

# An Indian summer of heatwaves made even more deadly with high particulate pollution – Spread and scale of summer air pollution in India 2022

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The summer of 2022 has not only been being unusually hot but also uncharacteristically high on particulate pollution, especially the North India. Air pollution is seen as a winter problem when cold and calm weather induced inversion traps pollution close to the ground. These pollution trapping meteorological conditions are not found during the summer season but despite this high PM<sub>2.5</sub> levels were observed across multiple cities and regions.

This has emerged from the analysis of summer air quality undertaken as part of the air quality tracker initiative of the Urban Lab of Centre for Science and Environment (CSE).

The summer pollution challenge is not limited to mega cities or to one specific region; it is a widespread national problem that requires urgent and deliberate action at a national scale. This requires quicker reforms and action in key sectors of pollution – vehicles, industry, power plants and waste management to bend the annual air pollution curve and daily spikes.

As availability of real time air quality data has improved in several regions with expansion of the air quality monitoring systems, it has become possible to assess the regional differences and understand the unique regional trends. This needs to inform the regional clean air action.

This air quality tracker initiative has helped to benchmark the summer air quality for peer-to-peer comparison within each region and inter-regional differences.

**Data analysis:** This analysis is based on publicly available granular real time data (15-minute averages) from the Central Pollution Control Board's (CPCB) official online portal Central Control Room for Air Quality Management. The data is captured from 356 official stations under the Continuous Ambient Air Quality Monitoring System (CAAQMS) spread across 174 cities in 26 states and union territories. Apart from Delhi, Puducherry and Chandigarh, there are 8 cities in Punjab, 24 cities in Haryana, 18 cities in Uttar Pradesh, 25 cities in Bihar, 6 cities in West Bengal, 8 cities in Rajasthan, 15 cities in Madhya Pradesh, 6 cities in Gujarat, 5 cities in Andhra Pradesh, 23 cities in Karnataka, two in Odisha, 6 cities in Kerala, 10 cities in Maharashtra, 3 cities in Tamil Nadu, 2 cities in Chhattisgarh, city each in Anurachal Pradesh, Jammu & Kashmir, Telangana, Assam, Meghalaya, Mizoram, Nagaland, Sikkim, Manipur and Tripura.

Delhi (40), Mumbai (21), Bengaluru (10), Chennai (8), Pune (8), Ahmedabad (9), Kolkata (7), Lucknow (7), Hyderabad (14), Patna (6), Agra (6), Moradabad (5), Ghaziabad (4), Noida (4), Gurugram (4), Faridabad (4), Navi Mumbai (4), Kanpur (4), Varanasi (4), Prayagraj (3), Meerut (3), Jaipur (3), Howrah (3), Kochi (3), Chandigarh (3), Gandhinagar (3), Gaya (3), Muzzafarpur (3), Thiruvananthapuram (2), Guwahati (2), Greater Noida (2), Chandrapur (2), Firozabad (2) and Gwalior (2) have more than one real-time station, therefore citywide average is used for analysis and it is defined as average of all city stations that meet minimum 75 per cent data completeness criteria.

Even though there are multiple real time monitors in a few cities but many could not be considered for summer air pollution analysis due to data gaps and lack of quality data. Moreover, in several cases the real time monitors have been set up recently and therefore long term data is not available. Several cities of south and northeastern region have got their real time monitors in April 2022. Meghalaya got 1 more station in Shillong out of their 1 real time monitor, Tripura got 1 more station in Agartala, Manipur got 2 real time monitors in Imphal, Sikkim got 1 station in Gangtok. Hyderabad got 8 new real time monitors in June 2022. Bihar got 3 more real time monitors in 3 cities in March 2022. Uttar Pradesh got 1 station each in Baghpat, Firozabad, and Jhansi in March 2022. Additionally, the Central Pollution Control Board is reporting same data for Aurangabad, Bihar and Aurangabad, Maharashtra.



**Regional divisions**

North India: Delhi, Uttar Pradesh, Punjab, Haryana, Rajasthan, Jammu & Kashmir

Northeast India: Assam, Meghalaya, Mizoram, Tripura, Nagaland, Arunachal Pradesh

West India: Gujarat and Maharashtra

Central India: Madhya Pradesh and Chhattisgarh

East India: Bihar, West Bengal, Odisha and Jharkhand

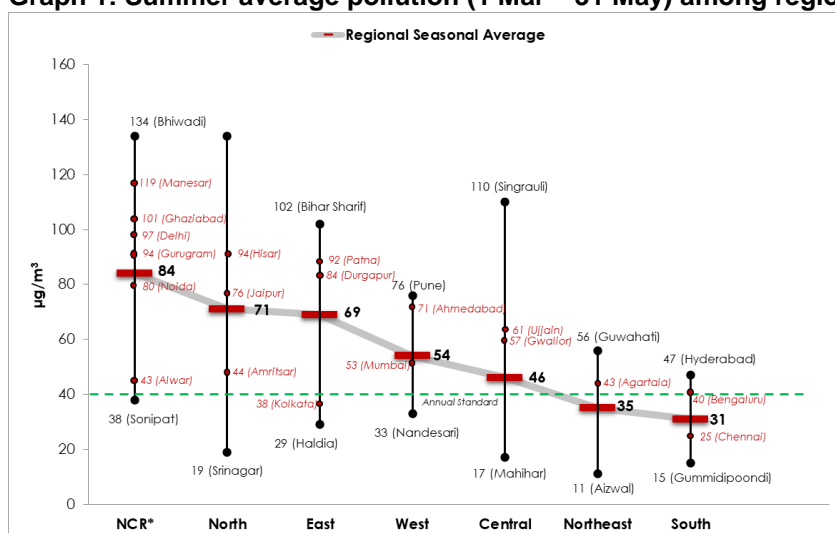
South India: Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, Telangana, and Puducherry

## Key findings

**Regional profile of summer pollution shows North India to be most polluted with Delhi-NCR being the pollution hotspot:** Summer average PM<sub>2.5</sub> for North India stood at 71  $\mu\text{g}/\text{m}^3$ , the highest among all the regions. East India with 69  $\mu\text{g}/\text{m}^3$  summer average was the second worst. West India (54  $\mu\text{g}/\text{m}^3$ ) and Central India (46  $\mu\text{g}/\text{m}^3$ ) also recorded summer level access of 40  $\mu\text{g}/\text{m}^3$ . Northeast India (35  $\mu\text{g}/\text{m}^3$ ) and South India (31  $\mu\text{g}/\text{m}^3$ ) were the cleanest.

Within North India, Delhi NCR was found to be most polluted sub-region. The cities of Delhi-NCR recorded very high summer PM<sub>2.5</sub> averages, with Bhiwadi reporting the highest summer average of 134  $\mu\text{g}/\text{m}^3$ . Manesar (119  $\mu\text{g}/\text{m}^3$ ), Ghaziabad (101  $\mu\text{g}/\text{m}^3$ ), Delhi (97  $\mu\text{g}/\text{m}^3$ ), Gurugram (94  $\mu\text{g}/\text{m}^3$ ) and Noida (80  $\mu\text{g}/\text{m}^3$ ) followed Bhiwadi as cities with worst PM<sub>2.5</sub> levels this summer. The PM<sub>2.5</sub> average of NCR region is almost three times the average of the cities in southern India (See *Graph 1: Trend in summer average pollution among regions of India*).

**Graph 1: Summer average pollution (1 Mar – 31 May) among regions of India**



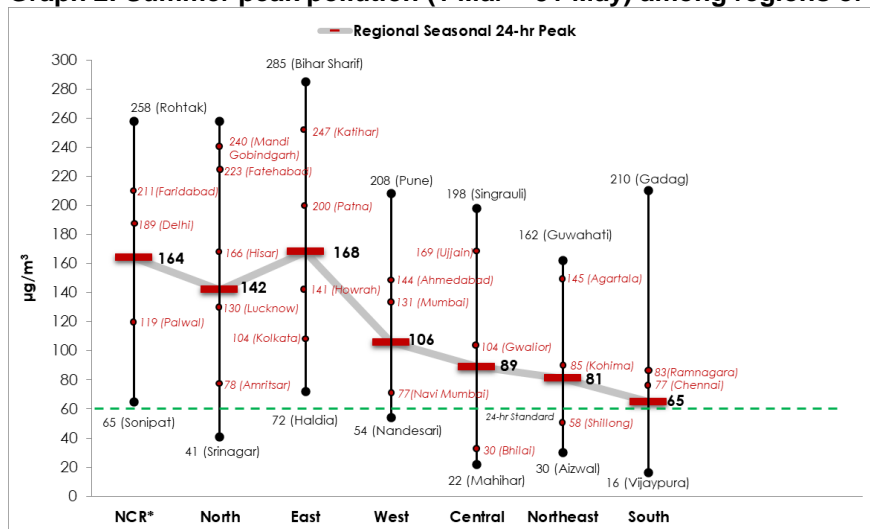
Note: Regional PM<sub>2.5</sub> peak is based on mean of summer peak value determined for each cities in the region. \* NCR is a sub-region within North India.

Source: CSE analysis of CPCB's real time air quality data

**Daily peak pollution was highest in East India, cities of Bihar worst performers:** Summer peak PM<sub>2.5</sub> for East India stood at 168  $\mu\text{g}/\text{m}^3$ , the highest among all the regions. North India with 142  $\mu\text{g}/\text{m}^3$  summer peak was the second worst. West India (106  $\mu\text{g}/\text{m}^3$ ), Central India (89  $\mu\text{g}/\text{m}^3$ ), Northeast India (81  $\mu\text{g}/\text{m}^3$ ) and South India (65  $\mu\text{g}/\text{m}^3$ ) also recorded summer peak in excess of 60  $\mu\text{g}/\text{m}^3$  (See *Graph 2: Summer peak pollution (1 Mar – 31 May) among regions of India*). Within North India, Delhi NCR was found to be most polluted sub-region.

The cities of Bihar recorded very high summer PM<sub>2.5</sub> averages, with Bihar Sharif reporting the highest summer peak of 285  $\mu\text{g}/\text{m}^3$ . Katihar (245  $\mu\text{g}/\text{m}^3$ ) and Patna (200  $\mu\text{g}/\text{m}^3$ ) also recorded peak level in excess of 200  $\mu\text{g}/\text{m}^3$ . Rohtak recorded the highest peak pollution in North India with a 258  $\mu\text{g}/\text{m}^3$  daily peak.

It is important to note that mega cities are not the most polluted in any of the regions, it is the smaller and upcoming cities that are pollution hotspots.

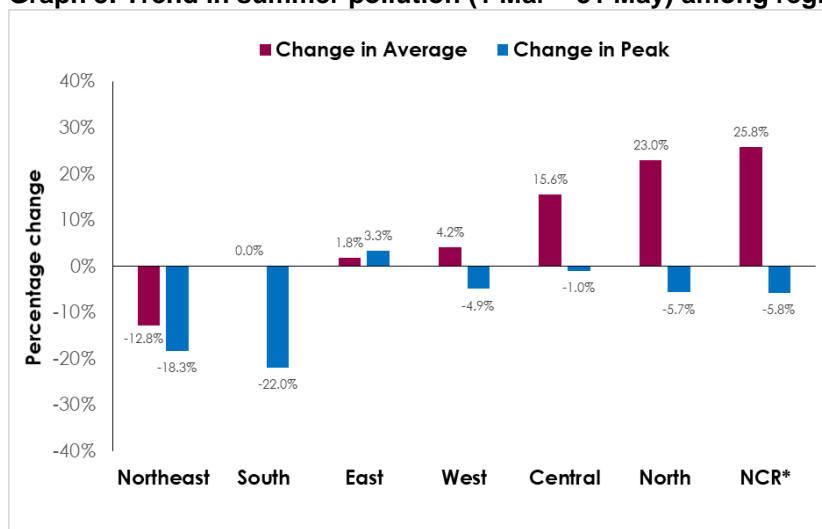
**Graph 2: Summer peak pollution (1 Mar – 31 May) among regions of India**

Note: Regional PM2.5 peak is based on mean of summer peak value determined for each cities in the region. \* NCR is a sub-region within North India.

Source: CSE analysis of CPCB's real time air quality data

**The average pollution this summer is higher than the previous summer:** The regional PM2.5 levels this summer is higher compared to previous summer in North, Central, East and West regions. PM2.5 levels remained stagnate in South India while Northeast registered a decline.

North India have recorded a staggering 23 per cent increase in seasonal PM2.5 level compared to the previous summer based on an average of cities that have valid daily PM2.5 concentration data of both summers (1 March to 31 May). Within North India, NCR was the worst performing sub-region with 25.8 per cent increase in seasonal PM2.5 level. Central India registered increase of 15.6 per cent while West India (4.2 per cent) and East India (1.8 per cent) registered increase under five per cent. South India showed no change in the seasonal average but saw a decline of 22 per cent in seasonal peak. Northeast India registered drop in both seasonal average (-12.8 per cent) and seasonal peak (-18.3 per cent). East India was the only region which registered an increase in its seasonal peak compared to last summer (See *Graph 3: Trend in summer pollution among regions of India*).

**Graph 3: Trend in summer pollution (1 Mar – 31 May) among regions of India**

Note: Based on cities that have data for both summer seasons (2021 and 2022). \* NCR is a sub-region within North India.

Source: CSE analysis of CPCB's real time air quality data

**Smaller cities and towns dominate the most polluted list for this summer:** Bhiwadi in Rajasthan was the most polluted city in India this summer with seasonal average of 134  $\mu\text{g}/\text{m}^3$ . Manesar in Haryana was the second most polluted city with a seasonal average of 119  $\mu\text{g}/\text{m}^3$ . Singrauli in Madhya Pradesh is the third most polluted city with seasonal average of 110  $\mu\text{g}/\text{m}^3$ . Rohtak, Haryana and Muzaffarnagar, UP are the other cities in the top five most polluted cities (See Table 1: 20 cities with the worst summer air quality 2022).

12 cities of Delhi-NCR feature in top 20 cities with highest pollution levels this summer. From peak summer pollution perspective Northern Haryana cities completely dominate the list of most polluted with significantly worse 24-hr averages compared to rest of the cities.

Aizwal in Mizoram and Gummidipoondi in Tamil Nadu were the least polluted cities in the country this summer.

**Table 1: 20 cities with the worst summer air quality 2022**

Rank	City	Summer PM2.5 average ( $\mu\text{g}/\text{m}^3$ )	Peak 24hr value ( $\mu\text{g}/\text{m}^3$ )
1	Bhiwadi, RJ	134	222
2	Manesar, HR	119	198
3	Singrauli, MP	110	198
4	Rohtak, HR	108	258
5	Muzaffarnagar, UP	107	185
6	Bahadurgarh, HR	102	195
7	Ghaziabad, UP	101	201
8	Charkhi Dadri, HR	100	172
9	Delhi, DL	95	163
10	Katihar, BH	95	247
11	Hisar, HR	94	166
12	Dharuhera, HR	93	178
13	Faridabad, HR	93	194
14	Yamuna Nagar, HR	92	197
15	Patna, BH	91	167
16	Gurugram, HR	91	157
17	Kurukshetra, HR	91	199
18	Jodhpur, RJ	89	142
19	Mandi Gobindgarh, PB	89	240
20	Hapur, UP	84	225

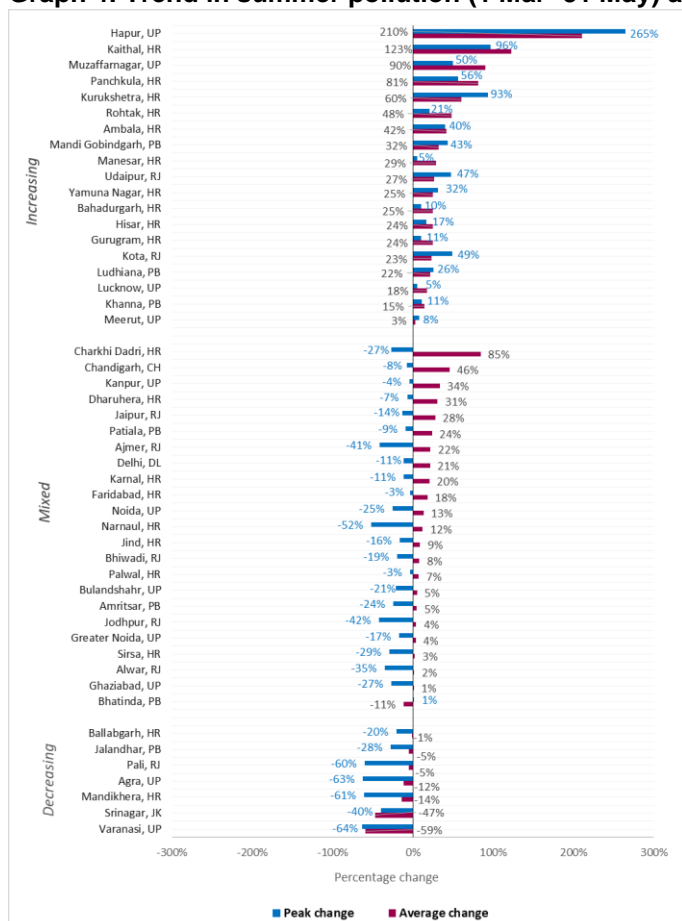
Source: CSE analysis of CPCB's real time air quality data

## Summer air quality in North India

The northern region includes 60 cities with real time monitoring facilities and are spread across the states of Punjab, Haryana, Jammu & Kashmir, Chandigarh, Delhi-NCR, Rajasthan and UP. 54 of these cities had functional monitoring in 2021 summer as well. Geographically, this region represents the North Central Plains.

**Cities with increasing trend:** 19 cities in the region show increasing trend, i.e. both summer average and peak increased compared to their previous summer. Hapur in Uttar Pradesh saw a staggering spike of 210 percent in the summer average and a peak average increase of 265 per cent. It was followed by Kaithal in Haryana that registered 123 per cent increase in summer average and 96 per cent increase in peak. Other cities that show increase include Muzaffarnagar, Panchkula, Kurukshetra, Rohtak, Ambala, Mandi Gobindgarh, Manesar, Udaipur, Yamuna Nagar, Bahadurgarh, Hisar, Gurugram, Kota, Ludhiana, Lucknow, Khanna, and Meerut (See *Graph 4: Trend in summer pollution among cities of North India*).

**Graph 4: Trend in summer pollution (1 Mar- 31 May) among cities of North India**



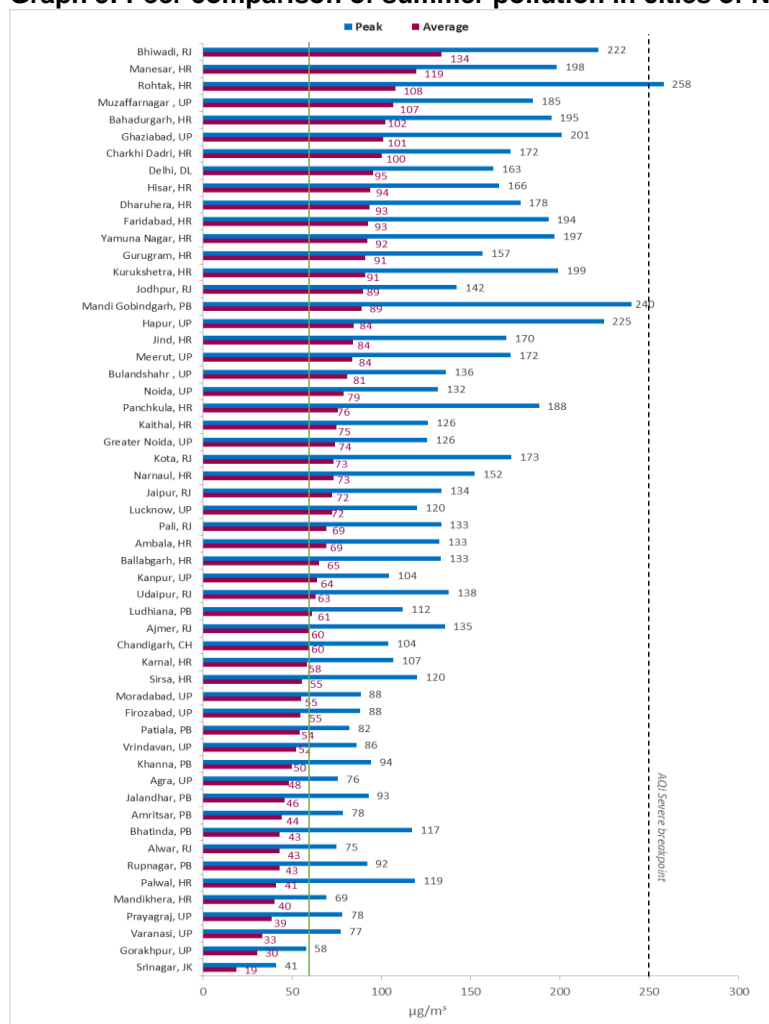
Note: Change in summer average and peak of a city is based on mean of daily PM<sub>2.5</sub> values recorded at CAAQM stations in the city that have minimum 75 per cent data for this summer and previous summer.

Source: CSE analysis of CPCB's real time air quality data

**Cities with mixed trend:** 23 cities in the region show mixed trend, i.e. their summer average has increased but the peak pollution declined compared to their previous summer. Only Bhatinda is showing decline in their summer average (11 per cent) and increase of 1 percent in peak pollution compared to last summer. Narnaul has the most divergent trend as its peak average declined by 52 per cent but its summer average is 12 per cent higher. Charkhi Dadri in Haryana show the most increase of 85 percent in their summer average and registered 27 per cent lower peak pollution followed by Chandigarh, Kanour, Dharuhera, Jaipur, Patiala, Ajmer, Delhi, Karnal, Faridabad, Noida, Narnaul, Jind, Bhiwadi, Palwal, Bulandshahr, Amritsar, Jodpur, Greater Noida, Sirsa, Alwar, Ghaziabad, and Bhatinda.

**Cities recording declining trend in summer pollution:** 7 cities show declining trend, i.e. both summer average and peak decreased compared to their previous summer. Varanasi in Uttar Pradesh saw the highest decline with a drop of 59 per cent in their summer average and 64 per cent lower peak. Other cities with declining trend include Ballabgarh, Jalandhar, Pali, Agra, Mandikhera, and Srinagar.

**Graph 5: Peer comparison of summer pollution in cities of North India**



Note: Summer average and peak of a city is based on mean of daily PM2.5 values recorded at CAAQM stations in the city that have minimum 75 per cent data for this summer.

Source: CSE analysis of CPCB's real time air quality data

**Most polluted cities:** The top twelve most polluted spots are occupied by neighboring Delhi- NCR cities. Most polluted city in the region during summer was Bhiwadi with summer average of 134 µg/m³ followed by Manesar that had a summer average of 119 µg/m³. Other cities include Rohtak, Muzaffarnagar,

Bahadurgarh, Charkhi Dadri, Delhi, Hisar, Dharuhera, Faridabad, Yamuna Nagar, and Gurugram. Cities of Delhi-NCR completely dominated the list of the most polluted. Rohtak in Haryana shows the highest peak of 258 µg/m³ followed by Mandi Gobindgarh in Punjab with a 240 µg/m³ summer peak (See Graph 5: Peer comparison of summer pollution in cities of North India).

**Least polluted cities:** Srinagar is the cleanest city in North. Other cities with a lower summer average include Gorakhpur, Varanasi, and Prayagraj in UP. Interestingly, all of the northern cities—aside from Gorakhpur in Uttar Pradesh and Srinagar in J&K—had peak pollution levels that were higher than the standard limit of 60µg/m³.

## Summer air quality in East India

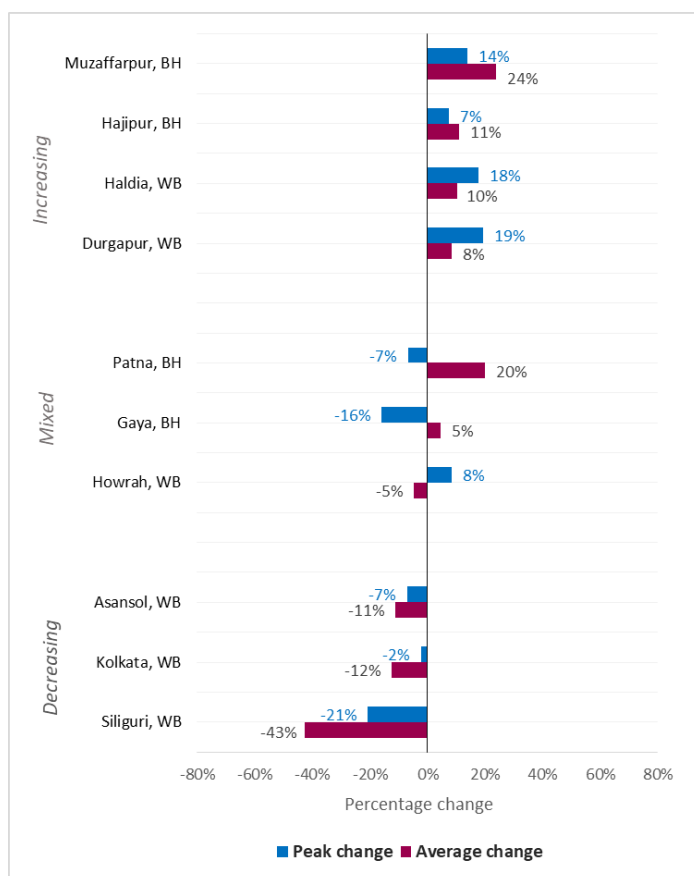
The eastern region includes 34 cities spread across Bihar, West Bengal, Jharkhand and Odisha. Geographically, this region represents the Eastern Plains and Eastern Highlands.

**Cities with increasing trend:** Four cities in the region show increasing trend, i.e. both summer average and peak increased compared to their previous summer. Muzaffarpur in Bihar saw a jump of 24 per cent in the summer average and 14 per cent increase in peak. Hajipur in Bihar registered 11 per cent increase in summer average and 7 per cent increase in peak. Other cities are Durgapur and Haldia in West Bengal (See Graph 6: Trend in summer pollution among cities of East India).

**Cities with mixed trend:** Three cities in the region show mixed trend, i.e. their summer average increased but peak pollution declined compared to their previous summer except Howrah in West Bengal which saw a summer average drop of 5% while seeing an 8% increase in peak pollution levels compared to the previous summer. Patna in Bihar saw a summer average increase of 20 per cent and a decline of 7 percent in the peak followed by Gaya in Bihar with 16 per cent decline in the peak average and a summer average increase of 5 per cent.

**Cities with declining trend:** Three cities in the region show declining trend, i.e. both summer average and peak decreased compared to their last summer. Siliguri in West Bengal saw the most decline with a drop of 21 per cent in their summer average and 43 per cent lower peak. Kolkata also registered decline -- summer average declining by 12 per cent and peak by 2 per cent.

**Graph 6: Trend in summer pollution (1 Mar- 31 May) among cities of eastern region**



Note: Change in summer average and peak of a city is based on mean of daily PM<sub>2.5</sub> values recorded at CAAQM stations in the city that have minimum 75 per cent data for this summer and previous summer.

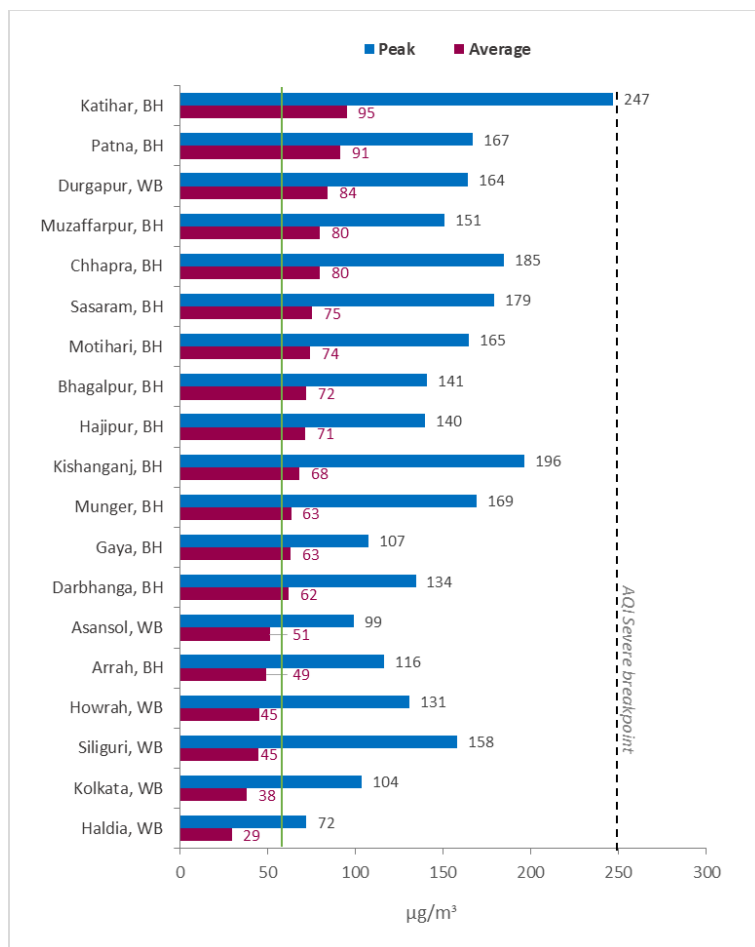
Source: CSE analysis of CPCB's real time air quality data



**Most polluted cities:** Most polluted city in the region was Katihar in Bihar with summer average of 95  $\mu\text{g}/\text{m}^3$ . It is followed by Patna in Bihar with summer average of 91  $\mu\text{g}/\text{m}^3$  and Durgapur in West Bengal with 84  $\mu\text{g}/\text{m}^3$ . The next ten most polluted spots were occupied by the small cities of Bihar. Arrah in Bihar is the least polluted with summer average of 49  $\mu\text{g}/\text{m}^3$ . All the cities of West Bengal except Durgapur showed their summer average below the standard limit of 60  $\mu\text{g}/\text{m}^3$  (See Graph 7: Peer comparison of summer pollution in cities of East India).

**Least polluted cities:** Haldia and Kolkata in West Bengal recorded the lowest summer average in the region. All the cities in the region had peak pollution levels above 24-hr standard.

**Graph 7: Peer comparison of summer pollution in cities of East India**



Note: Summer average and peak of a city is based on mean of daily PM<sub>2.5</sub> values recorded at CAAQM stations in the city that have minimum 75 per cent data for this summer.

Source: CSE analysis of CPCB's real time air quality data

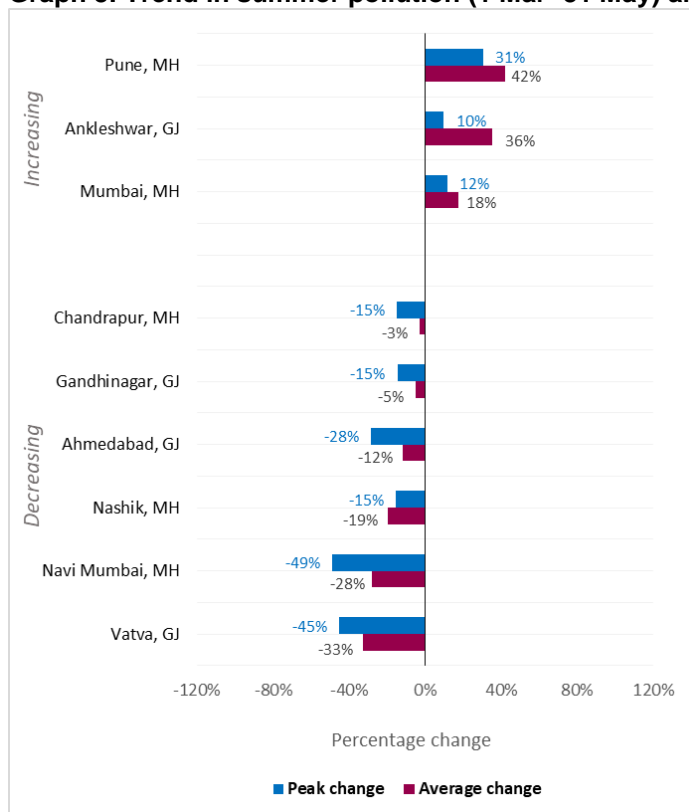
## Summer air quality in West India

The region includes 16 cities spread across Gujarat and Maharashtra. Geographically, this region represents the arid west, Northern Deccan plateau and Konkan Coast. The cities are only showing the increasing and decreasing trend in the summer air pollution.

**Cities with increasing trend:** Three cities in the region show increasing trend, i.e. both summer average and peak increased compared to their previous summer. Pune in Maharashtra saw a jump of 42 per cent in the summer average and 31 per cent increase in peak. Ankleshwar in Gujarat registered 36 per cent increase in summer average and 10 per cent increase in peak. Mumbai in Maharashtra registered 18 per cent increase in summer average and 12 per cent increase in peak. (See *Graph 8: Trend in summer pollution among cities of West India*).

**Cities with declining trend:** Six cities in the region show declining trend, i.e. both summer average and peak decreased compared to their last summer. Vatva in Gujarat saw the most decline with a drop of 33 per cent in their summer average and 45 per cent lower peak. It is followed by Navi Mumbai where the summer average declined by 28 per cent and peak by 49 per cent. Other cities that show declining trend include Nashik, Ahmedabad, Gandhinagar, and Chandrapur.

**Graph 8: Trend in summer pollution (1 Mar- 31 May) among cities of West India**



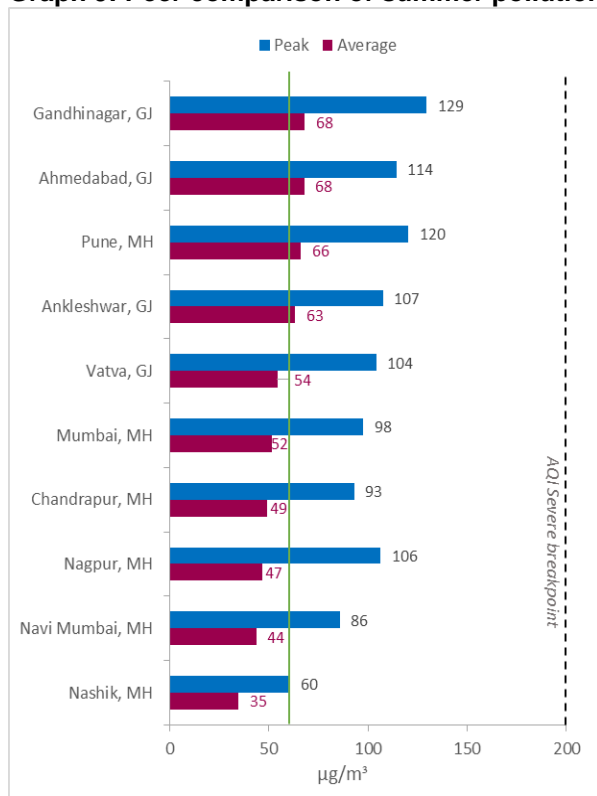
Note: Change in summer average and peak of a city is based on mean of daily PM<sub>2.5</sub> values recorded at CAAQM stations in the city that have minimum 75 per cent data for this summer and previous summer.

Source: CSE analysis of CPCB's real time air quality data

**Most polluted cities:** Most polluted city in the region was Gandhinagar with seasonal average of 68  $\mu\text{g}/\text{m}^3$ . Next two spot were occupied by Ahmedabad and Pune. (See Graph 9: Peer comparison of summer pollution in cities of West India).

**Least polluted cities:** Nashik in Maharashtra recorded the lowest summer average in the region followed by Navi Mumbai, Nagpur, and Chandrapur. Other than Nashik, all the cities in the region saw peak pollution levels above the standard limit of 60  $\mu\text{g}/\text{m}^3$ .

**Graph 9: Peer comparison of summer pollution in cities of West India**



Note: Summer average and peak of a city is based on mean of daily PM<sub>2.5</sub> values recorded at CAAQM stations in the city that have minimum 75 per cent data for this summer.

Source: CSE analysis of CPCB's real time air quality data

## Summer air quality in Central India

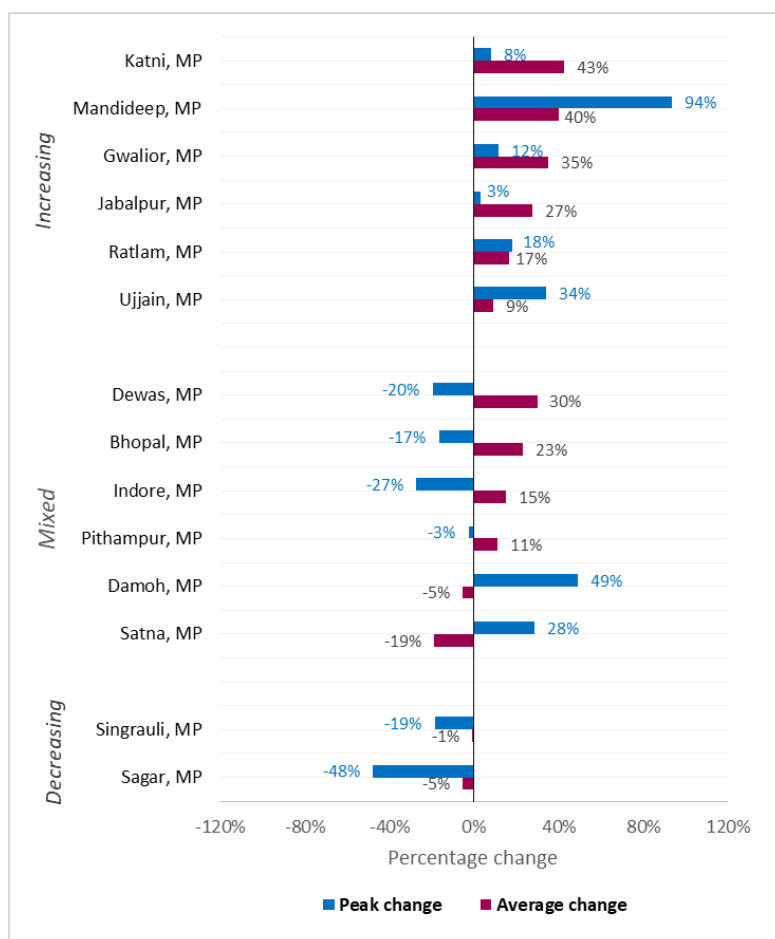
The region includes 17 cities spread across Madhya Pradesh and Chhattisgarh. 15 of these cities have data for both summers. Geographically this region represents the Central Highlands.

**Cities with increasing trend:** Six cities in the region show increasing trend, i.e. both summer average and peak increased compared to their last summer. Mandideep in Madhya Pradesh the most divergent trend with summer average increasing by 40 per cent but its peak was 94 per cent higher. Gwalior registered 35 per cent increase in summer average and 12 per cent increase in peak. Other cities that show increasing trend include Jabalpur, Ratlam, and Ujjain (See *Graph 10: Trend in summer pollution among cities of Central India*).

**Cities with mixed trend:** 6 cities in the region show mixed trend, i.e. their summer average increase but peak pollution decline compared to their last summer or visa-versa. Dewas in Madhya Pradesh registered 30 per cent increase in summer average and 20 per cent drop in peak. It is followed by Bhopal with summer average increase by 23 per cent but its peak was 17 per cent lower. Damoh and Satna had decline in summer average by 5 and 19 per cent but their peak was 49 and 28 per cent higher.

**Cities with declining trend:** Only two cities in the region show declining trend, i.e. both summer average and peak decreased compared to their last summer. Sagar in Madhya Pradesh saw the most decline with a drop of 48 per cent in their peak average and 5 per cent lower summer average, followed by Singrauli with 1 per cent decline in summer average and 19 per cent lower peak.

**Graph 10: Trend in summer pollution (1 Mar- 31 May) among cities of Central India**



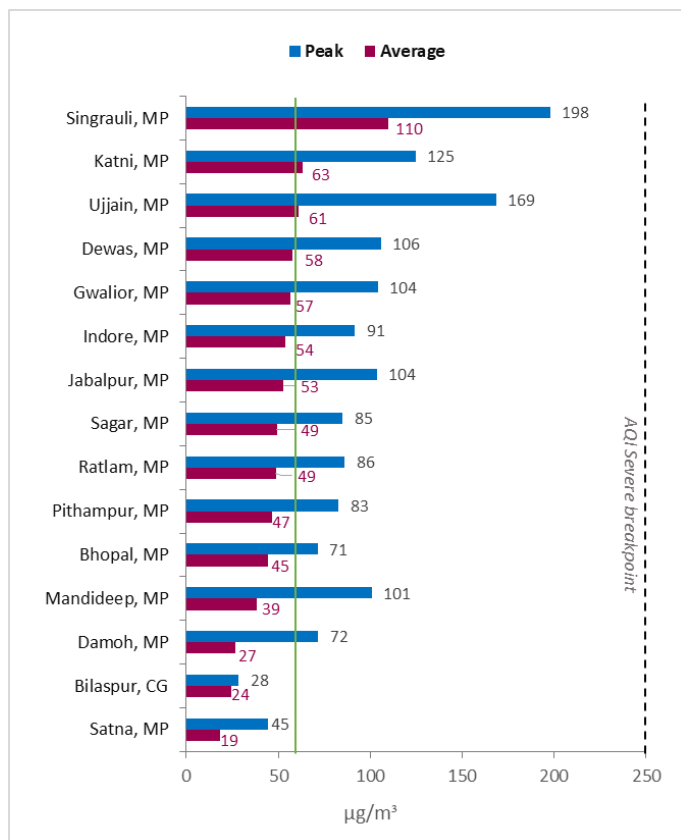
Note: Change in summer average and peak of a city is based on mean of daily PM<sub>2.5</sub> values recorded at CAAQM stations in the city that have minimum 75 per cent data for this summer and previous summer.

Source: CSE analysis of CPCB's real time air quality data

**Most polluted cities:** Most polluted city in the region was Singrauli with summer average of 110  $\mu\text{g}/\text{m}^3$ . Next two spot were occupied by Katni and Ujjain. Singrauli with peak 24-hr level of 198  $\mu\text{g}/\text{m}^3$  had highest peak pollution in the region (See Graph 11: Peer comparison of summer pollution in cities of Central India).

**Least polluted cities:** Satna and Bilaspur recorded the lowest summer average and peak average in the region while, all the other cities in the region saw peak pollution levels above the standard limit of 60  $\mu\text{g}/\text{m}^3$ .

**Graph 11: Peer comparison of summer pollution in cities of Central India**



Note: Summer average and peak of a city is based on mean of daily PM<sub>2.5</sub> values recorded at CAAQM stations in the city that have minimum 75 per cent data for this summer.

Source: CSE analysis of CPCB's real time air quality data

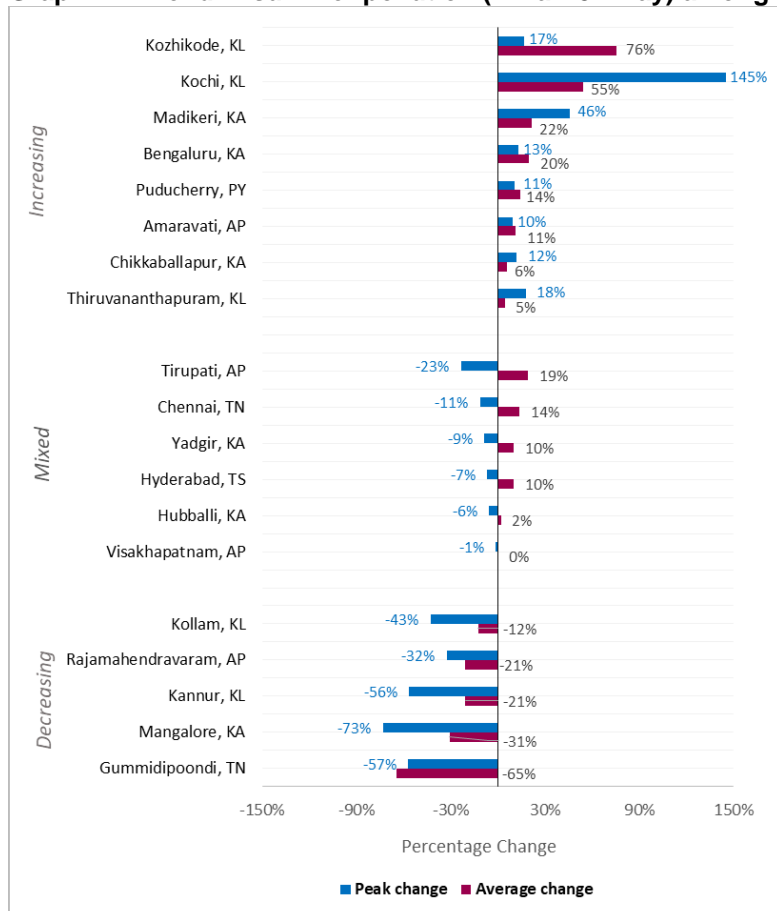
## Summer air quality in South India

The region includes 39 cities spread across Andhra Pradesh, Karnataka, Kerala, Puducherry, Tamil Nadu and Telangana. Geographically, this region represents the southern Deccan plateau, Western Ghats, Malabar and Coromandal coasts.

**Cities with increasing trend:** Eight cities in the region show increasing trend, i.e. both summer average and peak increased compared to their previous summer. Kozhikode saw a jump of 76 percent in summer average and 17 per cent increase in peak. Kochi has the most divergent trend with 55 per cent increase in the summer average but its peak increase by 145 per cent. Other cities with increasing trend in the region are Madikeri, Bengaluru, Puducherry, Amravati, Chikkaballapur, and Thiruvananthapuram (See *Graph 12: Trend in summer pollution among cities of South India*)

**Cities with mixed trend:** Six cities in the region show mixed trend, i.e. their summer average increase but peak pollution declined compared to their last summer. Tirupati in Andhra Pradesh saw increase in summer average by 19 per cent but its peak decline by 23 per cent. Chennai and Hyderabad also recorded mixed trend with summer average increase by 14 and 10 per cent but their peak was lower by 11 and 7 per cent. Visakhapatnam registered no change in summer average but its peak lower by 1 per cent. Other cities with mixed trend in the region are Hubballi, and Yadgir.

**Graph 12: Trend in summer pollution (1 Mar- 31 May) among cities of southern region**



Note: Change in summer average and peak of a city is based on mean of daily PM<sub>2.5</sub> values recorded at CAAQM stations in the city that have minimum 75 per cent data for this summer and previous summer.

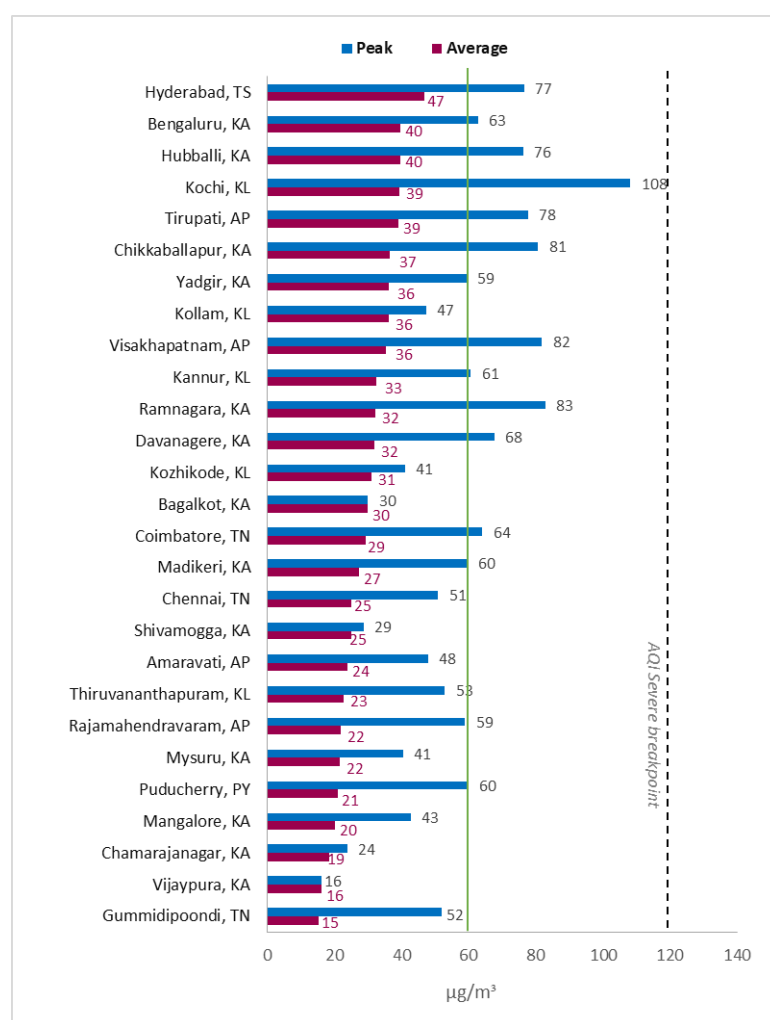
Source: CSE analysis of CPCB's real time air quality data

**Cities with declining trend:** Five cities in the region show declining trend, -- both summer average and peak decreased compared to their previous summer. Gummidipoondi in Tamil Nadu saw the highest decline with a drop of 65 per cent in their summer average and 57 per cent lower peak. Mangalore shows the most divergent trend with decline in peak average by 73 per cent and summer average decline by 31 per cent. Other cities with declining trend are Kannur, Rajamahendravaram, and Kollam.

**Most polluted cities:** Most polluted city in the region was Hyderabad with summer average of 47  $\mu\text{g}/\text{m}^3$ . It is followed by Bengaluru with 40  $\mu\text{g}/\text{m}^3$  (See *Graph 13: Peer comparison of summer pollution in cities of South India*).

**Least polluted cities:** Gummidipoondi in Tamil Nadu and Vijaypura in Karnataka recorded the lowest summer average in the region. All the cities in the region had their summer average lower than the 24-standard limit of 60  $\mu\text{g}/\text{m}^3$ .

**Graph 13: Peer comparison of summer pollution in cities of South India**



Note: Summer average and peak of a city is based on mean of daily PM<sub>2.5</sub> values recorded at CAAQM stations in the city that have minimum 75 per cent data for this summer.

Source: CSE analysis of CPCB's real time air quality data

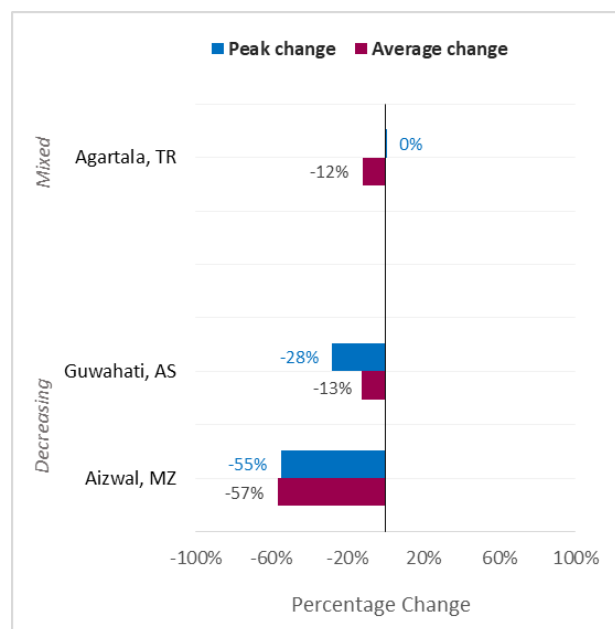
## Summer air quality in Northeast India

The region includes eight cities. Geographically this region represents the Eastern Himalayas and Brahmaputra plains.

**Cities with mixed trend:** Agartala in Tripura show mixed trend, i.e. their summer average registered no change but its peak pollution declined by 12 per cent compared to their last summer (See *Graph 14: Trend in summer pollution among cities of Northeast India*).

**Cities with declining trend:** Two cities in the region show declining trend, i.e. both summer average and peak decreased compared to their previous summer. Aizwal in Mizoram saw the most decline with a drop of 57 percent in their respective summer averages and 55 per cent lower peak. Guwahati registered 13 per cent decline in its summer average and peak level declining by 28 per cent.

**Graph 14: Trend in summer pollution (1 Mar- 31 May) among cities of Northeast India**



Note: Change in summer average and peak of a city is based on mean of daily PM2.5 values recorded at CAAQM stations in the city that have minimum 75 per cent data for this summer and previous summer.

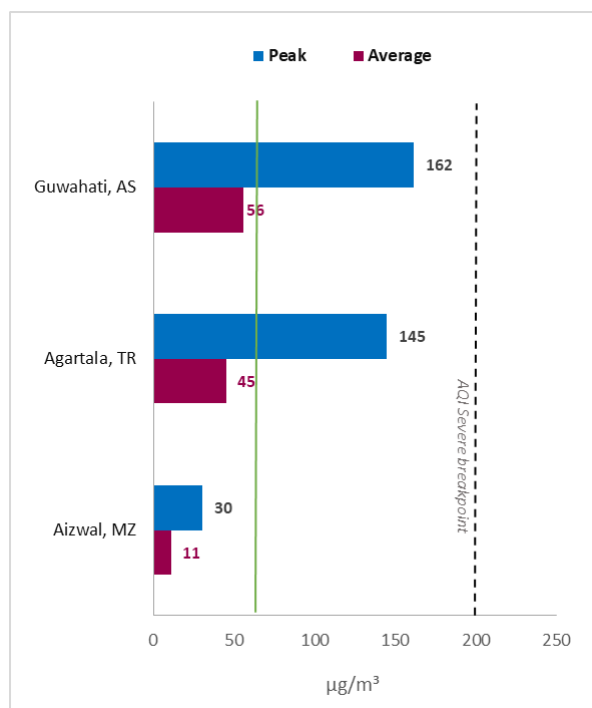
Source: CSE analysis of CPCB's real time air quality data



**Most polluted cities:** Most polluted city in the region include Guwahati with summer average of  $56 \mu\text{g}/\text{m}^3$ . This is followed by Agartala that registered summer average of  $45 \mu\text{g}/\text{m}^3$  (See Graph 15: Peer comparison of summer pollution in cities of Northeast India).

**Least polluted cities:** Aizwal recorded the lowest summer average in the region. Hill stations are relatively less polluted than cities in river valleys and foothills. Aizwal in Northeast had the lowest levels compared to all other cities of all regions this summer.

**Graph 15: Peer comparison of summer pollution in cities of Northeast India**



Note: Summer average and peak of a city is based on mean of daily PM<sub>2.5</sub> values recorded at CAAQM stations in the city that have minimum 75 per cent data for this summer.

Source: CSE analysis of CPCB's real time air quality data

**Annexure 1: All India peer comparison of summer pollution**

Rank	City	Summer PM2.5 average ( $\mu\text{g}/\text{m}^3$ )	Peak 24hr value ( $\mu\text{g}/\text{m}^3$ )
1	Bhiwadi, RJ	134	222
2	Manesar, HR	119	198
3	Singrauli, MP	110	198
4	Rohtak, HR	108	258
5	Muzaffarnagar, UP	107	185
6	Bahadurgarh, HR	102	195
7	Ghaziabad, UP	101	201
8	Charkhi Dadri, HR	100	172
9	Delhi, DL	95	163
10	Katihar, BH	95	247
11	Hisar, HR	94	166
12	Dharuhera, HR	93	178
13	Faridabad, HR	93	194
14	Yamuna Nagar, HR	92	197
15	Patna, BH	91	167
16	Gurugram, HR	91	157
17	Kurukshetra, HR	91	199
18	Jodhpur, RJ	89	142
19	Mandi Gobindgarh, PB	89	240
20	Hapur, UP	84	225
21	Jind, HR	84	170
22	Durgapur, WB	84	164
23	Meerut, UP	84	172
24	Bulandshahr, UP	81	136
25	Muzaffarpur, BH	80	151
26	Chhapra, BH	80	185
27	Noida, UP	79	132
28	Panchkula, HR	76	188
29	Sasaram, BH	75	179
30	Kaithal, HR	75	126
31	Motihari, BH	74	165
32	Greater Noida, UP	74	126
33	Kota, RJ	73	173
34	Narnaul, HR	73	152
35	Jaipur, RJ	72	134
36	Lucknow, UP	72	120
37	Bhagalpur, BH	72	141
38	Hajipur, BH	71	140
39	Pali, RJ	69	133
40	Ambala, HR	69	133
41	Gandhinagar, GJ	68	129
42	Kishanganj, BH	68	196
43	Ahmedabad, GJ	68	114
44	Pune, MH	66	120
45	Ballabgarh, HR	65	133
46	Kanpur, UP	64	104
47	Ankleshwar, GJ	63	107
48	Munger, BH	63	169
49	Udaipur, RJ	63	138

50	Katni, MP	63	125
51	Gaya, BH	63	107
52	Darbhanga, BH	62	134
53	Ujjain, MP	61	169
54	Ludhiana, PB	61	112
55	Ajmer, RJ	60	135
56	Chandigarh, CH	60	104
57	Karnal, HR	58	107
58	Dewas, MP	58	106
59	Gwalior, MP	57	104
60	Guwahati, AS	56	162
61	Sirsa, HR	55	120
62	Moradabad, UP	55	88
63	Firozabad, UP	55	88
64	Vatva, GJ	54	104
65	Patiala, PB	54	82
66	Indore, MP	54	91
67	Jabalpur, MP	53	104
68	Vrindavan, UP	52	86
69	Mumbai, MH	52	98
70	Asansol, WB	51	99
71	Khanna, PB	50	94
72	Sagar, MP	49	85
73	Arrah, BH	49	116
74	Chandrapur, MH	49	93
75	Ratlam, MP	49	86
76	Agra, UP	48	76
77	Hyderabad, TS	47	77
78	Pithampur, MP	47	83
79	Nagpur, MH	47	106
80	Jalandhar, PB	46	93
81	Agartala, TR	45	145
82	Howrah, WB	45	131
83	Siliguri, WB	45	158
84	Bhopal, MP	45	71
85	Amritsar, PB	44	78
86	Navi Mumbai, MH	44	86
87	Bhatinda, PB	43	117
88	Alwar, RJ	43	75
89	Rupnagar, PB	43	92
90	Palwal, HR	41	119
91	Mandikhera, HR	40	69
92	Bengaluru, KA	40	63
93	Hubballi, KA	40	76
94	Kochi, KL	39	108
95	Tirupati, AP	39	78
96	Prayagraj, UP	39	78
97	Mandideep, MP	39	101
98	Kolkata, WB	38	104
99	Chikkaballapur, KA	37	81
100	Yadgir, KA	36	59
101	Kollam, KL	36	47
102	Visakhapatnam, AP	36	82

103	Nashik, MH	35	60
104	Varanasi, UP	33	77
105	Kannur, KL	33	61
106	Ramnagara, KA	32	83
107	Davanagere, KA	32	68
108	Kozhikode, KL	31	41
109	Gorakhpur, UP	30	58
110	Bagalkot, KA	30	30
111	Haldia, WB	29	72
112	Coimbatore, TN	29	64
113	Madikeri, KA	27	60
114	Damoh, MP	27	72
115	Chennai, TN	25	51
116	Shivamogga, KA	25	29
117	Bilaspur, CG	24	28
118	Amaravati, AP	24	48
119	Thiruvananthapuram, KL	23	53
120	Rajamahendravaram, AP	22	59
121	Mysuru, KA	22	41
122	Puducherry, PY	21	60
123	Mangalore, KA	20	43
124	Srinagar, JK	19	41
125	Satna, MP	19	45
126	Chamarajanagar, KA	19	24
127	Vijayapura, KA	16	16
128	Gummidipoondi, TN	15	52
129	Aizwal, MZ	11	30

Note: Summer average of a city is based on mean of daily PM<sub>2.5</sub> values recorded at CAAQM stations in the city that have minimum 75 per cent data for this summer. Summer peak of a city is based on mean of the highest daily PM<sub>2.5</sub> value recorded at CAAQM stations in the city that meet the data completeness requirement.  
Source: CSE analysis of CPCB's real time air quality data.