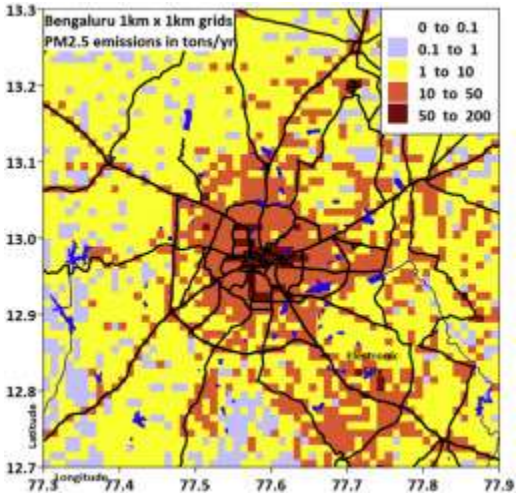
Abstract

Bengaluru - capital of the state of Karnataka is the original “Silicon Valley” of India. In this paper, we present a comprehensive snapshot of the state of air quality in Bengaluru, along with an emissions inventory for the pollutants necessary for chemical transport modeling at 0.01° grid resolution (approximately 1-km), for an urban airshed covering 60 × 60 grids (4300 km^2). For 2015, emission estimates for the city are 31,300 tons of $PM_{2.5}$, 67,100 tons of PM_{10}, 5300 tons of SO_2, 56,900 tons of NO_x, 335,550 tons of CO, and 83,500 tons of NMVOCs. Overall, transport is the key emission source for Bengaluru - vehicle exhaust and on-road dust resuspension account for a combined 56% and 70% of total $PM_{2.5}$ and PM_{10} emissions; followed by industries (17.8% including the brick kilns), open waste burning (11.0%), and domestic cooking, heating, and lighting (6.5%), in case of $PM_{2.5}$. We conducted particulate pollution source apportionment of local and non-local sources, using WRF meteorological model and CAMx chemical transport modeling system. A comparison of range of 24-hr average modeled $PM_{2.5}$ concentrations (36.5 ± 9.0 µg/m^3) and monitored $PM_{2.5}$ concentrations (32.3 ± 24.2 µg/m^3) by month, shows that the model catches the quantitative ranges and qualitative trends. The modeled source contributions highlight the vehicle exhaust (28%) and dust (including on-road resuspended dust and construction activities) (23%), and open waste burning (14%), as the key air pollution sources. Unless there is an aggressive strategy to improve urban planning and public transport options, pollutant emissions under the business as usual scenario are expected to increase at least 50% in 2030 and doubling the urban area with $PM_{2.5}$ annual averages above the national ambient standard of 40 µg/m^3.

Graphical abstract



Keywords

Air quality; Particulates; $PM_{2.5}$; Bengaluru; Bangalore; India; Emissions inventory; Chemical transport modelling; WRF-CAMx