



Regional air pollution in the North China Plain: insights from the Mount Tai Observatory

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The North China Plain (NCP) is one of the most industrialized and polluted regions in China. Mount Tai (36.25 N, 117.10 E; 1534 m altitude) is located in the center of the NCP and thus is representative of this region. Shandong University has operated the Mount Tai Observatory for over ten years to understand the long-term variation and formation mechanisms of regional air pollution. In this work, we summarize the research findings regarding O₃, nitrate aerosols, and particle number size distributions measured at Mount Tai to improve current understanding of formation of secondary air pollutants in this area.

This comprehensive study integrates long-term and short-term in situ measurements and model simulations. Observations show the worsening situation of regional O₃ and nitrate pollution. Summertime O₃ measured at Mt. Tai increased significantly by 1.7 ppbv yr⁻¹ for June and 2.1 ppbv yr⁻¹ for the July–August average during 2003–2015; the NO₃⁻/PM_{2.5} and NO₃⁻/SO₄²⁻ ratios also increased greatly at Mt. Tai from 2007 to 2014. To explore causes of these changes, the formation mechanisms of O₃ and secondary aerosols were studied using both chemical box models and 3-D chemical transport models. Understanding of some important questions, including a holistic characteristics of air pollution trend, different formation pathways of secondary pollutants, and impacts of meteorology and emission changes, have been improved by this study. Our work provides scientific arguments for developing effectiveness control strategies to improve air quality in NCP.