Guangdong-Hong Kong-Macao Pearl River Delta Regional Air Quality Monitoring Network

A Report of Monitoring Results in 2021

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Approved by	**:**	**Quality Management Committee of Guangdong-Hong Kong-Macao Pearl River Delta Regional Air Quality Monitoring Network**
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Purpose of the Report

This report provides the 2021 monitoring results from the Guangdong-Hong Kong-Macao Pearl River Delta Regional Air Quality Monitoring Network and their statistical analysis.

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1. Foreword

Since the Pearl River Delta (PRD) Regional Air Quality Monitoring Network came into operation on 30 November 2005, a half-yearly and an annual air quality monitoring reports were published every year since 2006.

With the growing concerns of air pollution control and economic development of the region, the environmental protection departments of Guangdong and Hong Kong had worked in collaboration with the environmental protection cum meteorological authorities of Macao to enhance the network by extending the coverage of monitoring area to Guangdong, Hong Kong and Macao in September 2014. The enhancements included the addition of monitoring stations from 16 to 23 to further improve the spatial distribution and the inclusion of two new monitoring parameters, i.e. carbon monoxide (CO) and fine suspended particulates ($PM_{2.5}$), to enrich the air quality monitoring information. At the same time, the network was renamed to "Guangdong-Hong Kong-Macao Pearl River Delta Regional Air Quality Monitoring Network" (the "Network").

With the enhancement of the network, the update of the national ambient air quality standards as well as the need for improving the reporting frequency of monitoring results, starting from 2014, the real-time hourly monitoring data was reported on a new internet platform to replace the daily Regional Air Quality Index (RAQI), the half-yearly report was also replaced by a quarterly report while the annual air quality monitoring report was maintained. The quarterly report is a brief statistical summary of the regional air quality monitoring results in a quarter. The annual report, in addition to the reporting of the monitoring data, provides a more detailed analysis and comparison of the air quality in the year.

2. Introduction to Guangdong-Hong Kong-Macao Pearl River Delta Regional Air Quality Monitoring Network

The PRD Regional Air Quality Monitoring Network was jointly established by the Guangdong Provincial Environmental Monitoring Centre[1] and the Environmental Protection Department of the Hong Kong Special Administrative Region (HKEPD) from 2003 to 2005. The network came into operation on 30 November 2005 and its data had been used for reporting Regional Air Quality Index (RAQI) to the public. At that time, the network comprised 16 automatic air quality monitoring stations (see Figure 1) across the PRD region. Ten of these stations were operated by the Ecological and Environmental Monitoring Centres of the individual cities in Guangdong while the three stations located in Hong Kong were managed by the HKEPD. The remaining three regional stations were operated by the Ecological and Environmental Monitoring Centre of Guangdong (GDEEMC). All stations were installed with equipment to measure the ambient concentrations of respirable suspended particulates (PM_{10} or RSP), sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and ozone (O_3).

The network was enhanced in September 2014 and renamed "Guangdong-Hong Kong-Macao Pearl River Delta Regional Air Quality Monitoring Network". The number of monitoring stations was increased from 16 to 23. Guangdong, on its original 13 stations, added five stations, including Nanshadawen[2] and Zhudong in Guangzhou, Duanfen and Huaguoshan in Jiangmen, and Xijiao in Huizhou. Hong Kong added Yuen Long monitoring station on the basis of its original three stations and Macao joined in with the monitoring station at Taipa Grande. As regards the monitoring

[1] Guangdong Provincial Environmental Monitoring Centre was renamed as Ecological and Environmental Monitoring Centre of Guangdong in December 2020.

[2] Owing to insufficient space after the extensive renovation work at Modiesha monitoring station in Guangzhou, this station closed permanently in 2021, whereas a new Nanshadawen monitoring station in Guangzhou joined the network.

parameters, the Network continued to monitor the original four air pollutants with the addition of two new monitoring parameters, i.e. carbon monoxide (CO) and fine suspended particulates ($PM_{2.5}$ or FSP). Figure 2 shows the latest spatial distribution of the monitoring stations after the enhancement of the network. Eight city monitoring stations of Guangdong have been operated by the operation-cum-maintenance agencies commissioned by the State since November 2016.

Based on the previous "Standard Operating Procedures on Quality Assurance and Quality Control of the PRD Air Quality Monitoring System for Guangdong and Hong Kong", the Network employs a revised "Standard Operating Procedures on Quality Assurance and Quality Control of the PRD Air Quality Monitoring System for Guangdong, Hong Kong and Macau" (QA/QC Operating Procedures) jointly developed by Guangdong, Hong Kong and Macau to ensure that the air quality monitoring results attain a high degree of accuracy and reliability, and meet the respective quality management policies of the three places. The design and operation of the Network comply with the requirements set out in the QA/QC Operating Procedures. In light of the development of the Network, the QA/QC Operating Procedures will be revised as and when necessary.

Figure 1：Spatial distribution of monitoring stations (Nov 2005 to Aug 2014)

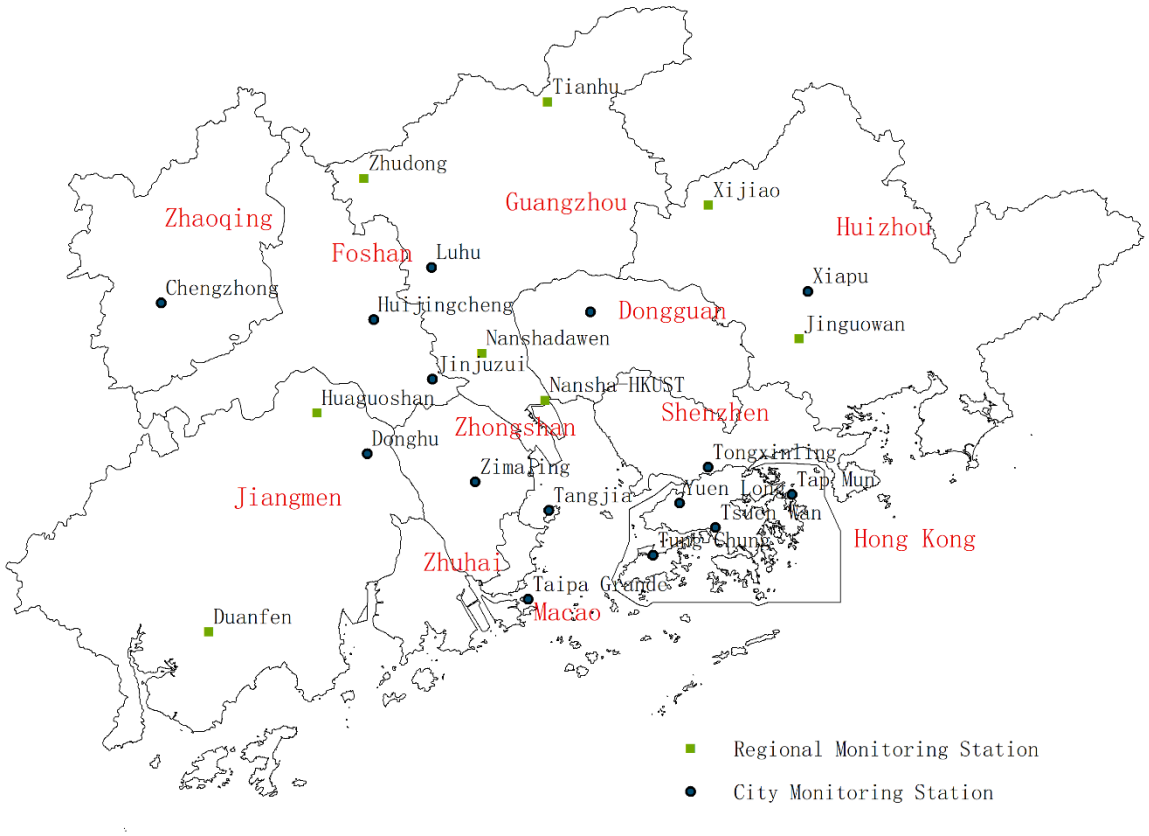

Figure 2：Spatial distribution of monitoring stations in the Network (from Jan 2021)

Remark: For the boundary of the administrative division of the Macao Special Administrative Region, according the Decree n.º665 of the State Council of the People's Republic of China, "the map of the administrative division of the Macao Special Administrative Region" was approved at the 116th Executive Meeting of the State Council on 16 December 2015.

To cope with the enhancement of the Network and the update of national ambient air quality standards, the internet platform has increased the data reporting frequency by replacing the previous RAQI that was published once a day to hourly dissemination of real time air quality monitoring information of each monitoring station.

The objectives of the Network are to:

- provide accurate air quality data to assist the governments of Guangdong, Hong Kong and Macao in understanding the air quality situation and pollution problems in the PRD region for formulating appropriate control measures;
- evaluate the effectiveness of the air pollution control measures through long-term monitoring;
- provide the public with information on the air quality of different areas in the region.

This is an annual report on the monitoring results for 2021. From 2015 onwards, the annual report covers the monitoring results of six monitoring parameters recorded at 23 monitoring stations of the Network.

Annexes A and B set out the site information of the monitoring stations and the methods used for measuring air pollutant concentrations respectively.

3. Operation of the Network

The overall operation of the Network was smooth in 2021. The average hourly data capture rate for the six air pollutants measured at all monitoring stations was 97.6%.

3.1 Quality Control (QC) and Quality Assurance (QA) Activities

The governments of Guangdong, Hong Kong, and Macao have fully implemented the agreed QC works, which include zero/span checks, precision checks, dynamic calibration, etc. The QA/QC works are carried out in accordance with the QA/QC Operating Procedures so as to ensure that the air quality data from the monitoring stations are highly accurate and reliable. To ensure the operation of the Network is in compliance with the QA/QC requirements, the GDEEMC, HKEPD, Environmental Protection Bureau of Macau SARG and Meteorological and Geophysical Bureau of Macao SARG jointly established the "Quality Management Committee of Guangdong-Hong Kong-Macao Pearl River Delta Regional Air Quality Monitoring Network" (Quality Management Committee, "QMC") to review and evaluate, on a quarterly basis, the performance of equipment, QA/QC works, data transmission system and operation of the Network. The QMC also conducts a system audit every year to evaluate the effectiveness of the quality management system. Based on the audit results, a report will be prepared to summarize any corrective measures and recommendations and the QMC will take appropriate follow-up actions.

3.2 Accuracy and Precision

The accuracy of the Network is evaluated by means of performance audits. The performance goals set for the gaseous pollutants and particulates (PM_{10} and $PM_{2.5}$) are ±20% and ±15% respectively. In 2021, we had carried out 460 audit checks on the analyzers and particulate samplers at the monitoring stations of the Network. The results showed that, based on the 95% probability limits, the accuracy of the Network ranged from -11.8% to 9.5%, which were within the required performance goals (see Figure 3).

Precision is a measure of repeatability and is calculated in accordance with the QA/QC Operating Procedures. The performance goals adopted for the gaseous pollutants and particulates (PM_{10} and $PM_{2.5}$) are ±15%. In 2021, we had carried out 4502 precision checks on the analyzers and samplers at the monitoring stations of the Network. The results showed that, based on the 95% probability limits, the precision of the Network ranged from -8.5% and 10.9%, which were within the required performance goals (see Figure 4). In 2021, the overall QA/QC performance of the Network was satisfactory and met all the requirements specified in the QA/QC Operating Procedures.

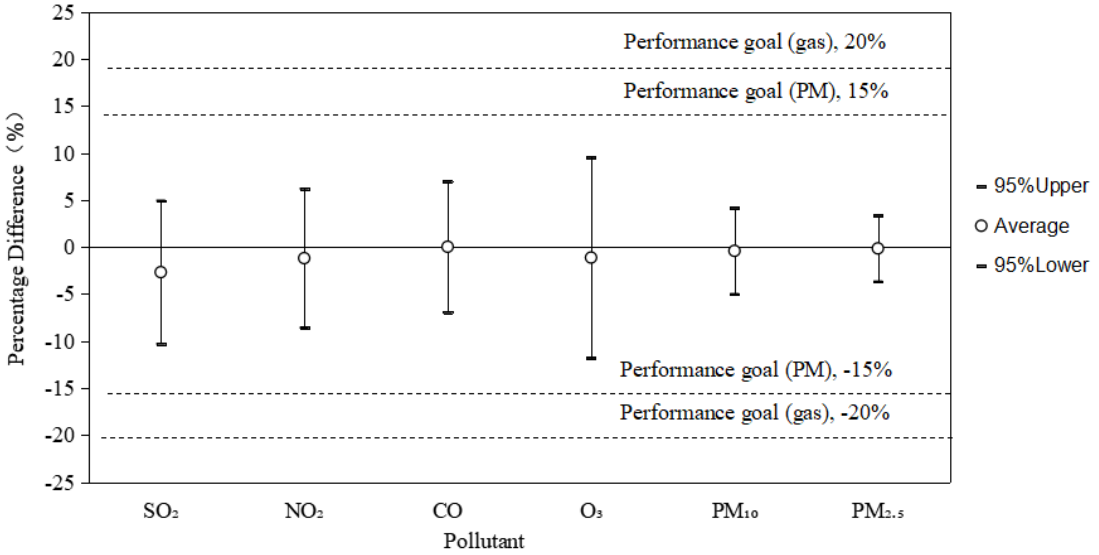

Figure 3：Accuracy of the monitoring network in 2021

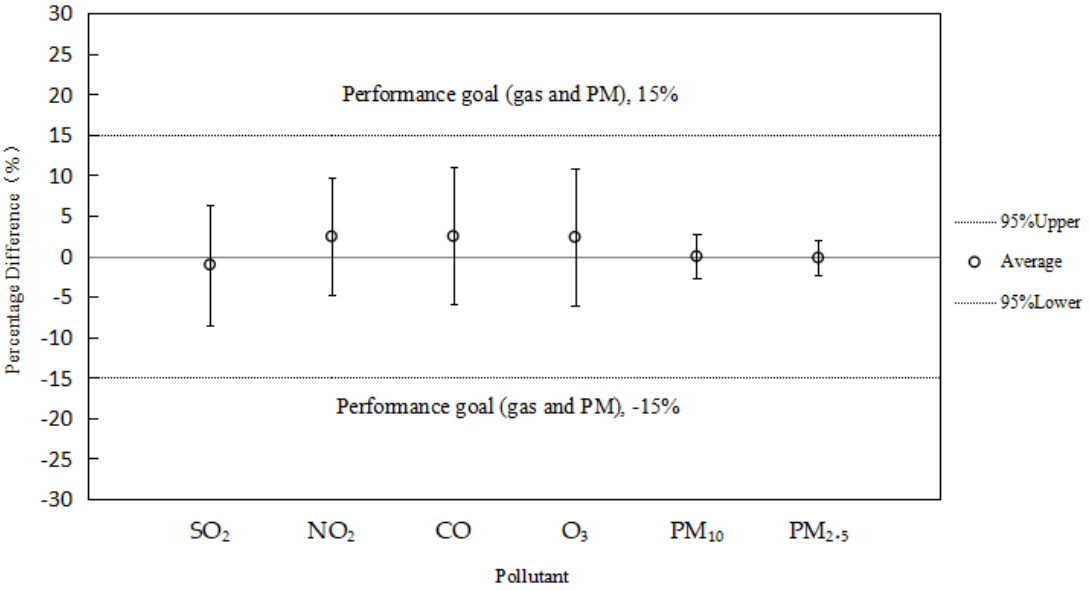

Figure 4：Precision of the monitoring network in 2021

4. Statistical Analysis of Pollutant Concentrations

Starting from 2014 annual report, the air quality assessment is conducted based on the class II limits of the national "Ambient Air Quality Standards" (NAAQS) (GB3095-2012). Per the amended version of the Standards, starting from 2019, the concentrations of gaseous pollutants are calculated at a reference temperature of 298.15K and a pressure of 101.325 kPa, while the concentrations of PM_{10} and $PM_{2.5}$ are measured at real-time temperature and atmospheric pressure during monitoring.

Owing to the low daily data capture rate in 2021 for ozone data at Xijiao station in Huizhou, and $PM_{2.5}$ data at Xijiao station in Huizhou, these data were not used for statistical analysis but for reference only.

4.1 Sulphur Dioxide (SO_2)

Sulphur dioxide (SO_2) comes mainly from the combustion of sulphur-containing fossil fuel. Its major sources of emissions include power plants, fuel combustion plants, vehicles and vessels. Apart from its impact on the human respiratory system, SO_2 can also be oxidized in the air to form sulphate, which has significant impact on the levels of particulate matters, acid rain and visibility in the region.

In 2021, the annual average of SO_2 recorded at each monitoring station in the Network ranged from 2 to 11 μg/m^3, and all stations were in compliance with the national annual average concentration limit (60 μg/m^3). As shown in Figure 5, the annual average concentrations of SO_2 recorded at all the monitoring stations were generally at a low level. During the year, all monitoring stations in the Network could comply with the national 24-hour average concentration limit (150 μg/m^3) and 1-hour average concentration limit (500 μg/m^3) of SO_2.

Tables 4.1a to 4.6c list the monthly maxima of hourly averages, the monthly maxima of daily averages with the 98th percentile of the year, the monthly and annual averages of SO_2 at each station respectively.

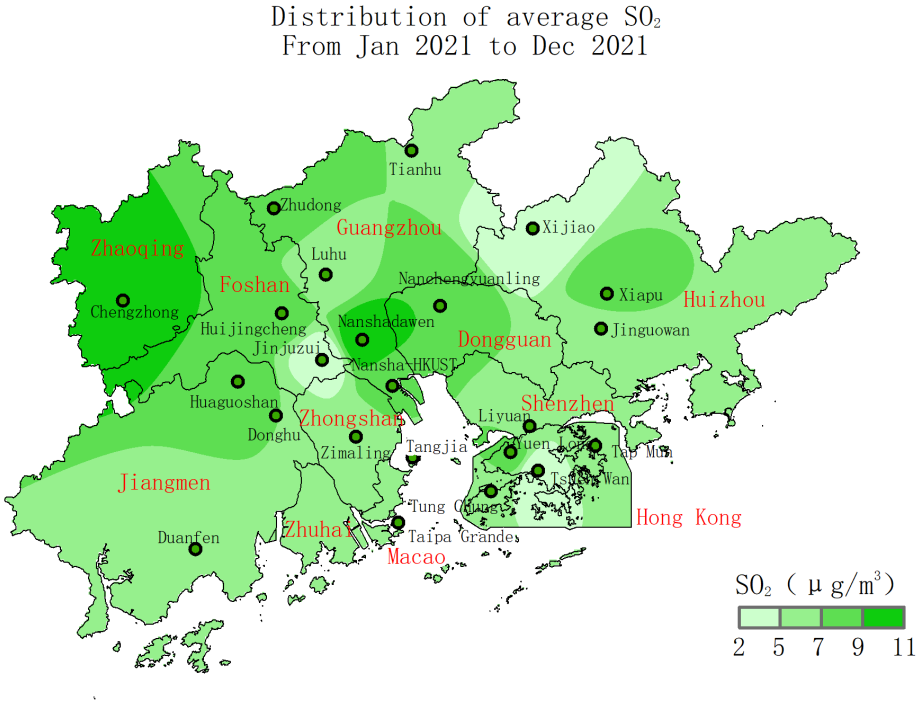

Figure 5：Spatial distribution of annual average concentrations of Sulphur Dioxide (SO_2)

Table 4.1a：Hourly averages of Sulphur Dioxide (the monthly maxima)

[Class II limit: 500 μg/m^3]

Monitoring Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Luhu (Guangzhou)	23	16	14	22	10	15	13	11	10	11	13	16
Modiesha (Guangzhou)	27	29	26	32	15	23	16	21	19	26	31	28
Nansha-HKUST (Guangzhou)	31	19	21	23	17	17	13	22	12	21	19	20
Tianhu (Guangzhou)	25	10	12	11	20	15	11	10	12	16	24	19
Zhudong (Guangzhou)	30	15	15	9	19	19	24	17	18	15	18	17
Tongxinling (Shenzhen)	14	8	6	30	8	12	6	7	12	8	9	9
Jinjuzui (Foshan)	20	21	14	23	8	12	9	20	11	12	12	11
Huijingcheng (Foshan)	49	26	26	64	15	39	31	27	36	22	22	37
Tangjia (Zhuhai)	24	14	20	18	11	20	18	10	9	13	17	15
Donghu (Jiangmen)	33	18	28	18	13	22	16	17	16	20	22	21
Duanfen (Jiangmen)	27	16	22	27	10	14	16	12	23	15	19	26
Huaguoshan (Jiangmen)	88	36	53	82	50	67	185	78	100	82	52	45
Chengzhong (Zhaoqing)	59	18	53	49	95	74	144	53	73	75	54	54
Xiapu (Huizhou)	31	24	20	25	20	40	16	14	22	28	66	17
Xijiao (Huizhou)	15	9	13	14	9	8	7	5	8	9	10	9
Jinguowan (Huizhou)	18	23	9	24	17	13	13	8	10	10	10	10
Zimaling (Zhongshan)	17	12	10	17	11	23	9	10	11	13	19	19
Nanchengyuanling (Dongguan)	25	20	23	20	14	17	21	18	20	14	17	15
Tap Mun (Hong Kong)	15	12	10	8	10	9	8	8	12	10	13	14
Tsuen Wan (Hong Kong)	16	15	14	13	12	18	15	18	13	14	12	14
Yuen Long (Hong Kong)	18	12	12	21	13	15	15	13	19	13	18	20
Tung Chung (Hong Kong)	14	13	12	11	10	15	13	10	16	12	7	14
Taipa Grande (Macao)	18	11	14	11	11	13	13	9	17	12	14	17

Remarks : All concentration units are in micrograms per cubic metre (μg/m^3).

Table 4.1b：Daily averages of Sulphur Dioxide (the monthly maxima and the 98th percentile of the year)

[Class II limit: 150 μg/m³]

Monitoring Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Compliance	98th percentile
Luhu (Guangzhou)	13	9	9	10	7	7	8	6	6	8	11	11	100.0%	12
Modiesha (Guangzhou)	18	11	18	15	9	13	13	13	15	12	17	16	100.0%	16
Nansha-HKUST (Guangzhou)	21	10	14	13	9	11	8	8	8	10	13	13	100.0%	14
Tianhu (Guangzhou)	15	7	8	7	12	12	9	8	8	10	13	14	100.0%	13
Zhudong (Guangzhou)	20	7	12	8	10	9	12	10	9	12	12	11	100.0%	13
Tongxinling (Shenzhen)	11	8	5	5	6	10	4	5	8	6	7	7	100.0%	9
Jinjuzui (Foshan)	13	7	8	8	5	4	4	7	8	8	7	6	100.0%	9
Huijingcheng (Foshan)	26	15	15	25	8	16	14	13	14	9	12	13	100.0%	19
Tangjia (Zhuhai)	14	7	11	9	7	7	7	8	6	7	10	11	100.0%	11
Donghu (Jiangmen)	16	7	14	11	9	10	9	9	9	11	13	11	100.0%	13
Duanfen (Jiangmen)	18	8	12	9	6	8	6	4	5	8	13	11	100.0%	13
Huaguoshan (Jiangmen)	27	8	12	23	14	16	34	20	27	19	16	13	100.0%	23
Chengzhong (Zhaoqing)	19	11	19	20	26	21	26	19	18	22	21	17	100.0%	20
Xiapu (Huizhou)	18	10	13	14	12	12	7	7	9	13	21	11	100.0%	15
Xijiao (Huizhou)	8	2	7	5	3	3	2	2	2	5	5	5	100.0%	5
Jinguowan (Huizhou)	12	6	6	8	6	6	5	3	5	6	7	7	100.0%	8
Zimaling (Zhongshan)	8	6	6	7	8	8	6	7	5	8	11	10	100.0%	8
Nanchengyuanling (Dongguan)	15	12	15	13	11	11	11	11	9	10	12	11	100.0%	14
Tap Mun (Hong Kong)	11	6	7	7	6	6	6	7	8	8	11	11	100.0%	10
Tsuen Wan (Hong Kong)	8	5	7	6	7	8	7	8	7	6	7	8	100.0%	7
Yuen Long (Hong Kong)	13	8	9	9	9	10	10	10	11	11	14	15	100.0%	14
Tung Chung (Hong Kong)	7	5	6	6	5	8	8	7	9	8	4	7	100.0%	8
Taipa Grande (Macao)	10	5	8	6	5	7	8	5	6	8	10	9	100.0%	9

Remarks： All concentration units are in micrograms per cubic metre (μg/m³).

Table 4.1c：The monthly and annual averages of Sulphur Dioxide

[Class II limit for annual average: 60 μg/m^3]

Monitoring Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
Luhu (Guangzhou)	9	7	7	5	5	5	5	5	5	6	8	8	6
Modiesha (Guangzhou)	11*	9	11	9	7	9	10	12	10	8	11	12	10
Nansha-HKUST (Guangzhou)	12	8	8	8	7	7	6	7	7	8	10	10	8
Tianhu (Guangzhou)	9	5	5	4	9	10	7	7	7	7	9	10	7
Zhudong (Guangzhou)	11	6	7	6	8	6	8	7	7	8	9	9	8
Tongxinling (Shenzhen)	8	5	4	4	4	5	4	5	5	5	6	5	5
Jinjuzui (Foshan)	7	4	5	4	3	2	3	3	4	3	5	4	4
Huijingcheng (Foshan)	15	11	10	8	6	7	8	6	7	7	8	8	8
Tangjia (Zhuhai)	8	5	6	6	5	5	6	6	5	6	8	10	6
Donghu (Jiangmen)	10	5	8	8	6	6	6	7	6	7	9	8	7
Duanfen (Jiangmen)	10	5	6	5	4	4	5	3	3	4	7	7	5
Huaguoshan (Jiangmen)	13	4	7	8	6	5	10	10	11	7	10	10	8
Chengzhong (Zhaoqing)	10	7	13	12	12	12	14	12	12	10	12	10	11
Xiapu (Huizhou)	12	8	10	10	9	8	6	5	7	8	12	6	8
Xijiao (Huizhou)	4	2	3	3	2	2	2	1	2*	3	3	3	2
Jinguowan (Huizhou)	7	5	5	5	5	4	4	3	4	4	5	5	5
Zimaling (Zhongshan)	5	4	3	4	5	5	4	5	4	5	7	7	5
Nanchengyuanling (Dongguan)	11	8	11	10	8	8	8	9	6	7	9	9	9
Tap Mun (Hong Kong)	6	5	5	5	5	5	5	6	6	7	8	9	6
Tsuen Wan (Hong Kong)	4	3	3	3	4	5	5	6	6	5	5	6	4
Yuen Long (Hong Kong)	9	7	7	8	8	8	8	9	10	10	12	5	8
Tung Chung (Hong Kong)	5	3	4	4	4	5	6	6	7	6	3	4	5
Taipa Grande (Macao)	6	4	4	4	4	4	5	5	4	6	7	5	5

Remarks : All concentration units are in micrograms per cubic metre (μg/m^3).

* The capture rate of validated daily data per month is below 85%.

4.2 Nitrogen Dioxide (NO_2)

Nitrogen Dioxide (NO_2) is mainly formed from oxidization of nitric oxide (NO) emitted in the process of combustion. Its major emission sources include power plants, fuel combustion plants, vehicles and vessels. Apart from its impact on human respiratory system, NO_2 can also be oxidized in the air to form nitrate, which has significant impact on the levels of particulate matters, acid rain and visibility in the region.

In 2021, the annual average of NO_2 recorded at each monitoring station in the Network ranged from 9 to 43 μg/m^3, among them, the monitoring station having the highest annual average value of NO_2 was located in the urban area. During the year, 6 monitoring stations in the Network recorded no exceedance of the national 24-hour average concentration limit (80 μg/m^3) while the corresponding compliance rates in the Network ranged from 96.6% to 100.0%; 16 monitoring stations recorded no exceedance of national 1-hour average concentration limit of NO_2 (200 μg/m^3).

Tables 4.2a to 4.2c list the monthly maxima of hourly averages, the monthly maxima of daily averages with the 98th percentile of the year, the monthly and annual averages of NO_2 at each station respectively.

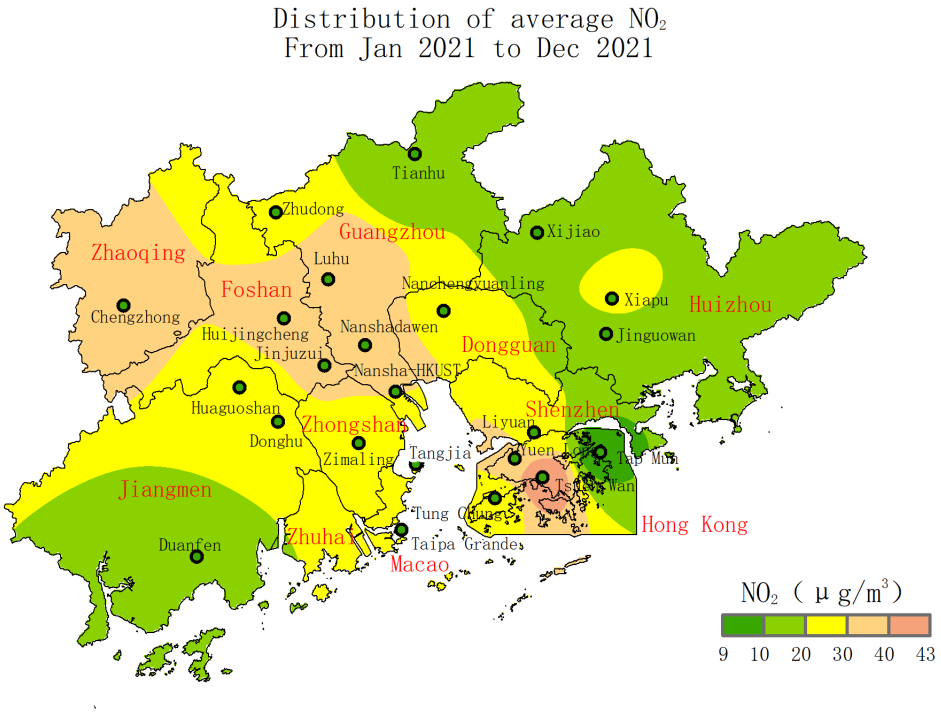

Figure 6：Spatial distribution of annual average concentrations of Nitrogen Dioxide (NO_2)

Table 4.2a：Hourly averages of Nitrogen Dioxide (the monthly maxima)

[Class II limit: 200 μg/m³]

Monitoring Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Luhu (Guangzhou)	259	171	124	134	88	83	94	82	104	135	116	132
Modiesha (Guangzhou)	208	100	142	116	106	79	72	98	112	123	143	168
Nansha-HKUST (Guangzhou)	191	86	138	115	84	63	66	69	112	103	105	133
Tianhu (Guangzhou)	60	37	50	46	38	28	36	26	35	30	27	34
Zhudong (Guangzhou)	133	82	71	95	103	63	58	63	80	63	72	78
Tongxinling (Shenzhen)	153	63	107	60	64	57	61	56	60	46	110	104
Jinjuzui (Foshan)	219	98	122	106	92	54	57	78	81	122	119	146
Huijingcheng (Foshan)	261	100	137	141	86	110	125	79	72	104	109	160
Tangjia (Zhuhai)	180	77	123	65	27	39	42	46	55	98	98	93
Donghu (Jiangmen)	210	80	134	78	44	44	36	55	62	99	110	145
Duanfen (Jiangmen)	91	40	79	54	19	23	31	27	27	52	63	67
Huaguoshan (Jiangmen)	185	73	121	76	43	42	37	54	58	72	80	111
Chengzhong (Zhaoqing)	196	139	102	102	104	124	102	57	95	118	117	136
Xiapu (Huizhou)	184	82	79	79	62	66	64	60	51	94	95	113
Xijiao (Huizhou)	44	28	45	38	38	30	30	22	23	17	20	26
Jinguowan (Huizhou)	113	38	56	53	45	32	32	44	57	39	33	50
Zimaling (Zhongshan)	148	80	106	84	56	48	45	49	54	101	116	123
Nanchengyuanling (Dongguan)	189	77	122	125	74	93	58	69	102	97	98	157
Tap Mun (Hong Kong)	82	62	47	47	33	42	52	39	54	28	55	77
Tsuen Wan (Hong Kong)	198	137	145	122	116	117	130	120	138	135	131	220
Yuen Long (Hong Kong)	172	105	120	102	104	95	105	96	114	122	173	202
Tung Chung (Hong Kong)	160	102	99	76	85	75	66	53	95	82	113	110
Taipa Grande (Macao)	141	83	104	92	52	45	44	54	51	81	106	105

Remarks : All concentration units are in micrograms per cubic metre (μg/m³).

Table 4.2b：Daily averages of Nitrogen Dioxide (the monthly maxima and the 98th percentile of the year) **[Class II limit: 80 μg/m³]**

Monitoring Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Compliance	98th percentile
Luhu (Guangzhou)	188	76	70	71	41	45	36	47	51	50	57	81	97.8%	80
Modiesha (Guangzhou)	124	52	78	71	48	41	38	47	52	68	77	99	96.6%	90
Nansha-HKUST (Guangzhou)	105	50	73	66	36	34	32	36	49	50	66	61	98.6%	73
Tianhu (Guangzhou)	49	20	32	24	22	15	17	14	17	14	14	16	100.0%	25
Zhudong (Guangzhou)	84	47	48	38	37	31	30	33	34	40	44	46	99.7%	48
Tongxinling (Shenzhen)	70	35	46	28	25	26	27	30	33	25	62	57	100.0%	56
Jinjuzui (Foshan)	144	55	71	56	24	37	35	38	49	68	67	87	97.5%	90
Huijingcheng (Foshan)	206	58	79	61	39	47	37	44	44	47	69	100	97.5%	90
Tangjia (Zhuhai)	88	38	51	38	15	25	21	25	24	45	56	60	99.4%	59
Donghu (Jiangmen)	102	40	59	55	25	23	24	30	27	51	70	98	97.8%	79
Duanfen (Jiangmen)	35	24	42	33	9	13	11	14	11	32	38	46	100.0%	37
Huaguoshan (Jiangmen)	135	47	71	51	25	23	23	28	26	37	55	70	98.9%	68
Chengzhong (Zhaoqing)	108	61	66	50	42	47	36	34	46	46	67	86	98.3%	78
Xiapu (Huizhou)	83	30	38	37	30	27	26	27	30	31	41	46	99.4%	50
Xijiao (Huizhou)	25	13	21	20	20	12	15	10	7	11	13	17	100.0%	20
Jinguowan (Huizhou)	53	21	26	30	29	14	16	21	28	13	22	24	100.0%	29
Zimaling (Zhongshan)	99	40	56	45	26	26	21	28	25	49	68	67	98.9%	70
Nanchengyuanling (Dongguan)	132	47	58	66	28	34	32	45	54	36	47	61	98.4%	66
Tap Mun (Hong Kong)	42	19	24	24	15	14	22	20	33	16	22	30	100.0%	23
Tsuen Wan (Hong Kong)	124	75	72	71	58	60	61	67	59	46	69	93	97.8%	80
Yuen Long (Hong Kong)	109	59	72	53	42	47	51	54	68	53	82	104	98.3%	78
Tung Chung (Hong Kong)	92	54	55	42	42	42	31	32	54	47	65	64	99.7%	62
Taipa Grande (Macao)	83	42	62	49	30	29	19	28	27	49	74	76	99.7%	66

Remarks : All concentration units are in micrograms per cubic metre (μg/m³).

Table 4.2c：The monthly and annual averages of Nitrogen Dioxide

[Class II limit for annual average: 40 μg/m³]

Monitoring Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
Luhu (Guangzhou)	72	39	46	40	25	27	25	30	34	31	41	46	38
Modiesha (Guangzhou)	63*	32	47	40	24	26	24	28	32	34	53	60	38
Nansha-HKUST (Guangzhou)	51	22	40	39	19	19	18	21	25	22	39	43	30
Tianhu (Guangzhou)	15	11	17	14	14	9	9	8	7	7	9	11	11
Zhudong (Guangzhou)	39	24	32	29	22	21	20	25	25	21	28	28	26
Tongxinling (Shenzhen)	36	19	19	13	13	14	15	18	17	16	31	33	20
Jinjuzui (Foshan)	63	24	38	32	13	18	16	19	25	25	43	52	31
Huijingcheng (Foshan)	71	27	39	39	21	24	21	27	29	27	39	49	34
Tangjia (Zhuhai)	45	19	26	19	7	11	10	11	14	22	32	35	21
Donghu (Jiangmen)	53	18	32	27	13	15	13	16	17	26	41	52	27
Duanfen (Jiangmen)	18	10	14	10	4	8	8	6	8	16	26	33	13
Huaguoshan (Jiangmen)	55	21	32	29	12	14	16	15	20	23	33	42	26
Chengzhong (Zhaoqing)	54	28	37	32	23	26	25	24	31	25	38	47	33
Xiapu (Huizhou)	36	17	24	22	19	17	15	19	18	17	23	28	21
Xijiao (Huizhou)	14	9	14	13	13	8*	8	6	5*	7	8	10	10
Jinguowan (Huizhou)	25	13	19	19	15	7	7	11	11	9	12	15	14
Zimaling (Zhongshan)	52	17	27	21	8	9	10	12	15	25	42	48	24
Nanchengyuanling (Dongguan)	53	25	34	32	18	21	21	26	28	20	30	36	29
Tap Mun (Hong Kong)	16	9	9	7	6	6	7	10	9	8	12	14	9
Tsuen Wan (Hong Kong)	59	48	43	40	40	40	38	42	39	32	48	51	43
Yuen Long (Hong Kong)	57	41	39	33	24	26	31	34	38	34	54	56	39
Tung Chung (Hong Kong)	44	29	26	20	14	16	14	17	25	24	38	42	26
Taipa Grande (Macao)	46	22	26	18	8	11	9	12	14	25	36	44	23

Remarks : All concentration units are in micrograms per cubic metre (μg/m³).

* The capture rate of validated daily data per month is below 85%.

4.3 Ozone (O_3)

Ozone (O_3) is not directly emitted from emission sources. It is formed by the photochemical reaction of oxygen, nitrogen oxides (NOx) and volatile organic compounds (VOCs) in the air under sunlight, and is one of the main components of photochemical smog. Ozone can cause irritation to the eyes, nose and throat. At elevated levels, it can increase a person's susceptibility to respiratory diseases and aggravate pre-existing respiratory diseases such as asthma.

The precursors of O_3 (NOx and VOCs) mainly originate from pollution sources in urban areas. However, as it usually takes several hours for O_3 to be formed and rise to its peak level, O_3 and its precursors can be transported to other areas downwind of their sources during this period. The concentrations of O_3 in downwind rural areas are therefore often higher than those in the urban areas.

In 2021, the annual average of O_3 recorded at each monitoring station in the Network ranged from 43 to 84 $\mu g/m^3$ with higher average values being recorded in rural areas such as Tianhu in Guangzhou and Tap Mun in Hong Kong, the situation was similar to the one in previous years. During the year, the compliance rates of the daily maximum 8-hour averages of O_3 in the Network ranged from 81.6% to 99.2%. All monitoring stations recorded exceedance of the national 1-hour average concentration limit (200 $\mu g/m^3$).

Tables 4.3a to 4.3c list the monthly maxima of hourly averages, the monthly maxima of daily maximum 8-hour averages with the 90th percentile of the year, the monthly and annual averages of O_3 at each station respectively.

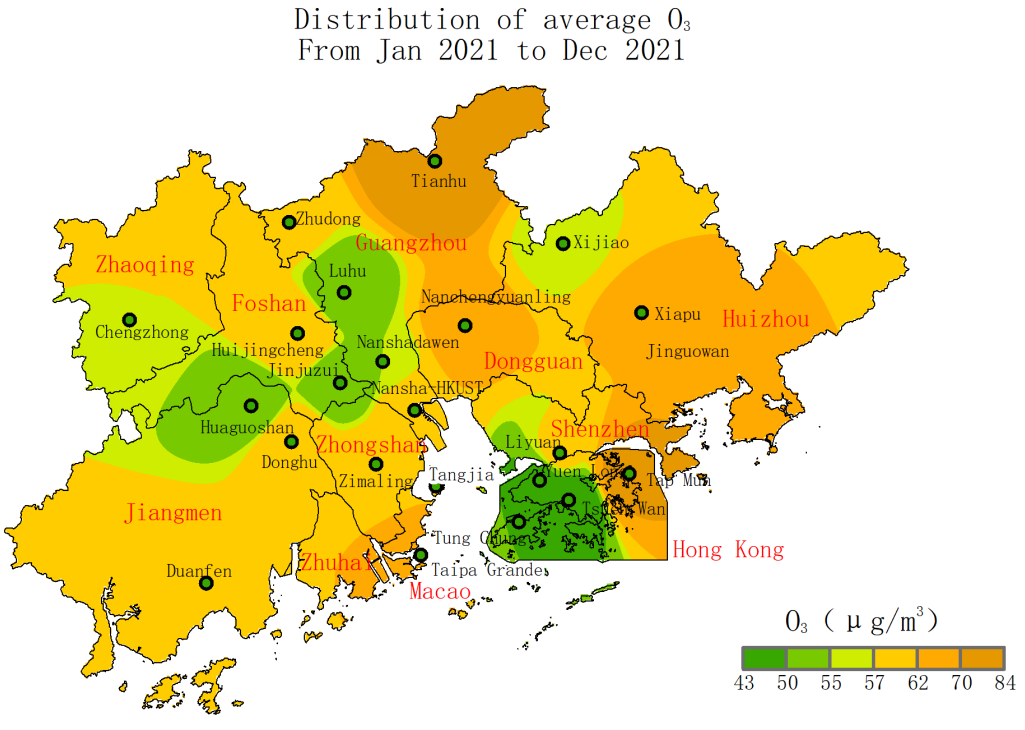

Figure 7：Spatial distribution of annual average concentrations of Ozone (O_3)

Remark: Jinguowan's data are excluded in the spatial distribution map owing to its low daily data capture rate in 2021.

Table 4.3a：Hourly averages of Ozone (the monthly maxima)

[Class II limit: 200 μg/m³]

Monitoring Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Luhu (Guangzhou)	204	215	203	331	237	242	250	244	257	197	176	186
Modiesha (Guangzhou)	209	255	341	348	242	243	295	255	296	236	219	197
Nansha-HKUST (Guangzhou)	238	298	256	322	209	305	278	252	316	271	242	261
Tianhu (Guangzhou)	282	217	232	351	245	194	200	211	253	236	183	152
Zhudong (Guangzhou)	290	176	179	206	195	222	249	392	254	236	240	171
Tongxinling (Shenzhen)	218	187	226	202	194	252	304	164	282	158	208	216
Jinjuzui (Foshan)	196	197	216	328	175	231	306	272	273	231	201	207
Huijingcheng (Foshan)	232	264	287	360	229	233	270	285	314	315	219	227
Tangjia (Zhuhai)	210	297	246	215	244	272	245	156	263	248	240	299
Donghu (Jiangmen)	278	265	296	276	220	277	279	225	267	230	188	246
Duanfen (Jiangmen)	205	168	145	225	174	170	203	131	165	206	200	230
Huaguoshan (Jiangmen)	192	209	207	237	198	242	193	181	223	197	179	219
Chengzhong (Zhaoqing)	211	182	181	207	170	263	243	254	247	230	157	188
Xiapu (Huizhou)	209	154	179	237	245	173	214	204	216	158	197	142
Xijiao (Huizhou)	224	205	225	298	238	164	252	170	190	218	181	144
Jinguowan (Huizhou) ^	270	177	197	281	305	189	204	191	245	142	199	151
Zimaling (Zhongshan)	246	233	269	303	224	260	257	200	269	234	220	269
Nanchengyuanling (Dongguan)	333	252	290	459	229	204	264	292	277	215	209	183
Tap Mun (Hong Kong)	193	178	204	209	195	292	329	144	344	179	174	198
Tsuen Wan (Hong Kong)	126	111	115	207	170	233	313	109	219	130	169	180
Yuen Long (Hong Kong)	183	152	170	213	232	248	336	156	277	145	187	172
Tung Chung (Hong Kong)	203	249	186	232	232	221	270	159	236	220	203	181
Taipa Grande (Macao)	232	264	152	180	241	230	205	173	239	227	206	202

Remarks : All concentration units are in micrograms per cubic metre (μg/m³).

^ Data are for reference only owing to its low daily data capture rate in 2021.

Table 4.3b：Daily maximum 8-hour averages of Ozone (the monthly maxima and the 90th percentile of the year) **[Class II limit: 160 μg/m³]**

Monitoring Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Compliance	90th percentile
Luhu (Guangzhou)	153	184	179	259	205	198	192	208	217	154	140	145	91.7%	154
Modiesha (Guangzhou)	174	198	267	278	220	227	245	189	252	193	145	145	83.7%	181
Nansha-HKUST (Guangzhou)	166	197	187	239	178	258	228	186	255	217	191	203	81.6%	179
Tianhu (Guangzhou)	252	190	200	281	220	168	173	190	226	207	168	140	87.5%	163
Zhudong (Guangzhou)	221	158	149	164	155	180	194	288	221	213	168	152	88.3%	161
Tongxinling (Shenzhen)	152	135	150	162	170	219	259	120	226	135	153	174	95.4%	133
Jinjuzui (Foshan)	138	170	173	249	159	208	257	194	225	182	132	155	90.8%	146
Huijingcheng (Foshan)	185	223	213	284	211	217	212	197	273	218	178	164	84.2%	183
Tangjia (Zhuhai)	166	229	165	178	227	253	219	127	198	215	194	216	90.0%	159
Donghu (Jiangmen)	208	210	240	231	201	250	245	160	241	207	155	194	86.2%	168
Duanfen (Jiangmen)	169	147	135	208	137	154	166	110	149	173	178	184	96.5%	142
Huaguoshan (Jiangmen)	166	184	165	208	173	197	160	130	192	176	143	178	94.9%	142
Chengzhong (Zhaoqing)	167	170	161	183	150	243	201	194	201	198	135	155	93.0%	146
Xiapu (Huizhou)	160	139	147	196	214	136	167	179	190	130	157	125	96.2%	139
Xijiao (Huizhou)	194	169	179	238	207	137	183	141	137	181	143	124	95.3%	141
Jinguowan (Huizhou) ^	213	149	163	242	230	154	146	159	207	125	153	136	95.2%	141
Zimaling (Zhongshan)	184	194	210	235	204	230	236	141	222	210	171	193	90.6%	155
Nanchengyuanling (Dongguan)	209	203	210	330	200	189	203	240	250	192	169	155	83.3%	174
Tap Mun (Hong Kong)	154	154	157	185	162	246	269	100	296	169	156	152	94.8%	146
Tsuen Wan (Hong Kong)	103	93	105	140	137	188	200	79	164	117	112	111	99.2%	100
Yuen Long (Hong Kong)	133	120	142	162	176	224	281	99	203	126	133	133	96.7%	120
Tung Chung (Hong Kong)	118	151	125	158	173	204	201	109	184	157	131	123	98.6%	117
Taipa Grande (Macao)	179	188	140	170	192	203	182	149	169	200	161	150	96.4%	142

Remarks : All concentration units are in micrograms per cubic metre (μg/m³).
^ Data are for reference only owing to its low daily data capture rate in 2021.

Table 4.3c：The monthly and annual averages of Ozone

Monitoring Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
Luhu (Guangzhou)	44	60	42	55	53	55	62	46	66	53	51	44	52
Modiesha (Guangzhou)	49*	70	44	63	52	53	64	51	79	56	42	33	55
Nansha-HKUST (Guangzhou)	62	81	52	70	48	56	57	46	80	64	66	59	62
Tianhu (Guangzhou)	98	99	70	79	77	74	79	78	94	89	88	80	84
Zhudong (Guangzhou)	60	55	46	47	55	62	71	63	76	63	53	50	58
Tongxinling (Shenzhen)	63	67	60	77	46	49	48	35	61	63	70	56	58
Jinjuzui (Foshan)	46	66	45	56	46	51	59	45	69	53	48	39	52
Huijingcheng (Foshan)	51	79	49	67	60	61	67	57	88	65	57	45	62
Tangjia (Zhuhai)	67	77	60	78	53	58	52	41	59	65	79	59	62
Donghu (Jiangmen)	58	81	52	67	56	57	64	50	78	66	61	50	61
Duanfen (Jiangmen)	67	71	56	68	48	56	52	45	54	68	76	61	60
Huaguoshan (Jiangmen)	51	67	42	58	51	51	49	44	59	55	52	46	52
Chengzhong (Zhaoqing)	51	67	46	59	50	57	62	51	70	66	55	47	57
Xiapu (Huizhou)	66	71	61	73	58	54	57	51	70	64	70	56	63
Xijiao (Huizhou)	68	58	58	68	56	51	52	46	38	59	57	54	56
Jinguowan (Huizhou) ^	74	71	59	77	58	54	45*	41	58	55	67	55	60*
Zimaling (Zhongshan)	54	75	54	72	57	59	60	45	69	61	57	49	59
Nanchengyuanling (Dongguan)	66	79	63	81	59	61	64	52	79	63	65	56	65
Tap Mun (Hong Kong)	88	84	76	98	55	61	55	41	73	78	94	80	73
Tsuen Wan (Hong Kong)	49	49	45	62	28	33	31	21	42	55	58	47	43
Yuen Long (Hong Kong)	48	53	49	70	43	42	39	28	45	55	55	45	48
Tung Chung (Hong Kong)	50	51	48	66	43	45	43	31	52	58	59	48	50
Taipa Grande (Macao)	67	75	61	81	49	55	53	49	69	73	84	57	64

Remarks : All concentration units are in micrograms per cubic metre ($\mu g/m^3$).

* The capture rate of validated daily data per month is below 85%.

^ Data are for reference only owing to its low daily data capture rate in 2021.

4.4 Carbon Monoxide (CO)

Carbon Monoxide (CO) is formed when the fuel is not completely burned. Except for methane conversion, plant emissions, forest fires and other natural sources, deforestation, grassland and waste incineration, and the use of fossil fuels and civilian fuel are the main anthropogenic sources of CO. In most urban areas, the major emission source of CO is automobiles.

In 2021, the annual average of CO recorded at each monitoring station in the Network ranged from 0.4 to 0.7 mg/m^3. During the year, all monitoring stations in the Network were in compliance with the national 1-hour and 24-hour average concentration limits (10 mg/m^3 and 4 mg/m^3).

Tables 4.6a to 4.6c list the monthly maxima of hourly and daily averages, the maxima of daily averages with the 95th percentile of the year, the monthly and annual averages of CO at each station respectively.

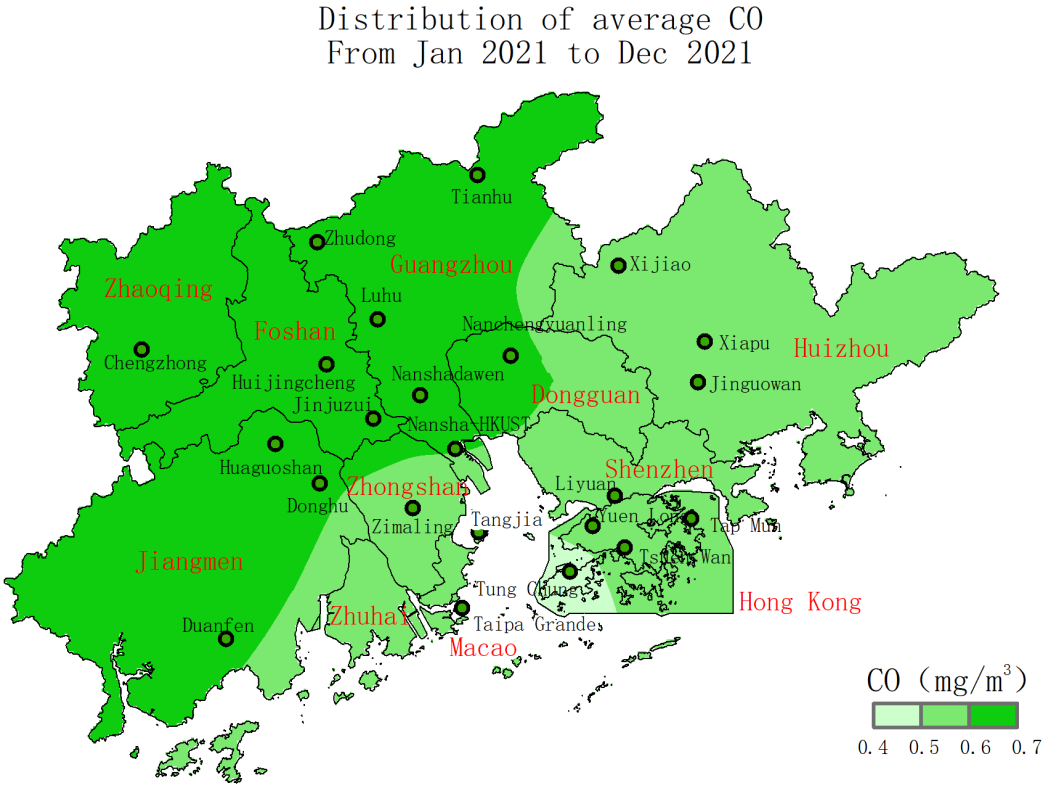

Figure 8：Spatial distribution of annual average concentrations of Carbon Monoxide (CO)

Table 4.4a：Hourly averages of Carbon Monoxide (the monthly maxima)

[Class II limit: 10 mg/m^3]

Monitoring Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Luhu (Guangzhou)	2.1	1.6	1.6	1.7	1.3	1.2	1.4	1.4	1.3	1.2	1.3	1.3
Modiesha (Guangzhou)	1.8	1.4	1.5	1.8	1.4	1.0	1.8	1.2	1.6	1.2	1.4	1.5
Nansha-HKUST (Guangzhou)	1.5	1.1	1.1	2.0	1.2	1.2	0.9	1.5	1.2	1.0	1.1	1.3
Tianhu (Guangzhou)	1.2	1.0	1.1	1.2	1.2	0.8	1.0	1.1	0.8	1.0	1.1	1.3
Zhudong (Guangzhou)	1.4	1.2	1.2	1.2	1.0	0.9	0.9	1.0	1.2	1.1	1.2	1.4
Tongxinling (Shenzhen)	1.6	1.0	1.1	1.0	0.9	0.9	0.9	0.9	1.1	1.0	1.1	1.3
Jinjuzui (Foshan)	2.9	1.7	2.0	1.4	1.4	0.9	0.9	1.0	1.2	1.3	0.9	1.5
Huijingcheng (Foshan)	3.3	1.3	2.4	1.6	1.1	1.0	1.0	1.0	1.0	1.5	1.1	2.4
Tangjia (Zhuhai)	1.2	0.8	1.1	1.1	1.0	0.8	0.9	0.9	0.8	1.2	1.2	1.0
Donghu (Jiangmen)	2.8	1.4	1.5	1.8	1.1	1.1	0.9	1.4	1.1	1.6	1.3	2.3
Duanfen (Jiangmen)	1.4	1.3	1.5	1.0	0.9	0.8	1.3	0.7	1.0	1.1	1.0	1.2
Huaguoshan (Jiangmen)	1.6	1.1	1.5	1.3	1.1	1.0	0.8	0.9	1.1	1.2	1.1	2.2
Chengzhong (Zhaoqing)	2.3	1.4	1.8	1.2	1.1	1.0	0.9	1.0	1.5	1.1	1.4	1.6
Xiapu (Huizhou)	2.2	1.0	1.2	1.2	0.9	0.9	0.9	0.9	1.0	1.2	1.1	1.4
Xijiao (Huizhou)	1.3	1.0	1.6	0.9	1.0	0.8	1.0	1.6	0.7	0.9	1.0	1.0
Jinguowan (Huizhou)	1.3	0.9	1.1	1.1	1.1	2.8	1.0	0.7	1.6	1.0	1.0	1.3
Zimaling (Zhongshan)	1.5	0.9	1.2	1.1	1.0	1.0	1.1	0.9	0.9	1.3	1.1	1.3
Nanchengyuanling (Dongguan)	2.2	0.9	1.4	1.1	1.2	1.0	0.9	1.2	1.0	1.0	1.1	1.3
Tap Mun (Hong Kong)	1.2	0.7	0.9	1.0	0.8	0.8	0.6	0.6	0.8	1.0	0.7	1.1
Tsuen Wan (Hong Kong)	1.2	1.1	0.9	1.0	0.9	1.0	1.1	1.0	0.9	1.1	1.0	1.0
Yuen Long (Hong Kong)	1.5	1.1	1.2	1.0	0.8	1.1	0.9	1.1	1.3	0.9	1.2	2.1
Tung Chung (Hong Kong)	1.2	0.8	0.9	1.0	0.7	0.6	0.7	0.7	1.0	0.6	0.7	1.0
Taipa Grande (Macao)	1.2	1.1	1.1	1.1	1.3	1.6	1.3	1.2	1.1	1.3	1.1	1.0

Remarks : All concentration units are in milligrams per cubic metre (mg/m^3).

Table 4.4b：Daily averages of Carbon Monoxide (the monthly maxima and the 95th percentile of the year) **[Class II limit: 4 mg/m³]**

Monitoring Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Compliance	95th percentile
Luhu (Guangzhou)	1.7	0.9	1.1	1.2	1.1	0.8	0.8	0.8	0.9	0.9	0.8	1.0	100.0%	1.0
Modiesha (Guangzhou)	1.2	1.0	1.1	1.3	1.1	0.7	0.8	1.0	0.9	0.9	1.0	1.2	100.0%	1.0
Nansha-HKUST (Guangzhou)	1.0	0.7	0.9	1.2	0.9	1.0	0.7	0.8	0.9	0.8	0.9	1.1	100.0%	0.9
Tianhu (Guangzhou)	1.1	0.8	1.1	1.0	0.9	0.7	1.0	0.9	0.7	0.9	0.9	1.1	100.0%	0.9
Zhudong (Guangzhou)	1.2	0.9	1.0	1.0	0.8	0.6	0.7	0.8	1.0	0.9	1.0	1.1	100.0%	1.0
Tongxinling (Shenzhen)	1.1	0.8	0.8	0.7	0.8	0.9	0.7	0.8	0.8	0.8	0.8	0.9	100.0%	0.8
Jinjuzui (Foshan)	1.3	0.9	1.2	1.2	1.1	0.7	0.7	0.9	0.9	0.8	0.8	1.0	100.0%	1.0
Huijingcheng (Foshan)	2.0	1.0	1.4	1.1	0.9	0.8	0.6	0.8	0.7	0.8	0.8	1.1	100.0%	1.0
Tangjia (Zhuhai)	0.8	0.7	0.8	0.9	0.8	0.7	0.7	0.6	0.7	0.9	0.9	0.8	100.0%	0.7
Donghu (Jiangmen)	1.4	1.0	1.1	1.1	0.9	0.7	0.6	0.7	0.8	0.8	0.8	1.1	100.0%	1.0
Duanfen (Jiangmen)	1.1	0.9	1.1	0.9	0.7	0.7	0.5	0.5	0.7	0.8	0.9	1.0	100.0%	0.9
Huaguoshan (Jiangmen)	1.3	1.0	1.1	1.2	1.0	0.7	0.6	0.7	0.8	0.9	0.9	1.1	100.0%	1.0
Chengzhong (Zhaoqing)	1.1	1.0	1.3	1.0	0.8	0.7	0.6	0.6	0.8	0.8	0.9	1.0	100.0%	1.0
Xiapu (Huizhou)	1.0	0.7	0.8	0.9	0.8	0.7	0.7	0.8	0.8	0.7	0.7	0.9	100.0%	0.8
Xijiao (Huizhou)	1.2	1.0	1.0	0.8	0.8	0.5	0.8	0.9	0.6	0.9	0.8	0.9	100.0%	0.8
Jinguowan (Huizhou)	1.1	0.8	0.9	1.0	0.9	0.8	0.8	0.7	0.9	0.9	0.7	1.0	100.0%	0.9
Zimaling (Zhongshan)	0.9	0.8	1.0	0.9	0.8	0.7	0.7	0.8	0.7	0.8	0.8	1.0	100.0%	0.8
Nanchengyuanling (Dongguan)	1.2	0.6	1.0	1.0	1.0	0.7	0.8	0.9	0.8	0.8	0.8	0.9	100.0%	0.9
Tap Mun (Hong Kong)	1.1	0.7	0.7	0.9	0.7	0.7	0.5	0.5	0.7	0.9	0.6	1.0	100.0%	0.8
Tsuen Wan (Hong Kong)	1.1	0.8	0.7	0.8	0.8	0.9	0.9	0.8	0.7	0.9	0.7	0.8	100.0%	0.8
Yuen Long (Hong Kong)	1.2	0.8	1.1	0.8	0.7	0.9	0.7	0.8	1.0	0.7	0.9	1.0	100.0%	0.9
Tung Chung (Hong Kong)	0.8	0.6	0.7	0.6	0.5	0.5	0.5	0.6	0.5	0.5	0.4	0.9	100.0%	0.6
Taipa Grande (Macao)	0.9	0.9	1.0	0.9	0.9	1.5	0.8	0.8	0.9	1.2	0.9	0.9	100.0%	0.9

Remarks : All concentration units are in milligrams per cubic metre (mg/m³).

Table 4.4c：The monthly and annual averages of Carbon Monoxide

Monitoring Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
Luhu (Guangzhou)	0.8	0.7	0.8	0.8	0.6	0.7	0.6	0.7	0.8	0.7	0.5	0.6	0.7
Modiesha (Guangzhou)	0.9*	0.8	0.8	0.8	0.8	0.5	0.6	0.7	0.7	0.7	0.7	0.9	0.7
Nansha-HKUST (Guangzhou)	0.7	0.5	0.6	0.8	0.6	0.6	0.5	0.6	0.5	0.7	0.7	0.8	0.6
Tianhu (Guangzhou)	0.6	0.6	0.8	0.8	0.6	0.6	0.7	0.6	0.5	0.6	0.6	0.7	0.7
Zhudong (Guangzhou)	0.8	0.7	0.7	0.8	0.4	0.4	0.5	0.7	0.7	0.7	0.7	0.9	0.7
Tongxinling (Shenzhen)	0.8	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6
Jinjuzui (Foshan)	0.9	0.7	0.8	0.7	0.6	0.6	0.5	0.6	0.7	0.6	0.5	0.7	0.7
Huijingcheng (Foshan)	0.9	0.7	0.7	0.8	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.8	0.6
Tangjia (Zhuhai)	0.6	0.5	0.4	0.6	0.5	0.5	0.4	0.4	0.5	0.6	0.5	0.6	0.5
Donghu (Jiangmen)	0.9	0.6	0.8	0.7	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.8	0.6
Duanfen (Jiangmen)	0.8	0.7	0.6	0.5	0.4	0.5	0.4	0.4	0.5	0.7	0.7	0.7	0.6
Huaguoshan (Jiangmen)	0.9	0.7	0.8	0.9	0.6	0.5	0.5	0.5	0.7	0.7	0.7	0.8	0.7
Chengzhong (Zhaoqing)	0.7	0.7	0.7	0.7	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.7	0.6
Xiapu (Huizhou)	0.7	0.5	0.6	0.6	0.5	0.5	0.5	0.6	0.6	0.6	0.5	0.6	0.6
Xijiao (Huizhou)	0.7	0.6	0.7	0.6	0.4	0.3	0.5	0.6	0.4	0.6	0.6	0.6	0.5
Jinguowan (Huizhou)	0.8	0.7	0.7	0.7	0.7	0.6	0.5	0.4	0.6	0.6	0.6	0.7	0.6
Zimaling (Zhongshan)	0.6	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.6	0.6	0.5
Nanchengyuanling (Dongguan)	0.8	0.5	0.6	0.6	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.7	0.6
Tap Mun (Hong Kong)	0.6	0.5	0.5	0.5	0.5	0.4	0.3	0.4	0.5	0.7	0.4	0.7	0.5
Tsuen Wan (Hong Kong)	0.7	0.6	0.5	0.6	0.5	0.6	0.6	0.5	0.5	0.6	0.6	0.6	0.6
Yuen Long (Hong Kong)	0.8	0.6	0.7	0.5	0.4	0.6	0.5	0.6	0.7	0.5	0.7	0.7	0.6
Tung Chung (Hong Kong)	0.6	0.4	0.4	0.3	0.2	0.2	0.3	0.4	0.3	0.3	0.3	0.5	0.4
Taipa Grande (Macao)	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.6	0.7	0.9	0.6	0.7	0.6

Remarks : All concentration units are in milligrams per cubic metre (mg/m^3).

* The capture rate of validated daily data per month is below 85%.

4.5 Respirable Suspended Particulates (PM_{10})

Respirable suspended particulates (PM_{10} or RSP) in the atmosphere come from a great variety of emission sources, such as power plants, vehicles, vessels, cement and pottery manufacturing, fugitive dust, etc. while some are products of oxidization of gaseous pollutants in the air (e.g. sulphate formed from oxidation of SO_2) or formed from photochemical reactions. PM_{10} can penetrate deeply into human lungs and cause impact on human respiratory system. Furthermore, finer particles in PM_{10} have significant effect on visibility.

In 2021, the annual average of PM_{10} recorded at each monitoring station in the Network ranged from 23 to 52 $\mu g/m^3$, and all monitoring stations met the national annual average concentration limit (70 $\mu g/m^3$). During the year, 15 monitoring stations in the Network recorded no exceedance of the national 24-hour average concentration limit (150 $\mu g/m^3$) while the corresponding compliance rates in the Network ranged from 98.6% to 100.0%.

Table 4.5a and Table 4.5b list the monthly maxima of daily averages with the 95th percentile of the year, the monthly and annual averages of PM_{10} at each station respectively.

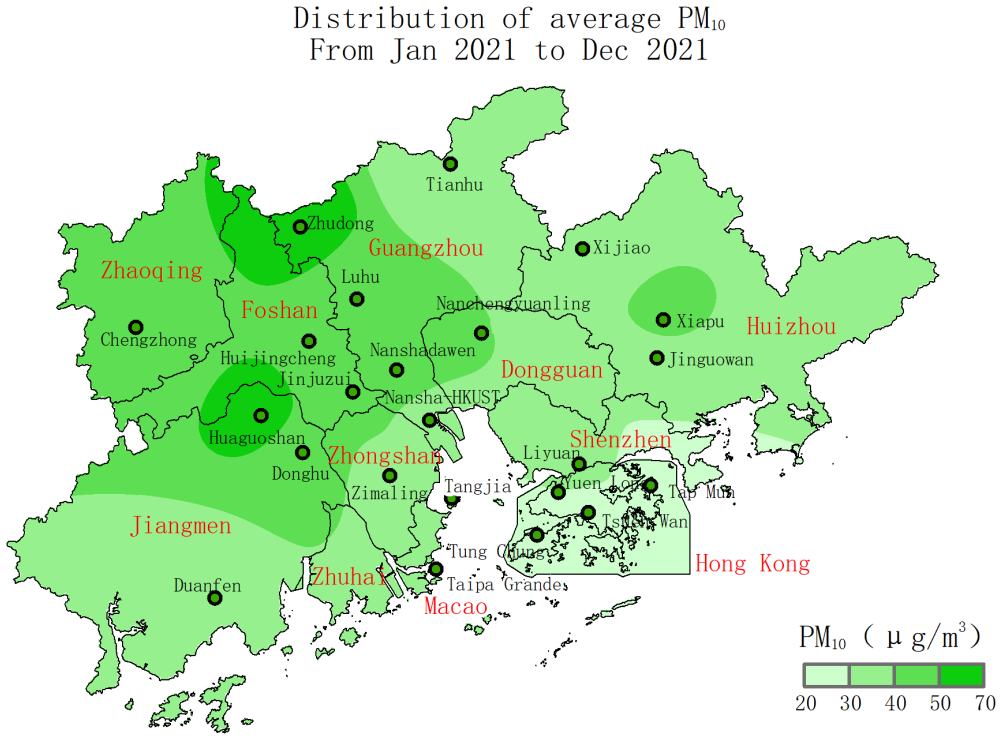

Figure 9：Spatial distribution of annual average concentrations of Respirable Suspended Particulates (PM_{10})

Table 4.5a：Daily averages of PM_{10} (the monthly maxima and the 95th percentile of the year)

[Class II limit: 150 μg/m³]

Monitoring Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Compliance	95th percentile
Luhu (Guangzhou)	248	67	136	113	62	57	48	47	65	58	69	89	99.2%	86
Modiesha (Guangzhou)	156	70	154	123	59	58	60	48	83	85	88	103	99.4%	93
Nansha-HKUST (Guangzhou)	116	56	122	101	40	61	43	42	57	65	68	74	100.0%	75
Tianhu (Guangzhou)	103	60	122	66	68	37	47	35	60	43	47	56	100.0%	59
Zhudong (Guangzhou)	184	87	140	106	95	55	55	60	79	80	88	72	99.7%	94
Tongxinling (Shenzhen)	124	57	110	94	38	55	44	32	52	49	74	77	100.0%	77
Jinjuzui (Foshan)	163	57	144	112	49	52	53	50	62	74	73	101	99.7%	84
Huijingcheng (Foshan)	269	80	148	128	67	61	62	50	74	73	82	164	98.6%	106
Tangjia (Zhuhai)	145	54	120	80	37	60	37	29	43	68	80	93	100.0%	79
Donghu (Jiangmen)	166	62	150	108	53	59	45	40	67	84	86	142	99.5%	106
Duanfen (Jiangmen)	116	52	124	77	35	36	34	25	40	58	69	95	100.0%	70
Huaguoshan (Jiangmen)	227	76	157	103	93	83	57	41	75	90	96	143	98.6%	102
Chengzhong (Zhaoqing)	137	67	136	90	64	73	41	43	66	71	71	94	100.0%	83
Xiapu (Huizhou)	122	59	106	117	61	54	56	48	72	60	70	72	100.0%	75
Xijiao (Huizhou)	93	54	100	95	63	34	38	35	48	44	40	42	100.0%	58
Jinguowan (Huizhou)	137	53	107	96	40	53	49	41	50	44	58	56	100.0%	66
Zimaling (Zhongshan)	115	53	115	87	46	61	53	35	55	73	80	85	100.0%	79
Nanchengyuanling (Dongguan)	182	63	118	123	46	58	45	39	64	63	64	87	99.2%	79
Tap Mun (Hong Kong)	118	51	68	96	39	48	33	20	37	39	46	68	100.0%	48
Tsuen Wan (Hong Kong)	96	37	82	89	35	56	36	26	42	40	50	71	100.0%	52
Yuen Long (Hong Kong)	109	43	92	88	39	67	41	28	49	49	64	98	100.0%	61
Tung Chung (Hong Kong)	92	37	61	98	35	49	40	29	41	42	64	80	100.0%	57
Taipa Grande (Macao)	121	51	113	111	45	46	41	27	46	62	82	90	100.0%	75

Remarks : All concentration units are in micrograms per cubic metre (μg/m³).

Table 4.5b：The monthly and annual averages of PM_{10}

[Class II limit for annual average: 70 μg/m³]

Monitoring Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
Luhu (Guangzhou)	87	45	60	51	32	29	28	28	37	32	47	52	44
Modiesha (Guangzhou)	86*	45	60	55	35	32	34	30	41	41	57	65	48
Nansha-HKUST (Guangzhou)	67	34	45	44	24	24	23	22	32	34	47	51	37
Tianhu (Guangzhou)	47	34	45	35	30	24	25	21	26	24	30	32	31
Zhudong (Guangzhou)	80	54	77	63	49	38*	39	39	47	39	46	46	52
Tongxinling (Shenzhen)	71	33	36	37	20	21	19	18	25	30	46	49	34
Jinjuzui (Foshan)	85	40	55	49	28	29	28	29	36	35	51	59	44
Huijingcheng (Foshan)	91	52	73	55	30	30	32	28	41	38	54	71	50
Tangjia (Zhuhai)	73	36	41	35	15	17	15	14	20	30	49	55	33
Donghu (Jiangmen)	88	43	59	48	26	28	25	24	34	41	58	73	46
Duanfen (Jiangmen)	68	32	40	31	17	20	19	15	18	27	46	50	32
Huaguoshan (Jiangmen)	95	53	59	55	35	36	33	30	41	44	60	74	51
Chengzhong (Zhaoqing)	69	40	55	43	28	30	29	27	37	32	41	46	40
Xiapu (Huizhou)	70	38	49	51	33	29	30	29	38	34	48	48	41
Xijiao (Huizhou)	47	34	44	41	32	24*	27	22	26*	20	27	27	31
Jinguowan (Huizhou)	63	36	41	41	24	25	25*	24	29	25	37	39	34
Zimaling (Zhongshan)	69	34	44	40	23	23	23	20	28	35	52	60	38
Nanchengyuanling (Dongguan)	80	39	48	49	25	26	28	26	36	32	46	49	40
Tap Mun (Hong Kong)	44	26	27	29	12	14	12	11	16	25	29	35	23
Tsuen Wan (Hong Kong)	43	24	28	29	15	18	15	14	19	22	29	37	24
Yuen Long (Hong Kong)	55	33	33	31	16	19	16	15	23	27	41	49	30
Tung Chung (Hong Kong)	48	26	24	29	14	16	13	14	17	24	39	44	26
Taipa Grande (Macao)	60	33	38	37	15	16	15	15	21	32	51	55	32

Remarks : All concentration units are in micrograms per cubic metre (μg/m³).

* The capture rate of validated daily data per month/year is below 85%.

4.6 Fine Suspended Particulates ($PM_{2.5}$)

Fine suspended particulates ($PM_{2.5}$) in the atmosphere come from a great variety of combustion sources, such as the emissions from power plants and diesel vehicles exhaust while some are products of oxidization of gaseous pollutants in the air (e.g. sulphate formed from oxidation of SO_2) or formed from photochemical reactions. $PM_{2.5}$ have significant effect on visibility.

In 2021, the annual average of $PM_{2.5}$ recorded at each monitoring station in the Network ranged from 14 to 30 $\mu g/m^3$, and all monitoring stations met the national annual average concentration limit (35 $\mu g/m^3$). During the year, 11 monitoring stations in the Network recorded no exceedance of the national 24-hour average concentration limit (75$\mu g/m^3$) while the corresponding compliance rates in the Network ranged from 97.8% to 100.0%.

Tables 4.6a and 4.6b list the monthly maxima of daily averages with the 95th percentile of the year, the monthly and annual averages of $PM_{2.5}$ at each station respectively.

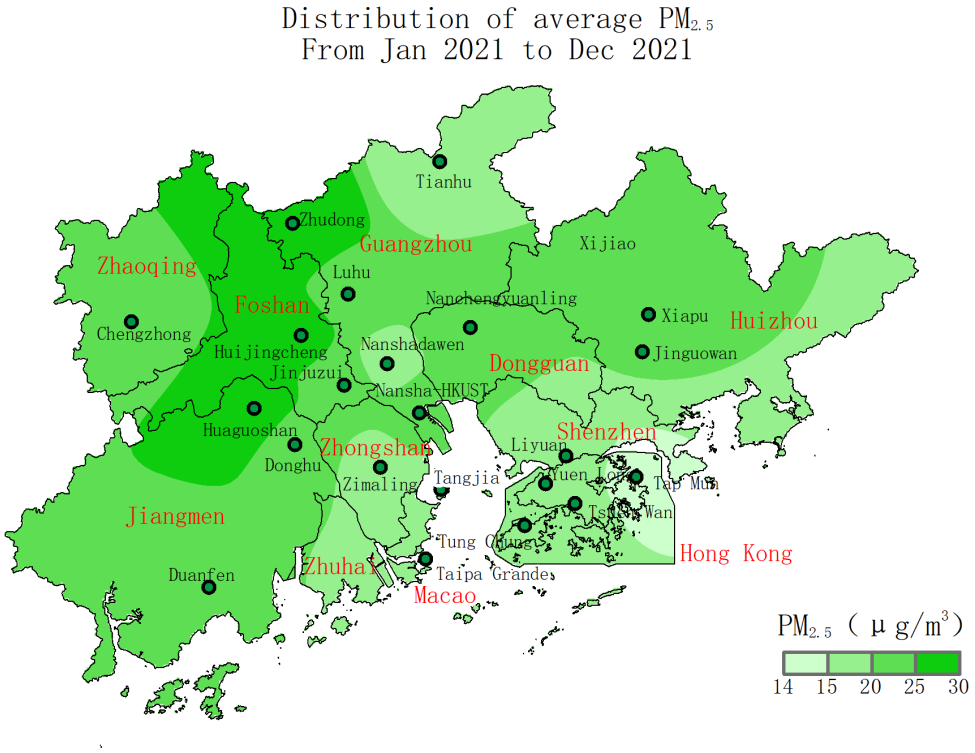

Figure 10：Spatial distribution of annual average concentrations of Fine Suspended Particulates ($PM_{2.5}$)

Remark: Xijiao's data are excluded in the spatial distribution map owing to its low daily data capture rate in 2021.

Table 4.6a：Daily averages of $PM_{2.5}$ (the monthly maxima and the 95th percentile of the year)

[Class II limit: 75 μg/m³]

Monitoring Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Compliance	95th percentile
Luhu (Guangzhou)	148	42	49	55	34	33	29	23	41	42	41	53	99.2%	44
Modiesha (Guangzhou)	60	33	49	44	28	39	33	24	43	46	39	46	100.0%	40
Nansha-HKUST (Guangzhou)	85	34	50	45	34	44	31	32	40	42	42	50	99.7%	42
Tianhu (Guangzhou)	70	41	48	41	41	20	32	22	39	29	30	39	100.0%	34
Zhudong (Guangzhou)	105	60	81	64	57	33	38	44	53	47	50	51	99.2%	54
Tongxinling (Shenzhen)	68	31	52	34	28	36	29	23	41	35	42	54	100.0%	41
Jinjuzui (Foshan)	87	33	45	42	26	32	30	27	36	50	41	59	99.4%	43
Huijingcheng (Foshan)	187	47	75	57	44	33	32	23	41	38	38	91	97.8%	57
Tangjia (Zhuhai)	101	39	62	37	22	46	22	16	30	34	44	58	99.7%	45
Donghu (Jiangmen)	96	49	68	42	32	35	33	21	41	49	44	66	99.2%	49
Duanfen (Jiangmen)	78	29	58	32	27	25	23	15	35	48	53	69	99.7%	49
Huaguoshan (Jiangmen)	150	42	73	61	49	46	44	33	60	68	60	106	97.8%	61
Chengzhong (Zhaoqing)	88	47	63	46	39	43	28	24	40	48	41	69	99.2%	48
Xiapu (Huizhou)	64	33	40	42	30	24	31	22	40	34	32	40	100.0%	39
Xijiao (Huizhou) ^	58	37	42	47	44	22	30	19	20	17	16	36	100.0%	37
Jinguowan (Huizhou)	57	29	40	41	27	32	38	22	43	38	36	38	100.0%	37
Zimaling (Zhongshan)	80	39	61	37	24	33	38	20	38	40	37	49	99.7%	41
Nanchengyuanling (Dongguan)	110	37	47	49	28	32	32	45	54	39	36	49	98.9%	43
Tap Mun (Hong Kong)	59	27	33	29	16	34	24	16	29	29	30	54	100.0%	29
Tsuen Wan (Hong Kong)	51	25	46	34	21	42	27	21	32	32	34	56	100.0%	34
Yuen Long (Hong Kong)	45	25	41	31	26	49	29	22	37	34	40	75	100.0%	36
Tung Chung (Hong Kong)	47	24	40	29	20	36	30	25	33	32	45	60	100.0%	38
Taipa Grande (Macao)	48	23	47	36	24	31	28	17	32	30	39	57	100.0%	35

Remarks : All concentration units are in micrograms per cubic metre (μg/m³).

^ Data are for reference only owing to its low daily data capture rate in 2021.

Table 4.6b：The monthly and annual averages of $PM_{2.5}$

[Class II limit for annual average: 35 μg/m³]

Monitoring Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
Luhu (Guangzhou)	47	27	29	25	16	15	15	15	21	19	25	30	24
Modiesha (Guangzhou)	35*	21	24	21	12	12	13	11	19	18	22	28	19
Nansha-HKUST (Guangzhou)	38	24	25	24	14	16	15	13	19	21	25	30	22
Tianhu (Guangzhou)	30	24	25	19	15	10	12	9	13	14	16	21	17
Zhudong (Guangzhou)	48	36	42	34	24	22	25	27	30	24	24	28	30
Tongxinling (Shenzhen)	40	20	19	18	10	10	10	10	15	16	23	27	18
Jinjuzui (Foshan)	42	23	25	22	13	13	14	14	18	20	25	33	22
Huijingcheng (Foshan)	55	30	38	28	15	14	16	13	20	18	24	38	26
Tangjia (Zhuhai)	43	24	27	20	9	10	8	8	10	17	24	32	19
Donghu (Jiangmen)	45	24	26	21	12	13	13	11	17	21	26	34	22
Duanfen (Jiangmen)	43	23	24	18	10	11	11	9	14	21	32	37	21
Huaguoshan (Jiangmen)	56	30	35	29	16	18	20	17	28	29	36	48	30
Chengzhong (Zhaoqing)	43	26	29	24	15	16	17	15	22	20	22	29	23
Xiapu (Huizhou)	38	24	26	24	14	12	13	13	18	17	22	25	21
Xijiao (Huizhou) ^	30	25	26	25	21*	14*	16*	9*	9	9	12	18	18*
Jinguowan (Huizhou)	35	18	21	23	14	13	15	14	19	18	23	24	20
Zimaling (Zhongshan)	38	21	21	19	11	12	12	9	14	18	24	30	19
Nanchengyuanling (Dongguan)	42	24	24	22	13	13	21	26	28	19	24	28	24
Tap Mun (Hong Kong)	25	17	16	14	7	8	7	6	11	13	16	22	14
Tsuen Wan (Hong Kong)	26	17	18	17	10	11	10	10	13	15	18	25	16
Yuen Long (Hong Kong)	27	18	16	15	10	11	10	10	15	17	24	31	17
Tung Chung (Hong Kong)	29	17	15	16	9	10	9	11	12	16	27	31	17
Taipa Grande (Macao)	27	16	17	16	9	10	8	7	11	15	20	26	15

Remarks : All concentration units are in micrograms per cubic metre (μg/m³).

* The capture rate of validated daily data per month/year is below 85%.

^ Data are for reference only owing to its low daily data capture rate in 2021.

4.7 Monthly Variations of Pollutant Concentrations

Figure 11 shows the monthly variations of the major pollutants (Sulphur Dioxide (SO_2), Nitrogen Dioxide (NO_2), Ozone (O_3), Respirable Suspended Particulates (PM_{10}), Fine Suspended Particulates ($PM_{2.5}$), and Carbon Monoxide (CO)) recorded by the Network in 2021. In general, the monthly average concentrations of SO_2, NO_2, PM_{10}, $PM_{2.5}$, and CO were higher during the winter season (first and fourth quarters of the year) and relatively lower in the summer months. The lower pollutant levels in summer were mainly due to the cleaner maritime air stream prevailed in the PRD region under the influence of southern monsoon, together with heavier rainfall and higher mixing layer that favoured the dispersion of pollutants. The ozone concentration was higher in February, April and September, mainly due to the fact that there were more days with meteorological conditions that favoured photochemical reactions (such as strong solar radiation and less amount of clouds) and resulted in more ozone formation during the period.

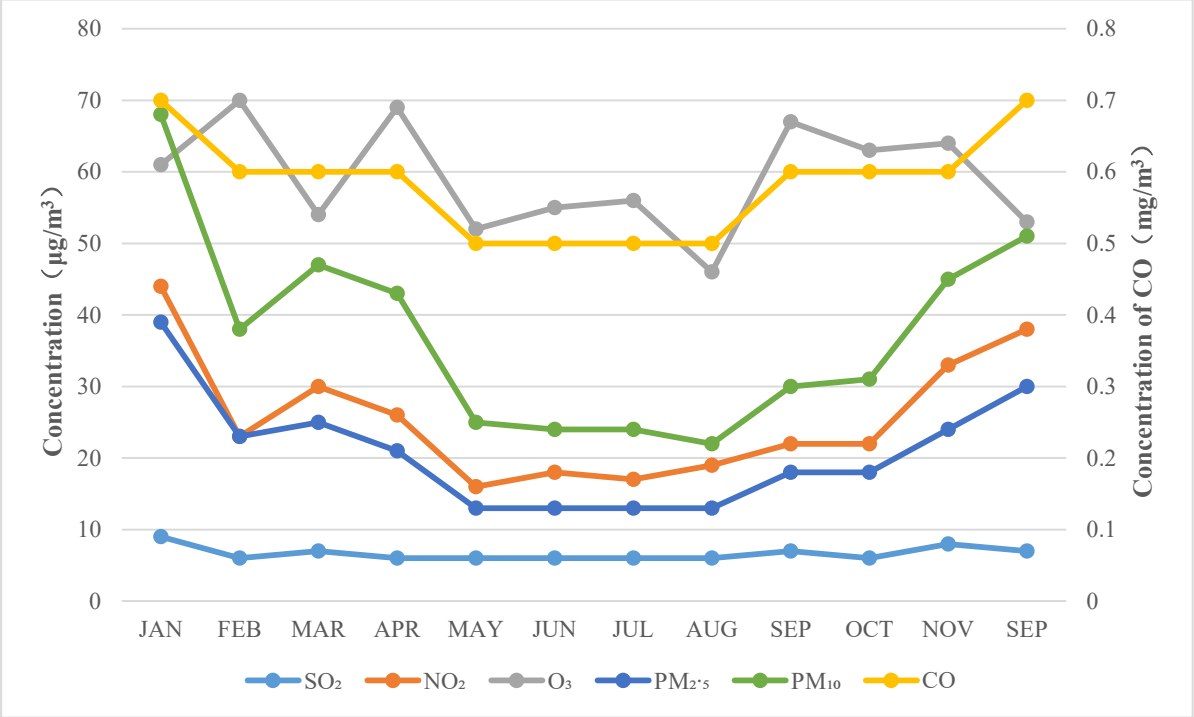

Figure 11：Monitoring network monthly variations of air pollutant concentrations

Remark: Ozone data at Xijiao station in Huizhou, and $PM_{2.5}$ data at Xijiao station in Huizhou are excluded from the calculation of the monthly variation of pollutant concentrations in 2021 owing to its low daily data capture rate during the year.

4.8 Annual Variations of Pollutant Concentrations (2006-2021)

Table 4.8 shows the annual average concentrations of air pollutants recorded by the Network from 2006 to 2021, while Figure 12 shows the trend of rate of changes in the annual pollutant concentrations.

From 2006 to 2021, the annual averages recorded by the Network for SO_2, NO_2, and PM_{10} decreased by 84%, 40% and 45% respectively, which exhibited a discernible downward trend with a descending rate of about 2.4, 1.1 and 2.0$\mu g/m^3$ per year respectively. As for CO and $PM_{2.5}$, these two parameters had been added to the Network in September 2014 and their annual averages decreased by 18% and 28% respectively between 2015 and 2021. These reductions indicate that the measures implemented in recent years by concerted or individual effort of Guangdong, Hong Kong and Macao, including retrofitting of power plants with flue-gas desulphurization facilities, tightening the vehicle emission standards, prohibiting import of heavy polluting vehicles, tightening the fuel specifications, and phasing out the more polluting industrial facilities in the PRD, etc., have improved the overall air quality in the PRD region. Compared with 2006, the annual average of O_3 in 2021 increased by 34%, reflecting the photochemical smog problem in the region has not yet been resolved. The Guangdong, Hong Kong and Macao governments will continue to implement emission reduction measures to further improve the air quality in the region and tackle the photochemical pollution problem.

Table 4.8：Annual averages of the pollutants in the monitoring network

Year	SO_2 ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	O_3 ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	CO (mg/m^3)
2006	43	42	44	67	-	-
2007	44	41	46	72	-	-
2008	36	40	46	65	-	-
2009	26	38	51	64	-	-
2010	23	39	49	59	-	-
2011	21	37	53	59	-	-
2012	17	35	49	52	-	-
2013	17	37	49	59	-	-
2014	14	34	52	50	-	-
2015	12	30	47	44	29	0.730
2016	11	32	44	41	26	0.728
2017	10	31	52	45	28	0.665
2018	9	29	53	42	25	0.611
2019	7	30	60	42	25	0.700
2020	6	24	56	34	20	0.611
2021	7	25	59	37	21	0.600

Remarks:

(1) All Tap Mun's pollutants data are excluded from the calculation of the annual averages of pollutants in 2016 owing to its low hourly data capture rate in 2016.

(2) Taipa Grande's PM_{10} and $PM_{2.5}$, Tap Mun's PM_{10} and Xijiao's $PM_{2.5}$ data are excluded from the calculation of the annual averages of pollutants in 2017 owing to its low daily data capture rate in 2017.

(3) All Tap Mun's pollutants and Jinguowan's O_3 data are excluded from the calculation of the annual averages of pollutants in 2018 owing to its low daily data capture rate in 2018.

(4) Zhudong's $PM_{2.5}$ data is excluded from the calculation of the annual averages of pollutants in 2019 owing to its low daily data capture rate in 2019.

(5) All Modiesha, Zhudong, Xijiao and Nanchengyuanling's pollutants data and Duanfen's SO_2, NO_2, O_3 and PM_{10} data are excluded from the calculation of the annual averages of pollutants in 2020 owing to its low daily data capture rate in 2020.

(6) Ozone data at Xijiao station in Huizhou, and $PM_{2.5}$ data at Xijiao station in Huizhou are excluded from the calculation of the annual averages of pollutants in 2021 owing to its low daily data capture rate in 2021.

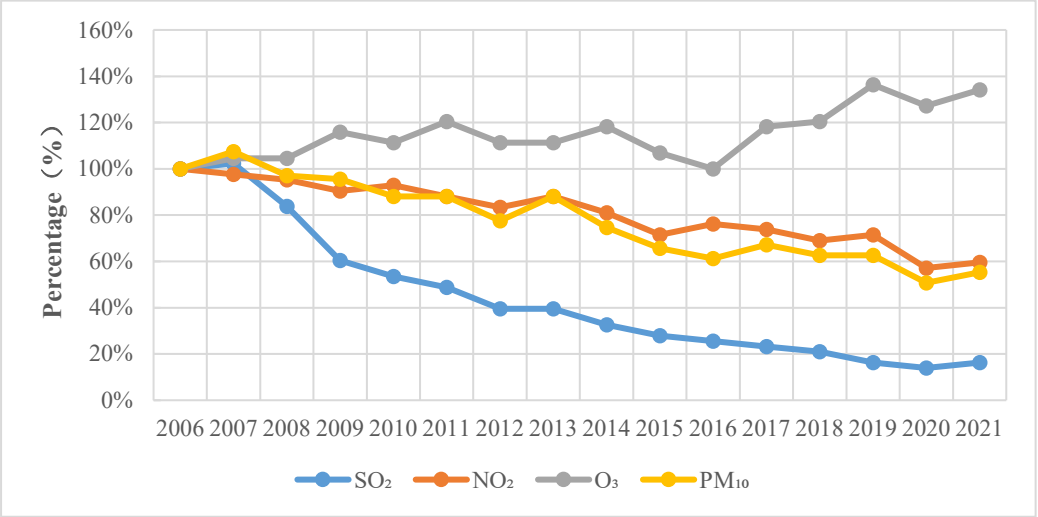

Figure 12：Trend of rates of changes in pollutant's annual averages in the monitoring network

Remarks:

(1) All Tap Mun's pollutants data are excluded from the calculation of the annual averages of pollutants in 2016 owing to its low hourly data capture rate in 2016.

(2) Taipa Grande's PM_{10} and Tap Mun's PM_{10} data are excluded from the calculation of the annual averages of pollutants in 2017 owing to its low daily data capture rate in 2017.

(3) All Tap Mun's pollutants and Jinguowan's O_3 data are excluded from the calculation of the annual averages of pollutants in 2018 owing to its low daily data capture rate in 2018.

(4) All Modiesha, Zhudong, Duanfenm Xijiao and Nanchengyuanling's pollutants data are excluded from the calculation of the annual averages of pollutants in 2020 owing to its low daily data capture rate in 2020.

(5) Ozone data at Xijiao station in Huizhou, and $PM_{2.5}$ data at Xijiao station in Huizhou are excluded from the calculation of the annual averages of pollutants in 2021 owing to its low daily data capture rate in 2021.

Annex A：Site Information of Monitoring Stations

Monitoring Stations	Address	Area Type	Sampling Height (Above P.D.)	Above Ground	Date Commenced Operation
Luhu (Guangzhou)	Jufong Garden of Luhu Park (Big yard, No. 11 Luhu Park)	City	30m	9m	1993
Nanshadawen[(1)] (Guangzhou)	Shinan Road, Dongchong Town, Nansha	City	23m	10m	Jan 2021
Nansha-HKUST[(2)] (Guangzhou)	HKUST Fok Ying Tung Research Institute, Nansha	Mixed educational/ commercial and residential/industrial	54m	28m	Oct 2004
Tianhu (Guangzhou)	Tianhu Park, Conghua	Background : rural	251m	13m	Oct 2004
Zhudong (Guangzhou)	Zhudong Village Committee, Chini Town, Huadu District	Rural	19m	10m	Dec 2011
Tongxinling[(3)] (Shenzhen)	Shennan Zhong Road, Futian District	City	38m	12m	Sep 1997
Jinjuzui (Foshan)	Foshan City Communist Party School, Jinjuzui, Shunde District	Tourist and cultural /educational	27m	17m	Oct 1999
Huijingcheng (Foshan)	No. 127, Fenjiang Nan Road, Chancheng District	Urban: mixed residential/commercial/ industrial	24m	14m	Feb 2000
Tangjia (Zhuhai)	Qiao Island Mangrove Monitoring Station, Tangjia Town	Mixed educational/ commercial and residential/industrial	13m	13m	Jan 2010
Donghu (Jiangmen)	Donghu Park, Jiangmen	City	17.5m	5m	Nov 2001
Duanfen (Jiangmen)	Duanfen Middle School, Taishan	Rural	15m	12m	Dec 2011
Huaguoshan (Jiangmen)	Huaguoshan, Taoyuan, Heshan	Rural	25m	15m	Feb 2012
Chengzhong (Zhaoqing)	No. 63, Zhengdong Road, Duanzhou District	Urban: mixed residential/commercial	38m	16m	Jun 2001
Xiapu (Huizhou)	No. 4 Xiabuhengjiang Road No. 3, Huicheng District	Urban: commercial	49m	20m	Dec 1999
Xijiao [(4)] (Huizhou)	Zhangbei Yaowei She Nationality Primary School, Henghe Town	Rural	44m	10m	Dec 2011
Jinguowan (Huizhou)	Jinguowan Ecological Farm, Huizhou	Residential	77m	8m	Oct 2004

Monitoring Stations	Address	Area Type	Sampling Height (Above P.D.)	Above Ground	Date Commenced Operation
Zimaling (Zhongshan)	Zimaling Park, Zhongshan	Mixed residential/ commercial	45 m	7m	Aug 2002
Nancheng-yuanling (5) (Dongguan)	Dongguan administration center	Mixed residential/ commercial/industrial	40 m	19m	May 2021
Tap Mun (Hong Kong)	Tap Mun Police Station	Background: rural	26m	11m	Apr 1998
Tsuen Wan (Hong Kong)	60 Tai Ho Road, Tsuen Wan	Urban: mixed residential/commercial/ industrial	21m	17m	Aug 1988
Yuen Long (Hong Kong)	Yuen Long District Office, 269 Castle Peak Road, Yuen Long	New Town: residential	31m	25m	Jul 1995
Tung Chung (Hong Kong)	6 Fu Tung Street, Tung Chung	New Town: residential	34.5m	27.5m	Apr 1999
Taipa Grande (Macao)	Rampa do Observatorio, Taipa Grande	Rural	120m	10m	Mar 1999

Remarks:

(1) Modiesha station closed permanently owing to insufficient space after the extensive renovation work at station, whereas Nanshadawen station joined the network in the 1st quarter of 2021.
(2) Wanqingsha station was renamed as Nansha-HKUST station in the 1st quarter of 2019.
(3) Liyuan station was renamed as Tongxinling station in the 1st quarter of 2019.
(4) Xijiao station was relocated to Zhangbei Yaowei She Nationality Primary School, Henghe Town, Boluo County, in the 4th quarter of 2019. The distance between the old and new sites is about 200 metres.
(5) Nancheng-yuanling station was relocated to Dongguan administration center in May 2021. The distance between the old and new sites is about 600 metres.

Annex B: Measurement Methods of Air Pollutant Concentration

Pollutants	**Measuring Principles**
Sulphur dioxide (SO_2)	UV fluorescence / Differential Optical Absorption Spectroscopy
Nitrogen dioxide (NO_2)	Chemiluminescence / Differential Optical Absorption Spectroscopy
Ozone (O_3)	UV absorption / Differential Optical Absorption Spectroscopy
Respirable suspended particulates (PM_{10})	Oscillating microbalance (TEOM) / Beta particulate monitor
Fine suspended particulates ($PM_{2.5}$)	Oscillating microbalance (TEOM) / Beta particulate monitor / Hybrid nephelometric / radiometric particulate mass monitor
Carbon monoxide (CO)	Gas filter correlation infrared absorption method / Non-dispersive infrared absorption method