Long-term trend of PM$_{2.5}$ over five Indian megacities using a new statistical approach

Abstract

PM$_{2.5}$ is one of the major contributors to air pollution in India, resulting in poor air quality and human health issues. The current study explores the applicability of *TTAinterfaceTrendAnalysis* (an 'R' language-based Graphical User Interface package) in estimating the annual and month-wise trends in PM$_{2.5}$ over five Indian megacities (New Delhi, Kolkata, Mumbai, Hyderabad, and Chennai). The package offers a one-stop solution for various statistical analyses such as data imputation, outlier detection, trend analysis, data smoothing, diagnostic tests, etc. The trends are estimated using seven (2014–2020) years of PM$_{2.5}$ data. All estimated month-wise trends of PM$_{2.5}$ over the study cities were found to be statistically non-significant. Annual trends (both with and without applying data smoothing techniques) were found to be statistically significant with magnitudes ranging between -0.27 and -5.2 µg m^{-3} y^{-1} (negative sign indicates a declining trend). Autocorrelation analysis and normality tests are also conducted using the inbuilt options of *TTAinterfaceTrendAnalysis.* Results obtained are thoroughly discussed and compared with those of similar contemporary studies. To our knowledge, the current study is the first to apply *TTAinterfaceTrendAnalysis* for quantifying long-term trends in PM$_{2.5}$. The sensitivity of the trend estimates due to the inclusion of COVID-19 lockdown PM$_{2.5}$ data was also examined. The net impact of lockdown on the PM$_{2.5}$ long-term trend ranged between -0.13 and 2.29 µg m^{-3} y^{-1} across the study cities.