

Monsoon: Delhi's baseline air quality (2026)

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At the closing of the monsoon season and onset of the winter, the air quality data of the monsoon months reveals the lower bound of Delhi's ambient air pollution when natural atmospheric "washout" and wet deposition effects are at their annual peak.

Even when rainfall substantially lowers fine particulate matter (PM_{2.5}) and provides relief, the overall Air Quality Index (AQI) continuously hovers between the "Moderate" and "Satisfactory" bands rather than reaching clean or "good" air quality levels consistently.

It is also evident that ambient air quality shows a rapid rebound during subsequent dry spells. On several days when particulate loads drop, secondary and gaseous pollutants—most notably ground-level ozone (O₃), nitrogen dioxide (NO₂), and carbon monoxide (CO)—emerge as the leading pollutant of the daily AQI.

With the imminent arrival of adverse post-monsoon winter meteorology that is characterised by shallow boundary layer heights, temperature inversions, light local winds, and stagnant atmospheric conditions—a massive trapping of ongoing, urban emissions are inevitably expected to trigger extreme seasonal pollution peaks. Air quality during monsoon highlights the lower bound baseline from which the winter level spiral.

This assessment of summer (April to May) and monsoon months (June – August) shows that round-the-year emission reductions must be dramatically strengthened. While monsoon washout is a temporary nature induced relief, relying on reactive, highly disruptive, and temporary emergency measures during winter also impact economic activities, daily livelihoods, informal sector wages, and overall industrial productivity in the region. Systemic, cross-sectoral, and airshed-wide solutions across the National Capital Region (NCR) must gain immediate momentum.

Methodology: This assessment has considered "Summer" as April 1 to May 31, 2026 (61 total days). "Monsoon" as June 1 to August 31, 2026 (92 total days). Daily precipitation represents the combined arithmetic mean of official measurements recorded at the IMD Safdarjung and Palam monitoring stations. An isolated event comprises one or more consecutive rainy days bounded by at least one prior dry day and followed by at least three consecutive dry days. This 3-day post-rain tracking window isolates PM_{2.5} recovery dynamics from secondary rain interventions. For rainfall events spanning multiple consecutive days, the "during rain" value reflects the mean PM_{2.5} level across the entire rainy period. Out of 12 isolated rainfall events identified across the study period, exactly 6 occurred during the monsoon. The study identifies statistical associations between rainfall and ambient PM_{2.5} changes; it does not isolate rainfall from other concurrent meteorological variables (e.g., mixing height, wind speed, wind direction, relative humidity) or localized changes in baseline emission fluxes.

The key findings

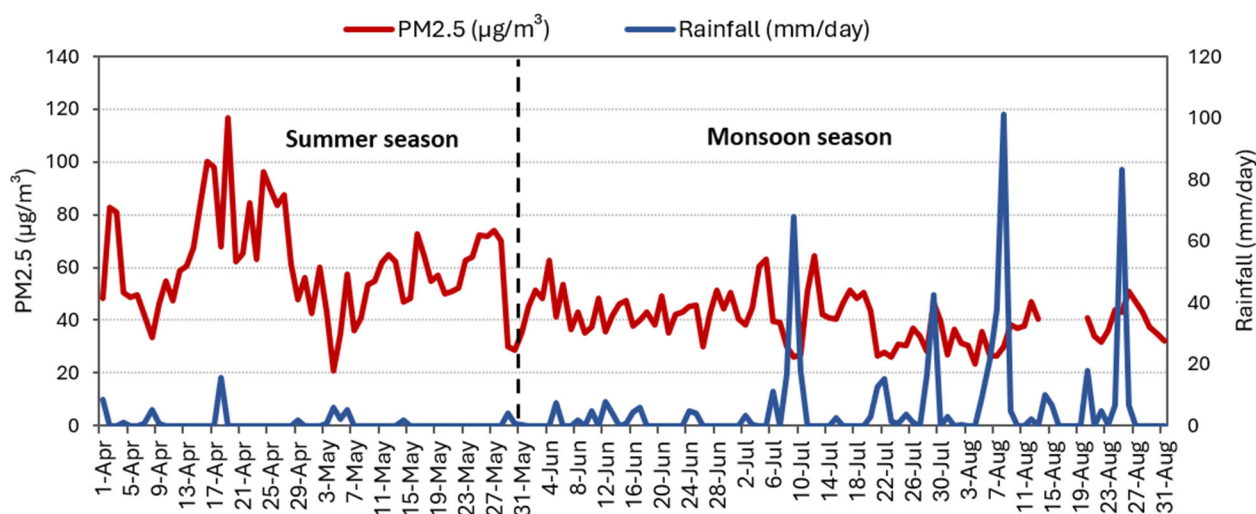
Only one good air quality day despite heavy rains: During the monsoon season, rainfall cause atmospheric cleansing through wet deposition, where raindrops scavenge suspended particulate matter. Spikes in daily mean rainfall correspond directly to downward dips in daily PM_{2.5} concentrations. The city recorded only one single "Good" AQI day during the entire 92-day monsoon season—on July 9, 2026—when the combined mean rainfall across the Safdarjung and Palam meteorological stations reached 67.75 mm. Conversely, the season's single highest daily rainfall event (101.05 mm on August 8, 2026) yielded only a "Satisfactory" AQI designation. Despite the drop, the monsoon seasonal average of 40.2 µg/m³ barely dropped further to reach the "Good" air quality day that principally according to the AQI is half of the National Ambient Air Quality Standard (NAAQS). This proves that even extreme, localized precipitation events are not cleaning adequately due to underlying baseline emissions. (Table 1. Daily rainfall (mean of Safdarjung and Palam) and Delhi PM_{2.5})

Table 1. Daily rainfall (mean of Safdarjung and Palam) and Delhi PM2.5

Season	Average Rainfall	Average PM2.5	Highest daily PM2.5	Average AQI	Highest daily AQI
Summer (Apr-May)	54.0 mm	60.2 $\mu\text{g}/\text{m}^3$	116.7 $\mu\text{g}/\text{m}^3$	169 (Moderate)	266 (Poor)
Monsoon (Jun-Aug)	576.9 mm	40.2 $\mu\text{g}/\text{m}^3$	64.5 $\mu\text{g}/\text{m}^3$	116 (Moderate)	261 (Poor)

Rebound dynamics of particulate matter post-rainfall: As soon as precipitation ceases, PM2.5 curves trajectory upward. Even during the peak of the monsoon, daily PM2.5 spiked to a high of 64.5 $\mu\text{g}/\text{m}^3$, while the daily AQI peaked at 261 (classified in the "Poor" category). (see Graph 1: Rainfall brings episodic relief from PM2.5 pollution (Apr 1, 2026 – Aug 31, 2026)). Between the summer (April–May 2026) and monsoon (June–August 2026) periods, Delhi's average PM2.5 concentration dropped from 60.2 $\mu\text{g}/\text{m}^3$ to 40.2 $\mu\text{g}/\text{m}^3$, representing a seasonal decline of approximately 33.2 per cent.

Graph 1: Rainfall brings episodic relief from PM2.5 pollution (Apr 1, 2026 – Aug 31, 2026)

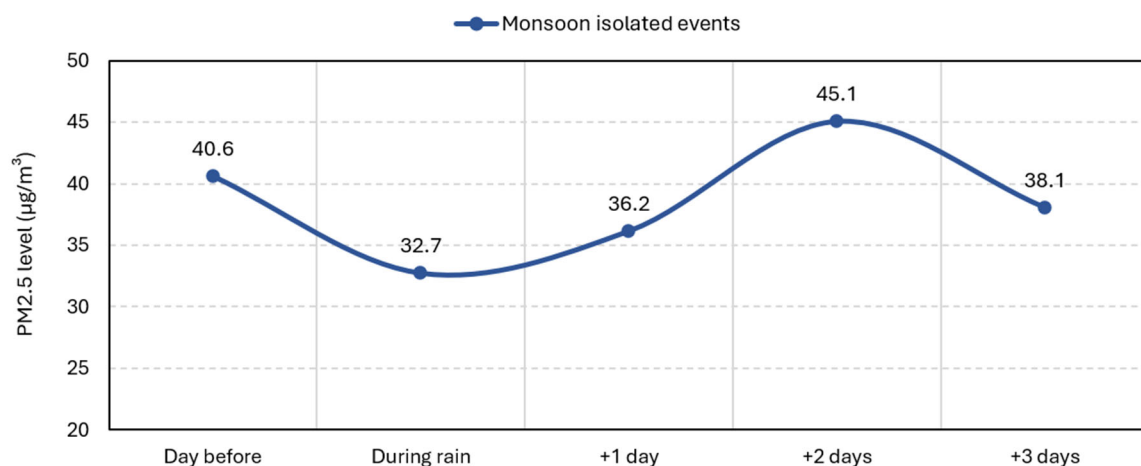


Source: CSE analysis of CPCB real-time data and average rainfall data of Palam and Safdarjung station from IMD

Persistent rainy spells and air quality: To evaluate the persistence of atmospheric cleaning induced by wet scavenging, the assessment tracked isolated rainfall events during the monsoon. An isolated rainfall event is defined as one or more consecutive rainy days preceded by at least one dry day and followed by at least three consecutive dry days (allowing uninhibited tracking of pollution accumulation). Across the six isolated monsoon rainfall events identified, PM2.5 dynamics exhibited a distinct "washout and quick rebound" pattern.

Prior to the onset of rain, the average baseline PM2.5 level stood at 40.6 $\mu\text{g}/\text{m}^3$. During active precipitation, wet scavenging drove PM2.5 concentrations down to 32.7 $\mu\text{g}/\text{m}^3$, marking an immediate reduction of approximately 19.5 per cent. However, this relief was short-lived: 24 hours post-rain PM2.5 concentrations rebounded to 36.2 $\mu\text{g}/\text{m}^3$ (a 10.7 per cent increase from the washout phase). 48 hours post-rain PM2.5 levels climbed rapidly to 45.1 $\mu\text{g}/\text{m}^3$ -- a 37.9 per cent surge above the washout concentration and stands 11.1 per cent higher than the pre-rain baseline (40.6 $\mu\text{g}/\text{m}^3$). This rapid bounce-back proves that while rainfall temporarily washes out particulate matter present in the lower atmosphere, it leaves background anthropogenic emissions completely unchecked. The moment ambient surfaces dry and atmospheric mixing normalizes, ongoing emissions from vehicles, industry, waste burning, and power generation rapidly rebuild ambient pollution loads. (Graph 2: PM2.5 rebounds quickly after rainfall ends).

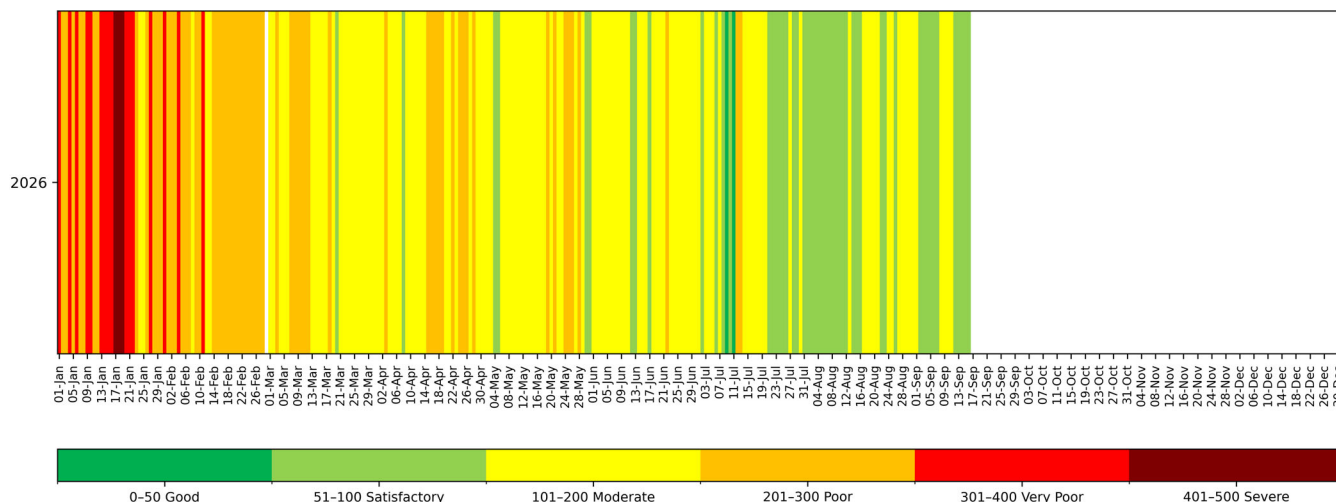
Graph 2: PM2.5 rebounds quickly after rainfall ends



Note: An isolated rainfall event is one or more consecutive rainy days preceded by a no-rain day and followed by at least three consecutive no-rain days. Consecutive rainy days are treated as one event. "During rain" represents average PM2.5 during the event. Monsoon events: n=6.

Trend in daily Air Quality Index: Comparing the distribution of daily AQI categories between summer and monsoon reveals a shift away from high-pollution days toward intermediate categories, though true "Good" air quality remains almost entirely elusive. "Moderate" air quality (AQI range 101–200) remained dominant, representing nearly six out of every ten monsoon days. A "Moderate" AQI designation corresponds to 24-hour average PM2.5 concentrations between 61 µg/m³ and 90 µg/m³—substantially exceeding the prescribed 24-hour national safe limit of 60 µg/m³. Consequently, even when the monsoon suppresses severe pollution events, the baseline atmosphere remains chronically polluted. (Graph 3: AQI distribution improves from summer to monsoon (2026))

Graph 3: AQI distribution improves from summer to monsoon (2026)



Source: CSE analysis of CPCB AQI data

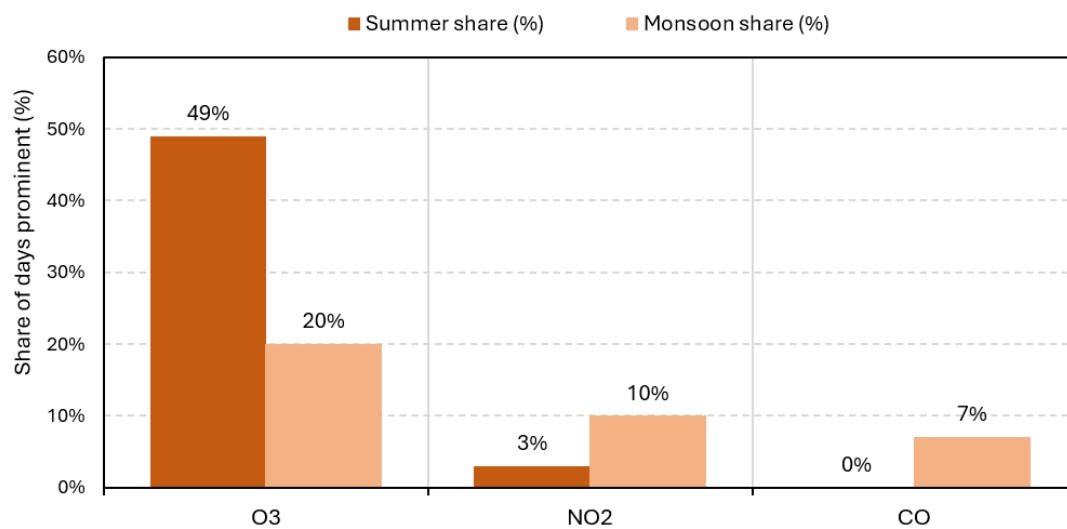
- **Summer performance:** Out of 61 analyzed days, 38 days (62.3 per cent) fell into the "Moderate" category, 17 days (27.9 per cent) were "Poor", 6 days (9.8 per cent) were "Satisfactory", and 0 days (0.0 per cent) were "Good".
- **Monsoon Performance:** Out of 92 analyzed days, "Poor" days plummeted to just 3 days (3.3 per cent). "Satisfactory" days rose to 35 days (38.0 per cent), while "Moderate" days remained the single largest share at 53 days (57.6 per cent). The season registered only 1 "Good" day (1.1 per cent). Neither season recorded "Very Poor" or "Severe" days.

Multi-pollutant dynamics – gaseous pollutants lead: While wet precipitation efficiently scavenges suspended physical particulates (PM10 and PM2.5), gaseous pollutants behave differently. As particulate levels drop, gases step in as the lead driver of the official daily AQI. (Graph 4: Gaseous pollutants remain a concern even during monsoon).

- **Ground-level ozone (O3):** Prominent on 49 per cent of summer days due to intense solar radiation and high temperatures. Although its share dropped during the cloudy monsoon, ozone remained the lead daily pollutant on 20 (Graph 4: Gaseous pollutants remain a concern even during monsoon) of all monsoon days (one out of every five days).
- **Nitrogen Dioxide (NO2):** Increased its prominent pollutant share more than threefold, rising from 3 per cent of summer days to 10 (Graph 4: Gaseous pollutants remain a concern even during monsoon) of monsoon days.
- **Carbon Monoxide (CO):** Rose from 0 per cent prominent days in summer to 7 per cent of monsoon days.

Thus, combustion-derived gaseous emissions (NOx, CO, and volatile organic compounds [VOCs] from vehicular transport, diesel generator sets, and industrial facilities) do not disappear during rain. Sunlight breaking through monsoon cloud cover triggers photochemical reactions between accumulated NOx and VOCs, forming toxic ground-level ozone. This multi-pollutant complexity proves that addressing particulates alone is insufficient for regional air quality management.

Graph 4: Gaseous pollutants remain a concern even during monsoon



Note: The percentages represent the share of days on which a pollutant was listed as prominent in the daily AQI.
Source: CSE analysis of CPCB AQI data

Next steps

According to the India Meteorological Department (IMD), the southwest monsoon officially withdrew from Delhi on September 23, 2026—two days earlier than the normal climatological withdrawal date of September 25 (based on 1971–2019 historical data). As the region transitions into the post-monsoon phase, Delhi loses the recurring atmospheric washing by monsoon rains.

Clearly, relying on seasonal weather or temporary emergency interventions during winter is no longer a viable strategy. Only sustained, year-round, airshed-wide emission reductions can secure clean, safe air for Delhi and the broader National Capital Region.

Accelerate regional EV adoption and establish zero-emission freight corridors. Expand high-capacity public transit and bridge last-mile gaps across the regional airshed.

Industrial sector needs clean fuel transition and electrification of low-medium temperature industrial processes across all formal and informal industrial hubs in the NCR. Stop non-compliant fuel use, informal waste burning, and unaddressed fugitive industrial emissions.

Enforce ward-level, 100 per cent segregated municipal waste collection and processing and remediation of legacy waste to eliminate open fires. Implement digital tracking for 100 per cent construction waste recycling and mandate the uptake of recycled materials in local infrastructure.

Ensure uninterrupted grid power and clean battery storage to eliminate DG set dependency and uptake of clean cooking across Delhi–NCR.

Need airshed governance and move from disruptive winter emergency bans to permanent, synchronized, year-round implementation framework across all sectors in the NCR districts.