

Pearl River Delta
Regional Air Quality Monitoring Network

A Report of Monitoring Results in 2008

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Approved by : **Pearl River Delta Air Quality
Management and Monitoring
Special Panel**

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Purpose of the Report

This report provides the 2008 monitoring results from the Pearl River Delta Regional Air Quality Monitoring Network and their statistical analysis.

Contents

	<u>Page</u>
1. Introduction to the Pearl River Delta Regional Air Quality Monitoring Network	1
2. Operation of the Network	2
2.1 Quality Control (QC) and Quality Assurance (QA) Activities	2
2.2 Accuracy and Precision	2
3. Statistical Analysis of Pollutant Concentrations	4
3.1 Sulphur Dioxide (SO₂)	4
3.2 Nitrogen Dioxide (NO₂)	7
3.3 Ozone (O₃)	10
3.4 Respirable Suspended Particulates (PM₁₀)	13
3.5 Monthly Variations of Pollutant Concentrations	16
3.6 Annual Variations of Pollutant Concentrations (2006-2008)	17
4. Statistical Analysis of the Regional Air Quality Index (RAQI)	18
4.1 Statistics on RAQI Grades	19
4.2 Spatial Distribution of Average RAQI Grades	20
4.3 Monthly Variations of Average RAQI	22
Annex A : Site Information of Monitoring Stations	23
Annex B : Measurement Methods of Air Pollutant Concentration	24

List of Tables

	<u>Page</u>
Table 3.1 a : The monthly maxima and minima of hourly averages of Sulphur Dioxide	5
Table 3.1 b : The monthly maxima and minima of daily averages of Sulphur Dioxide	5
Table 3.1 c : The monthly and annual averages of Sulphur Dioxide	6
Table 3.2 a : The monthly maxima and minima of hourly averages of Nitrogen Dioxide	8
Table 3.2 b : The monthly maxima and minima of daily averages of Nitrogen Dioxide	8
Table 3.2 c : The monthly and annual averages of Nitrogen Dioxide	9
Table 3.3 a : The monthly maxima and minima of hourly averages of Ozone	11
Table 3.3 b : The monthly maxima and minima of daily averages of Ozone	11
Table 3.3 c : The monthly and annual averages of Ozone	12
Table 3.4 a : The monthly maxima and minima of hourly averages of Respirable Suspended Particulates	14
Table 3.4 b : The monthly maxima and minima of daily averages of Respirable Suspended Particulates	14
Table 3.4 c : The monthly and annual averages of Respirable Suspended Particulates	15
Table 3.6 a : Annual averages of the pollutants from the monitoring network	17
Table 4.1 a : Statistics on RAQI grades of individual monitoring stations	19

List of Figures

	<u>Page</u>
Figure 1 : Spatial distribution of the PRD Regional Air Quality Monitoring Stations	1
Figure 2 : Accuracy of the PRD Regional Air Quality Monitoring Network in 2008	3
Figure 3 : Precision of the PRD Regional Air Quality Monitoring Network in 2008	3
Figure 4 : Spatial distribution of average concentrations of Sulphur Dioxide (SO₂) in the Network	4
Figure 5 : Spatial distribution of average concentrations of Nitrogen Dioxide (NO₂) in the Network	7
Figure 6 : Spatial distribution of average concentrations of Ozone (O₃) in the Network	10
Figure 7 : Spatial distribution of average concentrations of Respirable Suspended Particulates (PM₁₀) in the Network	13
Figure 8 : Monthly variations of average pollutant concentrations measured by the Network	16
Figure 9 : Stacked column chart of RAQI grades of individual monitoring stations	19
Figure 10 : Distribution of RAQI grades in the Network	20
Figure 11 : Spatial distribution of average RAQI grades in the Network	20
Figure 12 : The average RAQI of individual monitoring stations	21
Figure 13 : Monthly variations in average RAQI	22

1. Introduction to the Pearl River Delta Regional Air Quality Monitoring Network

The Pearl River Delta (PRD) Regional Air Quality Monitoring Network (the Network) was jointly established by the Guangdong Provincial Environmental Monitoring Centre (GDEMC) (formerly named as Guangdong Provincial Environmental Protection Monitoring Centre) and the Environmental Protection Department of the Hong Kong Special Administrative Region (HKEPD) from 2003 to 2005. It came into operation on 30 November 2005 and has been providing data for reporting of Regional Air Quality Index (RAQI) to the public since then.

The Network comprises 16 automatic air quality monitoring stations (see Figure 1) across the PRD region. Ten of these stations are operated by the Environmental Monitoring Centres of the individual cities in Guangdong while the 3 stations located in Hong Kong are managed by the HKEPD. The remaining 3 regional stations in the Network are operated by the GDEMC. The objectives of the Network are to :

- provide accurate air quality data that can help the Guangdong Provincial and HKSAR governments to appraise 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 various places in the region.

In order to ensure the air quality monitoring results attain a high degree of accuracy and reliability, the two governments had jointly developed a set of “Standard Operational Procedures on Quality Assurance and Quality Control of the PRD Air Quality Monitoring System for Hong Kong and Guangdong” (QA/QC Operating Procedures). The design and operation of the Network comply with the requirements set out in the QA/QC Operating Procedures.

All stations are installed with equipment to measure the ambient concentrations of respirable suspended particulate (PM₁₀ or RSP), sulphur dioxide (SO₂), nitrogen dioxide (NO₂) and ozone (O₃).

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

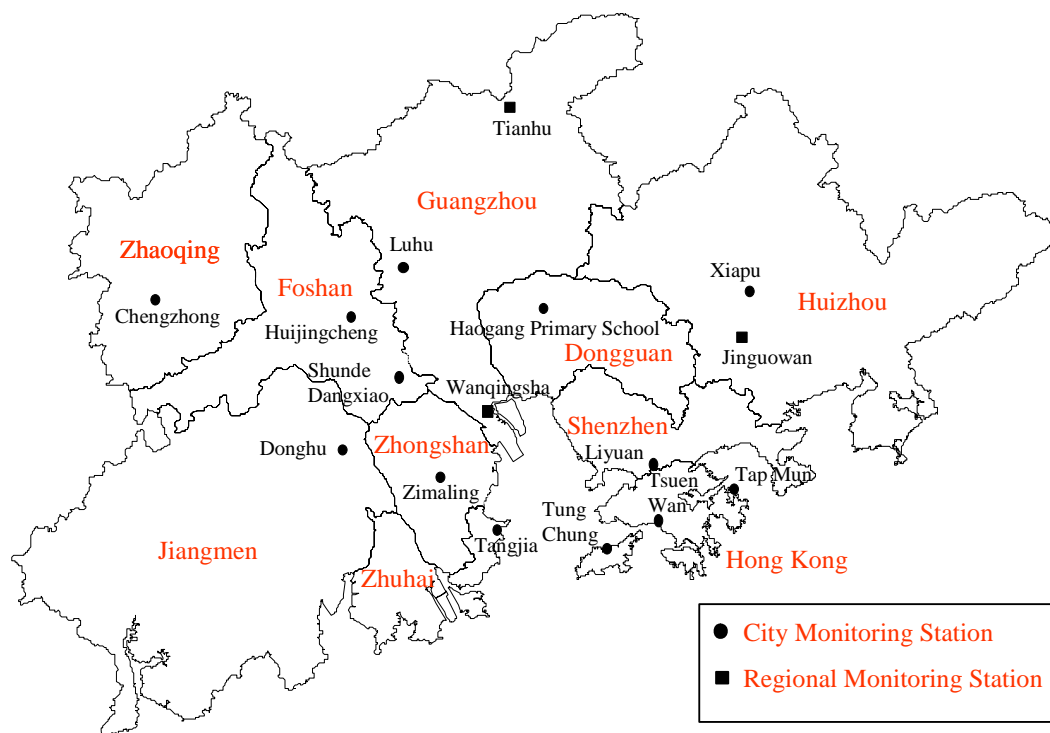


Figure 1 : Spatial distribution of the PRD Regional Air Quality Monitoring Stations

2. Operation of the Network

The Network was generally in smooth operation in 2008. The data capture rates of all monitoring stations in the Network averaged 91%.

In order to provide the public in both Guangdong and HKSAR with daily air quality information in different parts of the PRD region, the GDEMC and HKEPD established a daily reporting system of the Regional Air Quality Index (RAQI). The two Governments have been issuing the RAQI to the public at 4pm every day through the Internet since 30 November 2005.

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

The two governments have fully carried out the agreed QA/QC activities, which include zero/span checks, precision checks, dynamic calibration, etc., 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 complies continuously with the QA/QC requirements, the GDEMC and HKEPD have jointly set up the Guangdong-Hong Kong Quality Management Committee for the PRD Regional Air Quality Monitoring Network (the Quality Management Committee, QMC) to review, on a quarterly basis, the set-up of the network, its performance in QA/QC and the operation status of its data transmission system. The QMC will also conduct system audit once a year to evaluate the effectiveness of the quality management system. The findings of the system audit will be reported. The deficiency found and corrective measures suggested will be listed and followed up by the QMC.

2.2 Accuracy and Precision

The accuracy of the Network is assessed by means of performance audits. The control limits set for the gaseous pollutants and respirable suspended particulates (PM₁₀) are $\pm 15\%$ and $\pm 10\%$ respectively, these limits are similar to those of the United States Environmental Protection Agency and other international standards. In 2008, the GDEMC and HKEPD jointly carried out 363 audit checks on the analysers and samplers at the monitoring stations of the Network. The results showed that, based on the 95% probability limits, the accuracy of the Network varied between -12.5% to 9.4% and was within the specified control limits (see Figure 2).

Precision is a measure of repeatability and is calculated in accordance with the QA/QC Operating Procedures. The control limits adopted for the gaseous pollutants and respirable suspended particulates (PM₁₀) are $\pm 20\%$ and $\pm 10\%$ respectively. In 2008, the GDEMC and HKEPD jointly carried out 1378 precision checks on the analysers and samplers at the monitoring stations of the Network. The results showed that, based on the 95% probability limits, the precision of the Network varied between -11.2 % and 15.2 % and was within the specified control limits (see Figure 3). Overall, the QA/QC performance of the monitoring network was good in 2008, and met all the requirements specified in the QA/QC Operating Procedures.

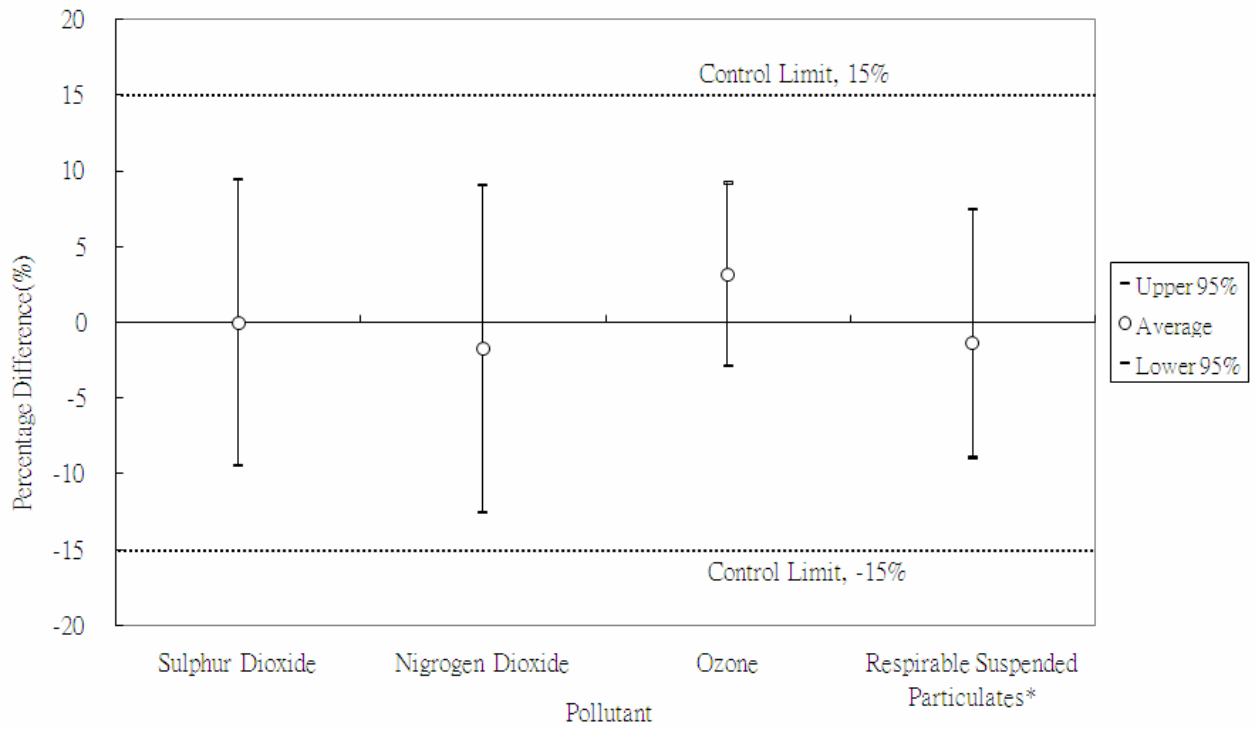


Figure 2 : Accuracy of the PRD Regional Air Quality Monitoring Network in 2008

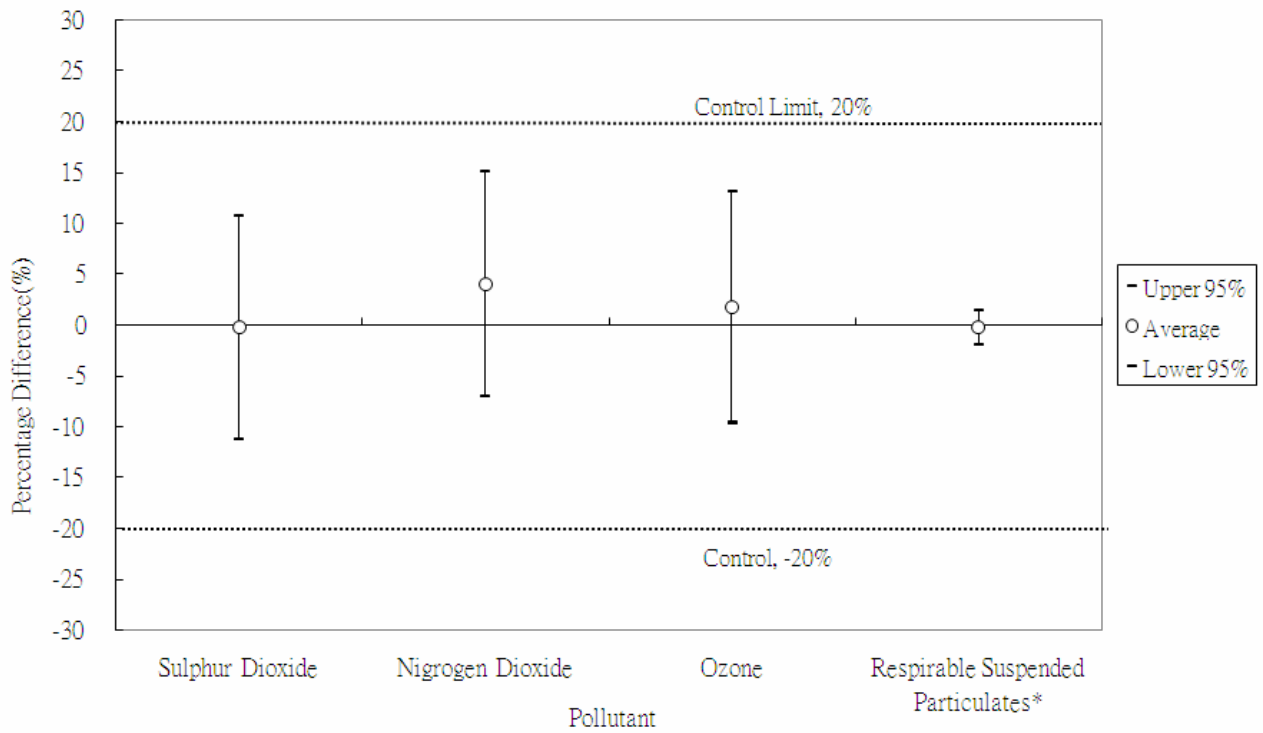


Figure 3 : Precision of the PRD Regional Air Quality Monitoring Network in 2008

* Both the accuracy and precision of the respirable suspended particulates (PM₁₀) adopt a control limit of ±10%.

3. Statistical Analysis of Pollutant Concentrations

3.1 Sulphur Dioxide (SO₂)

Sulphur dioxide (SO₂) 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 human respiratory system, SO₂ contributes substantially to acid rain. It can also be oxidized in the air to form sulphate which has a significant impact on the levels of respirable suspended particulates (PM₁₀) and visibility in the region.

The annual averages of SO₂ at various monitoring stations in the Network ranged from 0.015 mg/m³ to 0.069 mg/m³ in 2008, with values at 2 stations exceeding the national annual air quality standard[#] (0.06 mg/m³). As shown in Figure 4, the average levels of SO₂ at the north-western part of PRD and the Pearl River Estuary region were in general higher than those of other areas. Summary of the monthly and annual averages of SO₂ at various stations are in Table 3.1c.

During the year, 9 monitoring stations in the Network had recorded exceedance of the national daily air quality standard (0.15 mg/m³) of SO₂ while the corresponding national hourly standard (0.50 mg/m³) was exceeded at 6 monitoring stations. Details are in Table 3.1a and Table 3.1b.

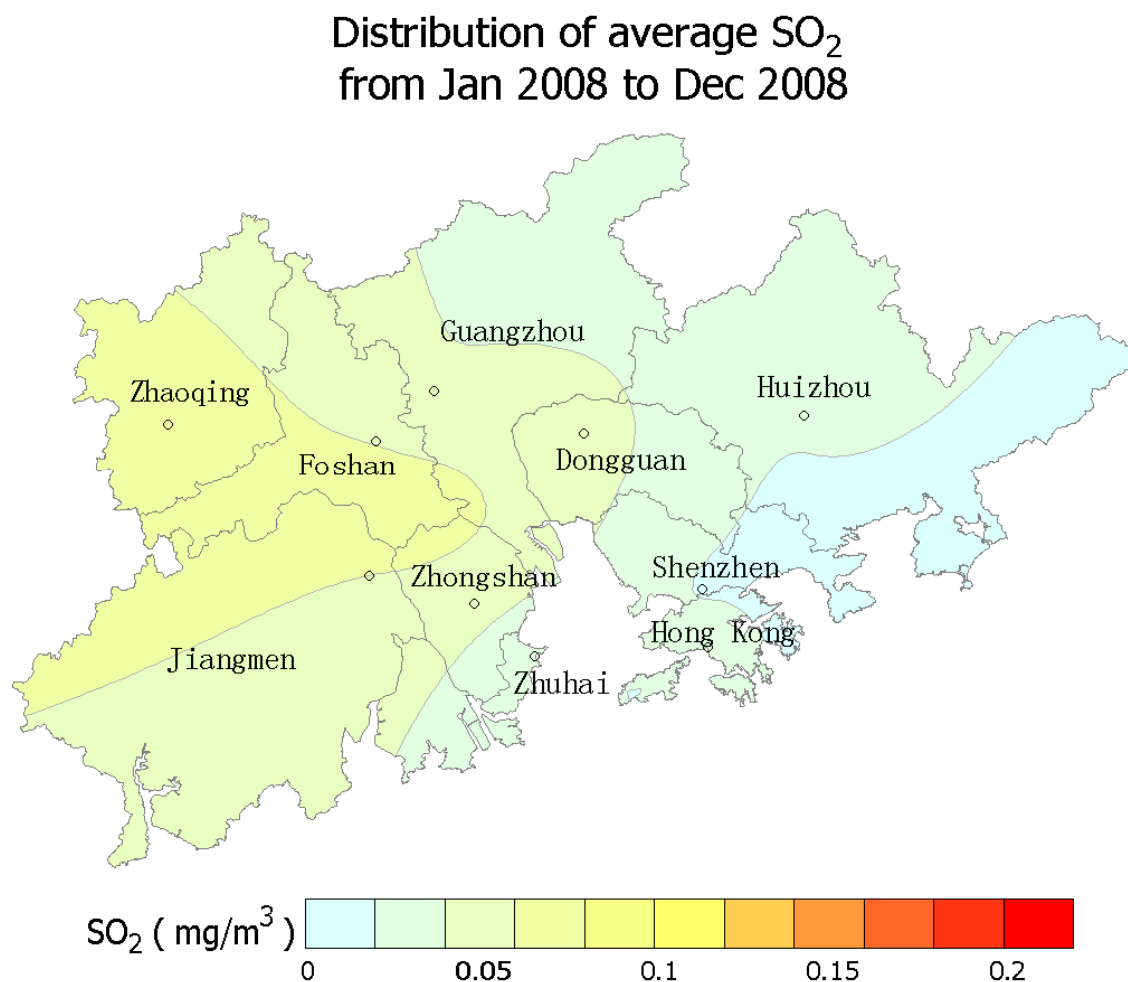


Figure 4 : Spatial distribution of average concentrations of Sulphur Dioxide (SO₂) in the Network

National Standards refer to Class 2 of the “National Ambient Air Quality Standards (GB 3095 – 1996 – revised version)” [NAAQS], which are applicable to residential, mixed commercial/residential, cultural, industrial and village areas.

Table 3.1 a : The monthly maxima and minima of hourly averages of Sulphur Dioxide

[Class 2 NAAQS (Hourly) : 0.50 mg/m³]

Monitoring Stations	Mth	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Exceed- ance Hours	Exceed- ance Rate
Luhu Park (Guangzhou)	Max	0.285	0.401	0.476	0.316	0.199	0.189	0.194	0.188	0.166	0.152	0.103	0.163	0	0.00%
	Min	0.002	0.002	0.003	0.002	0.001	0.002	0.002	0.001	0.004	0.002	0.001	0.004		
Wanqingsha (Guangzhou)	Max	0.481	0.246	0.549	0.363	0.303	0.254	0.228	0.220	0.283	0.288	0.200	0.345	2	0.02%
	Min	0.005	0.018	0.006	0.006	0.003	0.003	0.000	0.000	0.000	0.001	0.002	0.012		
Tianhu (Guangzhou)	Max	0.311	0.150	0.244	0.349	0.273	0.257	0.168	0.232	0.119	0.199	0.063	0.091	0	0.00%
	Min	0.006	0.006	0.007	0.006	0.007	0.007	0.008	0.007	0.008	0.008	0.009	0.010		
Liyuan (Shenzhen)	Max	0.167	0.188	0.194	0.146	0.124	0.127	0.144	0.084	0.146	0.183	0.094	0.079	0	0.00%
	Min	0.002	0.002	0.001	0.001	0.001	0.000	0.000	0.001	0.002	0.001	0.002	0.003		
Tangjia (Zhuhai)	Max	0.081	0.070	0.097	0.079	0.055	0.044	0.024	0.196	0.180	0.156	0.146	0.320	0	0.00%
	Min	0.003	0.004	0.005	0.004	0.003	0.003	0.003	0.000	0.000	0.000	0.003	0.011		
Shunde Dangxiao (Foshan)	Max	0.425	0.506	0.385	0.348	0.348	0.292	0.266	0.353	0.413	0.276	0.268	0.393	1	0.01%
	Min	0.012	0.008	0.022	0.012	0.006	0.000	0.001	0.001	0.005	0.010	0.009	0.004		
Huijingcheng (Foshan)	Max	0.566	0.373	0.394	0.385	0.362	0.183	0.323	0.335	0.312	0.177	0.323	0.448	2	0.03%
	Min	0.017	0.010	0.012	0.015	0.011	0.005	0.004	0.004	0.001	0.007	0.005	0.014		
Donghu (Jiangmen)	Max	0.661	0.496	0.447	0.202	0.253	0.217	0.183	0.177	0.337	0.276	0.383	0.380	2	0.02%
	Min	0.006	0.006	0.004	0.000	0.001	0.000	0.001	0.000	0.003	0.006	0.013	0.018		
Chengzhong (Zhaoqing)	Max	0.528	0.302	0.358	0.410	0.457	0.223	0.199	0.205	0.250	0.366	0.403	0.355	1	0.01%
	Min	0.014	0.010	0.012	0.011	0.005	0.002	0.001	0.003	0.006	0.006	0.007	0.017		
Xiapu (Huizhou)	Max	0.103	0.059	0.160	0.086	0.102	0.147	0.222	0.130	0.154	0.131	0.060	0.125	0	0.00%
	Min	0.006	0.006	0.008	0.007	0.008	0.002	0.001	0.001	0.000	0.003	0.003	0.010		
Jinguowan (Huizhou)	Max	0.108	0.085	0.072	0.110	0.086	0.058	0.196	0.093	0.133	0.159	0.045	0.064	0	0.00%
	Min	0.009	0.009	0.011	0.010	0.011	0.011	0.010	0.006	0.000	0.001	0.001	0.003		
Haogang (Dongguan) #	Max	0.383	0.313	0.540	0.343	0.517	0.350	0.451	0.431	0.395	0.400	0.219	0.241	2	0.02%
	Min	0.005	0.004	0.014	0.011	0.008	0.005	0.006	0.003	0.003	0.001	0.006	0.013		
Zimaling Park (Zhongshan)	Max	0.438	0.271	0.419	0.267	0.273	0.134	0.117	0.166	0.241	0.246	0.216	0.286	0	0.00%
	Min	0.008	0.017	0.011	0.001	0.000	0.000	0.000	0.000	0.001	0.001	0.006	0.011		
Tsuen Wan (HKSAR)	Max	0.150	0.133	0.161	0.163	0.260	0.283	0.339	0.301	0.198	0.119	0.139	0.112	0	0.00%
	Min	0.008	0.011	0.010	0.009	0.012	0.014	0.014	0.010	0.012	0.013	0.011	0.008		
Tap Mun (HKSAR)	Max	0.205	0.177	0.178	0.208	0.153	0.065	0.156	0.116	0.207	0.154	0.070	0.177	0	0.00%
	Min	0.007	0.004	0.002	0.002	0.001	0.001	0.002	0.002	0.000	0.004	0.005	0.003		
Tung Chung (HKSAR)	Max	0.159	0.170	0.172	0.131	0.064	0.061	0.096	0.291	0.256	0.089	0.122	0.098	0	0.00%
	Min	0.000	0.003	0.001	0.000	0.003	0.000	0.000	0.004	0.007	0.003	0.002	0.002		

Table 3.1 b : The monthly maxima and minima of daily averages of Sulphur Dioxide

[Class 2 NAAQS (Daily) : 0.15 mg/m³]

Monitoring Stations	Mth	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Exceed- ance Days	Exceed- ance Rate
Luhu Park (Guangzhou)	Max	0.087	0.160	0.211	0.189	0.078	0.070	0.083	0.073	0.081	0.052	0.042	0.060	3	0.93%
	Min	0.010	0.017	0.018	0.005	0.006	0.014	0.005	0.005	0.016	0.003	0.003	0.008		
Wanqingsha (Guangzhou)	Max	0.167	0.126	0.175	0.202	0.104	0.076	0.097	0.088	0.088	0.118	0.113	0.167	6	1.79%
	Min	0.034	0.054	0.017	0.015	0.004	0.011	0.002	0.001	0.003	0.008	0.014	0.045		
Tianhu (Guangzhou)	Max	0.143	0.052	0.134	0.106	0.139	0.085	0.084	0.100	0.041	0.100	0.034	0.035	0	0.00%
	Min	0.007	0.007	0.009	0.008	0.007	0.008	0.010	0.008	0.009	0.009	0.009	0.012		
Liyuan (Shenzhen)	Max	0.073	0.068	0.058	0.066	0.035	0.028	0.053	0.039	0.055	0.056	0.034	0.036	0	0.00%
	Min	0.007	0.008	0.008	0.002	0.004	0.004	0.003	0.003	0.004	0.004	0.003	0.010		
Tangjia (Zhuhai)	Max	0.040	0.041	0.042	0.031	0.027	0.018	0.015	0.044	0.064	0.048	0.079	0.161	3	0.86%
	Min	0.010	0.011	0.013	0.006	0.004	0.004	0.004	0.002	0.003	0.004	0.003	0.027		
Shunde Dangxiao (Foshan)	Max	0.230	0.205	0.214	0.142	0.165	0.099	0.110	0.110	0.140	0.105	0.124	0.169	15	4.79%
	Min	0.031	0.024	0.043	0.038	0.012	0.017	0.016	0.016	0.013	0.023	0.019	0.015		
Huijingcheng (Foshan)	Max	0.224	0.141	0.175	0.253	0.153	0.068	0.137	0.100	0.112	0.100	0.125	0.185	16	4.83%
	Min	0.027	0.021	0.026	0.030	0.026	0.011	0.012	0.007	0.015	0.014	0.019	0.028		
Donghu (Jiangmen)	Max	0.194	0.161	0.163	0.108	0.106	0.110	0.099	0.050	0.165	0.121	0.160	0.166	17	5.20%
	Min	0.025	0.010	0.019	0.001	0.002	0.003	0.004	0.005	0.017	0.020	0.028	0.037		
Chengzhong (Zhaoqing)	Max	0.157	0.184	0.163	0.258	0.244	0.112	0.093	0.092	0.091	0.199	0.201	0.198	14	4.40%
	Min	0.030	0.017	0.028	0.023	0.010	0.012	0.012	0.012	0.016	0.023	0.030	0.045		
Xiapu (Huizhou)	Max	0.052	0.040	0.063	0.051	0.055	0.099	0.088	0.048	0.050	0.038	0.027	0.049	0	0.00%
	Min	0.010	0.009	0.011	0.009	0.016	0.012	0.004	0.003	0.005	0.010	0.005	0.015		
Jinguowan (Huizhou)	Max	0.040	0.038	0.040	0.038	0.042	0.025	0.069	0.043	0.039	0.041	0.019	0.046	0	0.00%
	Min	0.010	0.010	0.023	0.011	0.011	0.011	0.012	0.011	0.001	0.002	0.003	0.012		
Haogang (Dongguan) #	Max	0.169	0.133	0.307	0.163	0.135	0.110	0.187	0.196	0.138	0.151	0.091	0.097	7	2.08%
	Min	0.012	0.014	0.020	0.021	0.013	0.012	0.019	0.009	0.013	0.008	0.012	0.022		
Zimaling Park (Zhongshan)	Max	0.196	0.155	0.172	0.144	0.098	0.051	0.057	0.060	0.084	0.103	0.126	0.138	4	1.27%
	Min	0.020	0.044	0.019	0.013	0.004	0.002	0.001	0.001	0.003	0.005	0.014	0.031		
Tsuen Wan (HKSAR)	Max	0.093	0.070	0.063	0.062	0.065	0.087	0.108	0.130	0.076	0.073	0.056	0.042	0	0.00%
	Min	0.013	0.016	0.016	0.011	0.014	0.017	0.017	0.011	0.014	0.015	0.014	0.011		
Tap Mun (HKSAR)	Max	0.040	0.033	0.031	0.036	0.032	0.018	0.077	0.042	0.038	0.024	0.026	0.045	0	0.00%
	Min	0.009	0.009	0.005	0.004	0.004	0.002	0.003	0.004	0.002	0.005	0.007	0.010		
Tung Chung (HKSAR)	Max	0.099	0.095	0.050	0.067	0.034	0.023	0.031	0.079	0.071	0.036	0.044	0.045	0	0.00%
	Min	0.007	0.012	0.003	0.001	0.004	0.004	0.004	0.005	0.011	0.006	0.005	0.010		

Table 3.1 c : The monthly and annual averages of Sulphur Dioxide**[Class 2 NAAQS (Annual) : 0.06 mg/m³]**

Monitoring Stations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual Average
Luhu Park (Guangzhou)	0.034	0.053	0.079	0.076	0.043	0.039	0.037	0.042	0.039	0.017	0.014	0.025	0.041
Wanqingsha (Guangzhou)	0.088	0.083	0.078	0.059	0.041	0.027	0.026	0.021	0.042	0.042	0.062	0.094	0.055
Tianhu (Guangzhou)	0.027	0.027	0.043	0.036	0.039	0.029	0.041	0.040	0.017	0.019	0.018	0.023	0.030
Liyuan (Shenzhen)	0.023	0.030	0.025	0.016	0.015	0.011	0.016	0.013	0.017	0.014	0.016	0.023	0.018
Tangjia (Zhuhai)	0.025	0.020	0.023	0.017	0.012	0.008	0.007	0.012	0.021	0.017	0.036	0.072	0.022
Shunde Dangxiao (Foshan)	0.097	0.086	0.103	0.079	0.062	0.046	0.046	0.050	0.071	0.051	0.054	0.077	0.069
Huijingcheng (Foshan)	0.102	0.064	0.070	0.091	0.056	0.025	0.042	0.044	0.045	0.043	0.055	0.092	0.060
Donghu (Jiangmen)	0.084	0.058	0.078	0.041	0.027	0.033	0.031	0.025	0.065	0.072	0.084	0.109	0.060
Chengzhong (Zhaoqing)	0.087	0.060	0.086	0.085	0.077	0.040	0.044	0.041	0.051	0.071	0.087	0.096	0.069
Xiapu (Huizhou)	0.031	0.026*	0.031	0.025	0.035	0.048	0.022	0.017	0.015	0.017	0.017	0.032	0.026
Jinguowan (Huizhou)	0.022	0.023	0.032*	0.019	0.019	0.015	0.024	0.02*	0.009	0.008	0.010	0.020	0.018
Haogang (Dongguan) #	0.057	0.046	0.068	0.052	0.048	0.036	0.048	0.051	0.048	0.037	0.038	0.058	0.049
Zimaling Park (Zhongshan)	0.091	0.088	0.070	0.042	0.028	0.011	0.012	0.014	0.035	0.037	0.072	0.078	0.048
Tsuen Wan (HKSAR)	0.030	0.033	0.035	0.026	0.033	0.042	0.043	0.034	0.029	0.023	0.021	0.022	0.031
Tap Mun (HKSAR)	0.025	0.021	0.017	0.012	0.011	0.005	0.012	0.012	0.013	0.014	0.017	0.020	0.015
Tung Chung (HKSAR)	0.032	0.033	0.025	0.016	0.014	0.009	0.011	0.018	0.029	0.013	0.016	0.022	0.020

Remark : 1. All concentration units are in milligrams per cubic metre.

2. “*” denotes that the data capture rate does not meet the minimum requirements for determining a representative value.

3.2 Nitrogen Dioxide (NO₂)

Nitrogen Dioxide (NO₂) is mainly formed from oxidization of nitrogen monoxide (NO) emitted in the process of combustion. Its major emission sources include power plants, vehicles, industrial combustion plants, etc. Apart from the impact on human respiratory system, it can also be oxidized in the air to form nitrate, which has significant impact on the levels of particulates, acid rain and visibility in the region.

The annual averages of NO₂ at various monitoring stations in the Network ranged from 0.014 mg/m³ to 0.070 mg/m³ in 2008; all are in compliance with the national annual air quality standard (0.08 mg/m³). During the period, 11 monitoring stations in the Network had recorded exceedance of the national daily air quality standard (0.12 mg/m³) of NO₂ while the corresponding national hourly standard (0.24 mg/m³) was exceeded at 11 monitoring stations. Please refer to Figures 5 and Tables 3.2a to 3.2c for details.

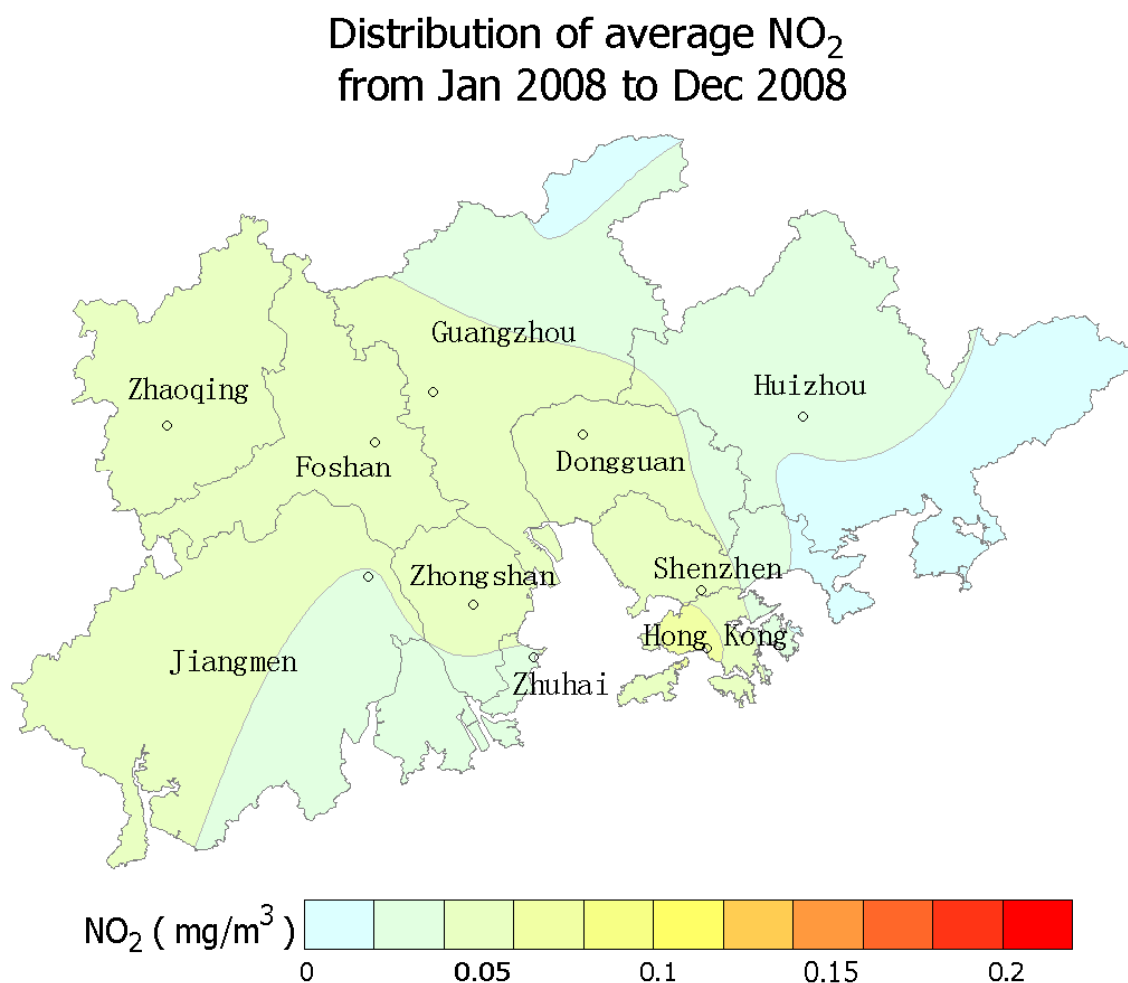


Figure 5 : Spatial distribution of average concentrations of Nitrogen Dioxide (NO₂) in the Network

Table 3.2 a : The monthly maxima and minima of hourly averages of Nitrogen Dioxide

[Class 2 NAAQS (Hourly) : 0.24 mg/m3]

Monitoring Stations	Mth	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Exceed- ance Hours	Exceed- ance Rate
Luhu Park (Guangzhou)	Max	0.189	0.302	0.296	0.208	0.196	0.122	0.149	0.142	0.096	0.110	0.086	0.157	14	0.18%
	Min	0.014	0.010	0.025	0.024	0.003	0.012	0.007	0.001	0.006	0.003	0.010	0.012		
Wanqingsha (Guangzhou)	Max	0.290	0.296	0.258	0.206	0.085	0.051	0.084	0.084	0.138	0.126	0.177	0.211	7	0.09%
	Min	0.013	0.013	0.001	0.000	0.004	0.000	0.002	0.001	0.001	0.001	0.003	0.015		
Tianhu (Guangzhou)	Max	0.025	0.070	0.184	0.136	0.087	0.106	0.074	0.078	0.050	0.094	0.033	0.063	0	0.00%
	Min	0.008	0.007	0.005	0.004	0.004	0.003	0.006	0.005	0.002	0.001	0.004	0.005		
Liyuan (Shenzhen)	Max	0.251	0.251	0.286	0.204	0.180	0.104	0.190	0.160	0.222	0.232	0.234	0.332	16	0.19%
	Min	0.011	0.008	0.010	0.006	0.008	0.005	0.007	0.000	0.000	0.003	0.010	0.014		
Tangjia (Zhuhai)	Max	0.169	0.171	0.154	0.169	0.103	0.087	0.075	0.062	0.098	0.090	0.116	0.201	0	0.00%
	Min	0.011	0.006	0.004	0.004	0.004	0.005	0.004	0.001	0.002	0.000	0.005	0.016		
Shunde Dangxiao (Foshan)	Max	0.385	0.290	0.230	0.163	0.158	0.105	0.105	0.130	0.147	0.146	0.173	0.218	9	0.12%
	Min	0.022	0.009	0.016	0.017	0.006	0.007	0.007	0.004	0.003	0.016	0.012	0.013		
Huijingcheng (Foshan)	Max	0.362	0.246	0.248	0.199	0.167	0.124	0.127	0.142	0.185	0.124	0.186	0.246	32	0.41%
	Min	0.022	0.014	0.016	0.010	0.004	0.007	0.003	0.013	0.001	0.019	0.015	0.005		
Donghu (Jiangmen)	Max	0.392	0.268	0.210	0.080	0.138	0.106	0.068	0.063	0.112	0.124	0.161	0.215	12	0.15%
	Min	0.012	0.010	0.008	0.006	0.006	0.004	0.004	0.003	0.006	0.010	0.014	0.023		
Chengzhong (Zhaoqing)	Max	0.258	0.198	0.227	0.148	0.177	0.140	0.116	0.115	0.117	0.161	0.160	0.292	5	0.06%
	Min	0.016	0.011	0.015	0.014	0.011	0.008	0.008	0.006	0.010	0.012	0.015	0.021		
Xiapu (Huizhou)	Max	0.230	0.132	0.157	0.135	0.120	0.102	0.124	0.083	0.107	0.101	0.116	0.209	0	0.00%
	Min	0.003	0.000	0.006	0.007	0.006	0.001	0.005	0.002	0.000	0.003	0.001	0.002		
Jinguowan (Huizhou)	Max	0.110	0.095	0.025	0.095	0.089	0.056	0.079	0.054	0.063	0.062	0.046	0.064	0	0.00%
	Min	0.001	0.002	0.006	0.000	0.000	0.000	0.001	0.002	0.000	0.000	0.000	0.004		
Haogang (Dongguan) #	Max	0.216	0.223	0.265	0.216	0.152	0.140	0.165	0.130	0.145	0.153	0.167	0.218	4	0.05%
	Min	0.009	0.012	0.011	0.015	0.016	0.009	0.011	0.007	0.007	0.010	0.007	0.013		
Zimaling Park (Zhongshan)	Max	0.310	0.196	0.187	0.188	0.150	0.069	0.093	0.074	0.086	0.143	0.167	0.228	5	0.07%
	Min	0.020	0.014	0.010	0.005	0.002	0.001	0.001	0.001	0.003	0.002	0.012	0.021		
Tsuen Wan (HKSAR)	Max	0.246	0.214	0.265	0.217	0.178	0.138	0.204	0.185	0.230	0.194	0.226	0.253	8	0.09%
	Min	0.018	0.012	0.018	0.017	0.018	0.009	0.014	0.005	0.004	0.015	0.012	0.014		
Tap Mun (HKSAR)	Max	0.104	0.075	0.115	0.113	0.102	0.052	0.130	0.077	0.087	0.076	0.060	0.086	0	0.00%
	Min	0.006	0.005	0.004	0.001	0.002	0.001	0.001	0.000	0.001	0.000	0.001	0.005		
Tung Chung (HKSAR)	Max	0.274	0.229	0.273	0.171	0.173	0.109	0.128	0.149	0.194	0.222	0.205	0.280	8	0.09%
	Min	0.007	0.006	0.002	0.003	0.000	0.002	0.003	0.001	0.007	0.006	0.010	0.013		

Table 3.2 b : The monthly maxima and minima of daily averages of Nitrogen Dioxide

[Class 2 NAAQS (Daily) : 0.12 mg/m3]

Monitoring Stations	Mth	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Exceed- ance Days	Exceed- ance Rate
Luhu Park (Guangzhou)	Max	0.133	0.182	0.194	0.132	0.088	0.068	0.065	0.075	0.053	0.062	0.054	0.096	14	4.36%
	Min	0.027	0.019	0.054	0.034	0.023	0.028	0.019	0.017	0.018	0.016	0.018	0.022		
Wanqingsha (Guangzhou)	Max	0.158	0.168	0.164	0.123	0.046	0.021	0.053	0.045	0.055	0.056	0.086	0.133	13	4.23%
	Min	0.035	0.036	0.007	0.004	0.025	0.002	0.006	0.008	0.009	0.011	0.016	0.037		
Tianhu (Guangzhou)	Max	0.011	0.030	0.084	0.049	0.065	0.048	0.042	0.036	0.023	0.048	0.019	0.025	0	0.00%
	Min	0.009	0.008	0.008	0.007	0.005	0.005	0.008	0.006	0.005	0.004	0.005	0.007		
Liyuan (Shenzhen)	Max	0.122	0.122	0.128	0.111	0.097	0.065	0.097	0.071	0.095	0.118	0.103	0.160	11	3.29%
	Min	0.043	0.024	0.030	0.028	0.027	0.025	0.026	0.021	0.022	0.032	0.031	0.042		
Tangjia (Zhuhai)	Max	0.088	0.098	0.099	0.091	0.049	0.048	0.046	0.028	0.032	0.039	0.070	0.111	0	0.00%
	Min	0.021	0.029	0.019	0.021	0.011	0.015	0.011	0.006	0.008	0.007	0.019	0.035		
Shunde Dangxiao (Foshan)	Max	0.221	0.156	0.149	0.093	0.094	0.049	0.060	0.064	0.091	0.076	0.098	0.139	19	5.99%
	Min	0.040	0.027	0.034	0.022	0.029	0.016	0.020	0.019	0.018	0.035	0.024	0.035		
Huijingcheng (Foshan)	Max	0.230	0.153	0.151	0.147	0.074	0.057	0.080	0.064	0.090	0.077	0.097	0.162	17	5.21%
	Min	0.039	0.029	0.037	0.022	0.027	0.017	0.027	0.027	0.036	0.030	0.034	0.020		
Donghu (Jiangmen)	Max	0.192	0.127	0.121	0.033	0.050	0.042	0.039	0.025	0.054	0.079	0.100	0.119	5	1.51%
	Min	0.024	0.015	0.013	0.007	0.008	0.008	0.006	0.008	0.017	0.014	0.023	0.039		
Chengzhong (Zhaoqing)	Max	0.153	0.135	0.120	0.082	0.083	0.061	0.049	0.054	0.054	0.087	0.094	0.170	12	3.79%
	Min	0.030	0.025	0.036	0.025	0.026	0.020	0.019	0.015	0.022	0.024	0.028	0.035		
Xiapu (Huizhou)	Max	0.094	0.050	0.069	0.074	0.079	0.045	0.066	0.047	0.047	0.040	0.056	0.093	0	0.00%
	Min	0.014	0.008	0.026	0.024	0.017	0.021	0.016	0.008	0.011	0.015	0.009	0.015		
Jinguowan (Huizhou)	Max	0.033	0.035	0.007	0.036	0.045	0.015	0.040	0.036	0.026	0.022	0.019	0.038	0	0.00%
	Min	0.006	0.009	0.006	0.005	0.006	0.001	0.007	0.005	0.003	0.001	0.005	0.011		
Haogang (Dongguan) #	Max	0.145	0.106	0.169	0.124	0.102	0.068	0.083	0.067	0.069	0.067	0.071	0.099	5	1.50%
	Min	0.025	0.023	0.049	0.036	0.027	0.018	0.022	0.018	0.021	0.021	0.016	0.022		
Zimaling Park (Zhongshan)	Max	0.189	0.120	0.101	0.115	0.083	0.044	0.038	0.038	0.047	0.065	0.094	0.120	3	0.98%
	Min	0.041	0.025	0.034	0.011	0.009	0.005	0.007	0.005	0.007	0.012	0.031	0.035		
Tsuen Wan (HKSAR)	Max	0.136	0.136	0.152	0.135	0.114	0.081	0.131	0.082	0.098	0.114	0.120	0.166	14	3.92%
	Min	0.041	0.053	0.058	0.049	0.051	0.038	0.031	0.015	0.036	0.049	0.047	0.044		
Tap Mun (HKSAR)	Max	0.041	0.036	0.030	0.035	0.053	0.024	0.052	0.042	0.040	0.039	0.019	0.032	0	0.00%
	Min	0.010	0.009	0.007	0.005	0.005	0.004	0.004	0.002	0.003	0.004	0.004	0.010		
Tung Chung (HKSAR)	Max	0.146	0.136	0.131	0.123	0.101	0.059	0.063	0.084	0.097	0.092	0.095	0.143	9	2.47%
	Min	0.021	0.021	0.011	0.008	0.005	0.008	0.010	0.009	0.016	0.014	0.027	0.046		

Table 3.2 c : The monthly and annual averages of Nitrogen Dioxide

[Class 2 NAAQS (Annual) : 0.08 mg/m³]

Monitoring Stations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual Average
Luhu Park (Guangzhou)	0.055	0.071	0.104	0.076	0.050	0.042	0.039	0.038	0.031	0.040	0.036	0.055	0.052
Wanqingsha (Guangzhou)	0.081	0.085	0.081	0.040	0.033*	0.010	0.017	0.020	0.033	0.037	0.046	0.086	0.049
Tianhu (Guangzhou)	0.01*	0.015	0.032	0.027	0.021	0.019	0.025	0.020	0.010	0.010	0.009	0.015	0.018
Liyuan (Shenzhen)	0.068	0.066	0.067	0.051	0.049	0.044	0.053	0.042	0.054	0.047	0.061	0.089	0.057
Tangjia (Zhuhai)	0.055	0.057	0.046	0.041	0.034	0.026	0.020	0.015	0.020	0.020	0.041	0.069	0.038
Shunde Dangxiao (Foshan)	0.087	0.074	0.080	0.051	0.046	0.032	0.033	0.033	0.049	0.054	0.061	0.090	0.058
Huijingcheng (Foshan)	0.087	0.071	0.087	0.068	0.049	0.032	0.040	0.041	0.049	0.048	0.057	0.086	0.059
Donghu (Jiangmen)	0.057	0.054	0.047	0.015	0.019	0.022	0.017	0.015	0.033	0.037	0.052	0.078	0.038
Chengzhong (Zhaoqing)	0.063	0.058	0.070	0.047	0.043	0.034	0.032	0.030	0.036	0.046	0.060	0.089	0.051
Xiapu (Huizhou)	0.038	0.025*	0.042	0.036	0.034	0.029	0.032	0.027	0.026	0.027	0.026	0.057	0.034
Jinguowan (Huizhou)	0.021	0.019	0.006*	0.016	0.016	0.005	0.019	0.014*	0.008*	0.008	0.011	0.020	0.014
Haogang (Dongguan) #	0.055	0.054	0.091	0.062	0.056	0.046	0.045	0.041	0.043	0.041	0.044	0.068	0.054
Zimaling Park (Zhongshan)	0.073	0.068	0.065	0.044	0.032	0.018	0.018	0.014	0.030	0.040	0.058	0.078	0.045
Tsuen Wan (HKSAR)	0.078	0.082	0.092	0.070	0.073	0.055	0.054	0.047	0.060	0.065	0.072	0.090	0.070
Tap Mun (HKSAR)	0.025	0.019	0.017	0.014	0.012	0.011	0.017	0.015	0.013	0.010	0.012	0.018	0.015
Tung Chung (HKSAR)	0.068	0.073	0.071	0.048	0.045	0.028	0.029	0.031	0.056	0.048	0.061	0.084	0.053

Remark : 1. All concentration units are in milligrams per cubic metre.

2. “*” denotes that the data capture rate does not meet the minimum requirements for determining a representative value.

3.3 Ozone (O₃)

Ozone (O₃) is not directly emitted from emission sources. It is formed by the photochemical reaction of oxygen, nitrogen oxides (NO_x) and volatile organic compounds (VOCs) in the air under sunlight, and is the main component of photochemical smog. Ozone can cause irritation to the eye, nose and throat. At elevated levels, O₃ can increase a person's susceptibility to respiratory diseases and aggravate pre-existing respiratory diseases such as asthma.

The precursors of O₃ (NO_x and VOCs) mainly originate from pollution sources in urban areas. However, as it usually takes several hours for O₃ to be formed and rise to its peak level, and O₃ and its precursors can be transported to rural areas downwind of their sources during this period, the concentrations of O₃ in rural areas are therefore often higher than that in the urban areas. The annual averages of O₃ in rural areas recorded by the Network ranged from 0.034 mg/m³ to 0.084 mg/m³ in 2008, with higher average values measured in rural areas such as Tianhu of Guangzhou, Tap Mun of Hong Kong and Jinguowan of Huizhou. During the year, all 16 monitoring stations in the Network had recorded exceedance of the national hourly standard (0.2 mg/m³) of ozone. Please refer to Figures 6 and Tables 3.3a to 3.3c for details.

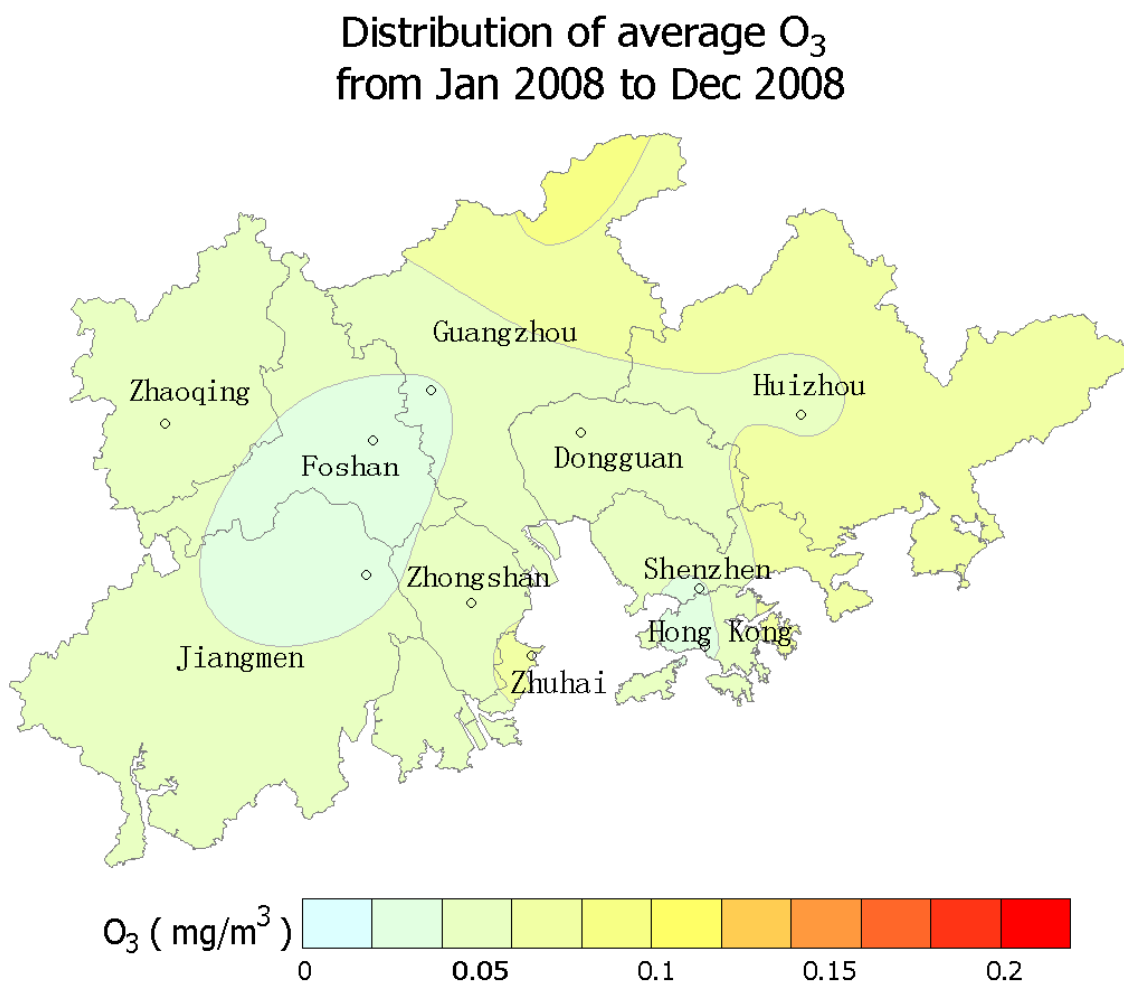


Figure 6 : Spatial distribution of average concentrations of Ozone (O₃) in the Network

Table 3.3 a : The monthly maxima and minima of hourly averages of Ozone

[Class 2 NAAQS (Hourly) : 0.20mg/m3]

Monitoring Stations	Mth	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Exceed- ance Hours	Exceed- ance Rate
Luhu Park (Guangzhou)	Max	0.170	0.210	0.198	0.168	0.275	0.301	0.313	0.245	0.260	0.260	0.200	0.198	61	0.78%
	Min	0.000	0.000	0.000	0.000	0.002	0.003	0.002	0.002	0.001	0.001	0.001	0.000		
Wanqingsha (Guangzhou)	Max	0.304	0.253	0.320	0.280	0.355	0.312	0.394	0.365	0.363	0.325	0.290	0.263	299	3.65%
	Min	0.003	0.003	0.002	0.003	0.001	0.000	0.000	0.005	0.004	0.003	0.001	0.000		
Tianhu (Guangzhou)	Max	0.222	0.171	0.281	0.226	0.298	0.283	0.304	0.273	0.226	0.236	0.160	0.211	126	1.64%
	Min	0.007	0.011	0.007	0.007	0.007	0.007	0.008	0.009	0.000	0.008	0.000	0.011		
Liyuan (Shenzhen)	Max	0.171	0.134	0.185	0.198	0.184	0.103	0.286	0.274	0.235	0.165	0.184	0.182	17	0.20%
	Min	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		
Tangjia (Zhuhai)	Max	0.330	0.192	0.352	0.269	0.378	0.336	0.130	0.381	0.368	0.333	0.353	0.371	248	3.36%
	Min	0.000	0.000	0.000	0.000	0.003	0.004	0.004	0.001	0.000	0.001	0.000	0.000		
Shunde Dangxiao (Foshan)	Max	0.173	0.132	0.226	0.284	0.292	0.340	0.336	0.274	0.285	0.287	0.252	0.180	143	1.84%
	Min	0.000	0.000	0.003	0.003	0.003	0.001	0.001	0.001	0.002	0.002	0.001	0.001		
Huijingcheng (Foshan)	Max	0.101	0.216	0.149	0.184	0.320	0.258	0.324	0.263	0.220	0.233	0.219	0.218	55	0.70%
	Min	0.001	0.003	0.001	0.001	0.002	0.001	0.001	0.003	0.001	0.002	0.000	0.000		
Donghu (Jiangmen)	Max	0.183	0.138	0.171	0.187	0.247	0.283	0.154	0.196	0.269	0.252	0.134	0.156	72	0.90%
	Min	0.001	0.002	0.002	0.001	0.001	0.002	0.004	0.003	0.003	0.004	0.003	0.003		
Chengzhong (Zhaoqing)	Max	0.248	0.224	0.205	0.184	0.206	0.285	0.250	0.234	0.263	0.261	0.208	0.187	52	0.66%
	Min	0.002	0.001	0.002	0.002	0.002	0.001	0.001	0.002	0.001	0.001	0.001	0.001		
Xiapu (Huizhou)	Max	0.173	0.135	0.201	0.216	0.252	0.254	0.381	0.275	0.204	0.256	0.146	0.159	86	1.07%
	Min	0.002	0.007	0.007	0.006	0.005	0.004	0.003	0.001	0.001	0.006	0.004	0.003		
Jinguowan (Huizhou)	Max	0.186	0.165	0.194	0.286	0.301	0.290	0.434	0.290	0.206	0.263	0.161	0.174	98	1.35%
	Min	0.004	0.019	0.025	0.007	0.006	0.007	0.006	0.005	0.004	0.008	0.005	0.009		
Haogang (Dongguan) #	Max	0.182	0.184	0.245	0.317	0.362	0.364	0.394	0.339	0.263	0.242	0.184	0.227	125	1.54%
	Min	0.002	0.003	0.003	0.002	0.001	0.003	0.002	0.003	0.004	0.003	0.002	0.000		
Zimaling Park (Zhongshan)	Max	0.262	0.223	0.265	0.246	0.386	0.289	0.255	0.293	0.341	0.282	0.274	0.227	229	3.01%
	Min	0.002	0.002	0.002	0.001	0.001	0.002	0.002	0.001	0.000	0.001	0.000	0.000		
Tsuen Wan (HKSAR)	Max	0.102	0.109	0.149	0.121	0.161	0.089	0.279	0.183	0.251	0.126	0.121	0.139	7	0.08%
	Min	0.002	0.001	0.004	0.005	0.006	0.008	0.007	0.008	0.007	0.007	0.007	0.006		
Tap Mun (HKSAR)	Max	0.181	0.176	0.231	0.225	0.230	0.139	0.444	0.310	0.351	0.209	0.200	0.220	64	0.76%
	Min	0.005	0.002	0.001	0.000	0.003	0.002	0.002	0.002	0.002	0.013	0.007	0.007		
Tung Chung (HKSAR)	Max	0.165	0.154	0.271	0.157	0.305	0.113	0.270	0.324	0.339	0.249	0.286	0.319	89	1.04%
	Min	0.002	0.003	0.001	0.004	0.004	0.002	0.002	0.002	0.003	0.003	0.003	0.004		

Table 3.3 b : The monthly maxima and minima of daily averages of Ozone

Monitoring Stations	Mth	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Luhu Park (Guangzhou)	Max	0.056	0.099	0.076	0.049	0.120	0.105	0.104	0.085	0.127	0.075	0.089	0.086
	Min	0.002	0.002	0.005	0.002	0.007	0.008	0.013	0.014	0.006	0.024	0.010	0.003
Wanqingsha (Guangzhou)	Max	0.102	0.082	0.117	0.085	0.151	0.091	0.157	0.153	0.129	0.119	0.097	0.088
	Min	0.004	0.008	0.006	0.008	0.011	0.016	0.018	0.035	0.023	0.041	0.025	0.004
Tianhu (Guangzhou)	Max	0.143	0.126	0.153	0.120	0.195	0.155	0.159	0.112	0.127	0.132	0.120	0.141
	Min	0.038	0.034	0.041	0.018	0.050	0.025	0.031	0.043	0.008	0.056	0.056	0.051
Liyuan (Shenzhen)	Max	0.043	0.064	0.085	0.071	0.113	0.041	0.092	0.076	0.091	0.078	0.073	0.078
	Min	0.001	0.003	0.010	0.002	0.002	0.000	0.002	0.008	0.007	0.016	0.024	0.024
Tangjia (Zhuhai)	Max	0.114	0.093	0.144	0.096	0.190	0.077	0.059	0.133	0.159	0.130	0.133	0.138
	Min	0.001	0.005	0.018	0.004	0.033	0.029	0.028	0.024	0.022	0.054	0.032	0.019
Shunde Dangxiao (Foshan)	Max	0.060	0.066	0.086	0.097	0.138	0.119	0.117	0.100	0.100	0.104	0.074	0.047
	Min	0.002	0.009	0.004	0.004	0.007	0.010	0.011	0.014	0.009	0.037	0.014	0.002
Huijingcheng (Foshan)	Max	0.037	0.131	0.046	0.067	0.074	0.101	0.089	0.104	0.094	0.097	0.076	0.073
	Min	0.004	0.005	0.003	0.002	0.007	0.005	0.007	0.010	0.009	0.025	0.011	0.009
Donghu (Jiangmen)	Max	0.055	0.078	0.074	0.062	0.111	0.101	0.058	0.090	0.110	0.091	0.052	0.073
	Min	0.002	0.004	0.003	0.002	0.008	0.013	0.009	0.012	0.013	0.015	0.005	0.005
Chengzhong (Zhaoqing)	Max	0.061	0.091	0.078	0.085	0.094	0.136	0.114	0.103	0.108	0.109	0.080	0.090
	Min	0.009	0.012	0.012	0.004	0.009	0.007	0.020	0.026	0.021	0.022	0.011	0.010
Xiapu (Huizhou)	Max	0.072	0.100	0.107	0.089	0.158	0.101	0.143	0.093	0.100	0.089	0.102	0.101
	Min	0.012	0.027	0.025	0.011	0.013	0.011	0.019	0.021	0.018	0.048	0.035	0.029
Jinguowan (Huizhou)	Max	0.101	0.114	0.128	0.113	0.197	0.122	0.163	0.111	0.121	0.108	0.121	0.120
	Min	0.013	0.039	0.094	0.019	0.030	0.026	0.028	0.031	0.024	0.046	0.040	0.033
Haogang (Dongguan) #	Max	0.056	0.088	0.094	0.068	0.145	0.111	0.139	0.153	0.105	0.099	0.080	0.098
	Min	0.003	0.010	0.012	0.006	0.012	0.006	0.012	0.017	0.029	0.032	0.028	0.022
Zimaling Park (Zhongshan)	Max	0.071	0.077	0.105	0.069	0.152	0.103	0.097	0.116	0.138	0.117	0.097	0.088
	Min	0.003	0.004	0.034	0.004	0.009	0.021	0.021	0.018	0.020	0.049	0.031	0.003
Tsuen Wan (HKSAR)	Max	0.053	0.065	0.099	0.077	0.116	0.048	0.072	0.052	0.092	0.083	0.070	0.070
	Min	0.008	0.009	0.008	0.007	0.009	0.009	0.009	0.010	0.009	0.014	0.024	0.015
Tap Mun (HKSAR)	Max	0.110	0.124	0.160	0.125	0.176	0.103	0.164	0.114	0.138	0.149	0.138	0.138
	Min	0.013	0.028	0.032	0.019	0.018	0.023	0.021	0.020	0.014	0.061	0.048	0.045
Tung Chung (HKSAR)	Max	0.064	0.100	0.134	0.103	0.159	0.051	0.103	0.088	0.105	0.108	0.077	0.096
	Min	0.003	0.005	0.020	0.013	0.011	0.013	0.014	0.013	0.008	0.027	0.019	0.008

Table 3.3 c : The monthly and annual averages of Ozone

Monitoring Stations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual Average
Luhu Park (Guangzhou)	0.019	0.044	0.032	0.019	0.034	0.028	0.040	0.040	0.060	0.052	0.051	0.039	0.038
Wanqingsha (Guangzhou)	0.031	0.041	0.062	0.044	0.057	0.037	0.062	0.064	0.073	0.082	0.060	0.052	0.056
Tianhu (Guangzhou)	0.071	0.097	0.103	0.070	0.097	0.059	0.077	0.078	0.070	0.095	0.098	0.099	0.084
Liyuan (Shenzhen)	0.020	0.036	0.051	0.032	0.037	0.009	0.024	0.027	0.044	0.054	0.053	0.052	0.037
Tangjia (Zhuhai)	0.044	0.052	0.082	0.050	0.076	0.043	0.043*	0.060	0.074	0.089	0.078	0.071	0.066
Shunde Dangxiao (Foshan)	0.019	0.034	0.049	0.038	0.045	0.026	0.044	0.039	0.056	0.063	0.044	0.023	0.039
Huijingcheng (Foshan)	0.015	0.037	0.020	0.020	0.024	0.018	0.035	0.047	0.045	0.059	0.046	0.039	0.034
Donghu (Jiangmen)	0.020	0.034	0.040	0.020	0.035	0.034	0.029	0.032	0.057	0.061	0.026	0.020	0.034
Chengzhong (Zhaoqing)	0.035	0.058	0.046	0.033	0.038	0.034	0.046	0.048	0.065	0.066	0.050	0.040	0.046
Xiapu (Huizhou)	0.038	0.061*	0.069	0.046	0.067	0.035	0.054	0.047	0.058	0.065	0.063	0.052	0.054
Jinguowan (Huizhou)	0.052	0.079	0.11*	0.071	0.087	0.047	0.063	0.06*	0.067	0.079	0.084	0.084	0.072
Haogang (Dongguan) #	0.025	0.049	0.054	0.038	0.048	0.032	0.045	0.060	0.066	0.068	0.055	0.061	0.050
Zimaling Park (Zhongshan)	0.031	0.041	0.068	0.040	0.058	0.044	0.044	0.050	0.080	0.078	0.060	0.043	0.053
Tsuen Wan (HKSAR)	0.022	0.034	0.044	0.034	0.039	0.018	0.017	0.022	0.041	0.052	0.046	0.039	0.034
Tap Mun (HKSAR)	0.060	0.079	0.100	0.070	0.087	0.044	0.044	0.044	0.075	0.102	0.099	0.098	0.076
Tung Chung (HKSAR)	0.024	0.040	0.061	0.040	0.055	0.028	0.030	0.033	0.055	0.067	0.054	0.054	0.045

Remark : 1. All concentration units are in milligrams per cubic metre.
2. “*” denotes that the data capture rate does not meet the minimum requirements for determining a representative value.

3.4 Respirable Suspended Particulates (PM₁₀)

Respirable suspended particulates (PM₁₀ or RSP) in the atmosphere come from a great variety of emission sources, such as power plants, vehicles, 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 SO₂) or from photochemical reactions. PM₁₀ can penetrate deeply into human lungs and cause impact on human respiratory system. Furthermore, finer particles in PM₁₀ have significant effect on visibility.

The annual averages of PM₁₀ at various monitoring stations in the Network ranged from 0.045 mg/m³ to 0.103 mg/m³ in 2008, with value at 1 station exceeding the national annual air quality standard (0.10 mg/m³). As shown in Figure 7, the average levels of PM₁₀ in the central part of PRD were generally higher than those in the coastal areas in the south. All monitoring stations except Tangjia had recorded exceedance of the national daily standard (0.15mg/m³) of PM₁₀. Please refer to Tables 3.4a to 3.4c for details.

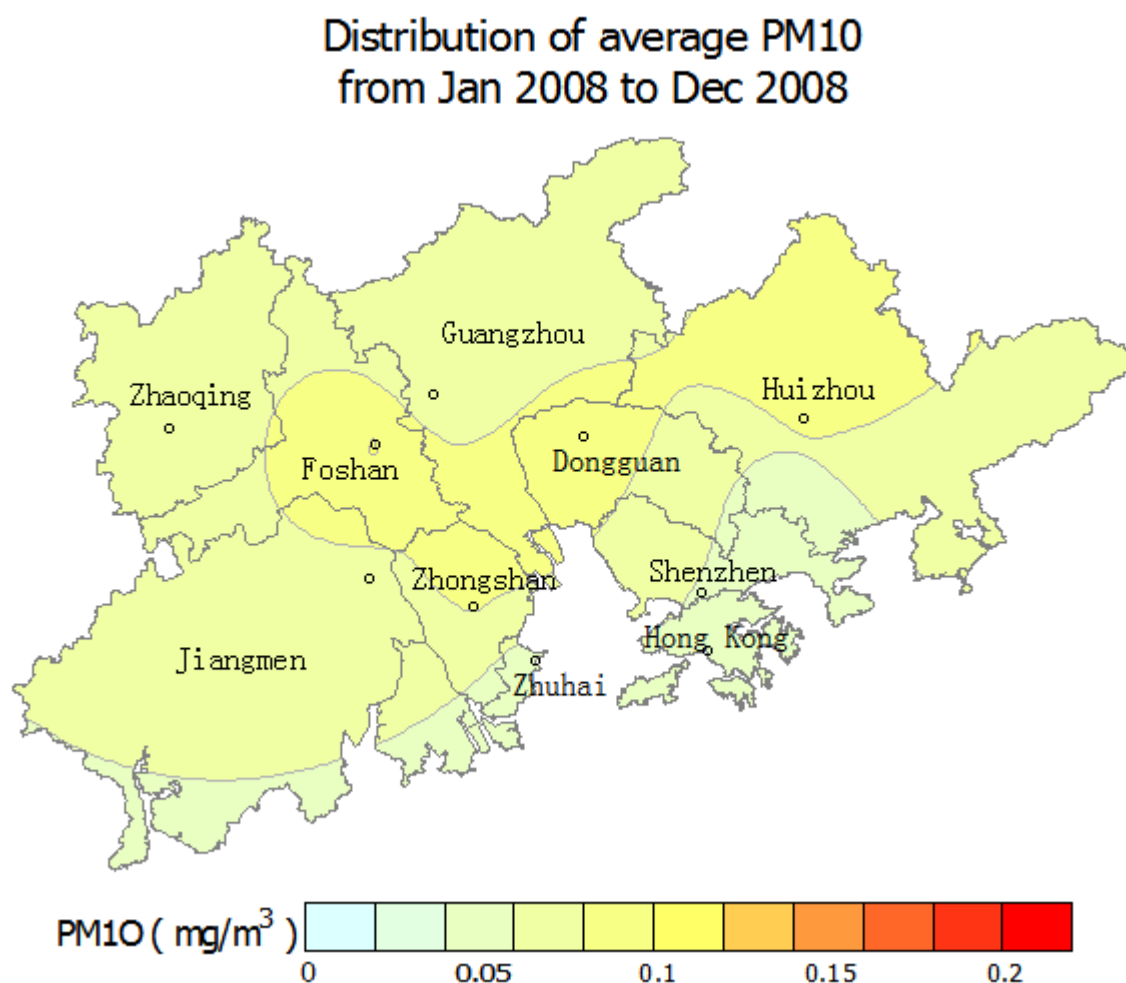


Figure 7 : Spatial distribution of average concentrations of Respirable Suspended Particulates (PM₁₀) in the Network

Table 3.4 a : The monthly maxima and minima of hourly averages of Respirable Suspended Particulates

Monitoring Stations	Mth	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Luhu Park (Guangzhou)	Max	0.264	0.318	0.304	0.222	0.186	0.132	0.175	0.135	0.164	0.174	0.225	0.284
	Min	0.001	0.009	0.008	0.007	0.000	0.000	0.002	0.000	0.001	0.000	0.000	0.038
Wanqingsha (Guangzhou)	Max	0.370	0.404	0.514	0.397	0.329	0.255	0.311	0.254	0.278	0.258	0.266	0.374
	Min	0.015	0.018	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.042
Tianhu (Guangzhou)	Max	0.241	0.230	0.295	0.328	0.230	0.216	0.244	0.179	0.197	0.189	0.148	0.201
	Min	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.003	0.001	0.003	0.002	0.002
Liyuan (Shenzhen)	Max	0.304	0.236	0.258	0.268	0.208	0.299	0.230	0.169	0.180	0.219	0.251	0.292
	Min	0.000	0.001	0.000	0.003	0.000	0.000	0.003	0.000	0.002	0.000	0.013	0.000
Tangjia (Zhuhai)	Max	0.154	0.148	0.188	0.223	0.162	0.078	0.103	0.122	0.156	0.139	0.226	0.271
	Min	0.004	0.003	0.009	0.005	0.005	0.006	0.005	0.000	0.000	0.000	0.001	0.002
Shunde Dangxiao (Foshan)	Max	0.532	0.433	0.345	0.294	0.311	0.180	0.277	0.175	0.286	0.255	0.327	0.464
	Min	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.001
Huijingcheng (Foshan)	Max	0.965	0.641	0.708	0.425	0.334	0.298	0.250	0.225	0.214	0.218	0.296	0.336
	Min	0.007	0.007	0.016	0.007	0.007	0.007	0.007	0.007	0.007	0.010	0.021	0.022
Donghu (Jiangmen)	Max	0.545	0.294	0.415	0.280	0.301	0.169	0.189	0.182	0.220	0.322	0.233	0.351
	Min	0.005	0.000	0.003	0.002	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.024
Chengzhong (Zhaoqing)	Max	0.328	0.249	0.290	0.307	0.232	0.161	0.131	0.153	0.167	0.215	0.235	0.415
	Min	0.005	0.002	0.008	0.002	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
Xiapu (Huizhou)	Max	0.465	0.324	0.379	0.331	0.488	0.222	0.242	0.198	0.324	0.202	0.236	0.392
	Min	0.020	0.019	0.027	0.000	0.000	0.000	0.000	0.000	0.001	0.002	0.002	0.000
Jinguowan (Huizhou)	Max	0.139	0.073	0.144	0.125	0.136	0.102	0.392	0.186	0.220	0.188	0.206	0.227
	Min	0.000	0.000	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010
Haogang (Dongguan) #	Max	0.534	0.245	0.751	0.388	0.247	0.253	0.302	0.243	0.274	0.225	0.236	0.401
	Min	0.000	0.000	0.000	0.005	0.006	0.000	0.000	0.000	0.003	0.004	0.002	0.011
Zimaling Park (Zhongshan)	Max	0.424	0.304	0.340	0.291	0.262	0.184	0.219	0.207	0.491	0.283	0.287	0.411
	Min	0.004	0.004	0.010	0.011	0.006	0.001	0.001	0.001	0.007	0.005	0.005	0.008
Tsuen Wan (HKSAR)	Max	0.205	0.188	0.212	0.148	0.146	0.170	0.207	0.165	0.227	0.160	0.215	0.210
	Min	0.006	0.011	0.007	0.006	0.016	0.010	0.008	0.010	0.011	0.011	0.022	0.021
Tap Mun (HKSAR)	Max	0.198	0.143	0.227	0.226	0.240	0.383	0.321	0.175	0.139	0.123	0.167	0.183
	Min	0.006	0.006	0.005	0.008	0.005	0.005	0.004	0.006	0.009	0.009	0.012	0.035
Tung Chung (HKSAR)	Max	0.251	0.204	0.246	0.256	0.182	0.176	0.189	0.227	0.225	0.170	0.227	0.265
	Min	0.008	0.010	0.006	0.008	0.005	0.004	0.004	0.005	0.008	0.006	0.017	0.024

Table 3.4 b : The monthly maxima and minima of daily averages of Respirable Suspended Particulates

[Class 2 NAAQS (Daily) : 0.15 mg/m3]

Monitoring Stations	Mth	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Exceed-ance Days	Exceed-ance Rate
Luhu Park (Guangzhou)	Max	0.208	0.189	0.214	0.125	0.112	0.069	0.115	0.077	0.103	0.111	0.150	0.184	11	3.35%
	Min	0.015	0.032	0.050	0.017	0.017	0.011	0.015	0.008	0.025	0.021	0.014	0.057		
Wanqingsha (Guangzhou)	Max	0.280	0.206	0.241	0.319	0.191	0.135	0.178	0.074	0.161	0.138	0.187	0.261	43	15.47%
	Min	0.032	0.028	0.059	0.033	0.034	0.019	0.001	0.011	0.026	0.016	0.030	0.061		
Tianhu (Guangzhou)	Max	0.144	0.112	0.170	0.146	0.181	0.133	0.127	0.111	0.102	0.099	0.103	0.122	5	1.52%
	Min	0.005	0.004	0.023	0.017	0.013	0.009	0.018	0.014	0.022	0.023	0.011	0.023		
Liyuan (Shenzhen)	Max	0.150	0.122	0.156	0.180	0.094	0.117	0.144	0.069	0.107	0.106	0.129	0.164	5	1.45%
	Min	0.020	0.015	0.022	0.022	0.010	0.013	0.012	0.013	0.012	0.014	0.032	0.030		
Tangjia (Zhuhai)	Max	0.092	0.109	0.101	0.136	0.078	0.051	0.065	0.051	0.079	0.086	0.138	0.126	0	0.00%
	Min	0.037	0.027	0.032	0.023	0.020	0.020	0.013	0.005	0.010	0.010	0.023	0.051		
Shunde Dangxiao (Foshan)	Max	0.310	0.158	0.161	0.172	0.196	0.095	0.161	0.096	0.147	0.134	0.189	0.278	27	8.68%
	Min	0.024	0.020	0.043	0.033	0.031	0.016	0.026	0.018	0.010	0.051	0.025	0.061		
Huijingcheng (Foshan)	Max	0.589	0.456	0.343	0.255	0.192	0.077	0.125	0.126	0.143	0.124	0.156	0.221	63	19.33%
	Min	0.031	0.029	0.058	0.033	0.029	0.022	0.028	0.023	0.031	0.034	0.041	0.041		
Donghu (Jiangmen)	Max	0.370	0.160	0.221	0.188	0.145	0.069	0.101	0.098	0.141	0.179	0.179	0.194	23	7.08%
	Min	0.025	0.018	0.031	0.028	0.031	0.018	0.023	0.016	0.011	0.011	0.019	0.057		
Chengzhong (Zhaoqing)	Max	0.229	0.193	0.169	0.142	0.152	0.084	0.097	0.074	0.095	0.153	0.143	0.255	20	6.19%
	Min	0.014	0.014	0.021	0.017	0.023	0.003	0.019	0.008	0.019	0.025	0.012	0.019		
Xiapu (Huizhou)	Max	0.264	0.209	0.223	0.200	0.237	0.100	0.124	0.098	0.140	0.148	0.121	0.184	46	14.79%
	Min	0.045	0.042	0.081	0.033	0.011	0.002	0.018	0.011	0.020	0.053	0.030	0.061		
Jinguowan (Huizhou)	Max	0.059	0.058	0.085	0.066	0.081	0.052	0.137	0.085	0.092	0.130	0.114	0.157	1	0.37%
	Min	0.005	0.005	0.043	0.010	0.010	0.003	0.025	0.025	0.022	0.011	0.022	0.049		
Haogang (Dongguan) #	Max	0.308	0.186	0.391	0.245	0.134	0.129	0.157	0.131	0.130	0.129	0.159	0.188	37	11.04%
	Min	0.026	0.039	0.044	0.033	0.034	0.032	0.027	0.020	0.039	0.029	0.029	0.045		
Zimaling Park (Zhongshan)	Max	0.245	0.190	0.204	0.238	0.153	0.082	0.124	0.118	0.162	0.141	0.213	0.251	35	10.90%
	Min	0.018	0.018	0.050	0.027	0.028	0.013	0.021	0.014	0.034	0.028	0.026	0.052		
Tsuen Wan (HKSAR)	Max	0.156	0.145	0.143	0.103	0.081	0.070	0.147	0.066	0.109	0.100	0.129	0.128	1	0.28%
	Min	0.023	0.021	0.031	0.026	0.020	0.023	0.018	0.022	0.026	0.029	0.032	0.045		
Tap Mun (HKSAR)	Max	0.097	0.114	0.156	0.137	0.122	0.147	0.160	0.081	0.094	0.103	0.123	0.141	2	0.57%
	Min	0.016	0.012	0.037	0.022	0.017	0.014	0.016	0.013	0.016	0.019	0.032	0.053		
Tung Chung (HKSAR)	Max	0.159	0.157	0.157	0.158	0.116	0.050	0.118	0.076	0.114	0.092	0.132	0.143	4	1.10%
	Min	0.027	0.026	0.027	0.017	0.010	0.010	0.010	0.013	0.014	0.019	0.029	0.040		

Table 3.4 c : The monthly and annual averages of Respirable Suspended Particulates**[Class 2 NAAQS (Annual) : 0.10 mg/m³]**

Monitoring Stations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual Average
Luhu Park (Guangzhou)	0.067	0.079	0.104	0.061	0.056	0.032	0.043	0.038	0.056	0.067	0.065	0.121	0.065
Wanqingsha (Guangzhou)	0.098*	0.131	0.141	0.115*	0.085	0.037	0.055*	0.031	0.075	0.089	0.094	0.153	0.093
Tianhu (Guangzhou)	0.053	0.069	0.097	0.068	0.071	0.037	0.060	0.058	0.063	0.062	0.048	0.067	0.062
Liyuan (Shenzhen)	0.074	0.073	0.079	0.055	0.047	0.029	0.034	0.029	0.059	0.057	0.074	0.102	0.059
Tangjia (Zhuhai)	0.058	0.060	0.061	0.047	0.040	0.029	0.027	0.022	0.037	0.052	0.067	0.085	0.050
Shunde Dangxiao (Foshan)	0.085	0.082	0.087	0.070	0.072	0.044	0.057	0.048	0.074	0.087	0.092	0.158	0.080
Huijingcheng (Foshan)	0.188	0.174	0.173	0.113	0.074	0.045	0.056	0.054	0.081	0.077	0.089	0.134	0.103
Donghu (Jiangmen)	0.110	0.096	0.087	0.069	0.068	0.035	0.041	0.040	0.075	0.077	0.071	0.119	0.075
Chengzhong (Zhaoqing)	0.081	0.084	0.088	0.068	0.061	0.032	0.041	0.034	0.050	0.070	0.068	0.120	0.066
Xiapu (Huizhou)	0.126	0.126*	0.164	0.106	0.070	0.031	0.050	0.047	0.074	0.082	0.079	0.133	0.091
Jinguowan (Huizhou)	0.029	0.038	0.056*	0.029	0.032	0.016	0.047	0.041*	0.061*	0.061	0.063	0.082	0.045
Haogang (Dongguan) #	0.107	0.099	0.159	0.084	0.083	0.052	0.055	0.060	0.081	0.088	0.085	0.131	0.090
Zimaling Park (Zhongshan)	0.094	0.106	0.108	0.064	0.057	0.031	0.044	0.037	0.092	0.085	0.110	0.142	0.082
Tsuen Wan (HKSAR)	0.069	0.078	0.076	0.049	0.046	0.033	0.038	0.035	0.057	0.062	0.066	0.080	0.057
Tap Mun (HKSAR)	0.061	0.079	0.085	0.055	0.053	0.027	0.032	0.027	0.049	0.062	0.063	0.088	0.057
Tung Chung (HKSAR)	0.074	0.086	0.078	0.050	0.048	0.020	0.026	0.025	0.057	0.056	0.068	0.092	0.057

Remark : 1. All concentration units are in milligrams per cubic metre.

2. “*”denotes that the data capture rate does not meet the minimum requirements for determining a representative value.

3.5 Monthly Variations of Pollutant Concentrations

Figure 8 shows the monthly variations of the major pollutants (SO_2 , NO_2 , O_3 , and PM_{10}) recorded by the Network in 2008. The overall concentrations of SO_2 , NO_2 and PM_{10} were generally higher during the periods from January to March and October to December. Levels of these pollutants were lower from June to August due to the heavier rainfall and higher mixing layer height in these summer months, which favoured the dispersion of pollutants. The relatively clean maritime air stream prevailed in the PRD region under the influence of southern monsoon also accounts for a lower level of pollution in summer time. As for ozone, the highest monthly averages occurred in October because it was relatively sunny and calm that favoured the formation and accumulation of ozone in the month. That notwithstanding, the monthly variations in concentrations of pollutants may change from year to year. Long-term monitoring is thus required before a general pattern can be established.

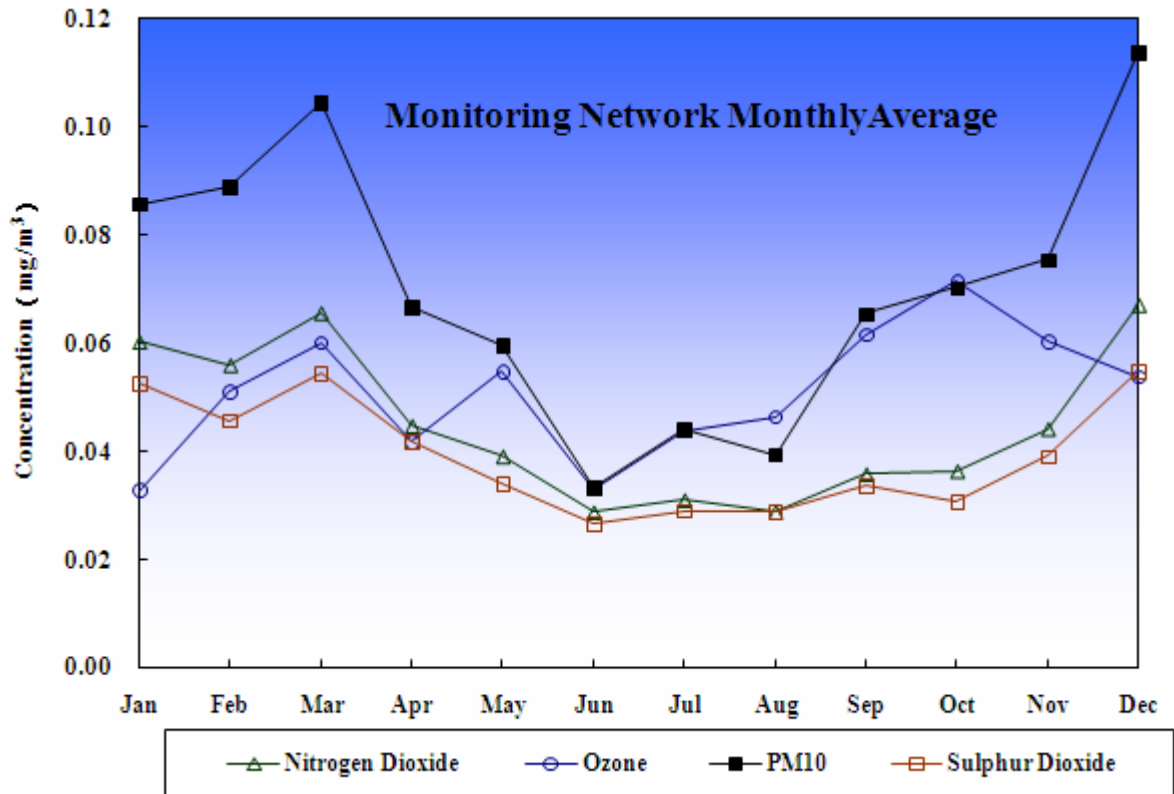


Figure 8 : Monthly variations of average pollutant concentrations measured by the Network

3.6 Annual Variations of Pollutant Concentrations (2006-2008)

Table 3.6 a shows the annual averages variations of the major pollutants (SO₂, NO₂, O₃, and PM₁₀) recorded by the Network from 2006 to 2008. As compared to 2007, the overall air quality in PRD region has shown improvement in 2008. The overall annual averages of SO₂ and PM₁₀ decreased by 19% and 11% respectively in 2008 as compared with 2007. The overall annual averages of NO₂, and O₃ remained the same between the 2 years. The Hong Kong and Guangdong governments will continue to implement control measures to further improve the air quality in the region.

Table 3.6 a : Annual averages of the pollutants from the monitoring network

	Sulphur Dioxide	Nitrogen Dioxide	Ozone	Respirable Suspended Particulates
2006	0.047	0.046	0.048	0.074
2007	0.048	0.045	0.051	0.079
2008	0.039	0.045	0.051	0.070

Remark : 1. All concentration units are in milligrams per cubic metre.

4. Statistical Analysis of the Regional Air Quality Index (RAQI)

The two governments of Guangdong and HKSAR jointly started reporting the RAQI since 30 November 2005 to provide the public with information about the air quality in different parts of the PRD region.

The RAQI is a composite indicator of the aggregate level of the four major regional air pollutants, namely sulphur dioxide (SO₂), nitrogen dioxide (NO₂), ozone (O₃) and respirable suspended particulates (PM₁₀). The higher the index value, the higher the regional air pollution levels. The RAQI is divided into the following five grades:

Grade	Regional Air Quality Index (RAQI) value [#]	Air Quality Condition in the Monitored Area
I	0 – 1	Concentrations of all pollutants are well within Class 2 of the National Ambient Air Quality Standards (NAAQS)
II	1 – 2	Concentrations of all pollutants are generally within Class 2 NAAQS
III	2 – 3	Concentrations of individual pollutants may approach or exceed Class 2 NAAQS
IV	3 – 4	Class 2 NAAQS are generally exceeded
V	>4	Class 2 NAAQS are significantly exceeded

The formula for calculating the RAQI is as follows:

$$I_c = \sum_{i=1}^4 \frac{C_i}{R_i}$$

where I_c stands for the RAQI, an indicator of the aggregate pollution level of four pollutants, namely, SO₂, NO₂, PM₁₀ and O₃. For SO₂, NO₂ and PM₁₀, C_i is the daily average concentration while R_i represents the daily average concentration limits of the corresponding pollutants as specified in Class 2 NAAQS. For O₃, C_i is the highest hourly average of a day while R_i represents the hourly average concentration limit in Class 2 NAAQS (refer to Class 2 NAAQS (GB 3095 – 1996) revised version).

[#] The upper limits of the range of Grades I, II, III and IV of the RAQI are inclusive.

4.1 Statistics on RAQI Grades

Table 4.1a summarise the statistics on the RAQI grades and effective days of RAQI for all monitoring stations in the Network from January to December 2008.

Table 4.1 a : Statistics on RAQI grades of individual monitoring stations

Monitoring Stations	District	Days with valid RAQI	Ratio of valid RAQI	Distribution of RAQI grades in 2008 (%)				
				Grade I	Grade II	Grade III	Grade IV	Grade V
Luhu Park	Guangzhou	313	86%	15.02	55.27	24.28	4.15	1.28
Wanqingsha	Guangzhou	336	92%	19.64	32.44	29.46	14.29	4.17
Tianhu	Guangzhou	321	88%	25.55	58.57	13.08	2.80	0.00
Liyuan	Shenzhen	341	93%	31.38	51.32	14.96	2.35	0.00
Tangjia	Zhuhai	310	85%	32.58	39.35	21.94	6.13	0.00
Shunde Dangxiao	Foshan	315	86%	11.75	43.81	28.25	12.38	3.81
Huijingcheng	Foshan	328	90%	12.20	46.34	27.74	7.32	6.40
Donghu	Jiangmen	336	92%	30.36	37.80	24.70	5.36	1.79
Chengzhong	Zhaoqing	318	87%	16.04	46.23	27.36	7.23	3.14
Xiapu	Huizhou	327	89%	19.57	55.96	21.10	3.36	0.00
Jinguowan	Huizhou	295	81%	37.63	54.92	7.12	0.34	0.00
Haogang	Dongguan	329	90%	8.51	47.11	30.40	10.64	3.34
Zimaling Park	Zhongshan	317	87%	23.34	34.70	28.08	11.99	1.89
Tsuen Wan	HKSAR	326	89%	18.10	64.11	17.18	0.61	0.00
Tap Mun	HKSAR	333	91%	37.24	57.66	4.50	0.30	0.30
Tung Chung	HKSAR	331	90%	33.84	39.88	21.75	4.53	0.00

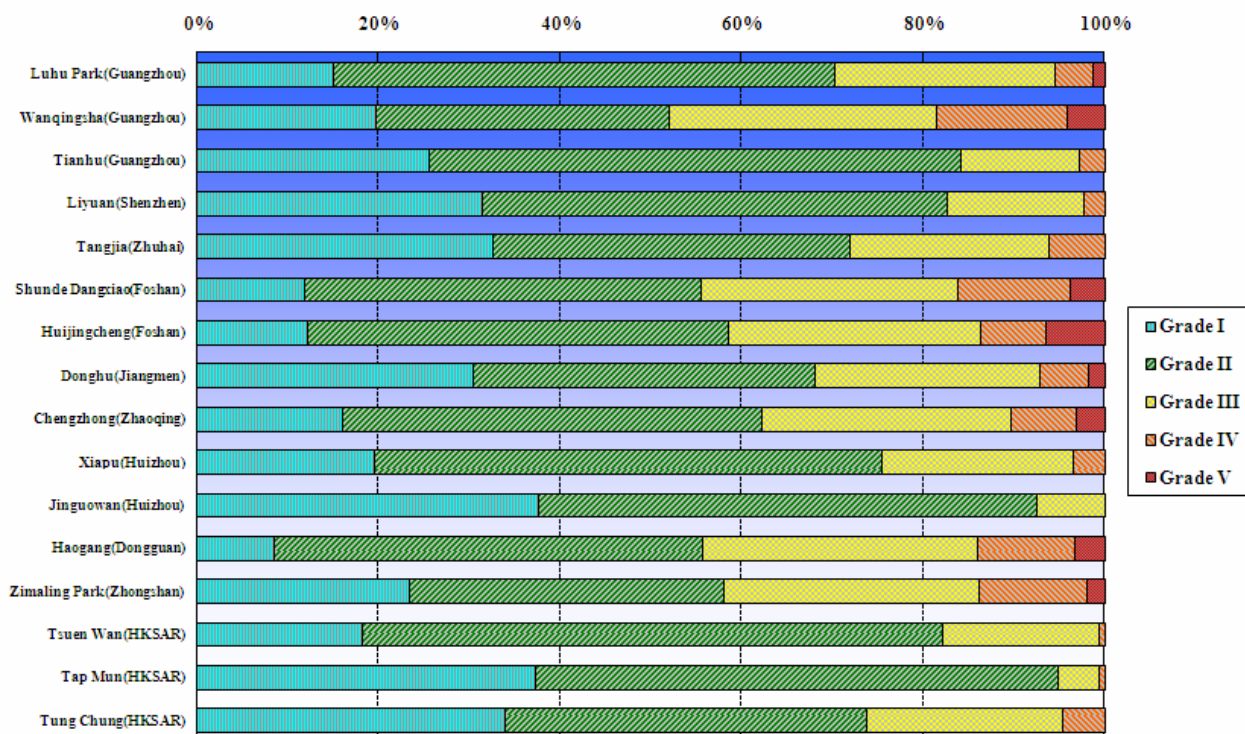


Figure 9 : Stacked column chart of RAQI grades of individual monitoring stations

Distribution of RAQI Grades (Jan - Dec 2008)

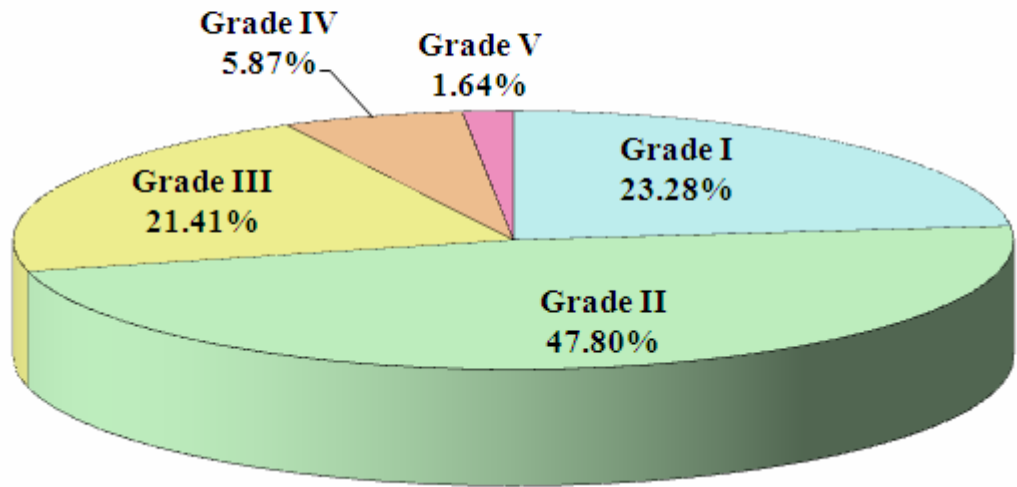


Figure 10 : Distribution of RAQI grades in the Network

Figure 10 shows the overall distribution of different RAQI grades recorded by the Network in 2008. As a whole, 71.08% of the RAQI values are at Grade I or II, meaning the pollutant concentrations are within Class 2 NAAQS, followed by 21.41% in Grade III, 5.87% at Grade IV and 1.64% in Grade V.

4.2 Spatial Distribution of Average RAQI Grades

Distribution of average RAQI from Jan 2008 to Dec 2008

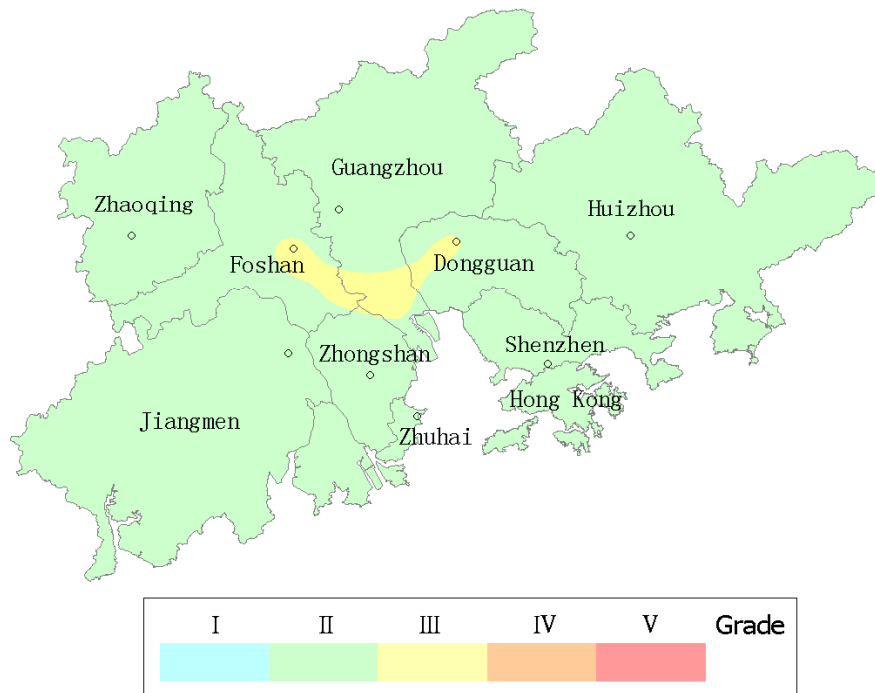


Figure 11 : Spatial distribution of average RAQI grades in the Network

Figure 11 shows the spatial distribution of RAQI annual average grades in 2008. It can be seen that the average RAQI values measured in most parts of the PRD region were at Grade II while the average values in the middle part of the region were at Grade III. Average RAQI values measured at individual monitoring stations in the Network are shown in Figure 12

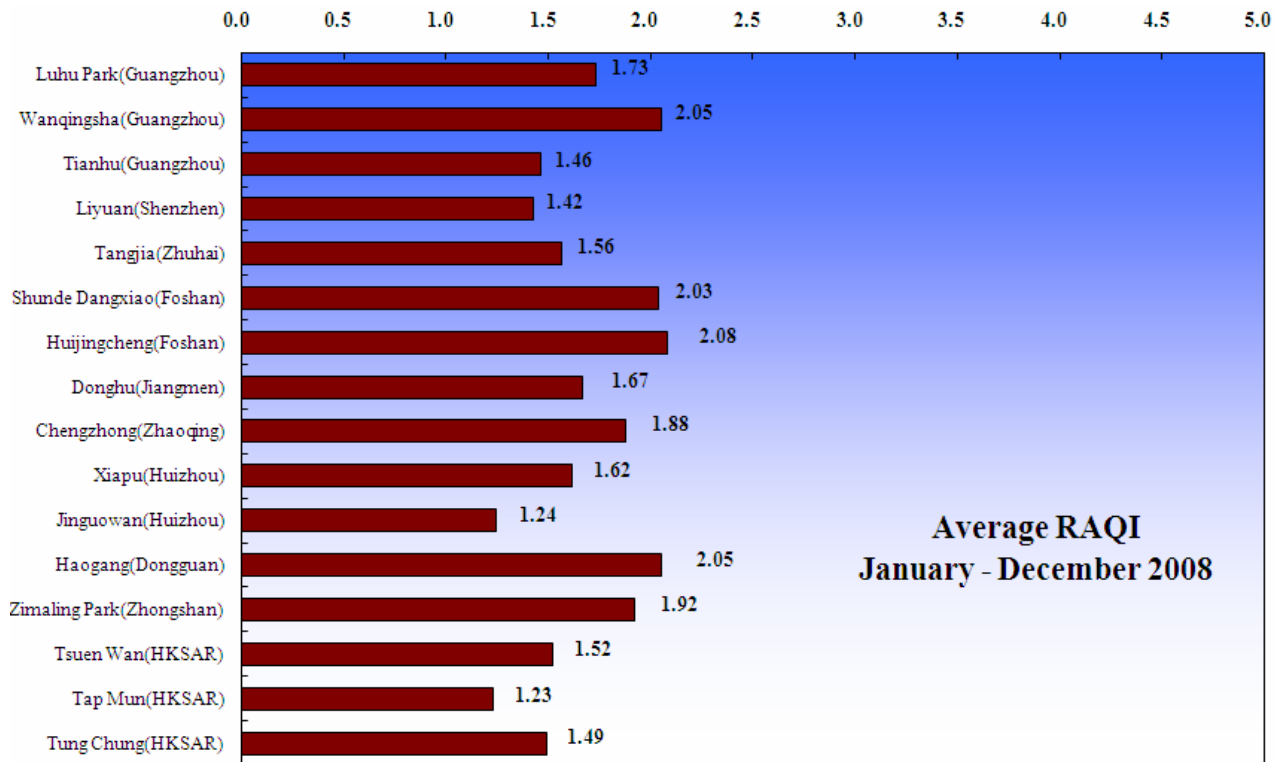


Figure 12 : The average RAQI of individual monitoring stations

4.3 Monthly Variations of Average RAQI

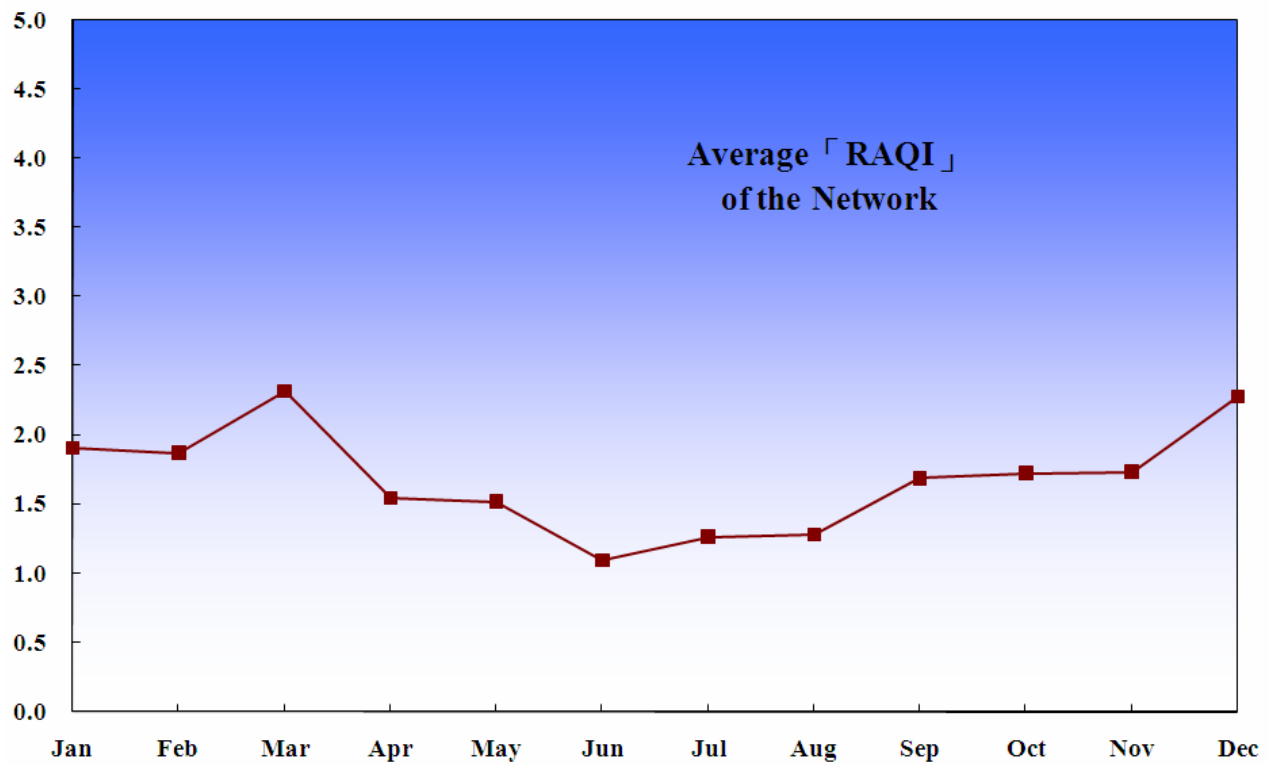


Figure 13 : Monthly variations in average RAQI

Figure 13 shows the monthly variations in the average RAQI values of the Network from January to December 2008. Except for March and December where the average RAQI values reached the Grade III level, the values in other months were within the Grade II category. The maximum and minimum RAQI values were recorded in March and June respectively.

Annex A : Site Information of Monitoring Stations

Monitoring Stations	Address	Area Type	Sampling Height (Above P.D.)	Above Ground	Date Commenced Operation
Luhu Park (Guangzhou)	Inside Jufong Garden of Luhu Park (Big yard, No. 11 Luhu Park)	City	30m	9m	1993
Wanqingsha (Guangzhou)	Wanqingsha Secondary School, Nansha	Mixed educational/commercial and residential/industrial	13m	12m	Oct 2004
Tianhu (Guangzhou)	Tianhu Park, Conghua City	Background : rural	251m	13m	Oct 2004
Liyuan (Shenzhen)	Shennan Zhong Road, Shenzhen City	City	38m	12m	Sep 1997
Tangjia (Zhuhai)	Building No. 1, Rong Yuan, Zhongshan University, Tangjia, Zhuhai City	Mixed educational/commercial and residential/industrial	24m	19m	Jan 2003
Shunde Dangxiao (Foshan) (or named Shunde Jinjuzui)	Roof-top of Educational Building, Foshan City Communist Party Shunde Jinjuzui	Tourist and cultural/educational	27m	17m	Oct 1999
Huijingcheng (Foshan)	No. 127, Fenjiang Nan Road, Chancheng Area	Urban: mixed residential/commercial/industrial	24m	14m	Feb 2000
Donghu (Jiangmen)	Inside Donghu Park, Jiangmen City	City	17.5m	5m	Nov 2001
Chengzhong (Zhaoqing)	No. 17, Qintian Road, Zhaoqing City	Urban: mixed residential/commercial	21m	16m	Jun 2001
Xiapu (Huizhou)	No. 4 Xiabuhengjiang Road No. 3, Huicheng Area	Urban: commercial	49m	20m	Dec 1999
Jinguowan (Huizhou)	Jinguowan Ecological Farm, Huizhou City	Residential	77m	8m	Oct 2004
Haogang (Dongguan)	Haogang Primary School, NanchengQu, Dongguan City	Mixed residential/commercial/industrial	18 m	14m	1998
Zimaling Park (Zhongshan)	Zimaling Park, Zhongshan City	Mixed residential/commercial	45 m	7m	Aug 2002
Tsuen Wan (HKSAR)	60 Tai Ho Road, Tsuen Wan	Urban: mixed residential/commercial/industrial	21m	17m	Aug 1988
Tap Mun (HKSAR)	Tap Mun Police Station	Background: rural	26m	11m	Apr 1998
Tung Chung (HKSAR)	6 Fu Tung Street, Tung Chung	New Town: residential	34.5m	27.5m	Apr 1999

Annex B : Measurement Methods of Air Pollutant Concentration

Pollutants	Measuring Principles
Sulphur Dioxide	UV fluorescence / Differential Optical Absorption Spectroscopy
Nitrogen Dioxide	Chemiluminescence / Differential Optical Absorption Spectroscopy
Ozone	UV absorption / Differential Optical Absorption Spectroscopy
Respirable Suspended Particulates	Oscillating microbalance (TEOM) Beta particulate monitor