HKUST
環境研究所
INSTITUTE FOR THE ENVIRONMENT

RAQM-5 Hong Kong Forum

Opportunities in the Greater Bay Area – Regional Collaboration & Exposure Management Breakthrough

The 5th International Symposium on Regional Air Quality Improvement in Rapidly Developing Economic Regions

Theme: Air Quality in China – Past, Past and Future

Air Quality in Hong Kong
Past, Present and Future

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The Hong Kong University of Science and Technology

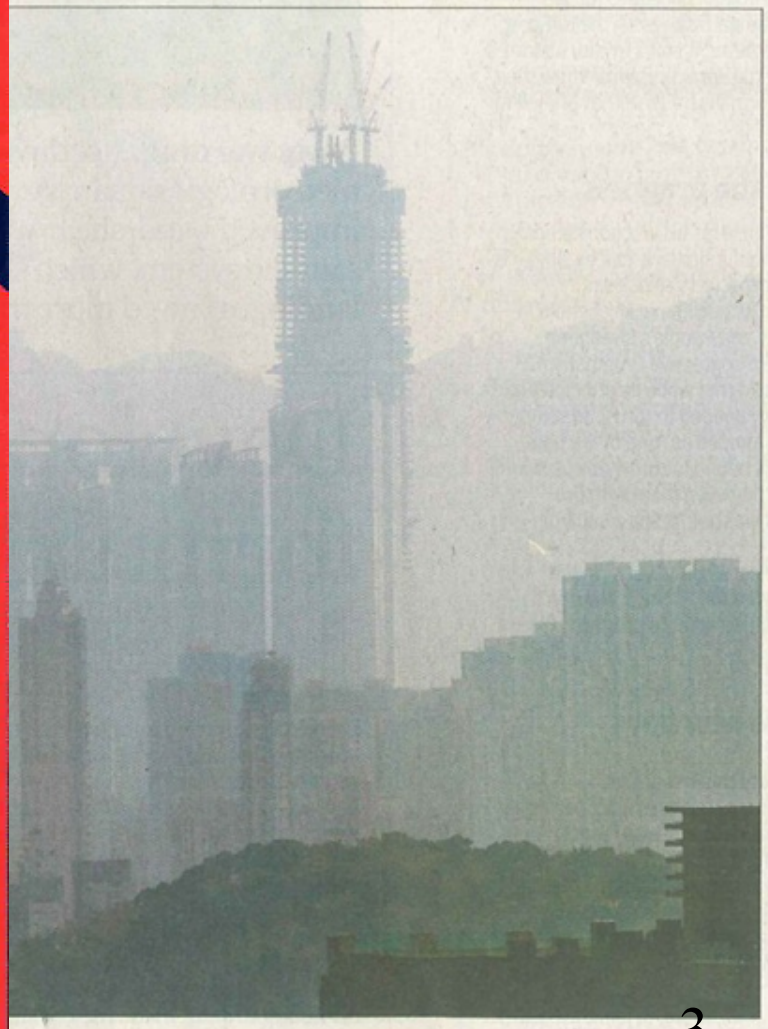
Hong Kong Regional Air Quality Forum

2017.11.20

South China Morning Post

SINCE 1903 | VOLUME LXIV | NO. 62

Tuesday, March 4, 2008 南華早報 see live updates at www.scmp.com HK $7



Impaired vision. Smog shrouds West Kowloon and Hong Kong Island in this view from Kowloon Tong, as the city choked on the heaviest pollution so far this year. The Air Pollution Index hit 154 in Central. The tallest buildings seen through the haze are (from left) Langham Place, a fuzzy Two IFC, The Waterfront, Sorrento and the partially built International Commerce Centre.

Photo: David Wong

Full report A3

Health Costs of Air Pollution in Hong Kong

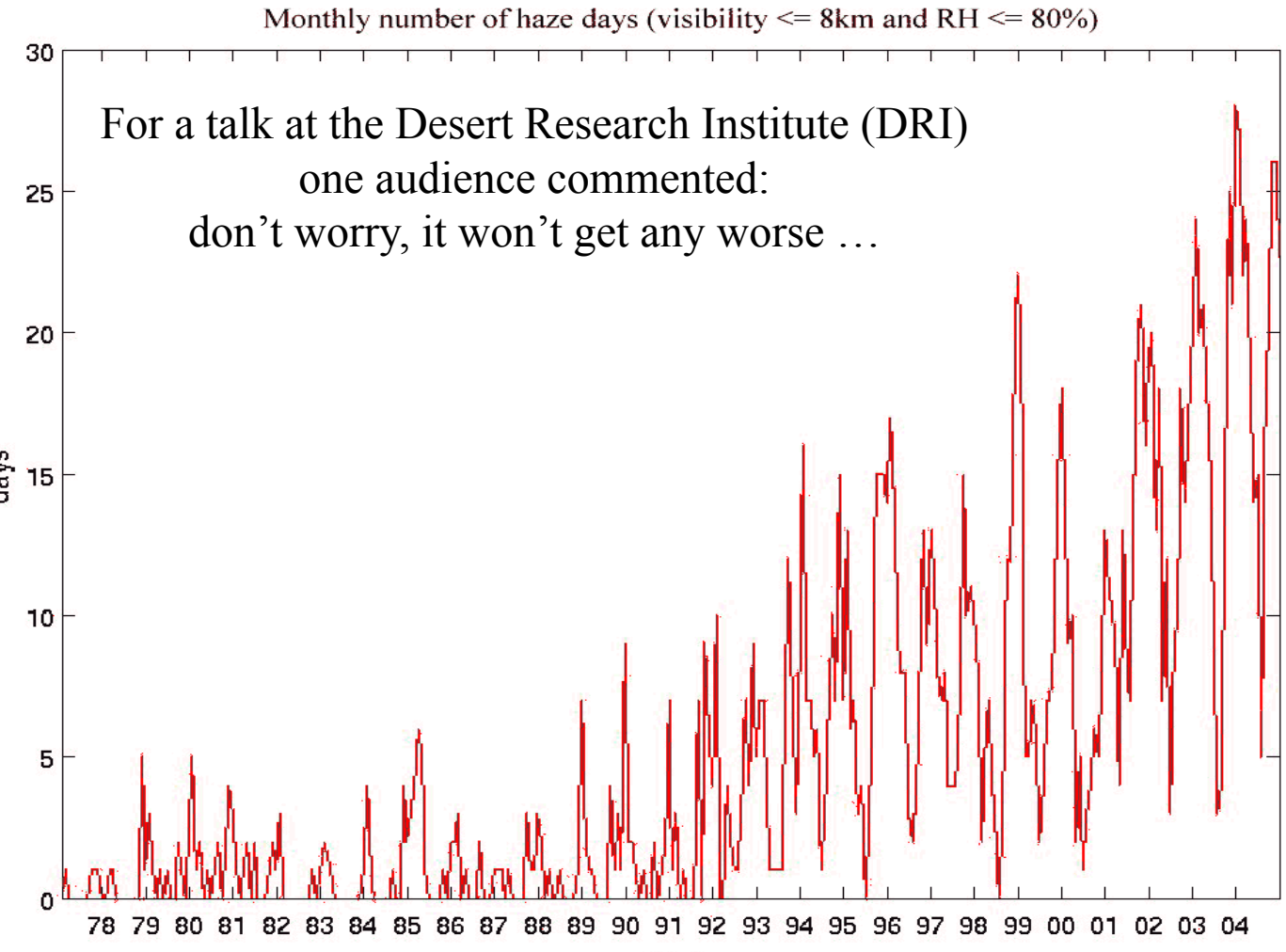
Five avoidable numbers to remember

200%	***Daily* Air pollutant concentrations** are now 200% higher than the World Health Organization Guidelines (2006) 24 hr Levels (Should not be exceeded more than 2 or 3 times annually)
6,800,000	**Family doctor** visits each year for respiratory problems.
64,000	**Hospital bed-days a year**, mostly for heart, lung and blood vessel diseases.
1,600	**Deaths** a year, mostly from heart attacks, stroke, pneumonia and other lung diseases.
20 billion	**Value of the direct benefits** of air quality improvement would be more than $20 billion a year.

(HKU, CUHK, HKUST, Civic Exchange Report, 2006)

***The above does not include indirect costs (Tourism, Business, Talent and long-term competitiveness) which are several times larger!**

Reports of Hazy Days (199701-200412)

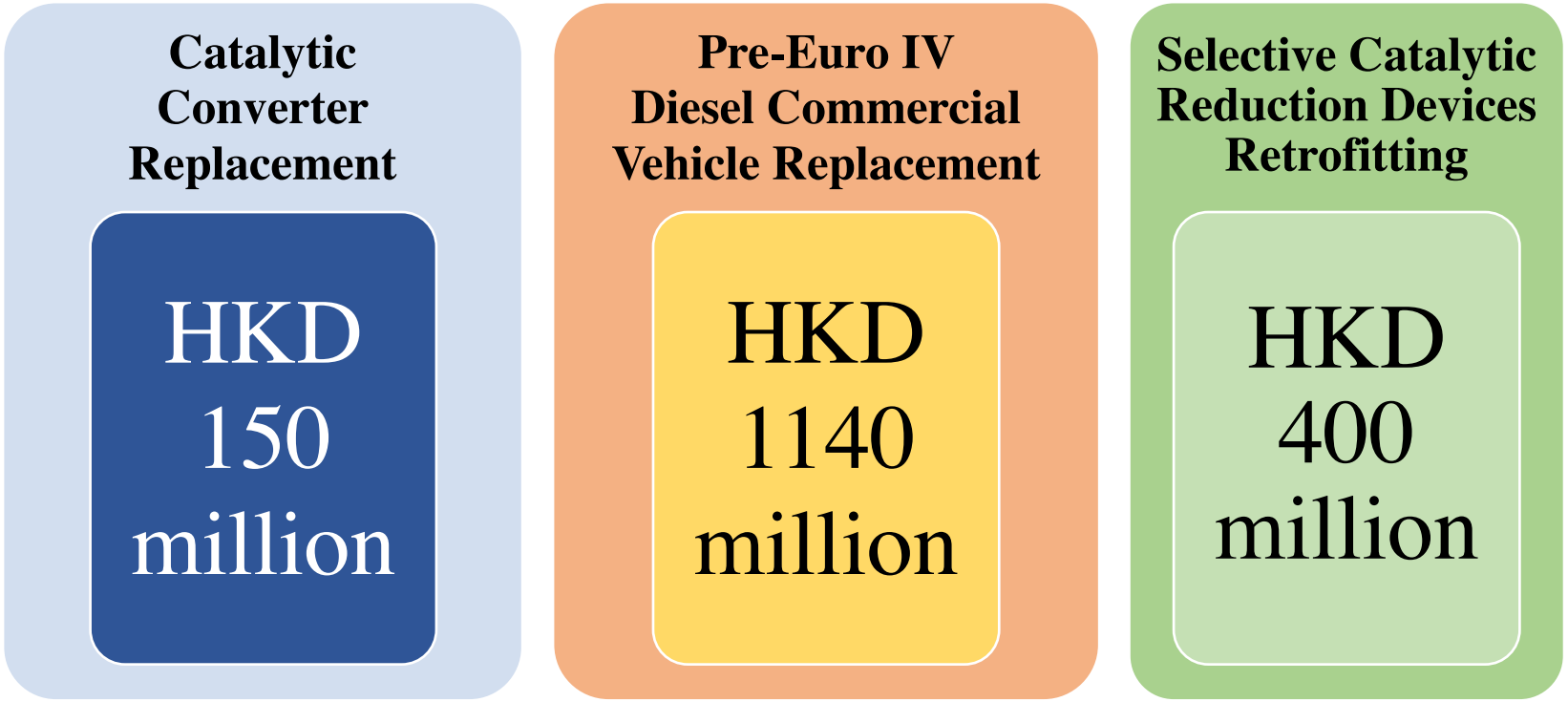


Source: HKUST

HK Air Quality Objectives (current)

µg/m3	空氣質素指標 HK AQOs (2014)		WHO Interim Targets			WHO
			IT-1	IT-2	IT-3	AQGs
二氧化硫 SO_2	10-min	500	--			500
	24-hr	125	125	50		20
可吸入懸浮粒子 RSP(PM_{10})	24-hr	100	150	100	75	50
	Annual	50	70	50	30	20
微細懸浮粒子 FSP ($PM_{2.5}$)	24-hr	75	75	50	37.5	25
	Annual	35	35	25	15	10
二氧化氮 NO_2	1-hr	200	--			200
	Annual	40	--			40
一氧化碳CO	1-hr	30,000	--			30,000
	8-hr	10,000	--			10,000
臭氧O_3	8-hr	160	160			100

Recent Vehicle Emission Controls in Hong Kong (2013-2019: 1.2 billion HKD)



Significant controls also introduced for power and marine emissions

Conclusion for Policy Makers

$PM_{2.5}$	Roadside	Ambient
Observed Concentration Changes	**-10.7±2.4**	**-6.7±1.8**
Conc. change due to wind changes	**-1.1±0.4**	**-0.3±0.2**
Conc. change NOT related to wind changes	**-10.7±1.6**	**-6.7±1.2**
Conc. change due to Control Policies	**-4.5±0.8**	**-2.8±0.1**
Catalytic Converter Replacement (15%)	-0.7±0.1	-0.4±0.4
Pre-Euro IV DCVs Replacement (76%)	-3.5±0.6	-2.2±0.0
SCR retrofit (9%)	-0.4±0.1	-0.3±0.5
Non-local changes	**-4.7±2.7**	

PM_{10}	Roadside	Ambient
Observed Concentration Changes	**-15.4±4.8**	**-9.9± 2.6**
Conc. change due to wind changes	**-0.9±0.3**	**-0.6±0.2**
Conc. change NOT related to wind changes	**-15.4±3.4**	**-9.9±1.9**
Conc. change due to Control Policies	**-6.8±1.4**	**-4.36±0.9**
Catalytic Converter Replacement (12%)	-0.79±0.2	-0.51±0.1
Pre-Euro IV DCVs Replacement (80%)	-5.41±1.2	-3.47±0.7
SCR retrofit (9%)	-0.59±0.1	-0.38±0.1
Non-local changes	**-6.6±5.6**	

排放量的轉變
Change in emission between 2010 and 2015

污染物 Pollutant	2010排放量 Emission (公噸Tonnes)	2015排放量 Emission (公噸Tonnes)	排放量的轉變 Change in Emission 2010-2015
SO_2	35,490	19,540	**-45.0 %**
NOx	108,500	91,700	**-15.5 %**
RSP	6,750	5,430	**-19.6 %**
FSP	5,330	4,300	**-19.3 %**
VOC	31,560	26,610	**-15.7 %**
CO	87,820	58,150	**-33.8 %**

Source: HKEPD

Figure 1: SO_2 long term trend

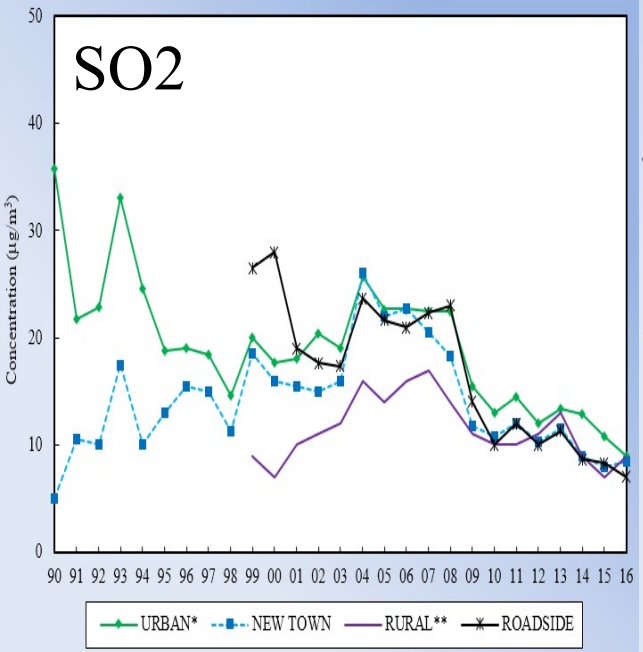


Figure 4: O_3 long term trend

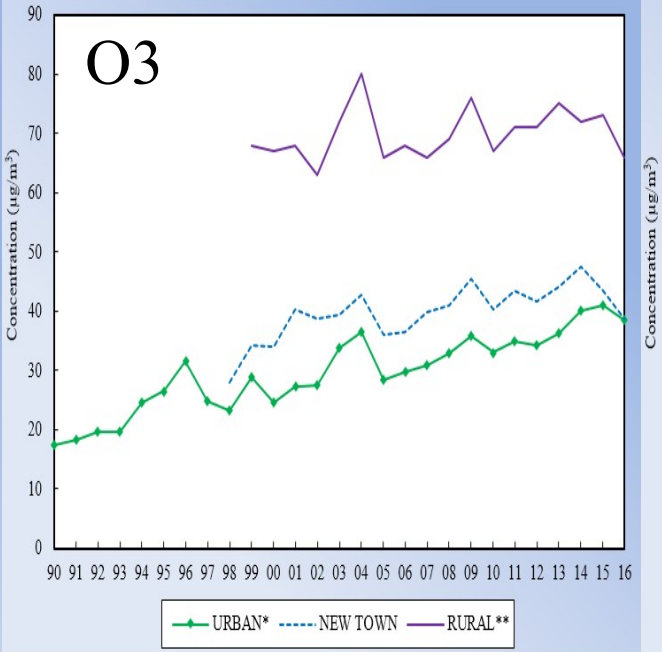


Figure 6: NO_2 long term trend

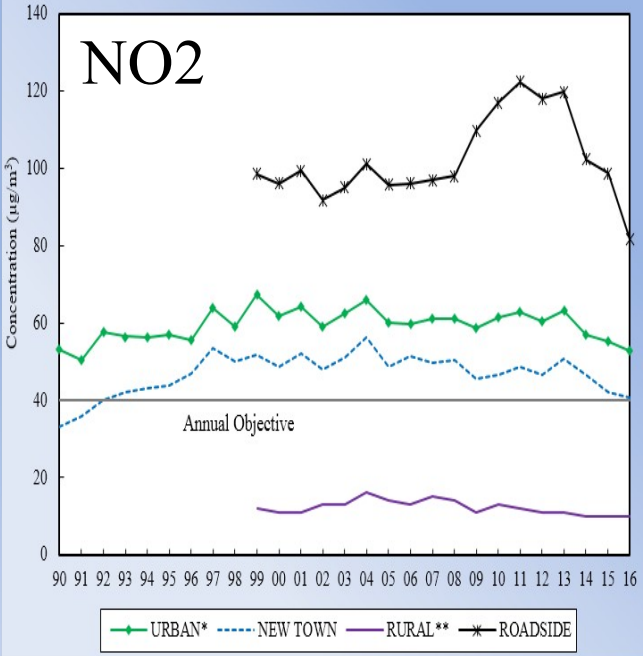


Figure 2: RSP long term trend

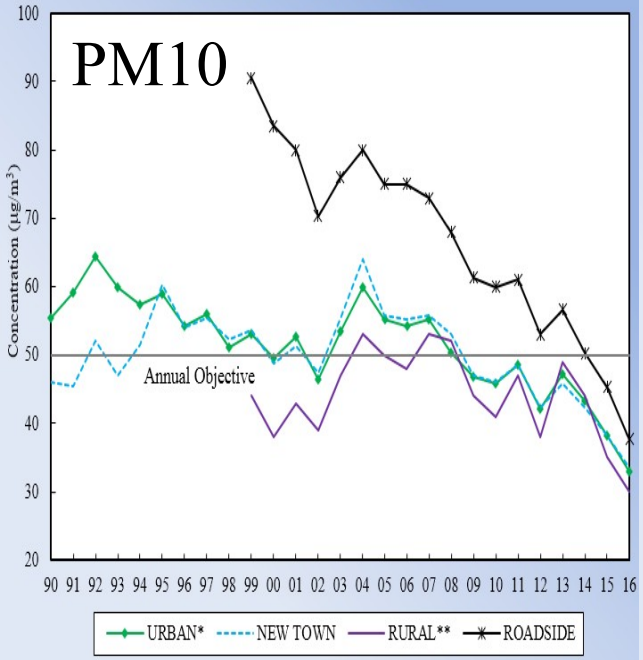


Figure 7: CO long term trend

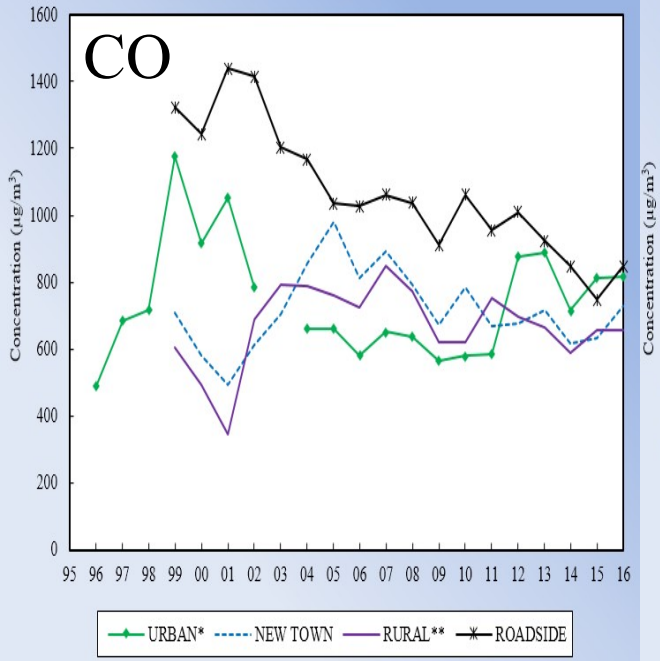
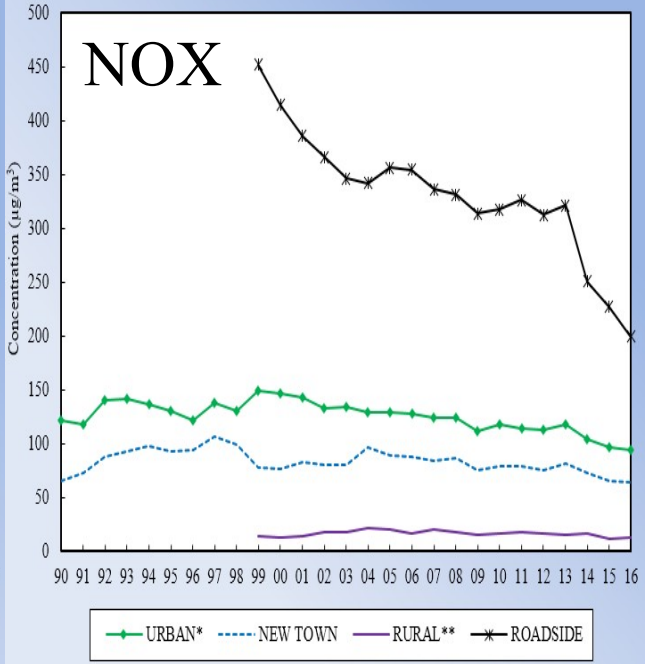
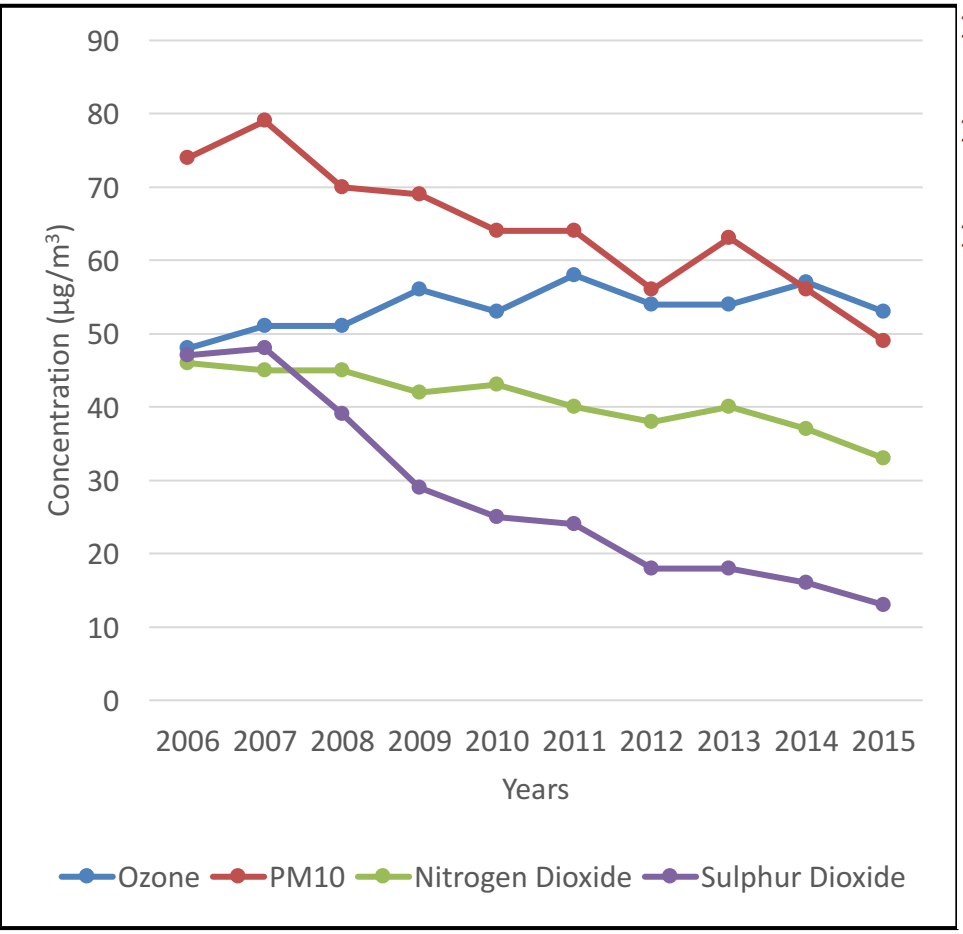
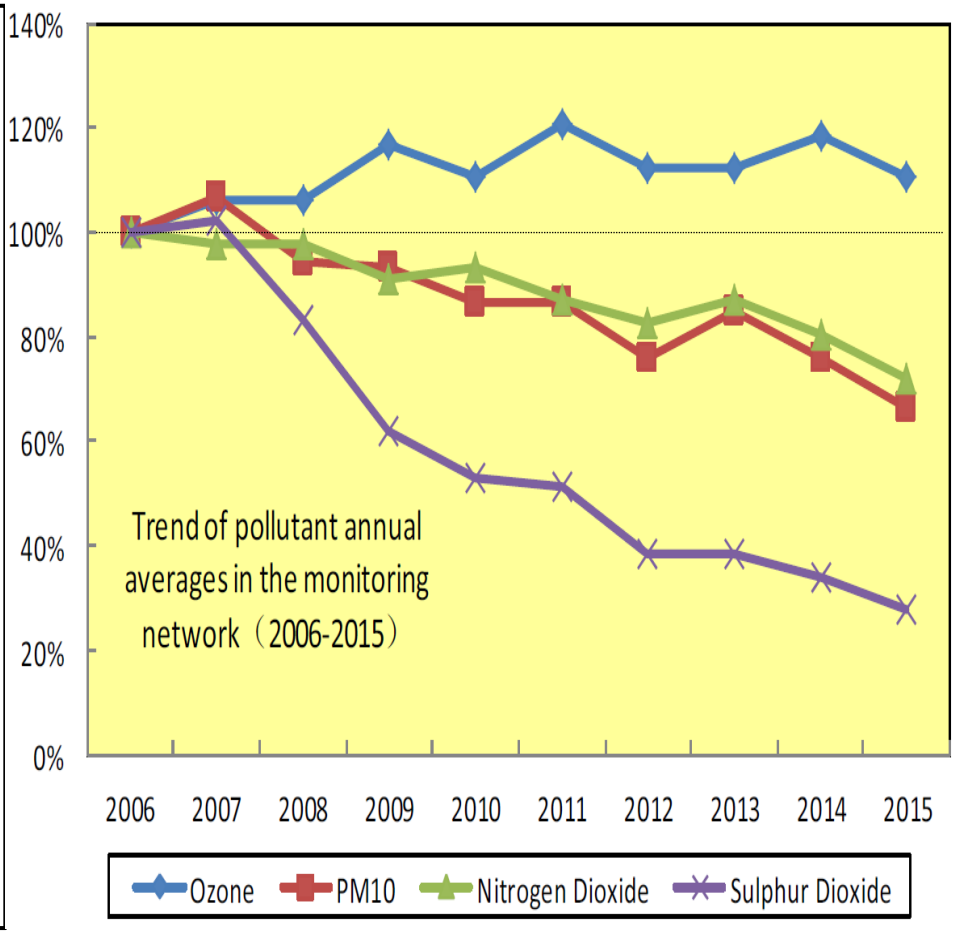


Figure 5: NOx long term trend



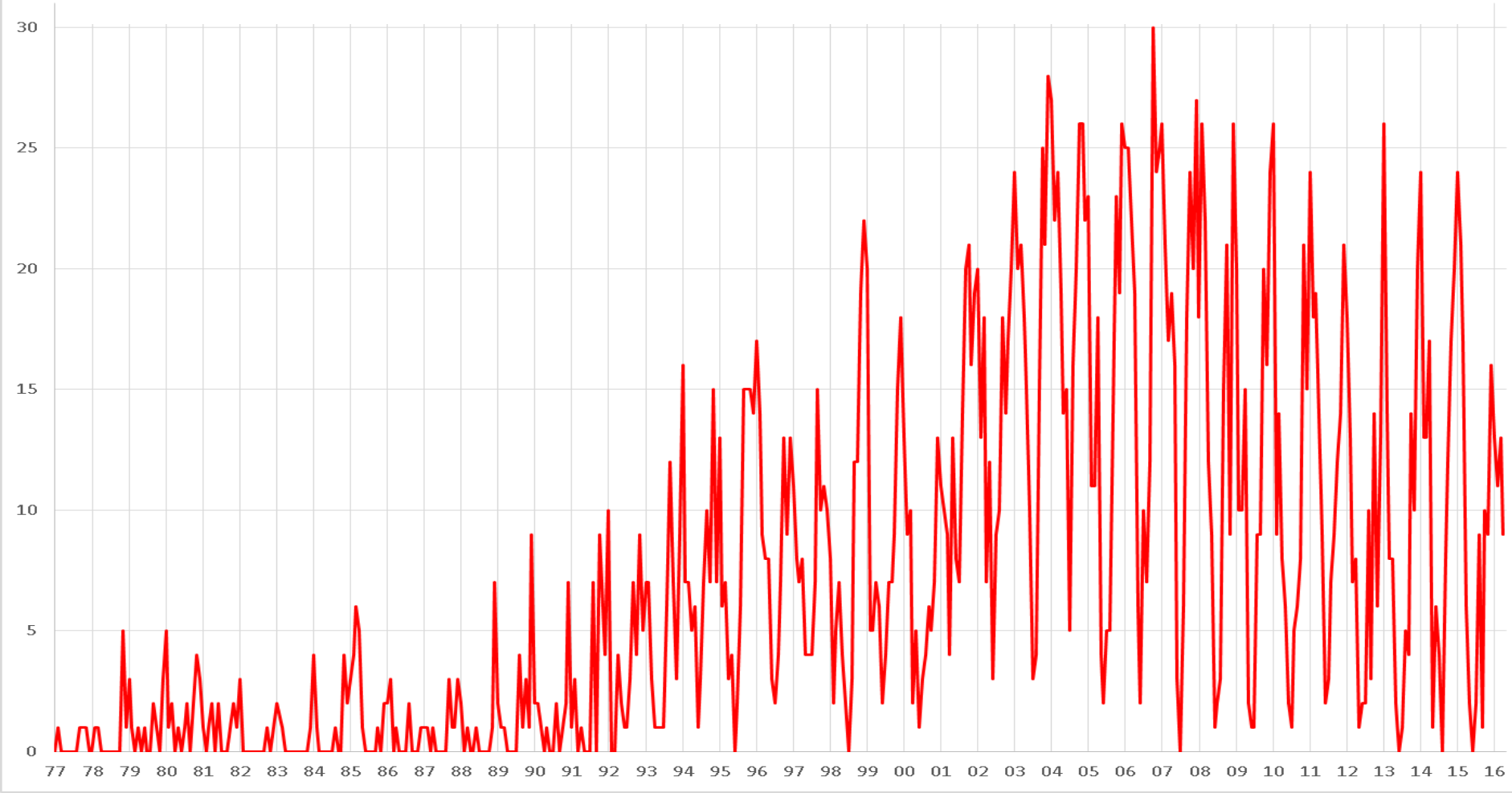
珠江三角洲監測網絡污染物濃度年平均值趨勢
Annual Average of Air Pollutants in the Pearl River Delta Monitoring Network



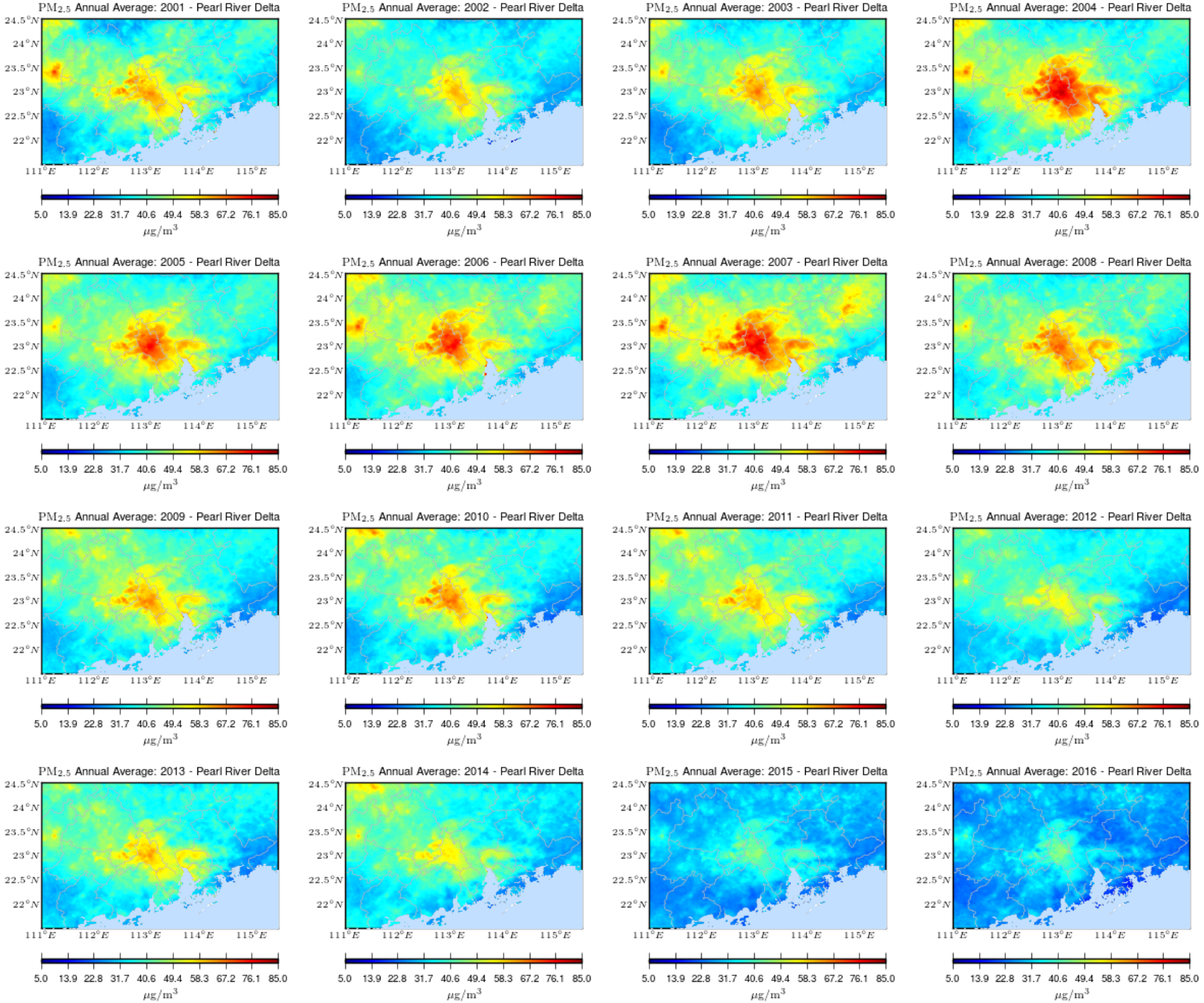


Source: HKEPD

Reports of Hazy Days (199701-201604)



Source: HKUST


PM2.5 Annual Average: 2001 - Pearl River Delta
PM2.5 Annual Average: 2002 - Pearl River Delta
PM2.5 Annual Average: 2003 - Pearl River Delta
PM2.5 Annual Average: 2004 - Pearl River Delta
PM2.5 Annual Average: 2005 - Pearl River Delta
PM2.5 Annual Average: 2006 - Pearl River Delta
PM2.5 Annual Average: 2007 - Pearl River Delta
PM2.5 Annual Average: 2008 - Pearl River Delta
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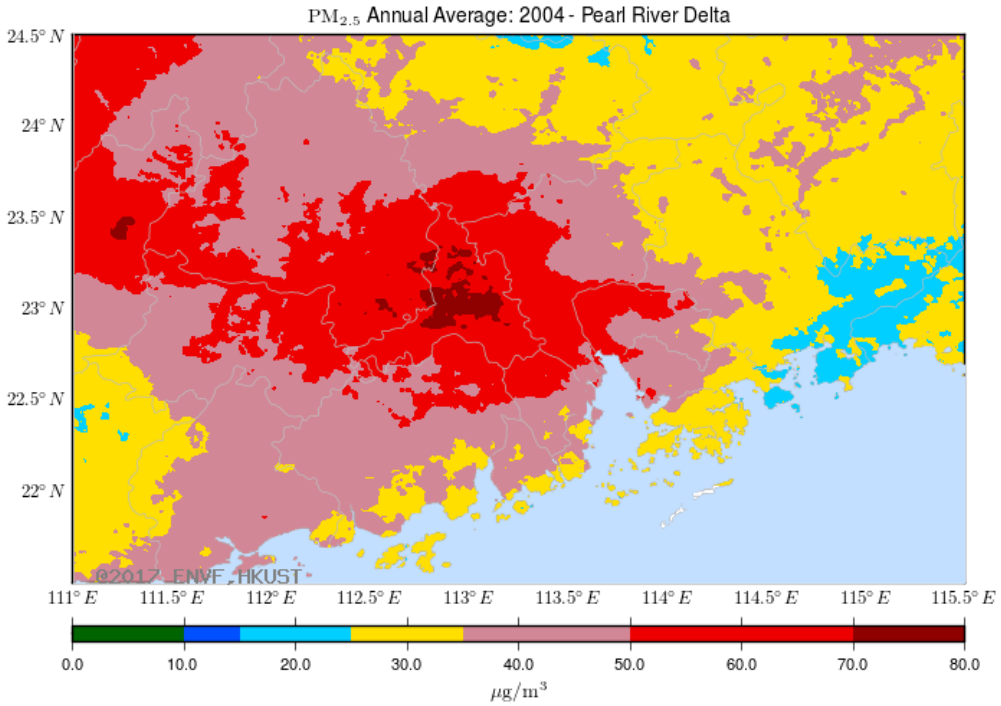
PM2.5 Annual Average: 2010 - Pearl River Delta
PM2.5 Annual Average: 2011 - Pearl River Delta
PM2.5 Annual Average: 2012 - Pearl River Delta
PM2.5 Annual Average: 2013 - Pearl River Delta
PM2.5 Annual Average: 2014 - Pearl River Delta
PM2.5 Annual Average: 2015 - Pearl River Delta
PM2.5 Annual Average: 2016 - Pearl River Delta
24.5°N
24°N
23.5°N
23°N
22.5°N
22°N
111°E
112°E
113°E
114°E
115°E
5.0 13.9 22.8 31.7 40.6 49.4 58.3 67.2 76.1 85.0
μg/m3

2004 PRD $PM_{2.5}$



Dark Red: $c > 70\ \mu g/m^3$ (more than double WHO IT1)

Red: $50 < c \leq 70\ \mu g/m^3$ (way above WHO IT1)

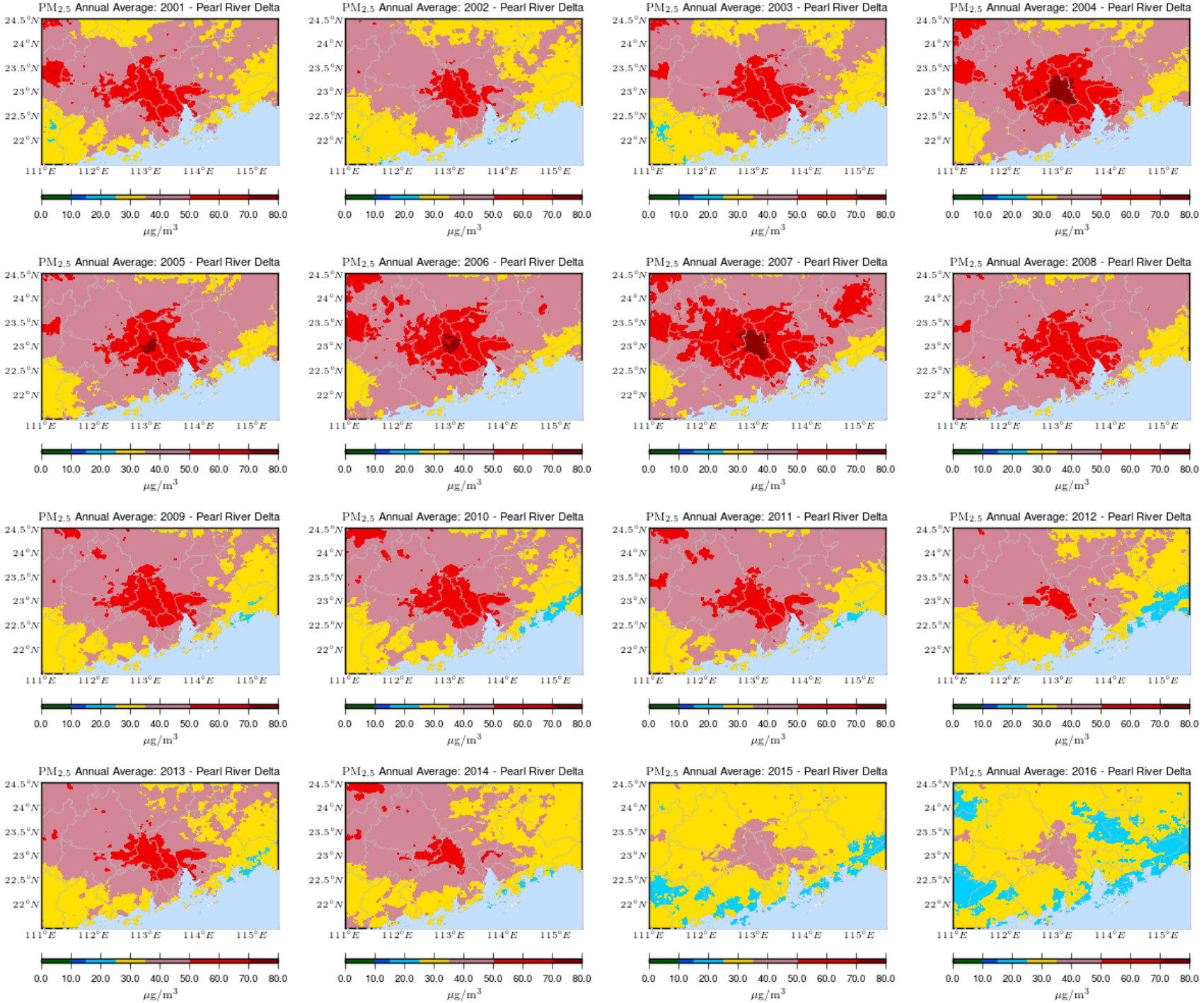
Pink: $35 < c \leq 50\ \mu g/m^3$ (above WHO IT1)

Yellow: $25 < c \leq 35\ \mu g/m^3$ (in compliance with WHO IT1)

Aqua: $15 < c \leq 25\ \mu g/m^3$ (in compliance with WHO IT2)

Dark Blue: $10 < c \leq 15\ \mu g/m^3$ (in compliance with WHO IT3)

Dark Green: $c \leq 10\ \mu g/m^3$ (in compliance with WHO AQG)


PM2.5 Annual Average: 2001 - Pearl River Delta
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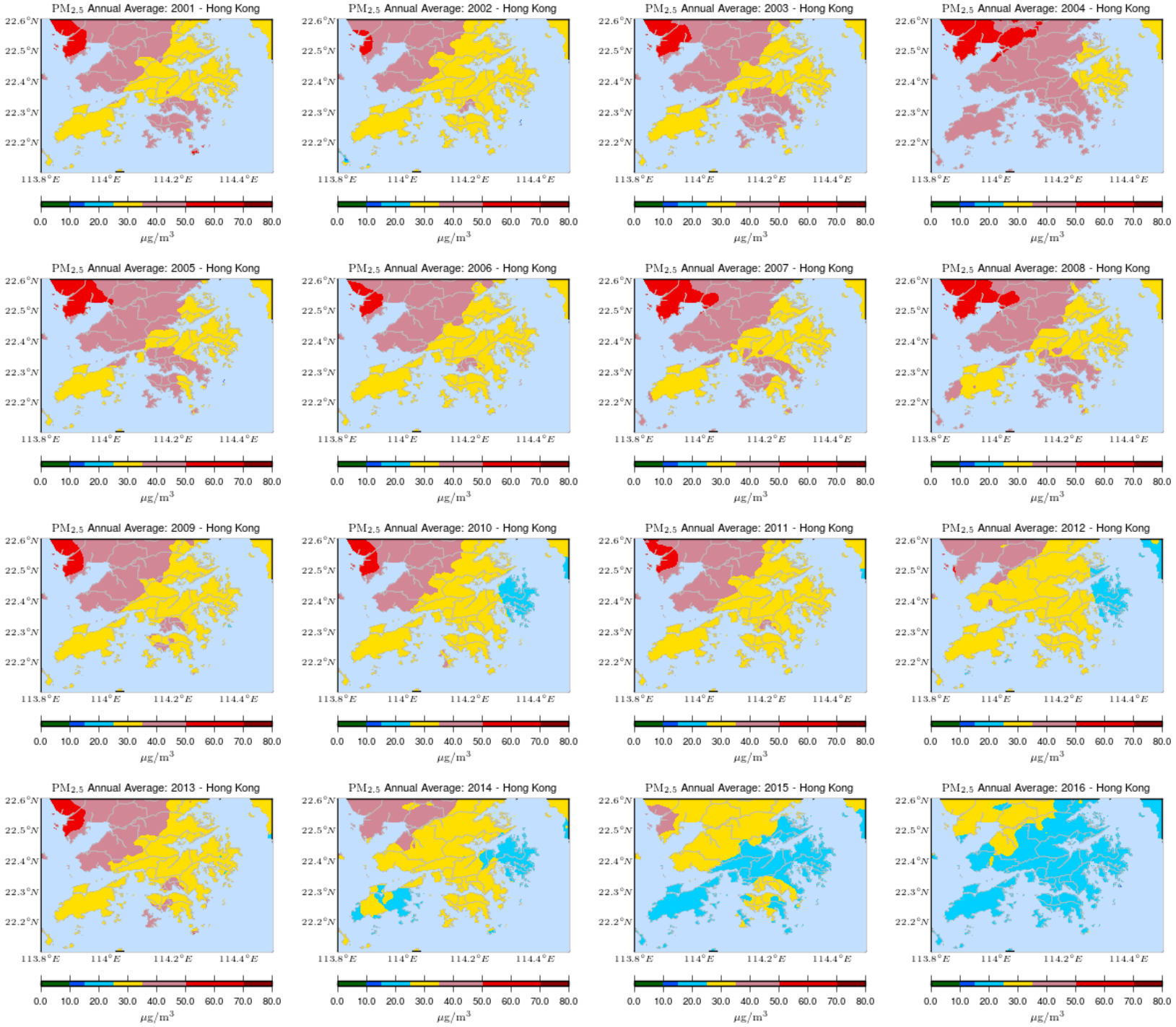
PM2.5 Annual Average: 2012 - Pearl River Delta
PM2.5 Annual Average: 2013 - Pearl River Delta
PM2.5 Annual Average: 2014 - Pearl River Delta
PM2.5 Annual Average: 2015 - Pearl River Delta
PM2.5 Annual Average: 2016 - Pearl River Delta
24.5°N
24°N
23.5°N
23°N
22.5°N
22°N
111°E
112°E
113°E
114°E
115°E
0.0 10.0 20.0 30.0 40.0 50.0 60.0 70.0 80.0
μg/m3


PM2.5 Annual Average: 2001 - Hong Kong
PM2.5 Annual Average: 2002 - Hong Kong
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PM2.5 Annual Average: 2013 - Hong Kong
PM2.5 Annual Average: 2014 - Hong Kong
PM2.5 Annual Average: 2015 - Hong Kong
PM2.5 Annual Average: 2016 - Hong Kong
22.6°N
22.5°N
22.4°N
22.3°N
22.2°N
113.8°E
114°E
114.2°E
114.4°E
0.0 10.0 20.0 30.0 40.0 50.0 60.0 70.0 80.0
μg/m3

Gather Public Views on Possible New Air Quality Improvement Measures

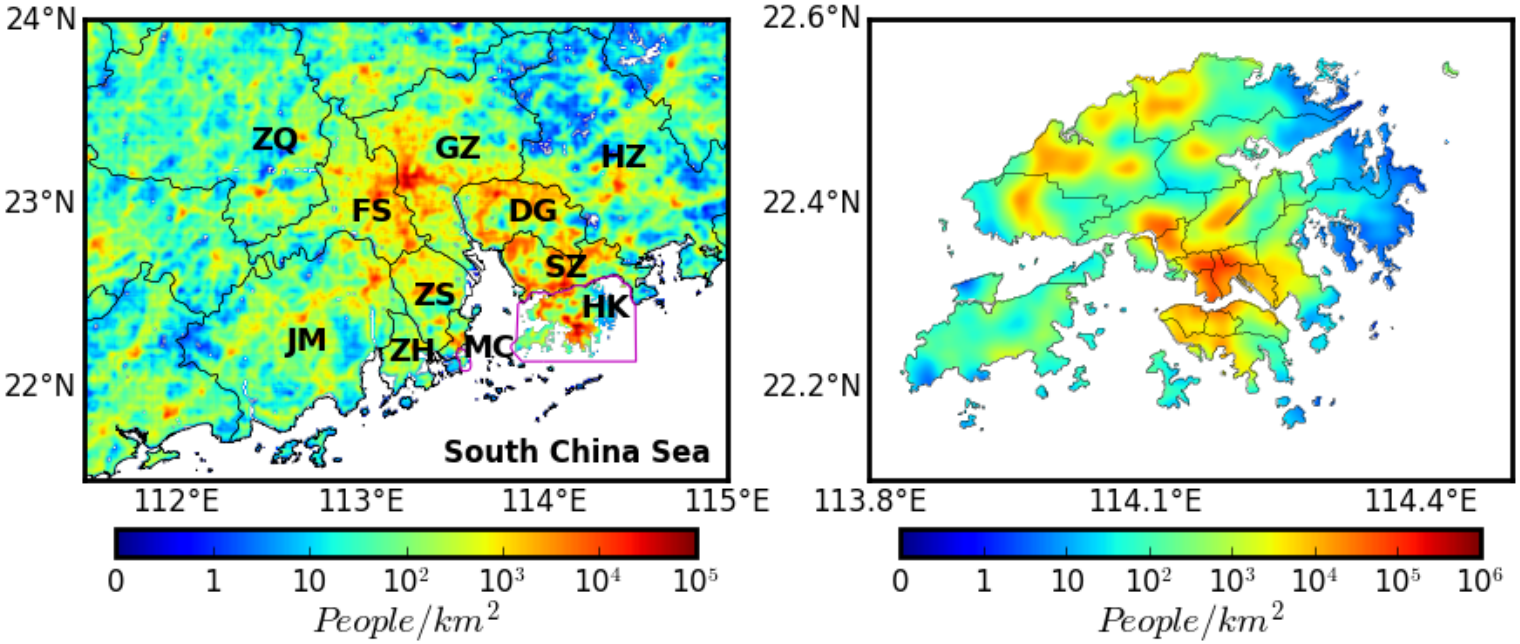
Session 1: 28 September 2017 (Thursday) • 2:15pm - 4:30pm
Session 2: 30 September 2017 (Saturday) • 10:00am - 12:30pm

Background

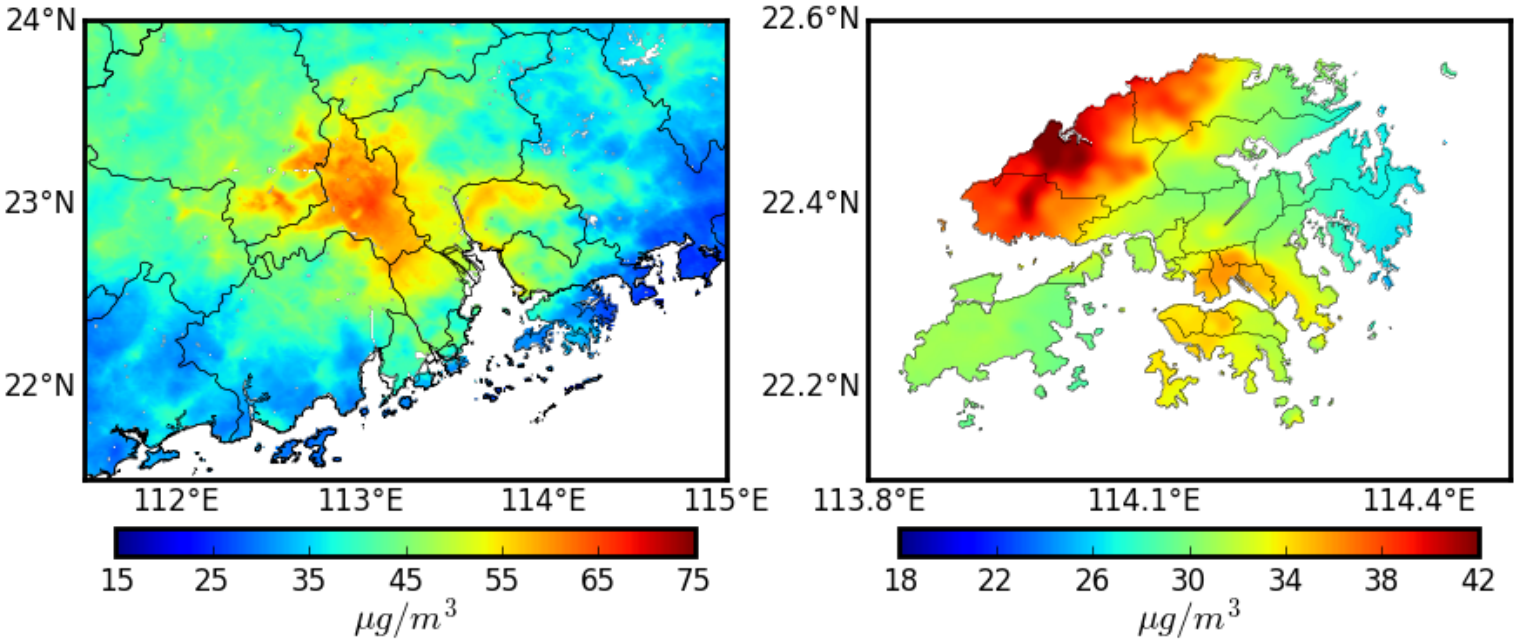
The prevailing Air Quality Objectives (AQOs) took effect on 1 January 2014. It is a statutory requirement under the Air Pollution Control Ordinance to review the AQOs at least once every five years. The Environment Bureau embarked on the review in mid-2016, aiming at completing the review in 2018. We would like to take the opportunity to engage the public to gather your views on the possible new measures to improve the air quality of Hong Kong.

15-year (2001-2015) mean population density & $PM_{2.5}$

Population density

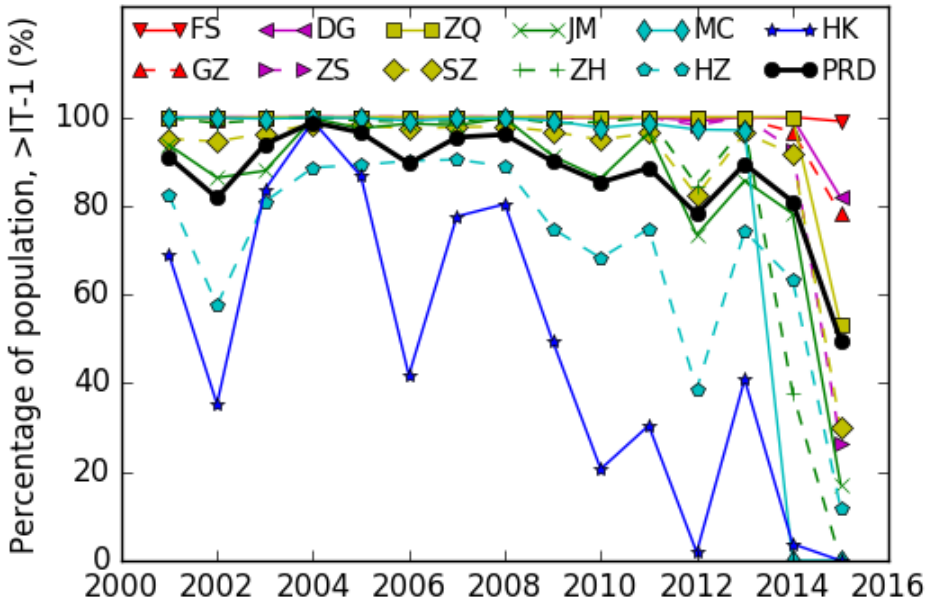


PM2.5

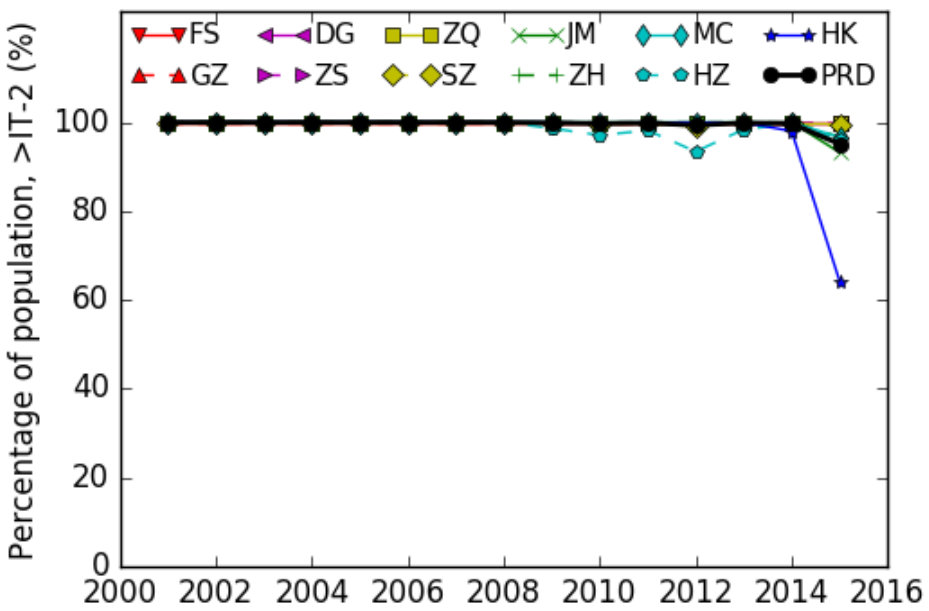


Percentage of population exposed to PM2.5 higher than WHO IT-1 (current NAAQS) and IT-2

IT-1

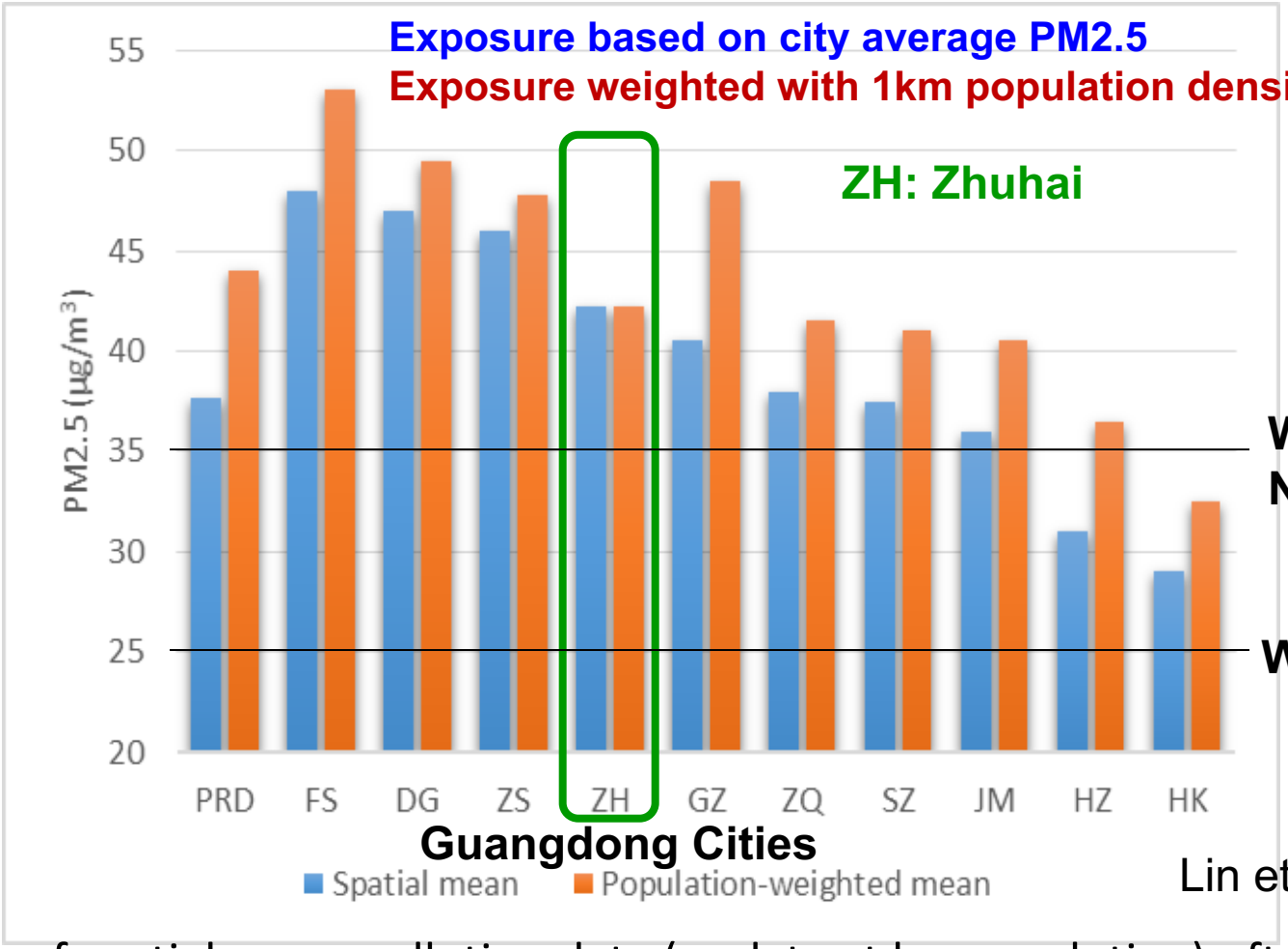


IT-2



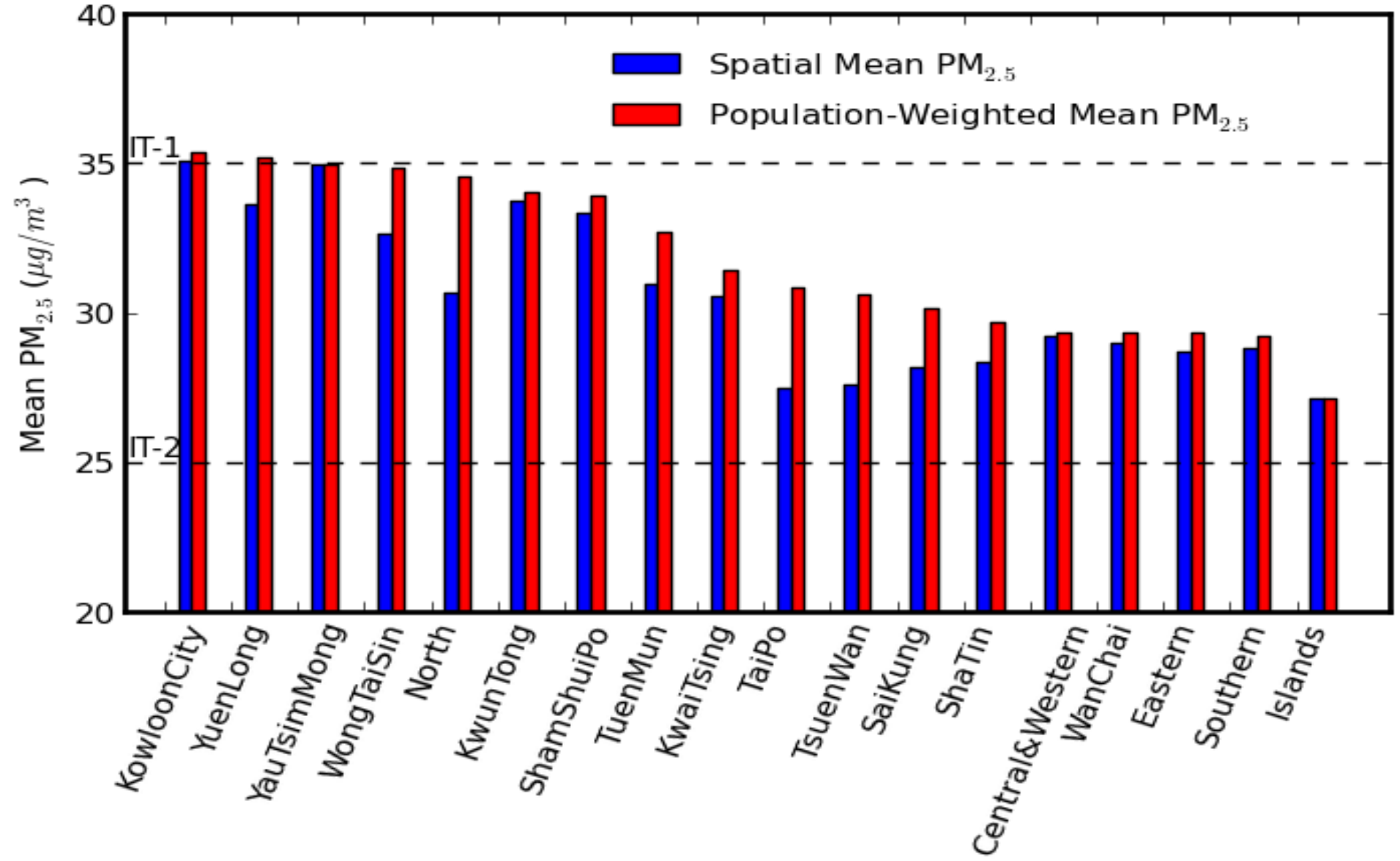
- For IT-1:
  - PRD: 99% in 2004 and 50% in 2015
  - HK: 99% in 2004, 0% in 2015
- For IT-2:
  - PRD: 95% in 2015
  - HK: 64% in 2015

$PM_{2.5}$ population exposure at city scale



Lin et al. (2016)

- Use of spatial mean pollution data (or data at low resolution) often underestimates population exposure (as large as 8 µg/m³ in GZ)
- Zhuhai (ZH) shows the least difference – it is most successful in urban planning and/or cleaning up highly-populated urban area;


Spatial Mean $PM_{2.5}$
Population-Weighted Mean $PM_{2.5}$
Mean $PM_{2.5}$ ($\mu g/m^3$)
40
35
30
25
20
IT-1
IT-2
KowloonCity
YuenLong
YauTsimMong
WongTaiSin
North
KwunTong
ShamShuiPo
TuenMun
KwaiTsing
TaiPo
TsuenWan
SaiKung
ShaTin
Central&Western
WanChai
Eastern
Southern
Islands

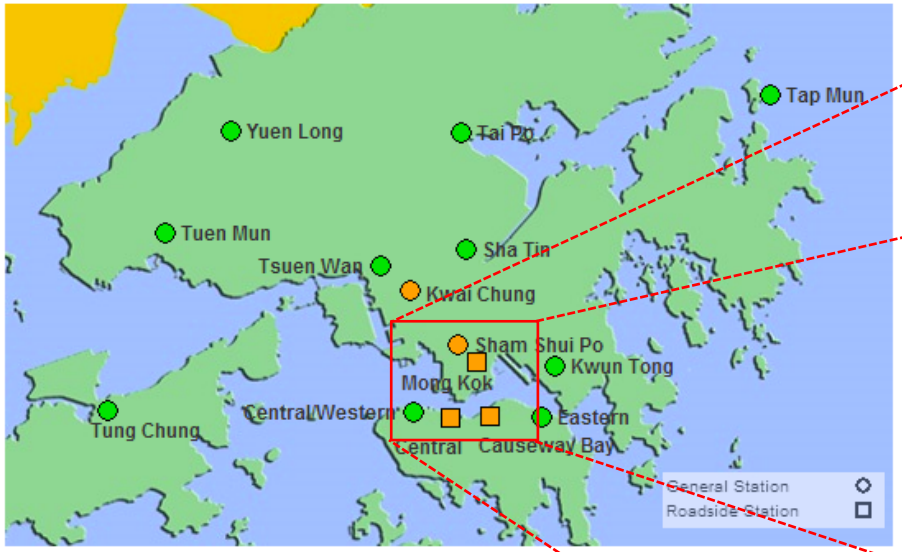
EPD - AQHI and Forecast - Google Chrome

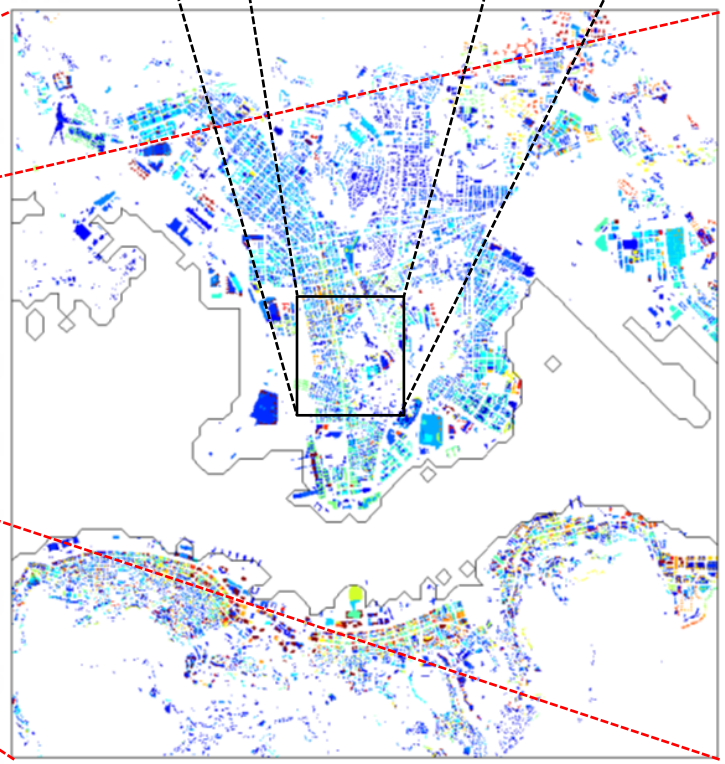
ww.aqhi.gov.hk/en.html

空氣質素健康指數
Air Quality Health Index

Text Only | 繁體版 | 简体版 | Print | A A A

There are large variabilities in air quality that our district scale AQMS network cannot show





Remark:

(1) The AQHI information is based on raw data taken directly from EPD's Air Quality Monitoring Network.

(2) The hourly reported AQHI is for short term health risk communication; for health risks of long-term exposure of the air quality, please refer to Annual Air Quality Index (Annual AQI).

(3) In case of station or equipment suspension due to maintenance, the data collection for calculation of AQHI at station will be affected, the data of a most similar station will then be

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… so they can better help themselves reduce their pollutant exposure and the associated health impacts

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