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Comparative Evaluation of Air Quality Dispersion Models for PM$_{2.5}$ at Air Quality Control Regions in Indian and UK Cities

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Abstract

Swelling urban populations and increased concentration of automobile traffic in and around cities have resulted in severe air pollution, threatening human health and undermining the productivity of the urban population. Air quality modelling is one of the important components of urban air quality management (UAQM). This paper contains comparative performance results of three most used commercial air quality models (AQMs) e.g. AERMOD, ADMS-urban and ISCST3. The models are evaluated based on their predictive accuracy of 1-h average PM$_{2.5}$ concentrations at selected air quality control regions (AQCRs) in the Delhi and Chennai cities in India and Newcastle city in the United Kingdom for critical winter period of year 2009. At Delhi AQCR, ISCST3 predictions of PM$_{2.5}$ concentrations are more accurate ($d = 0.66$) than AERMOD ($d = 0.51$) and ADMS-Urban ($d = 0.52$). Similar performance of the models have been observed at Chennai city AQCR, i.e., index of agreement 'd' = 0.52 for ISCST3 and $d = 0.40$ and 0.47 for AERMOD and ADMS-Urban, respectively. However, at Newcastle city AQCR, the ISCST3 has predicted PM$_{2.5}$ concentrations with an accuracy having $d = 0.56$ while AERMOD and ADMS, having $d = 0.53$ and 0.54, respectively. Differences in 'd' values clearly indicate *causal* nature of these Gaussian based models and their sensitivity to input data as well as their *parsimonies* (less input data requirement by models and more accuracy in output results) to geographical and meteorological conditions.

Keywords