

The study explores the challenges and opportunities for achieving carbon neutrality in China, with a focus on PM2.5 air quality and carbon sink estimation. It is supported by various funding sources, and the authors have declared no competing interests. The research utilizes an Earth system model to assess the impact of China's carbon neutrality pledge on global warming, demonstrating significant avoided warming under specific scenarios. The study underscores the significance of global cooperation in addressing climate change. The CNCN scenario aims to reduce China's carbon emissions by 89% in 2050 compared to 2030 levels, with substantial implications for global warming mitigation. Additionally, the CNCN ext scenario considers changes in CH₄ and N₂O emissions, with the CESM model used to simulate their effects on global mean surface temperature. The study provides data and code availability for further research. Overall, the research indicates that China's carbon neutrality efforts can potentially reduce global warming by 0.48 °C and 0.40 °C under different scenarios, with even greater mitigation effects when accounting for changes in CH₄ and N₂O emissions. These findings offer valuable insights for global climate mitigation strategies and aligning with the goals of the Paris Agreement.