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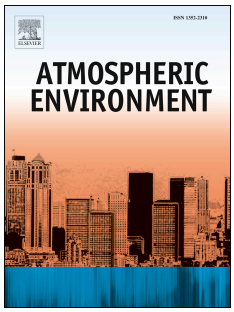

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A performance assessment and adjustment program for air quality monitoring networks in Shanghai

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Abstract

In this study, we evaluated the performance of Shanghai's air quality monitoring network (AQMN) using principal components analysis, an assignment method, and cluster analysis. Our goal was to improve the utilization of monitoring stations and evaluate Shanghai's air quality more comprehensively and accurately. Specifically, we (i) identified similar pollution sources or behaviors in the monitoring areas; (ii) identified redundant monitoring stations and re-evaluated the AQMN's performance without them; and (iii) proposed adjustments to the AQMN. We used data on particulates less than 2.5 μm ($PM_{2.5}$) and 10 μm (PM_{10}) in diameter, sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3), and carbon monoxide (CO) at stations in and around Shanghai from 1 January to 22 August 2014. For each pollutant, we grouped the monitoring stations into clusters based on their different pollution behaviors, revealing redundancy and inefficiency in the current AQMN that resulted from the concentrated station distribution and similarity of the monitoring environments. The analysis results showed that there exist redundant stations in the current AQMN of Shanghai. Furthermore, we proposed adjustments to Shanghai's AQMN: transfer four redundant stations and build a new station in the directions of the Taicang Experimental Primary School, Kunshan Zhenchuan Middle School, Suzhou Industrial Park, Wujiang Industrial Zone, and Jiaxing Monitoring Station. Our analysis suggests that, in addition to industrial, transportation, construction, and population influences inside Shanghai, external pollutants significantly affect Shanghai's air quality. Therefore, it is necessary to jointly prevent and control regional air pollution both in Shanghai and in neighboring cities.

Key Words: Air quality monitoring networks, Principal components analysis, Assignment method, Cluster analysis

1 Introduction

In recent years, severe large-scale and continuous haze has repeatedly affected central and eastern China. In early December 2013, the most serious haze (based on levels of particulates smaller than