

Exploring the use of ground-based remote sensing to identify new particle formation events: A case study in the Beijing area

Ying Zhang, Liuxin Dai, Gerrit de Leeuw , Zhengqiang Li

Aerospace Information Research Institute, Chinese Academy of Sciences, Beijing 100101, China

New Particle Formation (NPF) events are an important process of secondary aerosol production in the atmosphere, which has significant impacts on the Earth's radiation balance, air quality, and climate change. In this study, we develop a method to identify NPF events based on ground-based remote sensing, and propose ground-based remote sensing Proxy to identify NPF events using gaseous precursors and aerosol optical depth (AOD) from new particle sources and sinks in Beijing in the winter of 2022. We found that regional nucleation of SO₂ and HCHO with ground-based remote sensing proxies exceeding 0.44×10^{-4} and 1.07×10^{-4} is a significant signal for identifying the occurrence of NPF events. The daily variation of regional nucleation proxies on NPF days showed high noon and low morning and evening, and the peak proxies of SO₂ and HCHO were 5.24 and 7.84 times higher than those on the days of non-NPF events. Ground-based remote sensing has high temporal resolution compared to satellite observations and high reliability in identifying NPF events.

Key words: New Particle Formation; Ground-based remote sensing; Regional nucleation; Beijing