An invisible threat: Ground-level ozone – Metro cities

Anumita Roychowdhury and Sharanjeet Kaur

Lead Research and analysis: Sharanjeet Kaur

Centre for Science and Environment, New Delhi, July, 2025

New analysis of Centre for Science and Environment (CSE) finds that during the summer of 2025 ground-level ozone pollution has spiked across all mega cities (excluding Delhi that has been separately reported). While the number of monitoring stations exceeding the ozone standards have increased, this exceedance has also occurred nearly daily during this summer in Kolkata, Bengaluru, Mumbai, Hyderabad, and Chennai. This is an alert on the multi-pollutant crisis in the mega cities.

This has emerged from the latest air quality analysis by the Urban Lab at CSE under its air quality tracker initiative. CSE assessment highlights that unlike primary pollutants (emitted directly from sources), ozone is not emitted directly from any source. It forms through intricate chemical reactions involving nitrogen oxides (NOx), volatile organic compounds (VOCs), and carbon monoxide—pollutants released by vehicles, power plants, factories, and other combustion sources. In the presence of sunlight, these substances undergo a series of cyclic reactions that result in the formation of ozone near the ground. VOCs also have natural sources, such as vegetation, adding to the complexity. Ground-level ozone accumulates not only in urban environments but can also travel long distances, turning into a regional pollutant. Ozone also impacts agricultural productivity, threatening food security.

If unchecked this can become a serious public health crisis as ozone is a highly reactive gas and can be harmful even with short duration exposures. The current policy focus must be expanded to include improved monitoring, mitigation of this toxic gas and reduction in high local exposures. In contrast to northern cities where high summer temperatures and intense solar radiation influence high exceedance of ozone standards, cities in warmer climates experience consistent ozone exceedance during other seasons as well. Ozone mitigation needs drastic control of a range of gases from vehicles, industry and all combustion sources.

Inadequate monitoring, limited data and inadequate methods of trend analysis have weakened the understanding of this growing public health hazard across cities of India. Instead of only averaging out the levels for the city – which is the standard practice to estimate AQI and underestimates the gravity of the problem, It is also important to capture adequately the high levels of local build up and localized exposures in the hotspots and to design mitigation strategies accordingly.

CSE review further indicates that ground-level ozone poses can inflame and damage the airways, increase susceptibility to infections, and worsen respiratory conditions such as asthma, chronic bronchitis, and emphysema. Children with underdeveloped lungs, older adults, and individuals with existing respiratory conditions are particularly vulnerable. Ozone exposure increases the frequency and severity of asthma attacks, often leading to higher rates of hospitalization. Given its highly reactive nature the ambient air quality standards are set for 8 hour average instead of 24 hour average.

The *State of Global Air* report 2024 highlights that India registers some of the highest age-standardized death rates linked to ozone exposure. These trends underscore the urgent need for deeper investigation into city- and region-specific patterns to support targeted mitigation strategies.

The investigation method: This assessment has traced trends during summer (March-May) between 2022 to 2025 May (up to May 31st). The analysis is based on publicly available granular real time data (15-minute averages) from the CPCB's official online portal Central Control Room for Air Quality Management. The data has been captured from 80 official stations under the Continuous Ambient Air Quality Monitoring System (CAAQMS) spread Mumbai (31), Kolkata- Howrah (12), Bengaluru (14), Hyderabad (14) and Chennai (9).

Given the volatile and highly localized nature of ground-level ozone pollution build-up and its variability across space, and consistent with the global good practice, this analysis has considered station level trends in terms of number of days exceeding the 8-hour standard over time. As ozone formation depends on complex atmospheric chemistry and on photochemical reaction its level varies across time and space horizon.

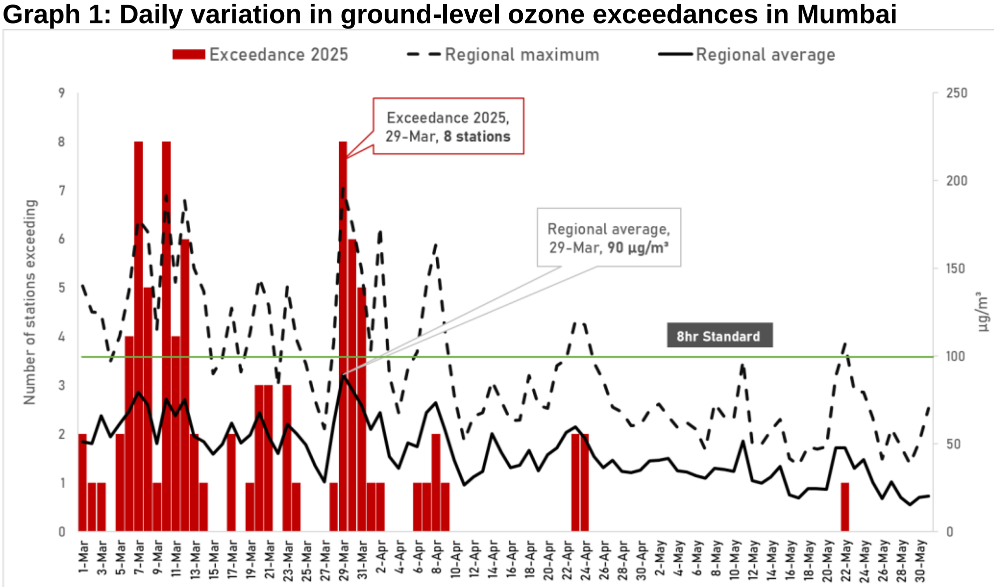
Meteorological parameters such as sunny and warm weather, stagnant wind patterns etc. have bearing on its formation. This analysis tracks exceedances at each station in metro cities. Breach of the standard by even one station is considered exceedance by the metro cities. Days with multiple stations exceeding the standard indicates the severity of the spatial spread and number of people exposed.

The study has considered global good practice and taken on board the USEPA approach of computing eight-hour averages for a day and then checking for the maximum value among them to capture the daily ozone pollution level. USEPA assesses city-wide or regional AQI based on the highest value recorded among all stations of the city or the region. Thus, trends have been calculated in terms of number of days when the daily level has exceeded the 8-hr standard (referred as exceedance days hereafter).

Mumbai

Summer trend: Between March 1 and May 31 this summer, Mumbai recorded ozone exceedance on 32 out of 92 days across its air quality monitoring stations. This marks a 42 per cent decline compared to same period last year. The worst day in terms of spatial spread was March 29, when 8 out of 31 monitoring stations of Mumbai reported exceedance *(See Graph 1: Daily variation in ground-level ozone exceedance in Mumbai).*

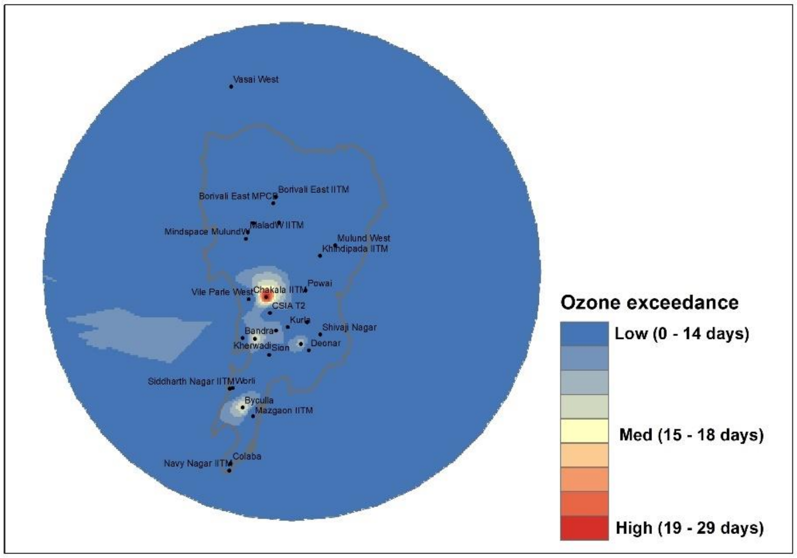
Graph 1: Daily variation in ground-level ozone exceedances in Mumbai



Note: Based on exceedances recorded at the monitoring stations at Mumbai. Exceedance is computed as daily maximum 8-hr average crossing the ground-level ozone 8-hr standard, i.e. 100 µg/m^3. Period of study is 1 March to 31 May 2025.
Source: CSE analysis of CPCB real-time data.

Ozone hotspots: Chakala is most chronically affected in Mumbai. It exceeded the standard for 29 days during March-May. It is followed by Byculla and Kherwadi.(See *Map 1: Hotspots of ground-level ozone exceedance in Mumbai (March-May 2025)*).

Map 1: Hotspots of ground-level ozone exceedance in Mumbai (March-May 2025)



Note: Exceedance is computed as daily maximum 8-hr average crossing the ground-level ozone 8-hr standard, i.e. 100 µg/m3. Data till 31 May 2025.
Source: CSE analysis of CPCB real time data.

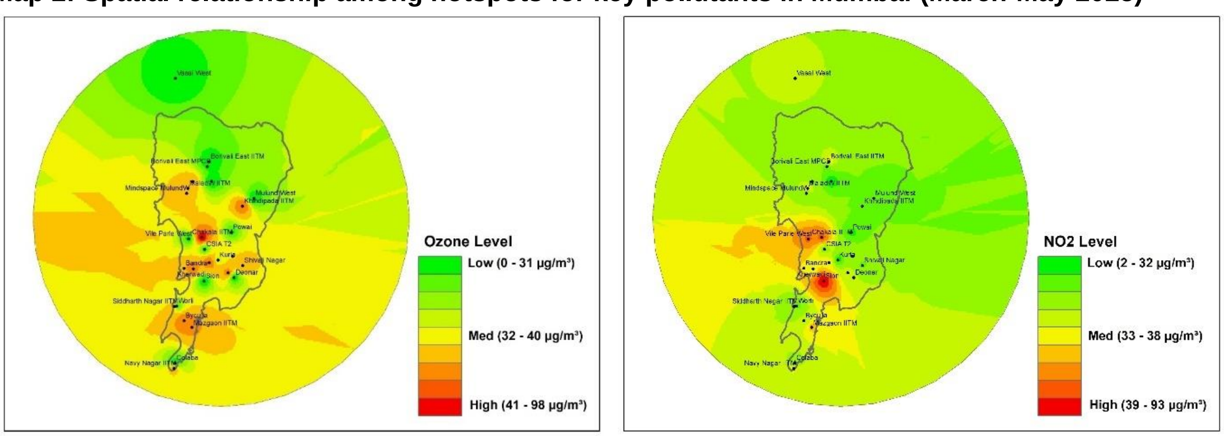
Locational variation and relationship with other pollutants: The spatial distribution of ground-level ozone generally shows an inverse relationship with nitrogen dioxide. In areas with high NO_2 concentrations particularly near traffic-dense corridors, ozone formation is typically suppressed as ozone reacts with nitric oxide (NO), and breaks down to dissipate.

Chakala consistently reports high concentrations of both NO_2 and ozone. Such localized variations underscore the complex interplay between precursor pollutants, meteorological conditions, and emission sources that shape ozone behavior across different parts of the city.

A comparison of May 2025 with May 2024 reveals that ground-level ozone is now persisting longer into the evening, even after sunset. However, the average hourly ozone peak this summer is 35 per cent lower than last year, indicating possible changes in atmospheric chemistry or precursor emissions. Daily trend show that when NO_2 levels increase during morning and evening hours it helps to neutralize ozone concentrations and dissipate it. But ozone levels rise during off-peak hours when NO2 levels are comparatively lower.

(See Map 2 : Spatial relationship among hotspots for key pollutants in Mumbai (March-May 2025) & Table 1: Seasonal values for NO2 and ground-level ozone at the stations in Mumbai (March-May, 2025))).

Map 2: Spatial relationship among hotspots for key pollutants in Mumbai (March-May 2025)



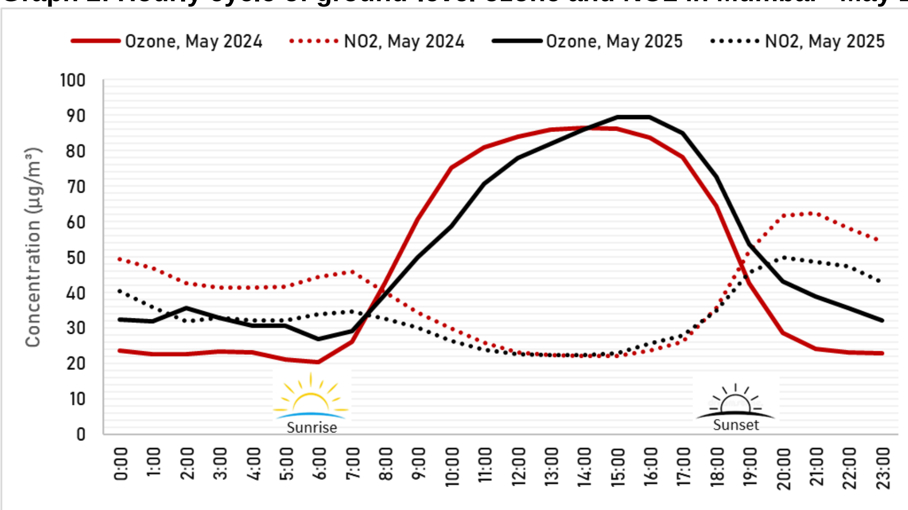
Note: Seasonal average computed as mean of monthly averages based on daily 24-hr average for NO2, while

daily maximum 8-hr average is used for ground-level ozone. Summer is defined as March to May. Data till 31 May 2025.
Source: CSE analysis of CPCB real-time data.

Moreover, it is also evident that ozone builds up during the day when it is off-peak traffic with lower NO2 concentration during those hours. The city has recorded an 11 per cent increase in its hourly NO_2 peak this summer. *(Graph 2: Hourly cycle of ground-level ozone and NO_2 in Mumbai – May 2024 vs 2025).*

A comparison of May 2025 with May 2024 reveals that ground-level ozone is now persisting longer into the evening, even after sunset. Despite this extended presence, the average hourly ozone peak this summer is 35 per cent lower than last year, indicating possible changes in atmospheric chemistry or precursor emissions.

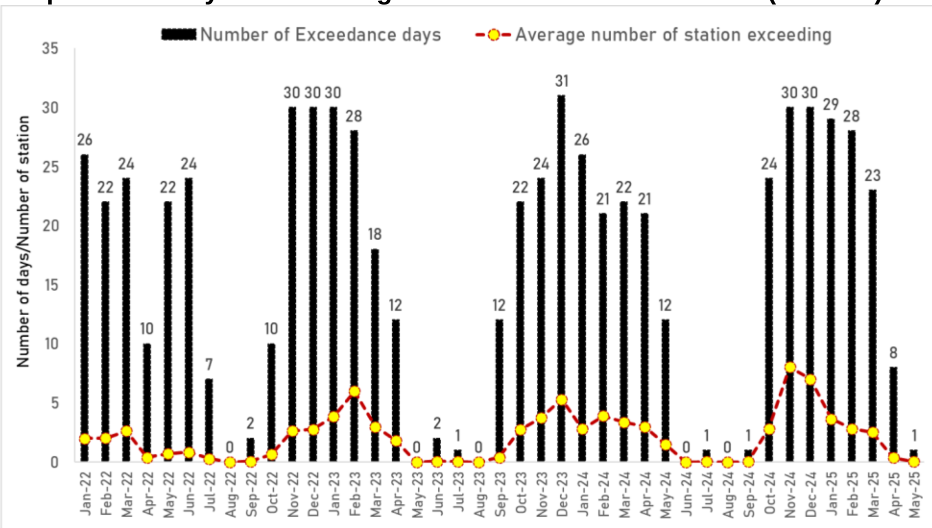
Graph 2: Hourly cycle of ground-level ozone and NO2 in Mumbai– May 2024 v/s May 2025



Note: 24-hr profile is based on mean hourly concentration of ground-level ozone and NO2 recorded at the monitoring stations of Mumbai for month of May in 2024 and 2025. Data till 31 May 2025.
Source: CSE analysis of CPCB real time data.

Ozone builds up during other seasons: Unlike northern cities, Mumbai records exceedance of ozone standards also during the winter months of December – February. During the winter of 2024-25, the city experienced 87 days of ozone exceedance—a 10 per cent rise from the previous winter's exceedance of 78 days. The atmospheric conditions, emission levels, and photochemical reactions of residual nitrogen oxides and volatile organic compounds (VOCs) etc contribute towards this trend. (See *Graph 3: Monthly variation in ground-level ozone in Mumbai (2022-25).*

Graph 3: Monthly variation in ground-level ozone in Mumbai (2022-25)



Note: Based on exceedances recorded at the monitoring stations at Mumbai. Exceedance is computed as daily maximum 8- hr average crossing the ground-level ozone 8-hr standard, i.e. 100 µg/m3. Data till 31 May 2025.

Source: CSE analysis of CPCB real-time data.

Table 1: Seasonal values for NO_2 and ground-level ozone in Mumbai (March-May, 2025)

Station	Exceedance days	Ozone level	NO2 level
Chakala IITM, Mumbai	29	98	60
Byculla, Mumbai	15	68	28
Kherwadi BandraEast, Mumbai	14	62	33
Chembur, Mumbai	10	65	30
Bandra Kurla, Mumbai	8	62	37
Siddharth Nagar, Mumbai	5	63	24
Ghatkopar, Mumbai	3	40	24
Mindspace MulundW, Mumbai	2	45	20
Shivaji Nagar, Mumbai	2	51	17
Khindipada IITM, Mumbai	1	67	19
Kandival West, Mumbai	1	51	21
Borivali IITM, Mumbai	0	42	39
CSIA_T2, Mumbai	0	7	22
Kurla, Mumbai	0	29	3
MaladW IITM, Mumbai	0	47	38
Mazgaon IITM, Mumbai	0	55	40
Navy Nagar IITM, Mumbai	0	53	35
Powai, Mumbai	0	9	7
Vile Parle West, Mumbai	0	7	57
BKC, IITM, Mumbai*	0	16	25
Colaba, Mumbai*	0	11	21
Deonar IITM, Mumbai*	0	28	28
Kandivali East, Mumbai*	0	15	2
MulundW, Mumbai*	0	18	12
Sion, Mumbai*	0	2	93
Vasai West, Mumbai*	0	7	29
Worli, Mumbai*	0	26	15
Sewri, Mumbai*	0	35	10
Borivali East, Mumbai*	NA	NA	15
Bandra MPCB, Mumbai*	NA	NA	NA
Bandra, Mumbai*	NA	NA	NA

Note: Exceedance is computed as daily maximum 8-hr average crossing the ground-level ozone 8-hr standard, i.e. 100 µg/m3. Seasonal average is based on daily values and for NO2 it is based on 24-hr average while daily value for ground-level ozone is based on maximum 8-hr average recorded on the given day. Values are in µg/m3. Data till 31 May 2025.

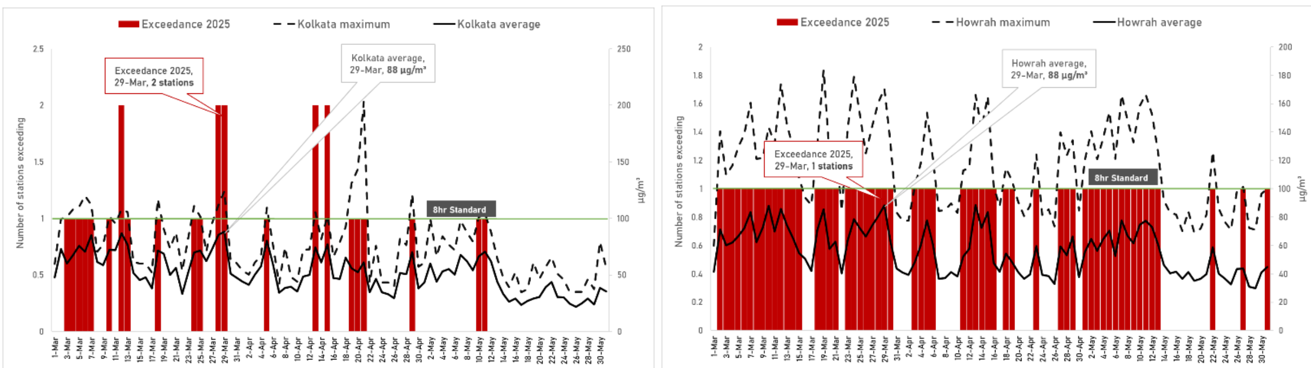
***Ozone data is not adequate for analyzing exceedance days.**

Source: CSE analysis of CPCB real time data.

Kolkata

Summer trend: About 22 out of 92 days this summer in Kolkata (between 1 March and 31 May) have registered exceedance among the air quality monitoring stations of Kolkata. This marks a 45 per cent decline compared to last summer. Kolkata has seen an overall improvement, with the average hourly ozone peak declining by 22 per cent this summer. *(See Graph 4: Daily variation in ground-level ozone exceedance in Kolkata and Howrah).*

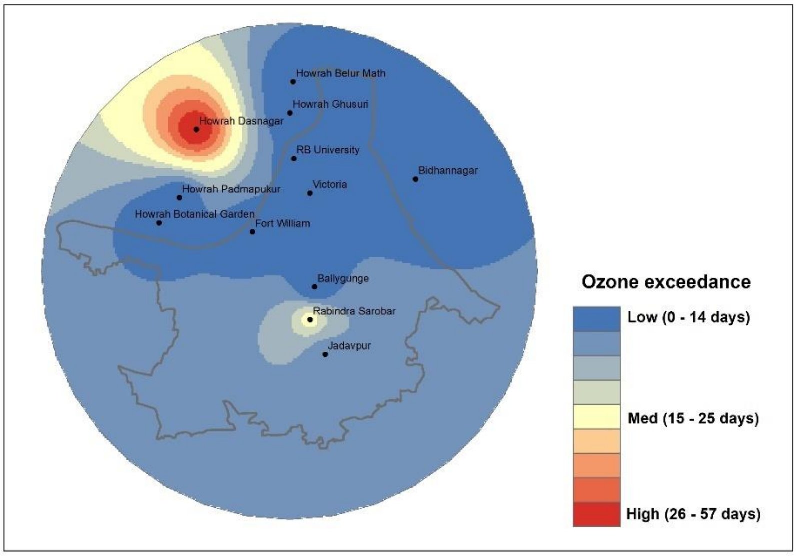
Graph 4: Daily variation in ground-level ozone exceedances in Kolkata and Howrah



Note: Based on exceedances recorded at the monitoring stations at Kolkata and Howrah. Exceedance is computed as daily maximum 8-hr average crossing the ground-level ozone 8-hr standard, i.e. 100 µg/m^3. Period of study is 1 March to 31 May 2025.
Source: CSE analysis of CPCB real-time data.

Locations with more days with ozone exceedance: Rabindra Sarobar and Jadavpur in Kolkata have seen more days exceeding the standards compared to other locations. (See *Map 3: Hotspots of ground-level ozone exceedance in Kolkata and Howrah (March-May 2025)*).

Map 3: Hotspots of ground-level ozone exceedance in Kolkata and Howrah (March-May 2025)

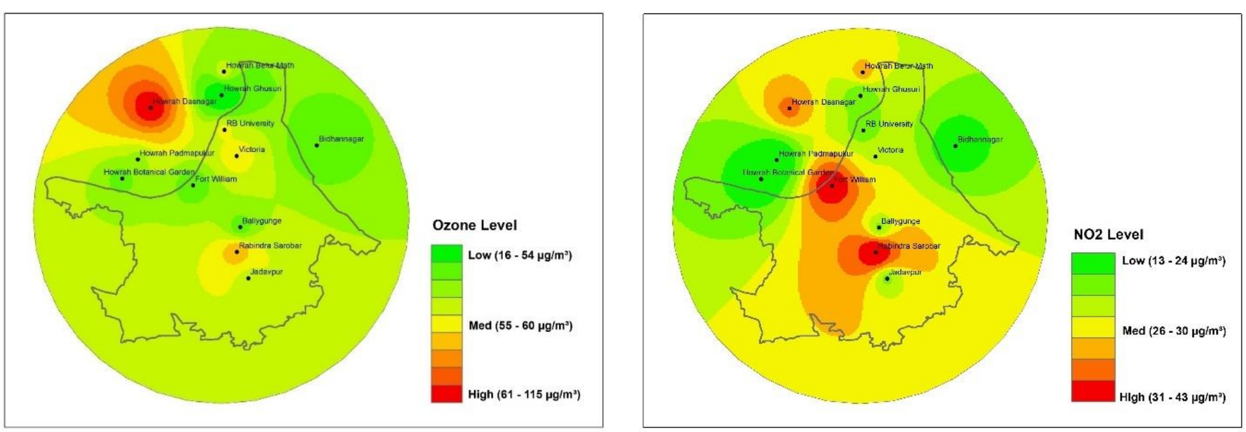


Note: Exceedance is computed as daily maximum 8-hr average crossing the ground-level ozone 8-hr standard, i.e. 100 µg/m3. Data till 31 May 2025.
Source: CSE analysis of CPCB real time data.

Locational variation and relationship with other pollutants: The spatial distribution of ground-level ozone generally shows an inverse relationship with nitrogen dioxide. In areas with high NO_2 concentrations particularly near traffic-dense corridors, ozone formation is typically suppressed where ozone reacts with nitric oxide to break down and dissipate. It usually drifts and builds up in areas with less pollution. *(See Map 4: Spatial relationship among hotspots for key pollutants in Kolkata and Howrah (March-May 2025) & Table 2: Seasonal values for NO2 and ground-level ozone at the stations in Kolkata and Howrah (March-May, 2025))*. In areas with high NO_2 concentrations particularly near traffic-dense corridors, ozone formation is typically suppressed where ozone reacts with nitric oxide (NO), breaking down in the process.

However, Dasnagar in Howrah has consistently reported high concentrations of both NO_2 and ozone. Such localized variations underscore the complex interplay between precursor pollutants, meteorological conditions, and emission sources that shape ozone behavior across different parts of the city.

Map 4: Spatial relationship among hotspots for key pollutants in Kolkata and Howrah (March-May 2025)



Note: Seasonal average computed as mean of monthly averages based on daily 24-hr average for PM2.5 and NO2, while daily maximum 8-hr average is used for ground-level ozone. Summer is defined as March to May. Data till 31 May 2025.

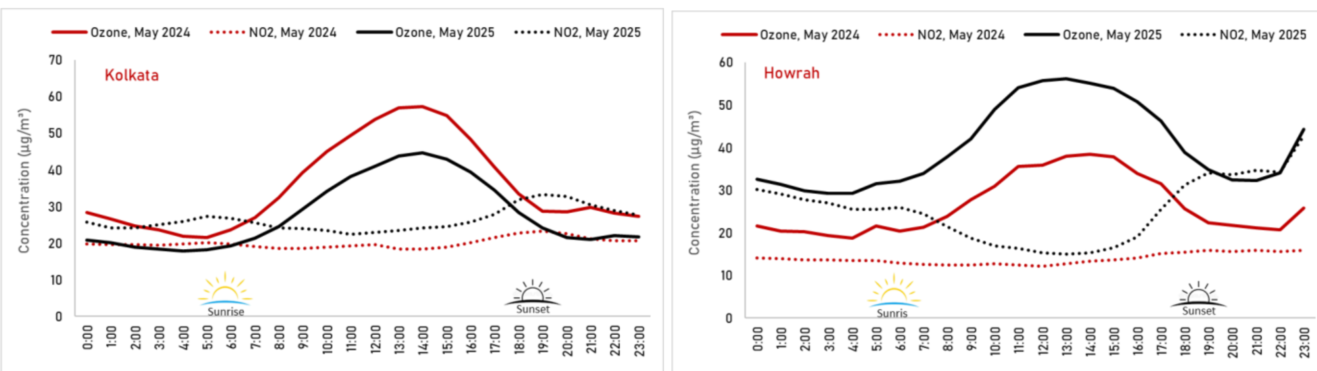
Source: CSE analysis of CPCB real-time data.

Ozone builds up during other seasons: While ozone pollution is typically associated with the summer months in northern regions due high stronger sun and heat, Kolkata has consistently recorded days with elevated ground-level ozone concentrations during the winter (November to February) and pre-monsoon seasons. Such localized variations underscore the complex interplay between precursor pollutants, meteorological conditions, and emission sources that shape ozone behavior across different parts of the city.

During the winter of 2024–25, Kolkata experienced 28 days of ozone exceedance, however, marking a 7 per cent decline from the 30 days recorded in the previous winter.

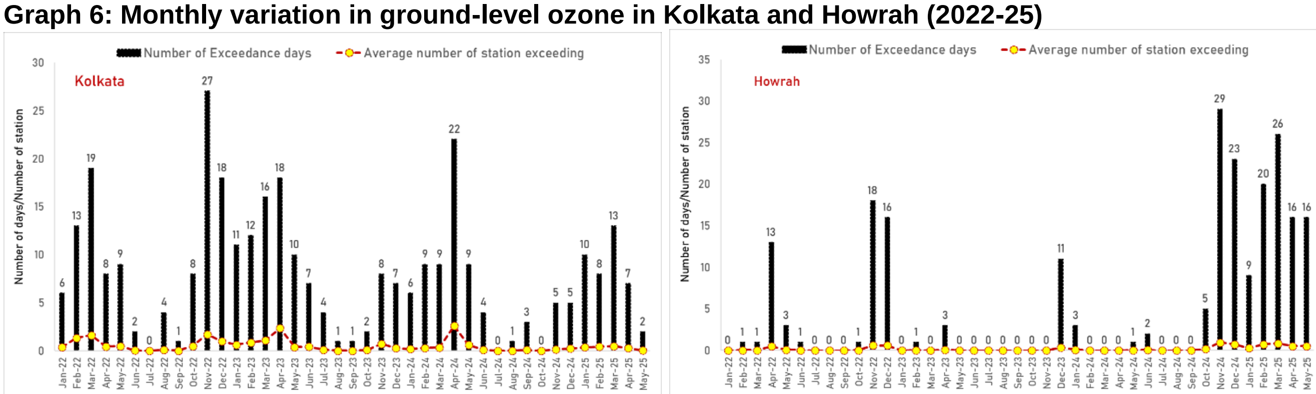
In the twin city of Howrah, 58 out of 92 days this summer (between 1 March and 31 May) have registered higher number of days exceeding the standards as per the data from the air quality monitoring stations. The newly added stations alone accounted for all 58 days of exceedance. Dasnagar in Howrah has shown the maximum exceedance. During winter, Howrah has witnessed 81 days of ozone exceedance – increasing from 14 days the previous year. *((See Graph 6: Monthly variation in ground-level ozone in Kolkata and Howrah (2022-25) and Graph 5: Hourly cycle of ground-level ozone and NO_2 in Kolkata and Howrah – May 2024 vs 2025)*

Graph 5: Hourly cycle of ground-level ozone and NO2 in Kolkata and Howrah – May 2024 v/s May 2025



Note: 24-hr profile is based on mean hourly concentration of ground-level ozone and NO2 recorded at the monitoring stations of Kolkata and Howrah for month of May in 2024 and 2025. Data till 31 May 2025.
Source: CSE analysis of CPCB real time data.

Graph 6: Monthly variation in ground-level ozone in Kolkata and Howrah (2022-25)



Note: Based on exceedances recorded at the monitoring stations at Kolkata and Howrah. Exceedance is computed as daily maximum 8- hr average crossing the ground-level ozone 8-hr standard, i.e. 100 µg/m3. Data till 31 May 2025.
Source: CSE analysis of CPCB real-time data.

Table 2: Seasonal values for NO2 and ground-level ozone in Kolkata and Howrah (March-May, 2025)

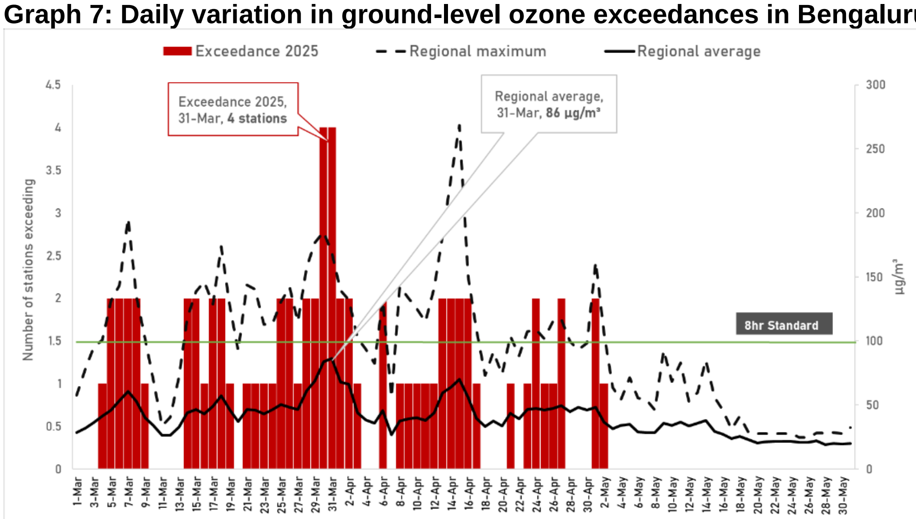
Station	Exceedance days	Ozone level	NO2 level
Dasnagar, Howrah	57	115	32
Rabindra Sarobar, Kolkata	17	66	43
Jadavpur, Kolkata	5	53	22
RB University, Kolkata	3	56	21
Kolkata_Victoria	2	59	25
Padmapukur, Howrah	1	50	14
Ballygunge, Kolkata	0	43	23
Bidhannagar, Kolkata	0	40	16
Fort William, Kolkata	0	42	41
Belur Math, Howrah	0	53	28
Ghusuri, Howrah	0	17	21
Botanical Garden, Howrah	0	44	16

Note: Exceedance is computed as daily maximum 8-hr average crossing the ground-level ozone 8-hr standard, i.e. 100 µg/m3. Seasonal average is based on daily values and for NO2 it is based on 24-hr average while daily value for ground-level ozone is based on maximum 8-hr average recorded on the given day. Values are in µg/m3. Data till 31 May 2025.
Source: CSE analysis of CPCB real time data.

Bengaluru

Summer trend: There have been 45 out of 92 days this summer (between 1 March and 31 May) that have registered days exceeding the ozone standards as per the data available from the air quality monitoring stations of Bengaluru. This marks a 29 per cent increase compared to last summer. *(See Graph 7: Daily variation in ground-level ozone exceedance in Bengaluru).*

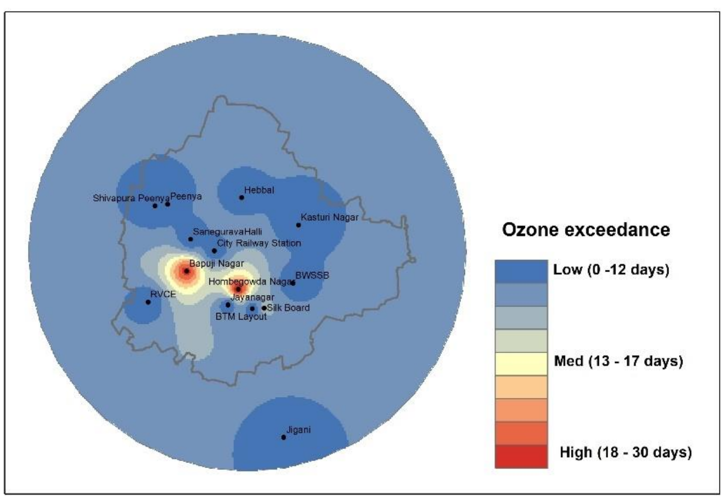
Graph 7: Daily variation in ground-level ozone exceedances in Bengaluru



Note: Based on exceedances recorded at the monitoring stations at Bengaluru. Exceedance is computed as daily maximum 8-hr average crossing the ground-level ozone 8-hr standard, i.e. 100 µg/m^3. Period of study is 1 March to 31 May 2025.
Source: CSE analysis of CPCB real-time data.

Ozone hotspots: Hombegowda Nagar has seen the maximum exceedance. It exceeded the standard for 31 days this March-May. It is followed by Bapuji Nagar.(See *Map 5: Hotspots of ground-level ozone exceedance in Bengaluru (March-May 2025)*).

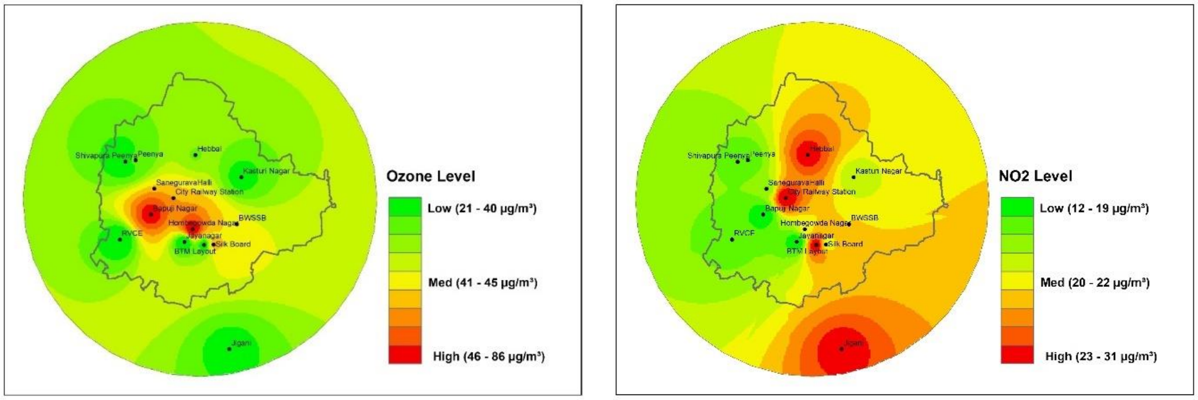
Map 5: Hotspots of ground-level ozone exceedance in Bengaluru (March-May 2025)



Note: Exceedance is computed as daily maximum 8-hr average crossing the ground-level ozone 8-hr standard, i.e. 100 µg/m3. Data till 31 May 2025.
Source: CSE analysis of CPCB real time data.

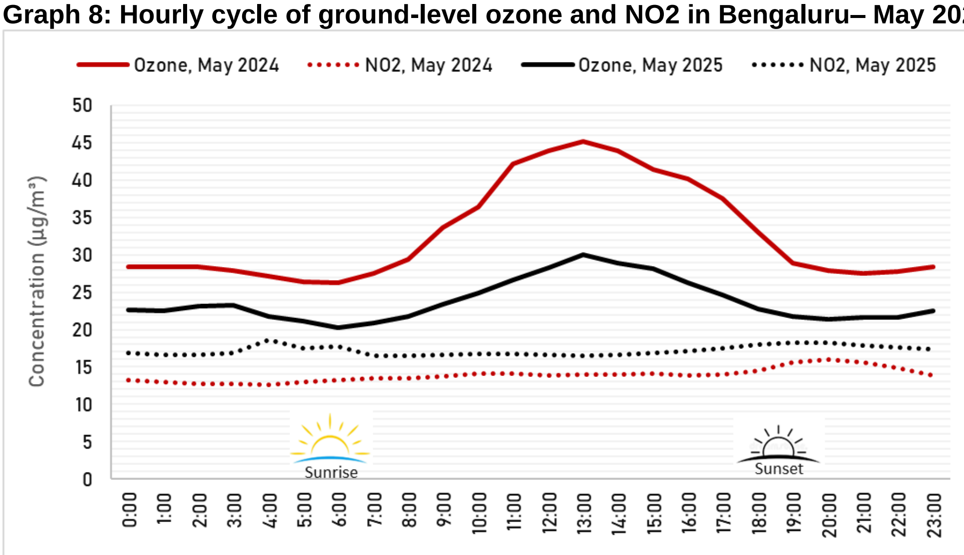
Locational variation and relationship with other pollutants: Notably, a comparison of May 2025 with May 2024 shows a 28 per cent decline in average hourly ozone peaks, and ozone is no longer persisting in the atmosphere after sunset, as was observed last year. Daily trend show that when NO_2 levels increase during morning and evening hours it helps to neutralize ozone concentrations and dissipate it. But ozone levels rise during off-peak hours when NO2 levels are *((See Map 6 : Spatial relationship among hotspots for key pollutants in Bengaluru (March-May 2025) & Table 3: Seasonal values for NO2, PM2.5 and ground-level ozone at the stations in Bengaluru (March-May, 2025 and Graph 8: Hourly cycle of ground-level ozone and NO_2 in Bengaluru – May 2024 vs 2025.).*

Map 6: Spatial relationship among hotspots for key pollutants in Bengaluru (March-May 2025)



Note: Seasonal average computed as mean of monthly averages based on daily 24-hr average for NO2, while daily maximum 8-hr average is used for ground-level ozone. Summer is defined as March to May. Data till 31 May 2025.
Source: CSE analysis of CPCB real-time data.

Graph 8: Hourly cycle of ground-level ozone and NO2 in Bengaluru– May 2024 v/s May 2025

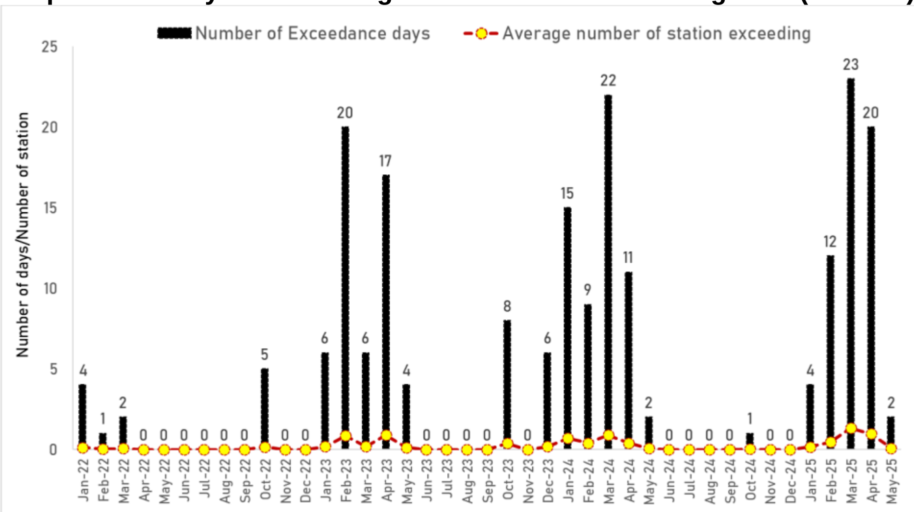


Note: 24-hr profile is based on mean hourly concentration of ground-level ozone and NO2 recorded at the monitoring stations of Bengaluru for month of May in 2024 and 2025. Data till 31 May 2025.
Source: CSE analysis of CPCB real time data.

Ozone builds up during other seasons: In Bengaluru, ozone formation occurs during both winter and summer, but conditions during cold, sunny winter mornings with stagnant air are particularly conducive to ozone build-up.

However, this year's data reveals a significant shift with ozone concentrations during the spring season (February to April) have shown a 31 per cent increase compared to the same period last year. This points to a growing trend of early-season ozone formation, driven by warmer temperatures, intensified solar radiation, and possibly changing precursor emission patterns.(See *Graph 9: Monthly variation in ground-level ozone in Bengaluru (2022-25)).*

Graph 9: Monthly variation in ground-level ozone in Bengaluru (2022-25)



Note: Based on exceedances recorded at the monitoring stations at Bengaluru. Exceedance is computed as daily maximum 8hr average crossing the ground-level ozone 8-hr standard, i.e. 100 µg/m3. Data till 31 May 2025.
Source: CSE analysis of CPCB real-time data.

Table 3: Seasonal values for NO2 and ground-level ozone in Bengaluru (March-May, 2025)

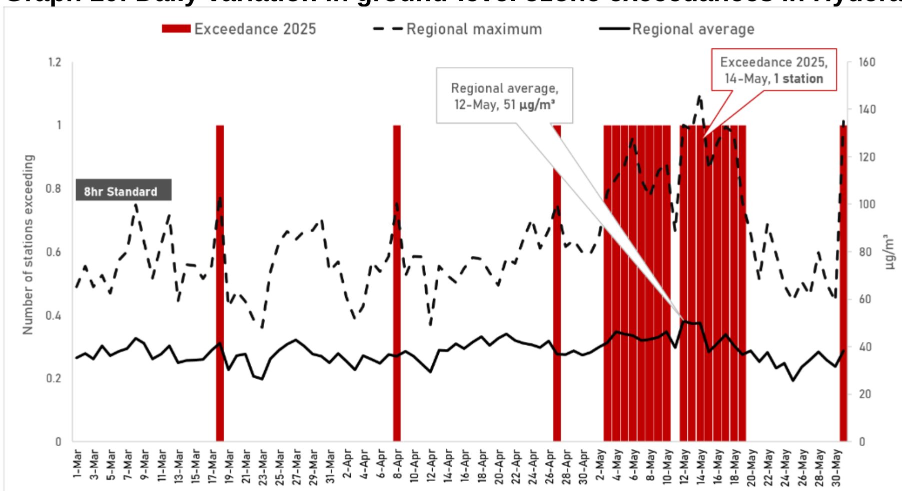
Station	Exceedance days	Ozone level	NO2 level
Hombegowda Nagar, Bengaluru	31	86.8	21.5
Bapuji Nagar, Bengaluru	29	80.2	12.7
Silk Board, Bengaluru	8	50.7	20.2
Peenya, Bengaluru	3	34.8	16.3
Hebbal, Bengaluru	2	36.2	28.8
BTM Layout, Bengaluru	0	26.2	30.0
BWSSB, Bengaluru	NA	NA	NA
City Railway Station, Bengaluru	NA	NA	30.9
Jayanagar, Bengaluru	0	20.8	12.5
SaneguravaHalli, Bengaluru	NA	NA	18.4
Jigani, Bengaluru	0	28.5	28.5
Kasturi Nagar, Bengaluru	0	28.8	19.8
RVCE, Bengaluru	0	23.4	16.9
Shivapura Peenya, Bengaluru	0	23.7	18.4

Note: Exceedance is computed as daily maximum 8-hr average crossing the ground-level ozone 8-hr standard, i.e. 100 µg/m3. Seasonal average is based on daily values and for NO2 it is based on 24-hr average while daily value for ground-level ozone is based on maximum 8-hr average recorded on the given day. Values are in µg/m3. Data till 31 May 2025.
Source: CSE analysis of CPCB real time data.

Hyderabad

Summer trend: About 20 days this summer (between 1 March and 31 May) that have registered exceedance of the ozone standards as per the data available from the air quality monitoring stations of Hyderabad. This marks a 55 per cent decline compared to last summer.
(See Graph 10: Daily variation in ground-level ozone exceedance in Hyderabad). The highest regional intensity was 51 µg/m³.

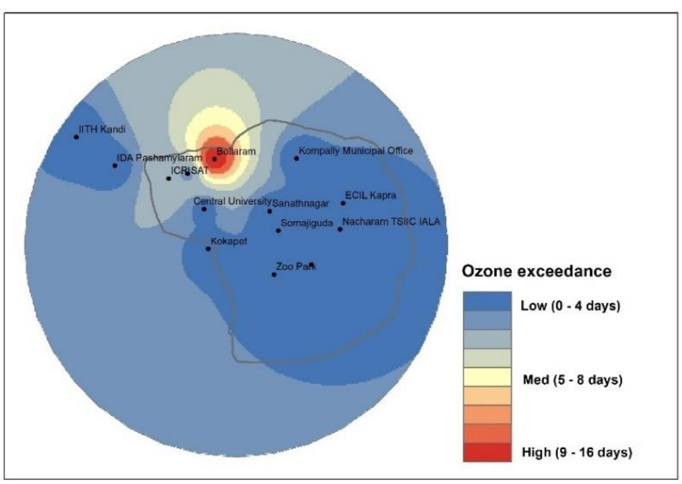
Graph 10: Daily variation in ground-level ozone exceedances in Hyderabad



Note: Based on exceedances recorded at the monitoring stations at Hyderabad. Exceedance is computed as daily maximum 8-hr average crossing the ground-level ozone 8-hr standard, i.e. 100 µg/m^3. Period of study is 1 March to 31 May 2025.
Source: CSE analysis of CPCB real-time data.

Ozone hotspots: Bollaram is the most chronically affected by ground-level ozone pollution. It exceeded the standard for 17 days this March-May. There have been no exceedances at other stations in the city barring ICRISAT (exceeding standard for 2 days) and Ramachandrapuram (one day). (See *Map 7: Hotspots of ground-level ozone exceedance in Hyderabad (March-May 2025)*).

Map 7: Hotspots of ground-level ozone exceedance in Hyderabad (March-May 2025)

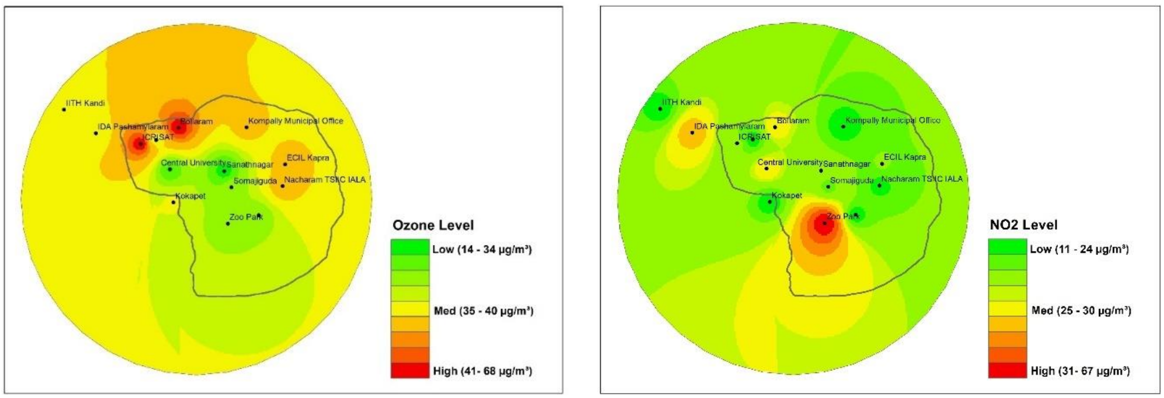


Note: Exceedance is computed as daily maximum 8-hr average crossing the ground-level ozone 8-hr

standard, i.e. 100 µg/m3. Data till 31 May 2025.
Source: CSE analysis of CPCB real time data.

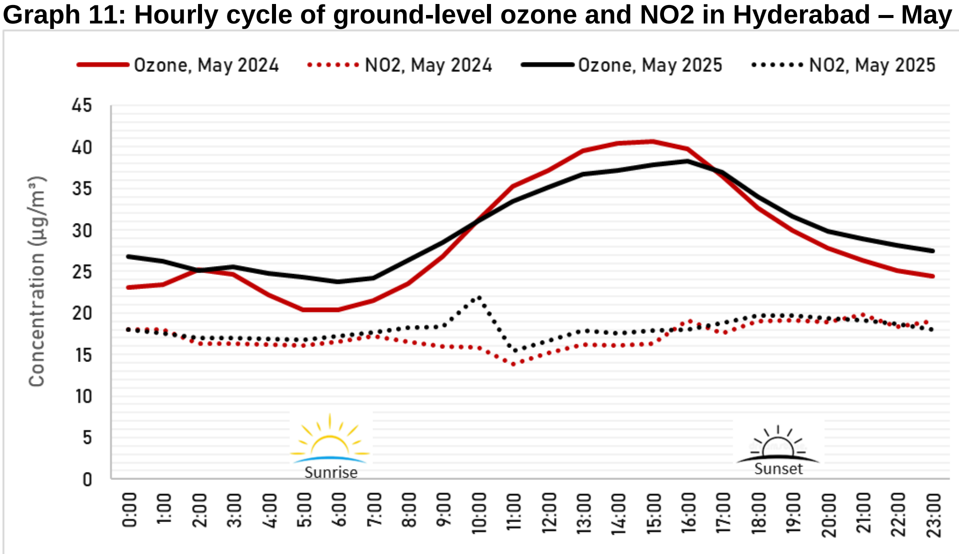
Locational variation and relationship with other pollutants: A comparison of May 2025 with May 2024 reveals that ground-level ozone is now lingering in the atmosphere even after sunset, and the average hourly ozone peak is 3 per cent higher than last year.*(See Map 8: Spatial relationship among hotspots for key pollutants in Hyderabad (March-May 2025) & Table 4: Seasonal values for NO2, PM2.5 and ground-level ozone at the stations in Hyderabad (March-May, 2025)* and *Graph 11: Hourly cycle of ground-level ozone and NO_2 in Hyderabad – May 2024 vs 2025.)*

Map 8: Spatial relationship among hotspots for key pollutants in Hyderabad (March-May 2025)



Note: Seasonal average computed as mean of monthly averages based on daily 24-hr average for NO2, while daily maximum 8-hr average is used for ground-level ozone. Summer is defined as March to May. Data till 31 May 2025.
Source: CSE analysis of CPCB real-time data.

Graph 11: Hourly cycle of ground-level ozone and NO2 in Hyderabad – May 2024 v/s May 2025

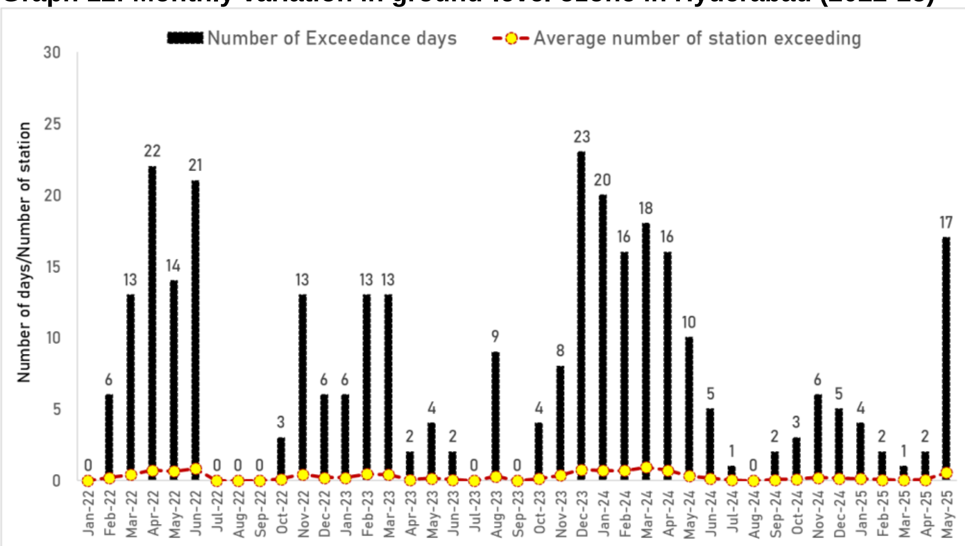


Note: 24-hr profile is based on mean hourly concentration of ground-level ozone and NO2 recorded at the monitoring stations of Hyderabad for month of May in 2024 and 2025. Data till 31 May 2025.
Source: CSE analysis of CPCB real time data.

Ozone builds up during other seasons: Hyderabad frequently experiences wintertime ozone exceedances, driven by cold, stagnant conditions and poor vertical mixing. Urban traffic and industrial emissions, when combined with low dispersion, lead to ozone accumulation even under weaker winter sun.

However, this winter season (December to January), the city witnessed a substantial improvement, recording just 9 days of ozone exceedance, a sharp decline from 43 days during the previous winter.(See *Graph 12: Monthly variation in ground-level ozone in Hyderabad (2022-25)).*

Graph 12: Monthly variation in ground-level ozone in Hyderabad (2022-25)



Note: Based on exceedances recorded at the monitoring stations at Hyderabad Exceedance is computed as daily maximum 8- hr average crossing the ground-level ozone 8-hr standard, i.e. 100 µg/m3. Data till 31 May 2025.
Source: CSE analysis of CPCB real-time data.

Table 4: Seasonal values for NO2, PM2.5 and ground-level ozone in Hyderabad (March-May, 2025)

Station	Exceedance days	Ozone level	NO2 level
Bollaram, Hyderabad	17	68	29
ICRISAT, Hyderabad	2	68	20
Ramachandrapuram, Hyderabad	1	36	12
Central University, Hyderabad	0	18	30
IDA Pashamylaram, Hyderabad	0	36	36
Sanathnagar, Hyderabad	0	14	21
Zoo Park, Hyderabad	0	28	67
ECIL Kapra, Hyderabad	0	44	20
IITH Kandi, Hyderabad	0	35	12
Kokapet, Hyderabad	0	36	12
Kompally Municipal Office, Hyderabad	0	44	12
Nacharam TSIIC IALA, Hyderabad	0	46	13
New Malakpet, Hyderabad	0	27	12
Somajiguda, Hyderabad	0	30	18

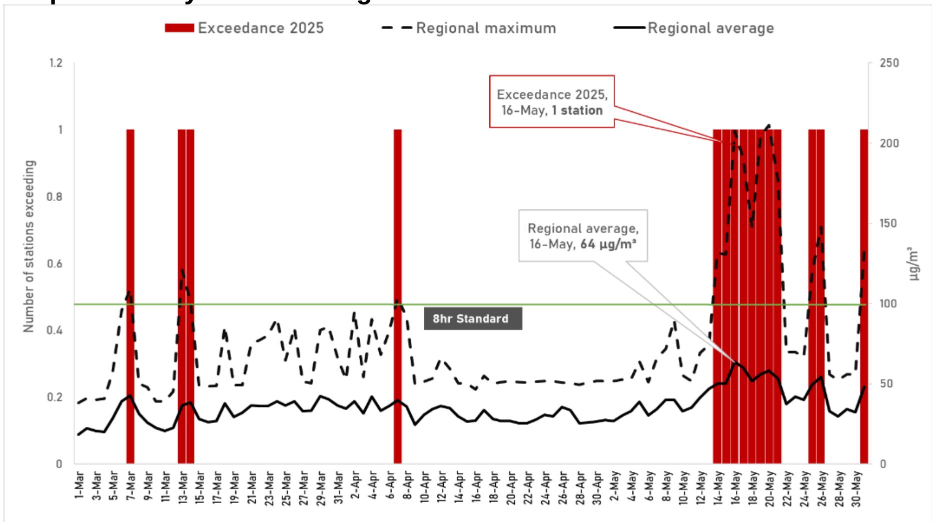
Note: Exceedance is computed as daily maximum 8-hr average crossing the ground-level ozone 8-hr standard, i.e. 100 µg/m3. Seasonal average is based on daily values and for NO2 it is based on 24-hr average while daily value for ground-level ozone is based on maximum 8-hr average recorded on the

given day. Values are in µg/m3. Data till 31 May 2025.
Source: CSE analysis of CPCB real time data.

Chennai

Summer trend: There have been only 15 out of 92 days this summer (between 1 March and 31 May) that have registered exceedance among the air quality monitoring stations of Chennai. However, no exceedance was reported during the same period last year. In comparison, the summer of 2023 saw 3 exceedance days, while 2022 recorded 19. The highest regional intensity this summer was 64 µg/m³. (*See Graph 13: Daily variation in ground-level ozone exceedance in Chennai).*

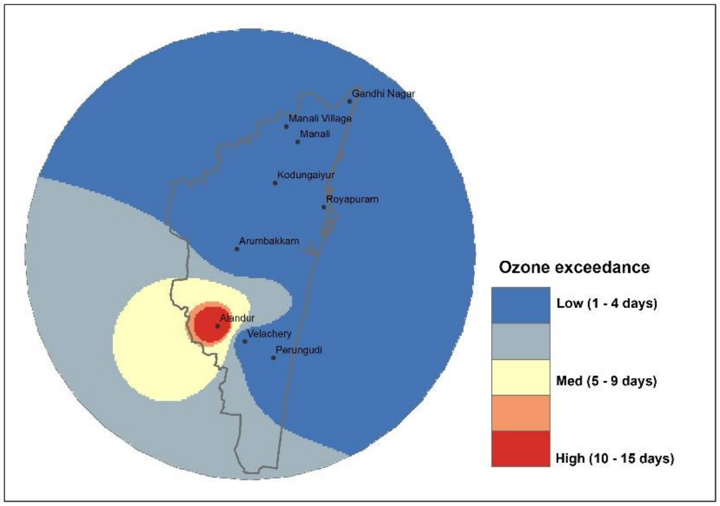
Graph 13: Daily variation in ground-level ozone exceedances in Chennai



Note: Based on exceedances recorded at the monitoring stations at Chennai. Exceedance is computed as daily maximum 8-hr average crossing the ground-level ozone 8-hr standard, i.e. 100 µg/m3. Period of study is 1 March to 31 May 2025.
Source: CSE analysis of CPCB real-time data.

Ozone hotspot: Alandur is the most chronically affected by ground-level ozone pollution. It exceeded the standard for 15 days this March-May. There have been no exceedances at other stations in the city.(See *Map 9: Hotspots of ground-level ozone exceedance in Chennai (March-May 2025)*).

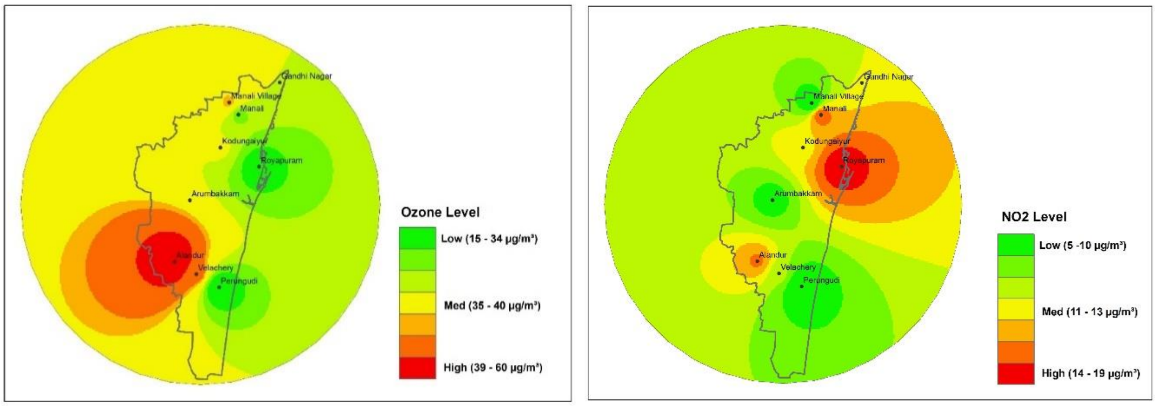
Map 9: Hotspots of ground-level ozone exceedance in Chennai (March-May 2025)



Note: Exceedance is computed as daily maximum 8-hr average crossing the ground-level ozone 8-hr standard, i.e. 100 µg/m3. Data till 31 May 2025.
Source: CSE analysis of CPCB real time data.

Locational variation and relationship with other pollutants: : Data from May 2025 reveals that ground-level ozone is now lingering in the atmosphere well after sunset, and the average hourly ozone peak has surged by 76 per cent compared to May 2024.*(See Map 10: Spatial relationship among hotspots for key pollutants in Chennai (March-May 2025) & Table 5: Seasonal values for NO2, PM2.5 and ground-level ozone at the stations in Chennai (March-May, 2025))*.

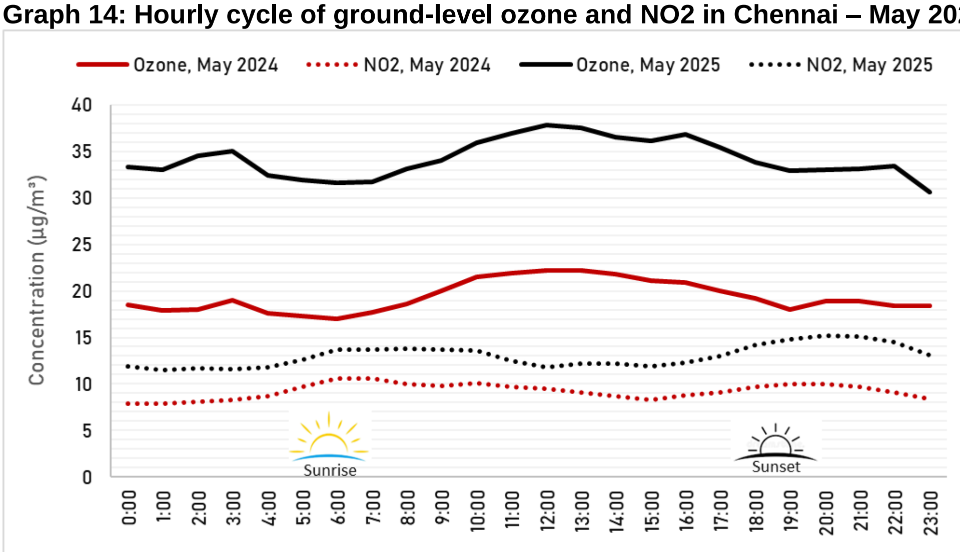
Map 10: Spatial relationship among hotspots for key pollutants in Chennai (March-May 2025)



Note: Seasonal average computed as mean of monthly averages based on daily 24-hr average for NO2, while daily maximum 8-hr average is used for ground-level ozone. Summer is defined as March to May. Data till 31 May 2025.
Source: CSE analysis of CPCB real-time data.

However, data from May 2025 reveals a concerning shift. Ground-level ozone is now lingering in the atmosphere well after sunset, and the average hourly ozone peak has surged by 76 per cent compared to May 2024 *(See Graph 14: Hourly cycle of ground-level ozone and NO_2 in Chennai – May 2024 vs 2025).*

Graph 14: Hourly cycle of ground-level ozone and NO2 in Chennai – May 2024 v/s May 2025

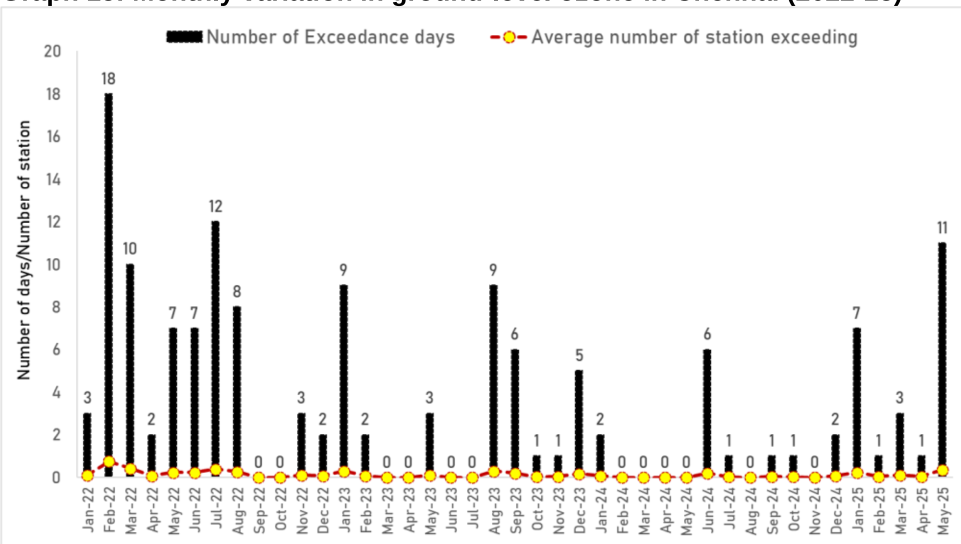


Note: 24-hr profile is based on mean hourly concentration of ground-level ozone and NO2 recorded at the monitoring stations of Chennai for month of May in 2024 and 2025. Data till 31 May 2025.
Source: CSE analysis of CPCB real time data.

Ozone builds up during other seasons: Chennai typically experiences rising ozone levels in the early summer months, when drier air, clear skies, and reduced wind speeds delay pollutant dispersion. This allows for increased photochemical activity, especially during bright, sunny days with minimal atmospheric mixing.

This summer (March to May 2025), Chennai recorded 15 days of ozone exceedance, marking a significant shift from zero exceedance days during the same period last year. Additionally, during the winter months (December–February), the number of ozone exceedance days has also risen from 7 days last year to 10 days this winter. (See *Graph 15: Monthly variation in ground-level ozone in Chennai (2022-25)).*

Graph 15: Monthly variation in ground-level ozone in Chennai (2022-25)



Note: Based on exceedances recorded at the monitoring stations at Chennai. Exceedance is computed as daily maximum 8- hr average crossing the ground-level ozone 8-hr standard, i.e. 100 µg/m3. Data till 31 May 2025.
Source: CSE analysis of CPCB real-time data.

Table 5: Seasonal values for NO2, PM2.5 and ground-level ozone in Chennai (March-May, 2025)

Station	Exceedance days	Ozone level	NO2 level
Alandur, Chennai	15	60	15
Kodungaiyur, Chennai	0	34	12
Manali Village, Chennai	0	42	6
Manali, Chennai	0	28	16
Perungudi, Chennai	0	16	5
Royapuram, Chennai	0	20	20
Velachery, Chennai	0	45	11
Arumbakkam, Chennai	NA	NA	8
Gandhi Nagar Ennore, Chennai	NA	NA	NA

Note: Exceedance is computed as daily maximum 8-hr average crossing the ground-level ozone 8-hr standard, i.e. 100 µg/m3. Seasonal average is based on daily values and for NO2 it is based on 24-hr average while daily value for ground-level ozone is based on maximum 8-hr average recorded on the given day. Values are in µg/m3. Data till 31 May 2025.
Source: CSE analysis of CPCB real time data

Way forward

Ground level ozone is beginning to emerge as a pollutant of concern with cities experiencing days exceeding the 8-hour standards. While the level of exceedance is expected to be higher during the summer months with strong sun-shine days and heat, this is emerging as a round the year problem in the warmer climate. Clean air action plan for cities and the states need to address this multi-pollutant challenge urgently. It is important to learn from the advanced economies that after controlling particulate pollution have fallen into the grip of rising NOx and ozone crisis. It is important to prevent this trap.

Clean air action plan for the city needs to integrate ozone mitigation to implement stringent measures to upscale zero emissions vehicles, clean industrial processes and fuels, eliminate waste burning with hundred percent remediation of legacy waste, collection, segregation and material recovery, and replace solid fuels with clean fuels in households. Integrate ozone in the Graded Response Action Plan to take emergency action to target the emitter of precursor gases like vehicles and industry that form ozone and to reduce short term exposures.

Develop regional action plan on ozone: Ground-level ozone gets created in polluted areas but drifts and accumulates in cleaner urban environments, urban peripheries and surrounding rural areas affecting agricultural productivity and food security. While in polluted areas ozone further reacts with pollutants to dissipate, in cleaner environment it lives longer. Ozone is thus a regional pollutant that requires effective control at both local and regional level.