is it the emissions or the meteorology?

simplest definition

$$\text{pollution } (\mu g/m^3) = \frac{\text{emissions } (\mu g)}{\text{volume } (m^3)}$$

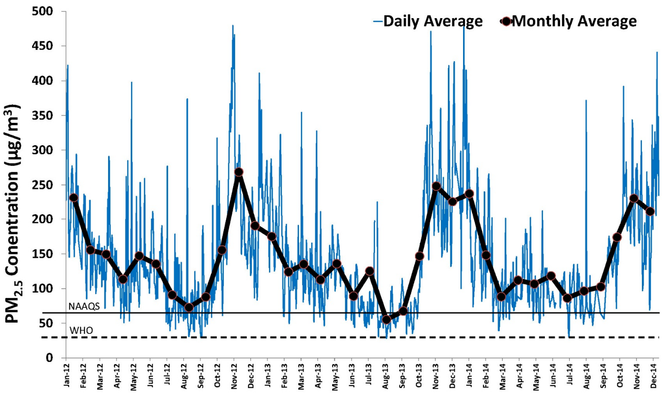
volume = width (W) * length (L) * mixing height (H)

Assuming that the city is a box of size **W** meters and **L** meters and
the prevailing meteorology allows for mixing of the emissions (**E**) over a height of **H** meters

Below are some assumed scenarios to understand the role of the emissions and the meteorology on a base scale of 1.0 for each of the parameters (assuming a uniform mixing in the box)

scenario	W	L	H	E	Pollution	% change
base case, all as usual	1.0	1.0	1.0	1.0	1.0	0%
city size doubles in width and length and no change in the emissions	2.0	2.0	1.0	1.0	0.25	-75%
emissions double, for the same city size	1.0	1.0	1.0	2.0	2.0	+100%
mixing height doubles, everything else same	1.0	1.0	2.0	1.0	0.5	-50%
mixing height halves, everything else same	1.0	1.0	½	1.0	2.0	+100%
emissions double and mixing height halves	1.0	1.0	½	2.0	4.0	+300%
emissions double and mixing height is quarter	1.0	1.0	¼	2.0	8.0	+700%

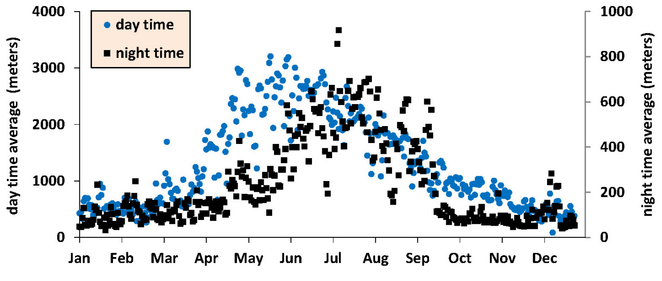
what happens in Delhi?



$PM_{2.5}$ pollution, average of data from four DPCC monitoring stations

annual average = 150 µg/m³
summer average = 75 µg/m³
winter average = 200 µg/m³

India 24 hr. standard = 60 µg/m³
WHO 24 hr. guideline = 25 µg/m³



modelled mixing height, (NCEP-WRF reanalysis data)

annual avg. = 1000 m

summer day avg. = 2000 m
winter day avg. = 500 m
summer night avg. = 500 m
winter night avg. = 100 m

	summer time	winter time
mixing heights	2 times the annual avg., leading to larger uniform mixing of emissions	¼ of the annual avg., leading to compressed air
precipitation	heavy rains, leading to wet scavenging of emissions	very limited rains
winds	heavy winds, leading to entrainment of emissions	slow northerly winds, leading to stagnant conditions
emissions	mostly vehicle exhaust, residential cooking, industrial combustion, power plants, diesel generator sets, open waste burning, and fugitive dust	mostly vehicle exhaust, residential cooking, industrial combustion, power plants, diesel generator sets, open waste burning, and fugitive dust, residential heating, commercial heating, brick kilns, open agricultural burning (following harvest only - **compared to summer time, there is a doubling of absolute emissions**
PM pollution	Lower than annual avg., with some clean and blue sky days, following the rains	higher than annual avg., with peak concentrations 8-10 times the annual avg., especially at night, when there is an increase in the emissions and a simultaneous decrease in the mixing layer height

This document presents a basic understanding necessary to link the dynamic nature of the meteorology (no hour is the same) and the dynamic nature of the emissions (no place is the same)

Send your questions and comments to
simair@urbanemissions.info

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