. Our results showed that average precipitation pH values were 4.86 and 4.84 in the 1990s and 2010s, respectively. This suggests that precipitation acid deposition in China has not seriously changes. Average SO_4^{2-} deposition declined from 30.73 to 28.61 kg S ha^{-1} yr^{-1} but average NO_3^- deposition increased from 4.02 to 6.79 kg N ha^{-1} yr^{-1} . Specifically, the area of severe precipitation acid deposition in southern China has shrunk to some extent as a result of decreasing pollutant emissions, whereas the area of moderate precipitation acid deposition has expanded in northern China, associated with rapid industrial and transportation development. Significant positive correlations have been found between precipitation acid deposition, energy consumption, and rainfall. Our findings provide a comprehensive evaluation of the spatiotemporal dynamics of precipitation acid deposition in China over past three decades, and confirm the idea that strategies implemented to save energy and reduce pollutant emissions in China have been effective in alleviating precipitation acid deposition. These findings might be used to demonstrate how developing countries could achieve economic development and environmental protection through the implementation of advanced technologies to reduce pollutant emissions.