# Real-time Air Quality Forecasts down to Street Scales

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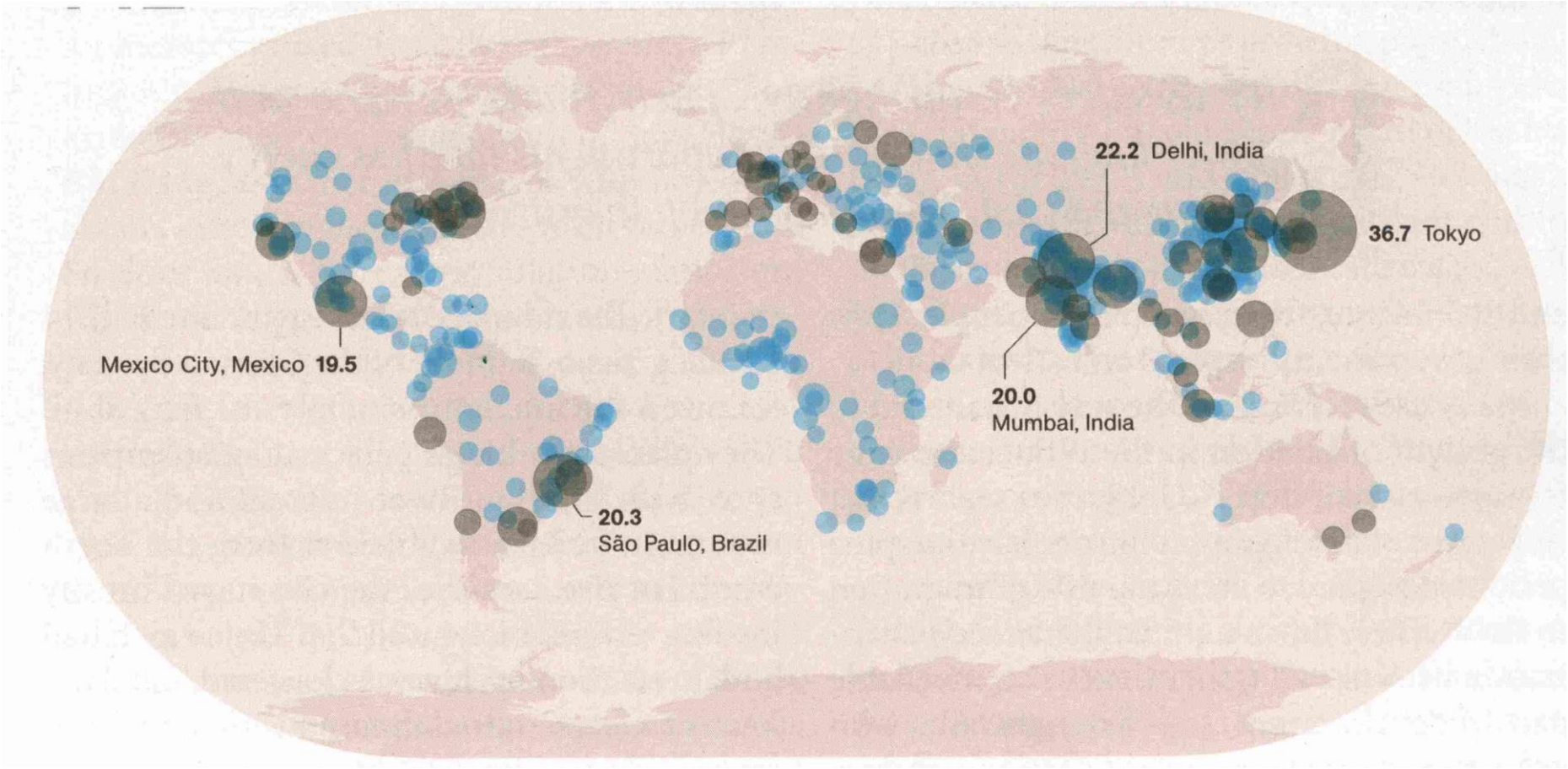
**Nov 22, 2016**

# Urbanization

**1900**
**16 cities**

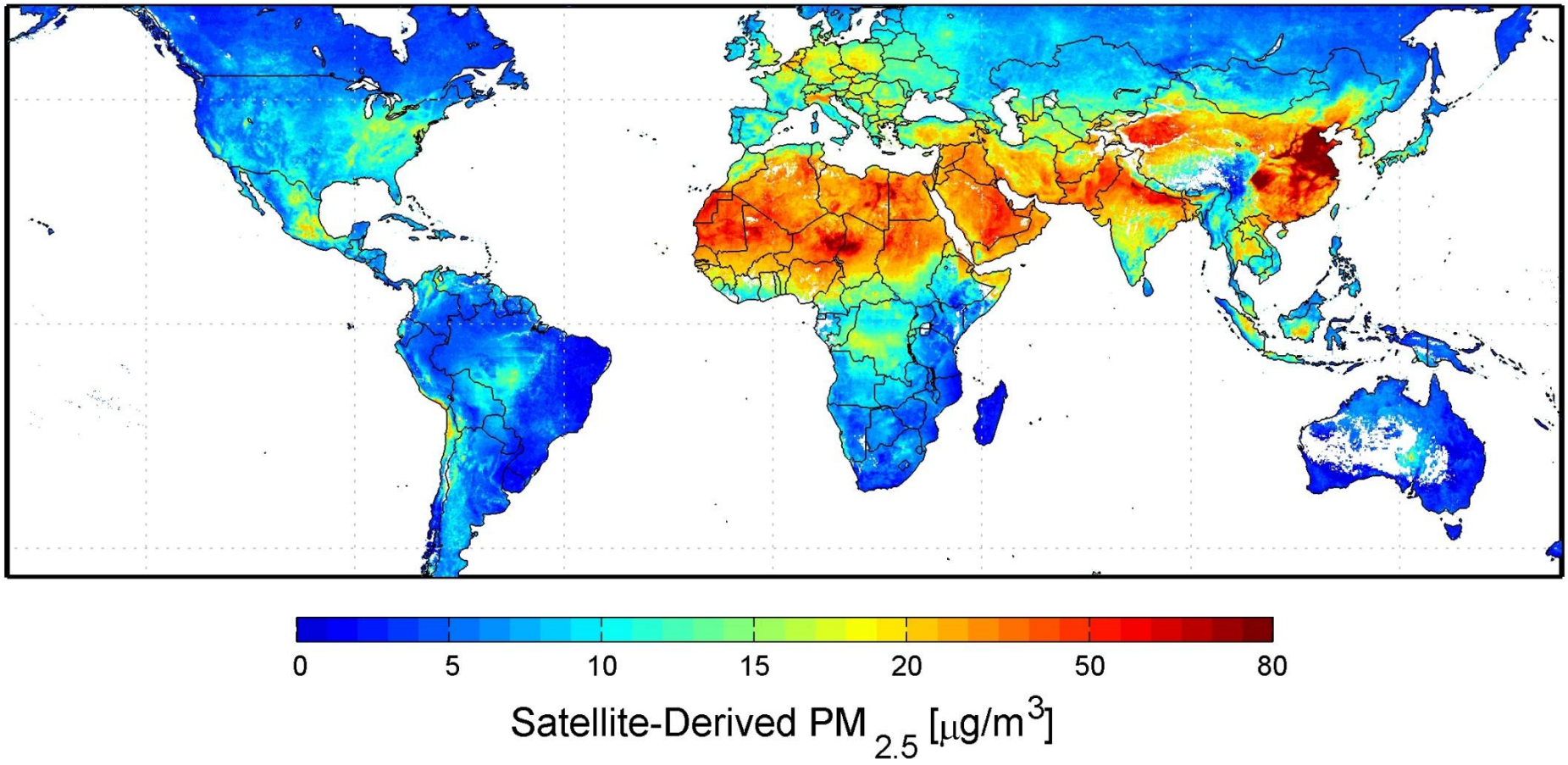
**1950**
**74** cities

**2011**
**442** cities




THE **FIVE** NATIONS WITH THE MOST CITIES OF ONE MILLION OR MORE:
CHINA **89** , India ·**46**, U.S. **42** , Brazil **21** , Mexico **12**.

National Geographic Dec 2011




Global satellite-derived map of $PM_{2.5}$ averaged over 2001-2006.

**Credit:** Dalhousie University, Aaron van Donkelaar

World Health Organization

## Media centre

# 7 million premature deaths annually linked to air pollution

News release

25 MARCH 2014 | GENEVA - In new estimates released today, WHO reports that in 2012 around 7 million people died - one in eight of total global deaths – as a result of air pollution exposure. This finding more than doubles previous estimates and confirms that air pollution is now the world's largest single environmental health risk. Reducing air pollution could save millions of lives.

### New estimates

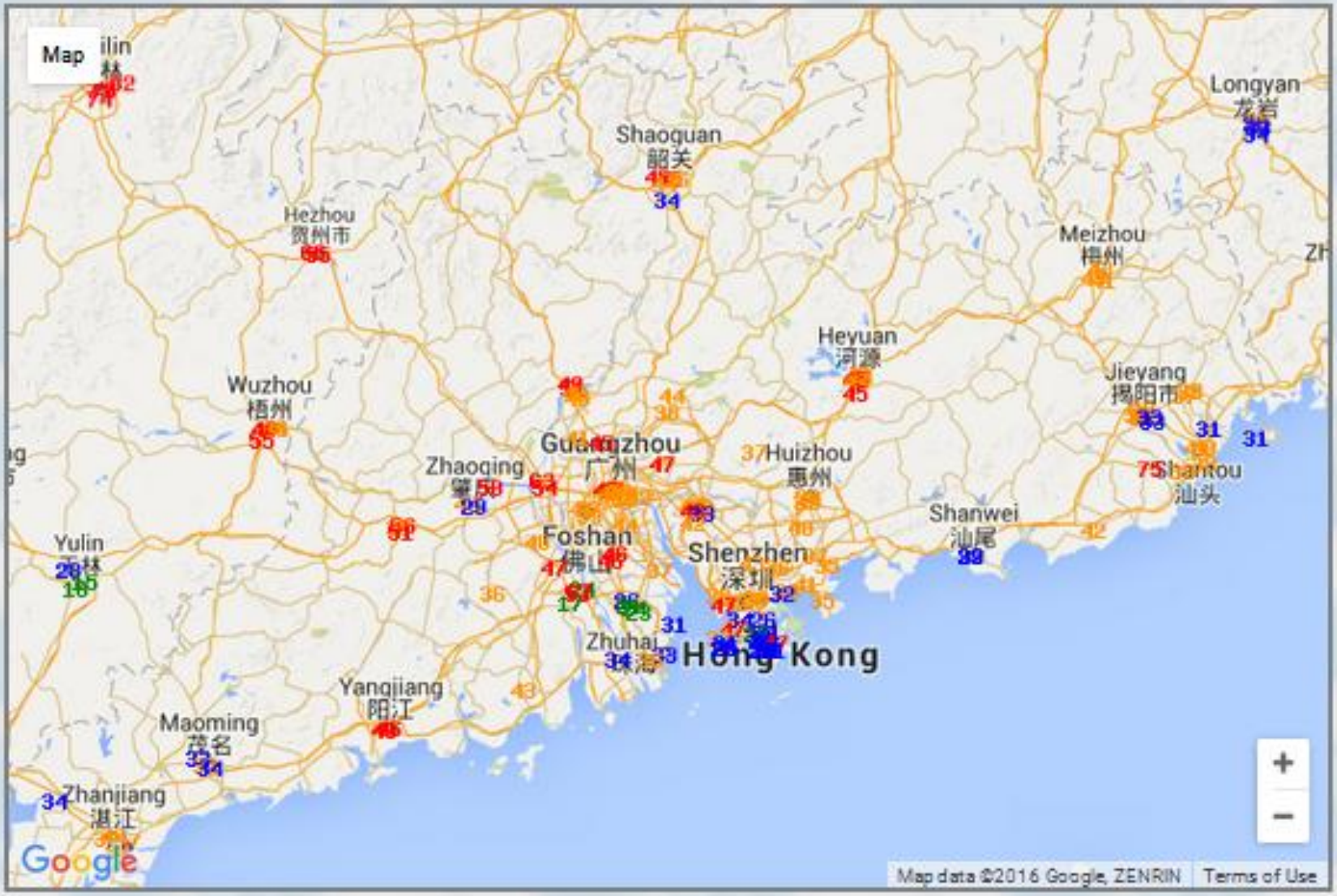
In particular, the new data reveal a stronger link between both indoor and outdoor air pollution exposure and cardiovascular diseases, such as strokes and ischaemic heart disease, as well as between air pollution and cancer. This is in addition to air pollution's role in the development of respiratory diseases, including acute respiratory infections and chronic obstructive pulmonary diseases.

**WHO (2014): Air Pollution is the world's largest single environmental health risk.**

**Linked to: cardiovascular respiratory pulmonary diseases**

**Spatial 2D Plot for Fine Suspended Particulates (FSPMC) (ug/m3)**

**Time:2016/02/06 00:00(UTC+0). No. of data points: 186**




25.0 35.0 45.0 Overlay Wind: Change Values

## HIGHLIGHTS

**Roadside Stations** : Moderate

**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 adopted. Such AQHI will be shown in italics.

## FORECAST of Health Risk

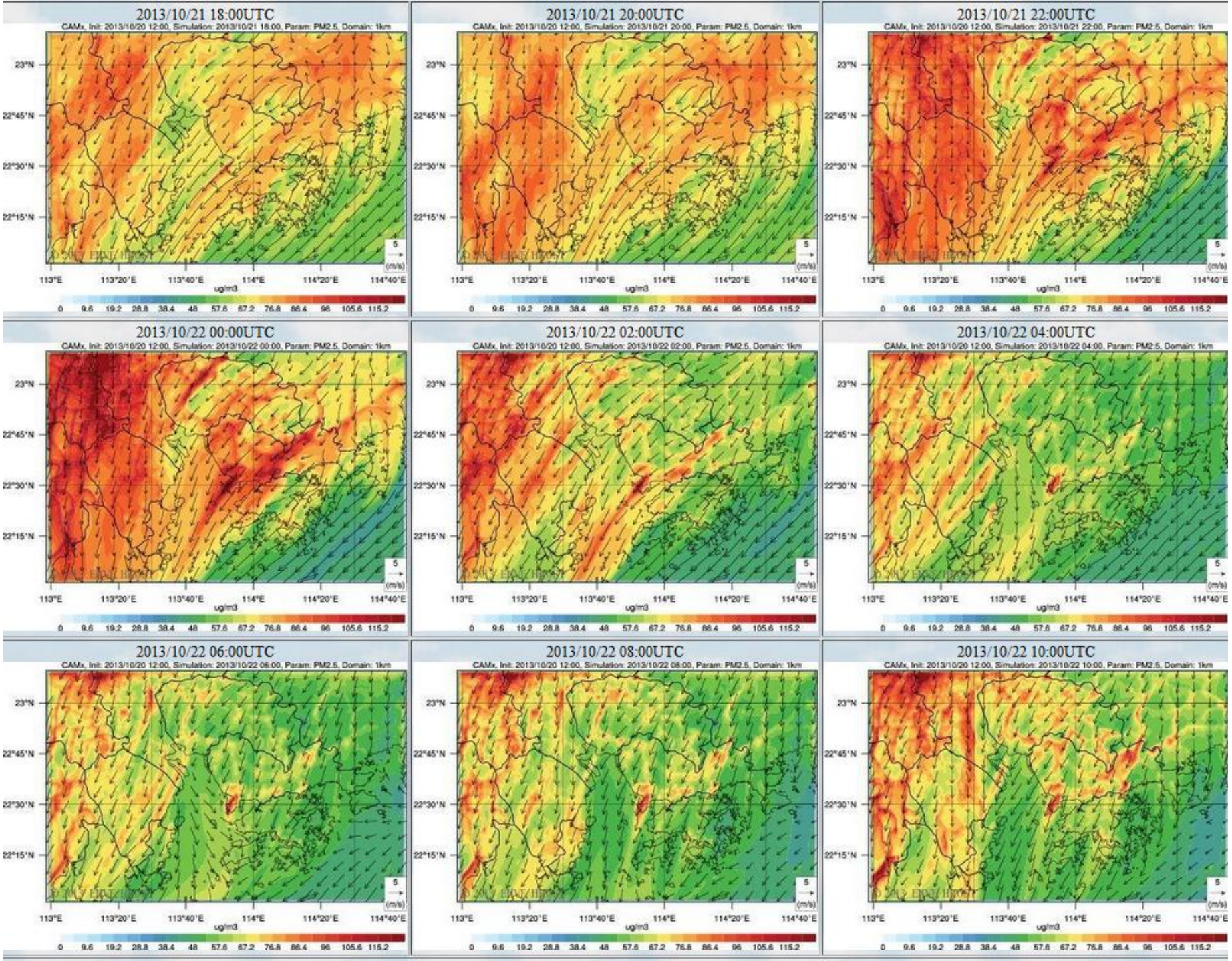
| 15-02-2016 | Today P.M. | Tomorrow A.M. |
|---|---|---|
| General Stations | Low to Moderate | Low to Moderate |
| Roadside Stations | Low to Moderate | Low to Moderate |

低 LOW | 中 MODERATE | 高 HIGH | 甚高 VERY HIGH | 嚴重 SERIOUS

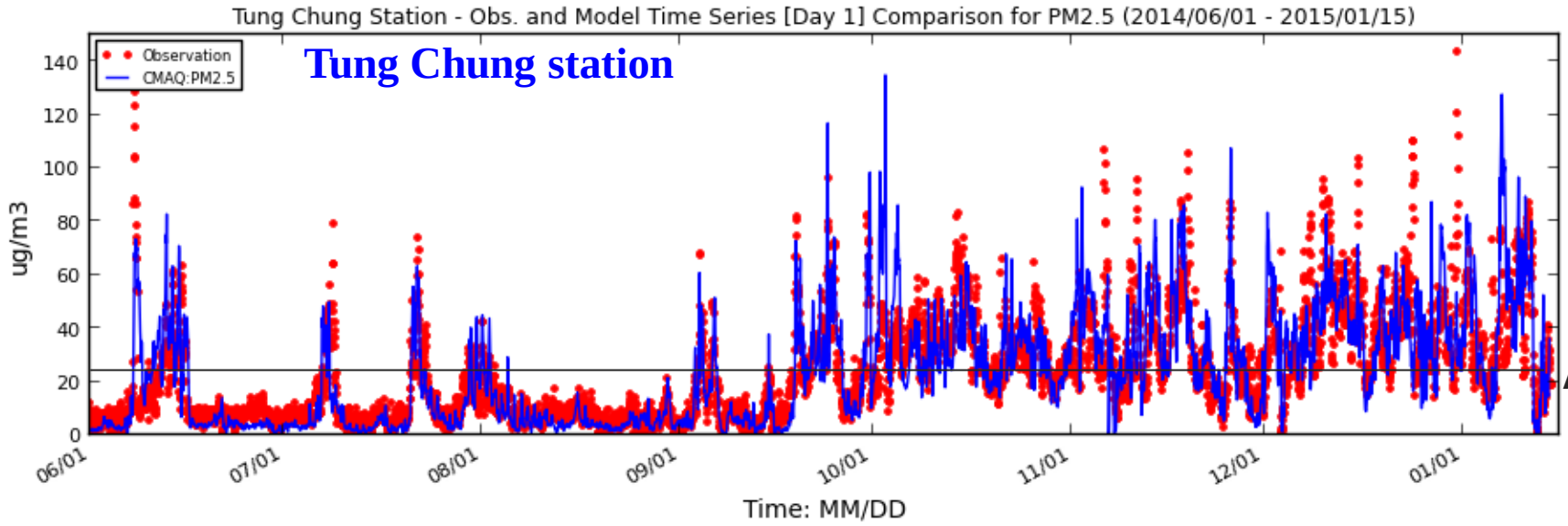
1 2 3 | 4 5 6 | 7 | 8 9 10 | 10+

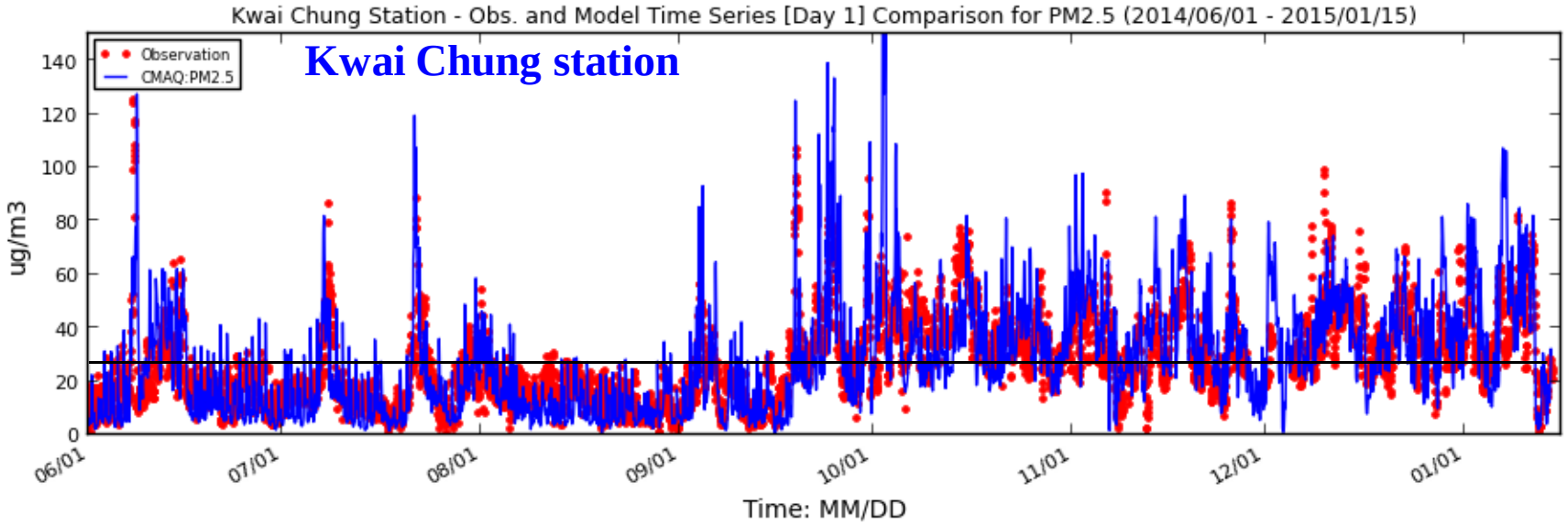
## Air Quality Health Index

| 15:00 15-02-2016 | | AQHI | Health Risk |
|---|---|---|---|
| General Stations | Central/Western | 3 | Low |
| | Eastern | 3 | Low |
| | Kwun Tong | 3 | Low |
| | Sham Shui Po | 3 | Low |
| | Kwai Chung | 3 | Low |
| | Tsuen Wan | 3 | Low |
| | Yuen Long | 3 | Low |
| | Tuen Mun | 3 | Low |
| | Tung Chung | 3 | Low |
| | Tai Po | 3 | Low |
| | Sha Tin | 3 | Low |
| | Tap Mun | - | - |
| Roadside Stations | Causeway Bay | 4 | Moderate |
| | Central | 4 | Moderate |
| | Mong Kok | 3 | Low |

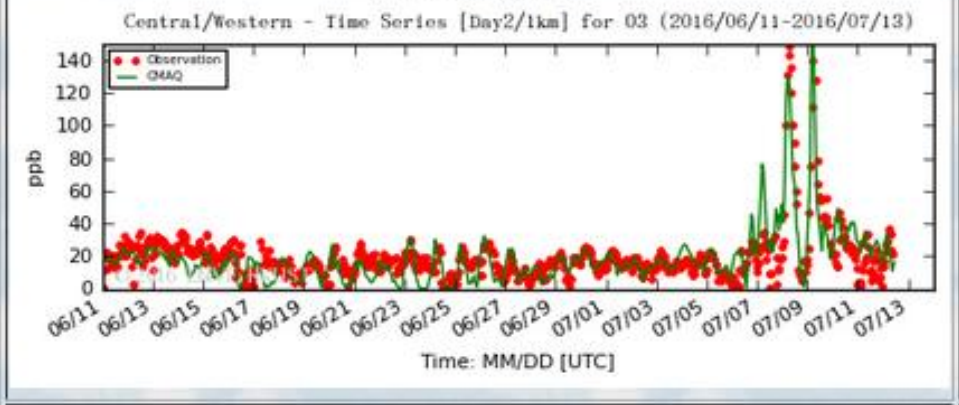

2013/10/21 18:00UTC
CAMx, Init: 2013/10/20 12:00, Simulation: 2013/10/21 18:00, Param: PM2.5, Domain: 1km
2013/10/21 20:00UTC
CAMx, Init: 2013/10/20 12:00, Simulation: 2013/10/21 20:00, Param: PM2.5, Domain: 1km
2013/10/21 22:00UTC
CAMx, Init: 2013/10/20 12:00, Simulation: 2013/10/21 22:00, Param: PM2.5, Domain: 1km
2013/10/22 00:00UTC
CAMx, Init: 2013/10/20 12:00, Simulation: 2013/10/22 00:00, Param: PM2.5, Domain: 1km
2013/10/22 02:00UTC
CAMx, Init: 2013/10/20 12:00, Simulation: 2013/10/22 02:00, Param: PM2.5, Domain: 1km
2013/10/22 04:00UTC
CAMx, Init: 2013/10/20 12:00, Simulation: 2013/10/22 04:00, Param: PM2.5, Domain: 1km
2013/10/22 06:00UTC
CAMx, Init: 2013/10/20 12:00, Simulation: 2013/10/22 06:00, Param: PM2.5, Domain: 1km
2013/10/22 08:00UTC
CAMx, Init: 2013/10/20 12:00, Simulation: 2013/10/22 08:00, Param: PM2.5, Domain: 1km
2013/10/22 10:00UTC
CAMx, Init: 2013/10/20 12:00, Simulation: 2013/10/22 10:00, Param: PM2.5, Domain: 1km
23°N
22°45'N
22°30'N
22°15'N
113°E
113°20'E
113°40'E
114°E
114°20'E
114°40'E
ug/m3
0 9.6 19.2 28.8 38.4 48 57.6 67.2 76.8 86.4 96 105.6 115.2
5
(m/s)

# Forecast results from 1/6/2014 – 14/1/2015

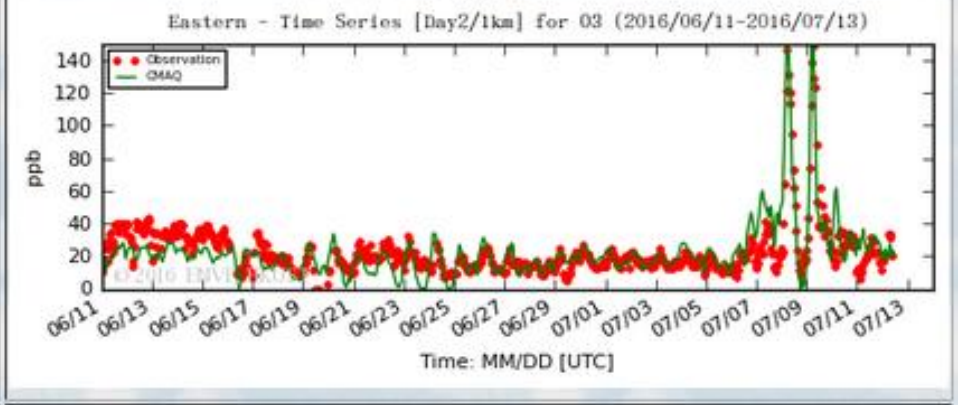


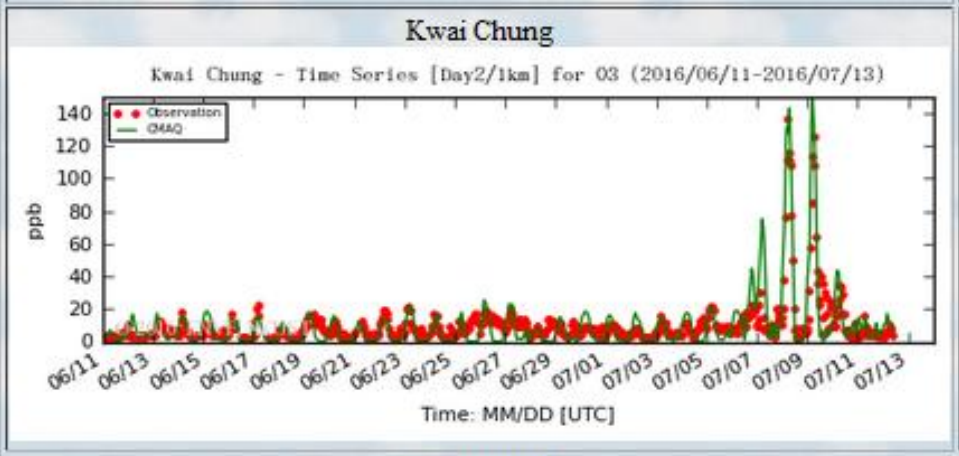
## Central/Western



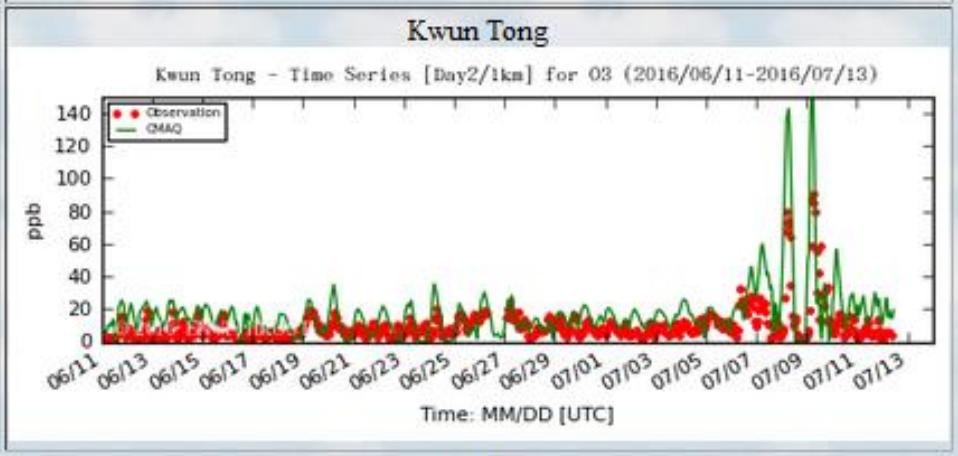

## Eastern



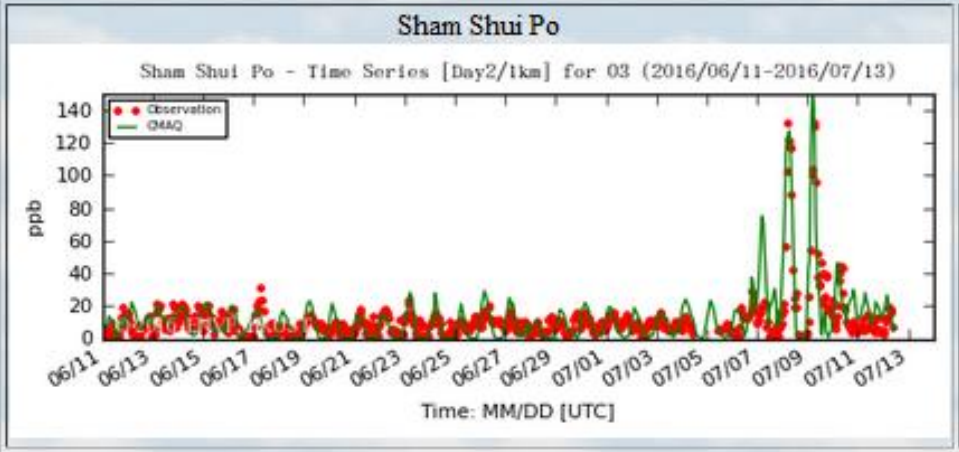

## Kwai Chung



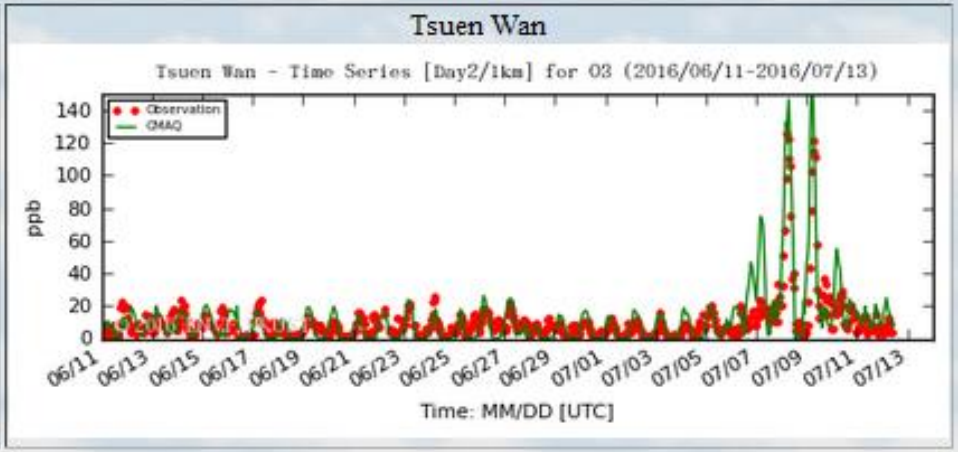

## Kwun Tong




## Sham Shui Po

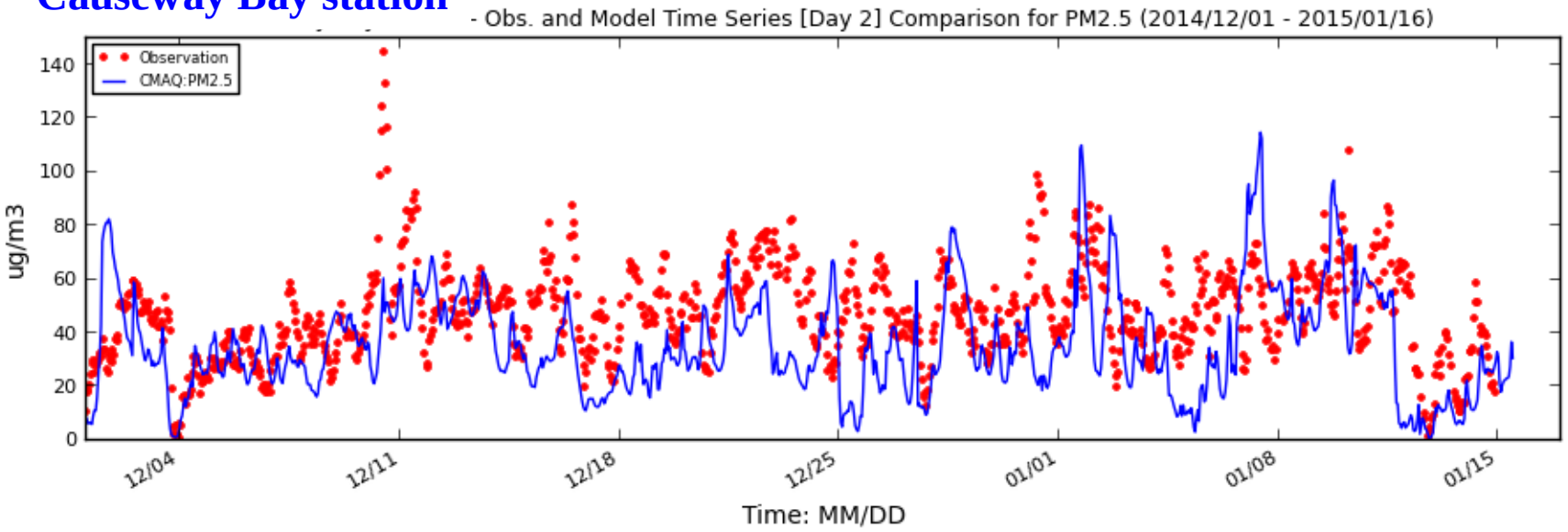



## Tsuen Wan



# Roadside forecast results from 1/12/2014 – 14/1/2015

**Causeway Bay station**




## Street Canyon dynamical down-scaling

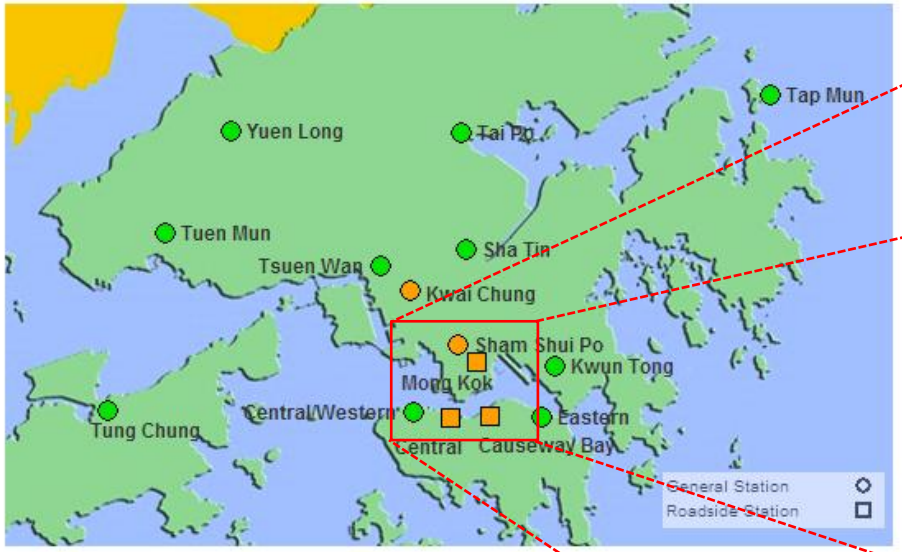
EPD - AQHI and Forecast - Google Chrome

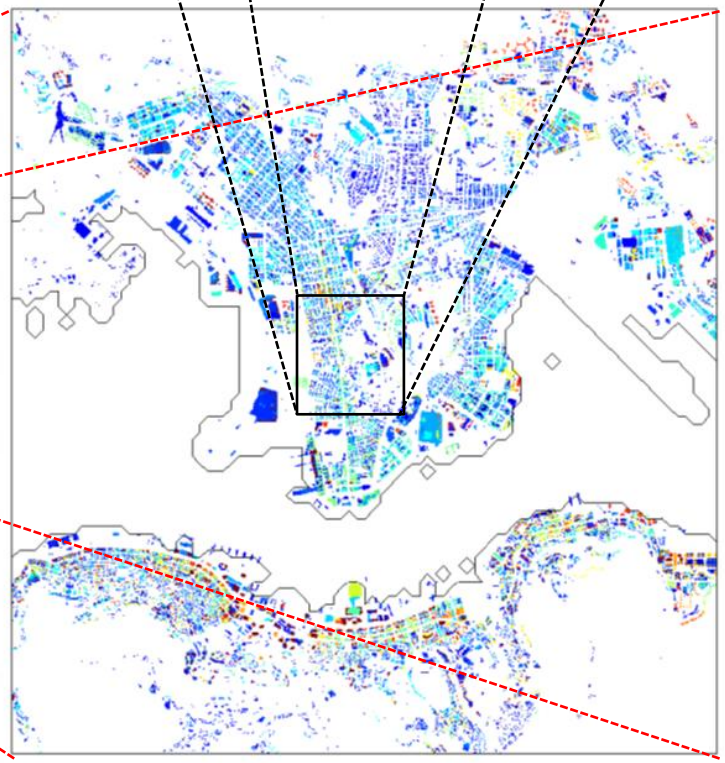
ww.aqhi.gov.hk/en.html

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 the current AQMS network cannot show

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# Measure $PM_{2.5}$ on a Tram (2013/8 – 2014/9)

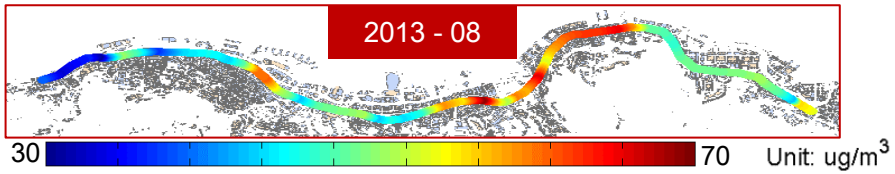
# HK Tram $PM_{2.5}$ Fixed by Time Sync Data Display (10m Average: 2013/08/12 14:30 - 2014/03/12 00:00)

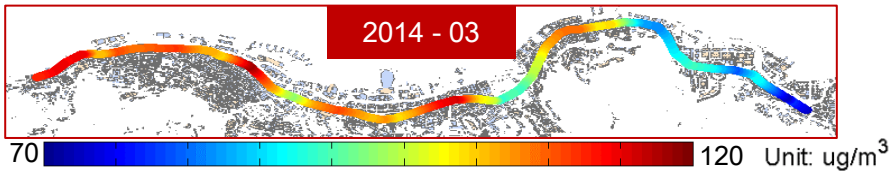
**No. of Grid Points = 1845**

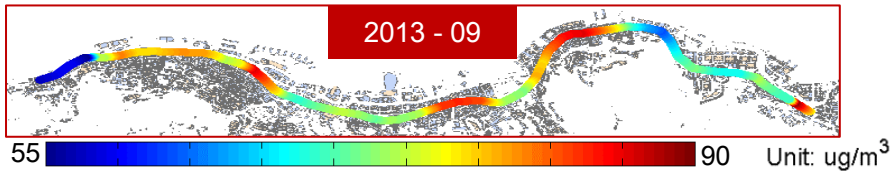
0.0 7.0 14.0 21.0 28.0 35.0 42.0 49.0 56.0 63.0 70.0 $ug/m^3$

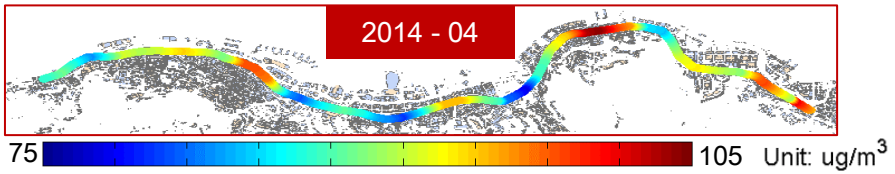
# Spatial Distribution of Monthly Mean $PM_{2.5}$ with Different Color Bar

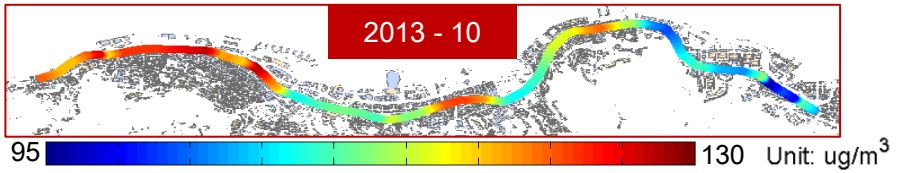
Spatial Pattern is Different in Different Months.

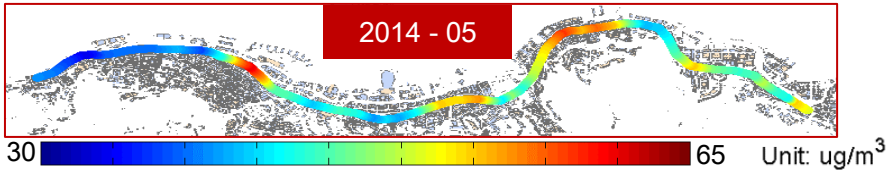


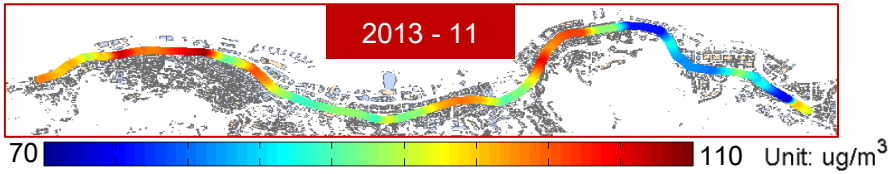



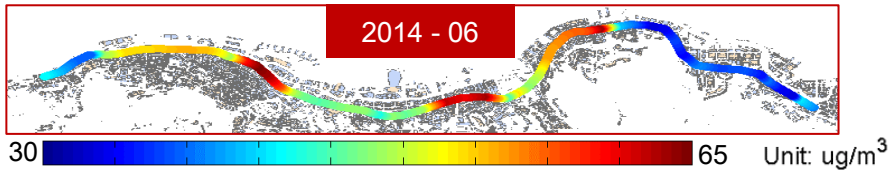



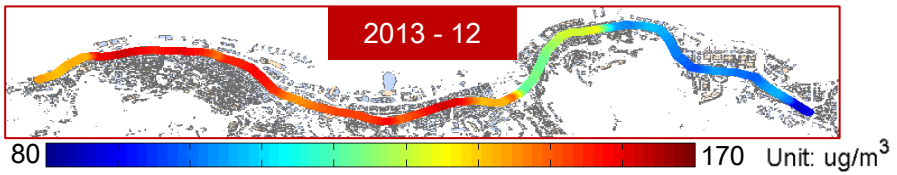



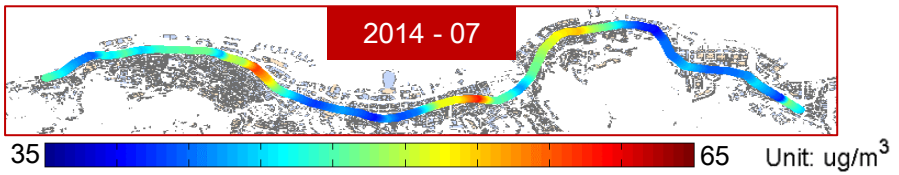



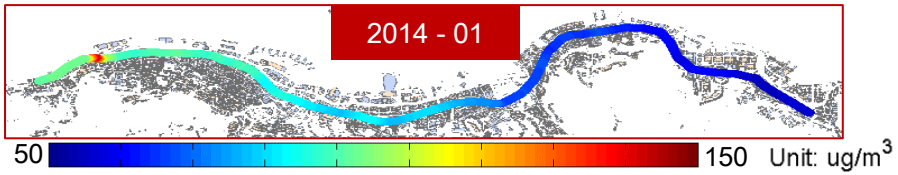



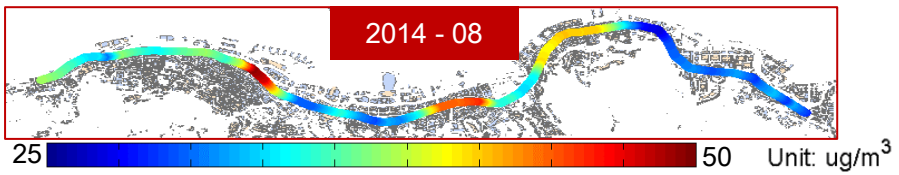



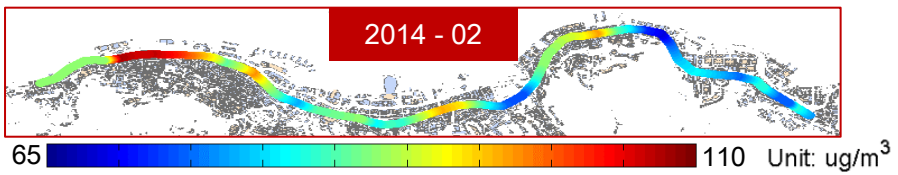



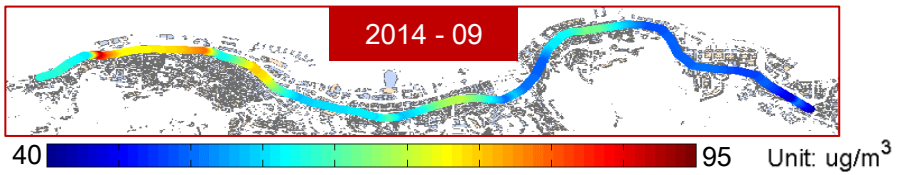



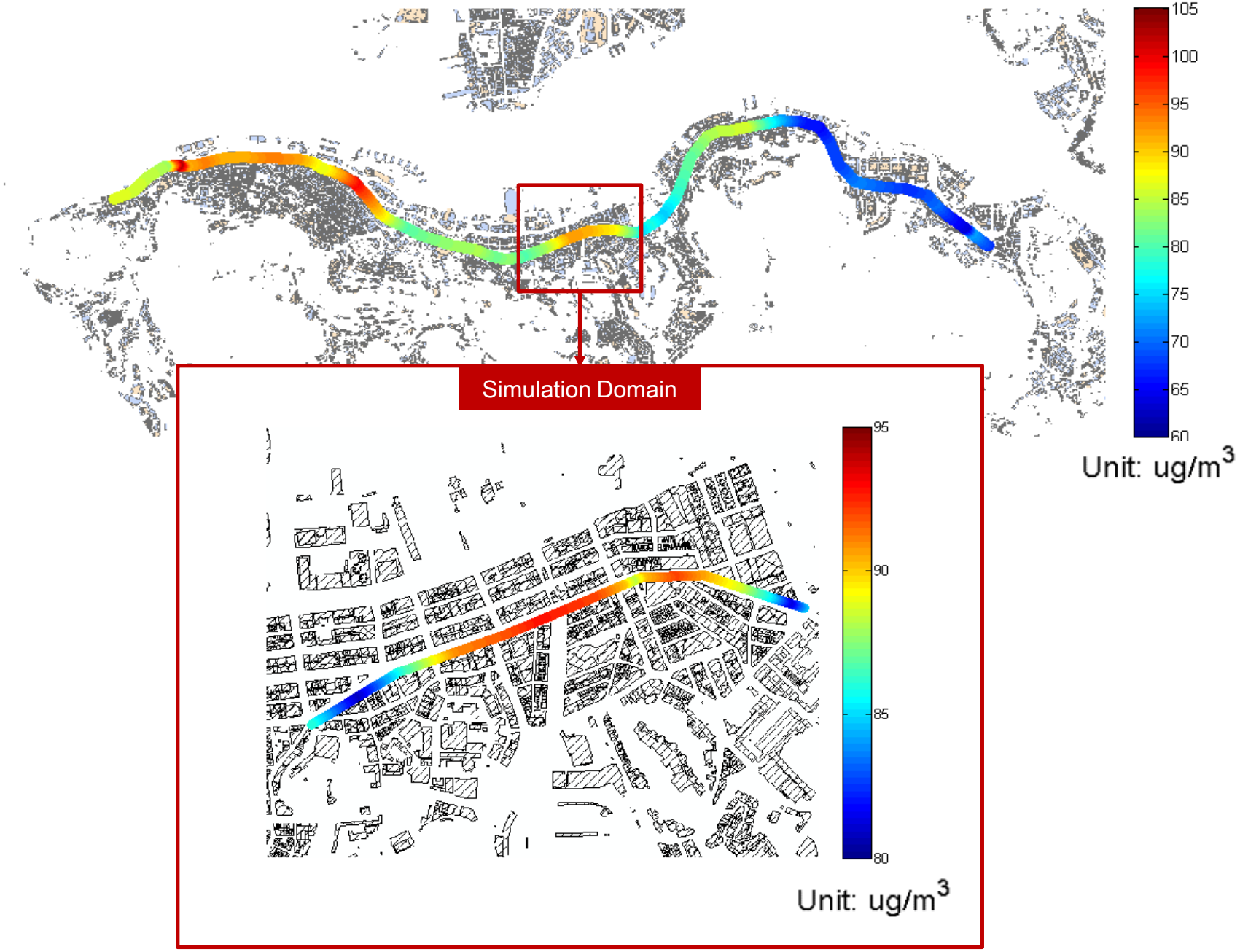



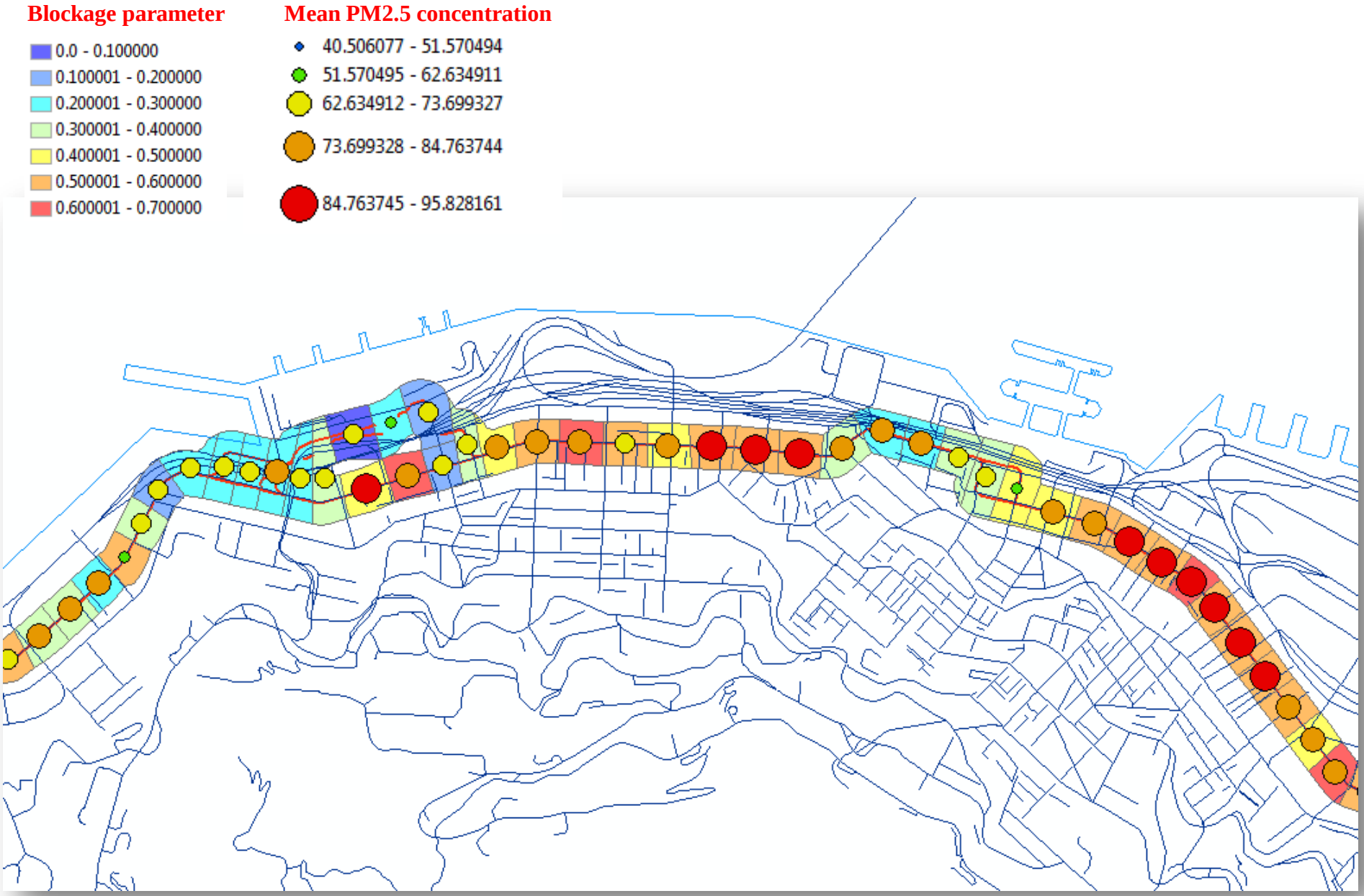



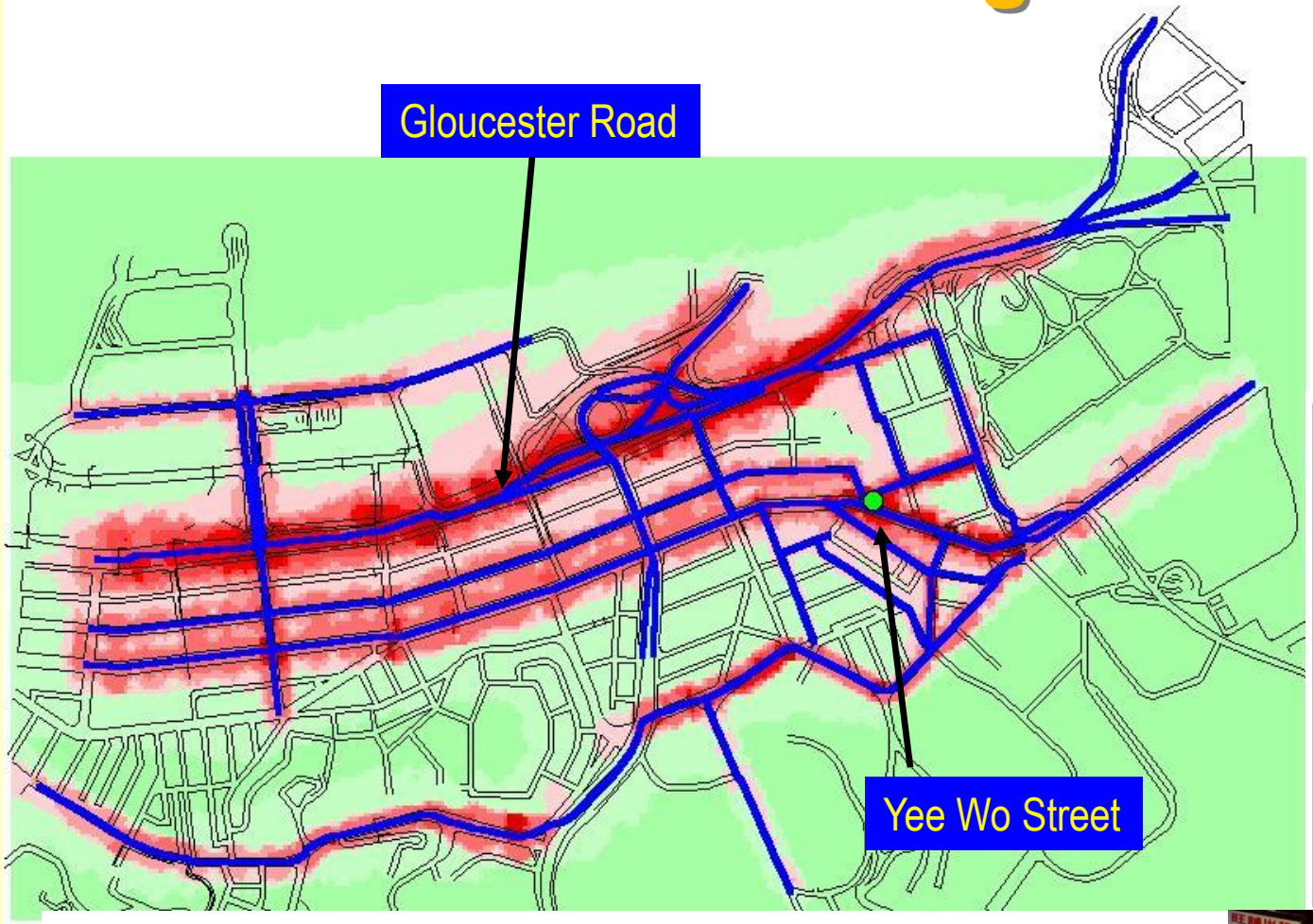
# Annual Mean $PM_{2.5}$ Concentration from 2013-08-12 to 2014-09-25

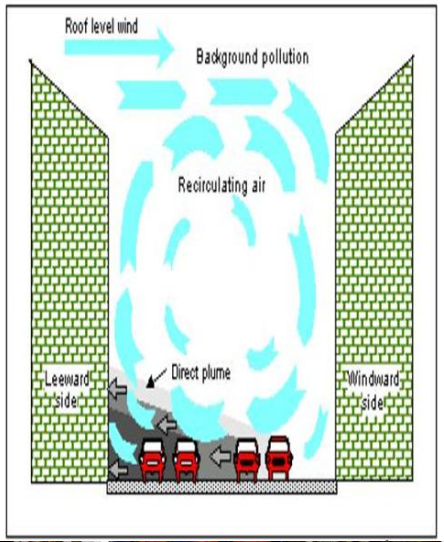


# $\lambda_p$ and average $PM_{2.5}$ in grid



# Concentration of NOx at ground level



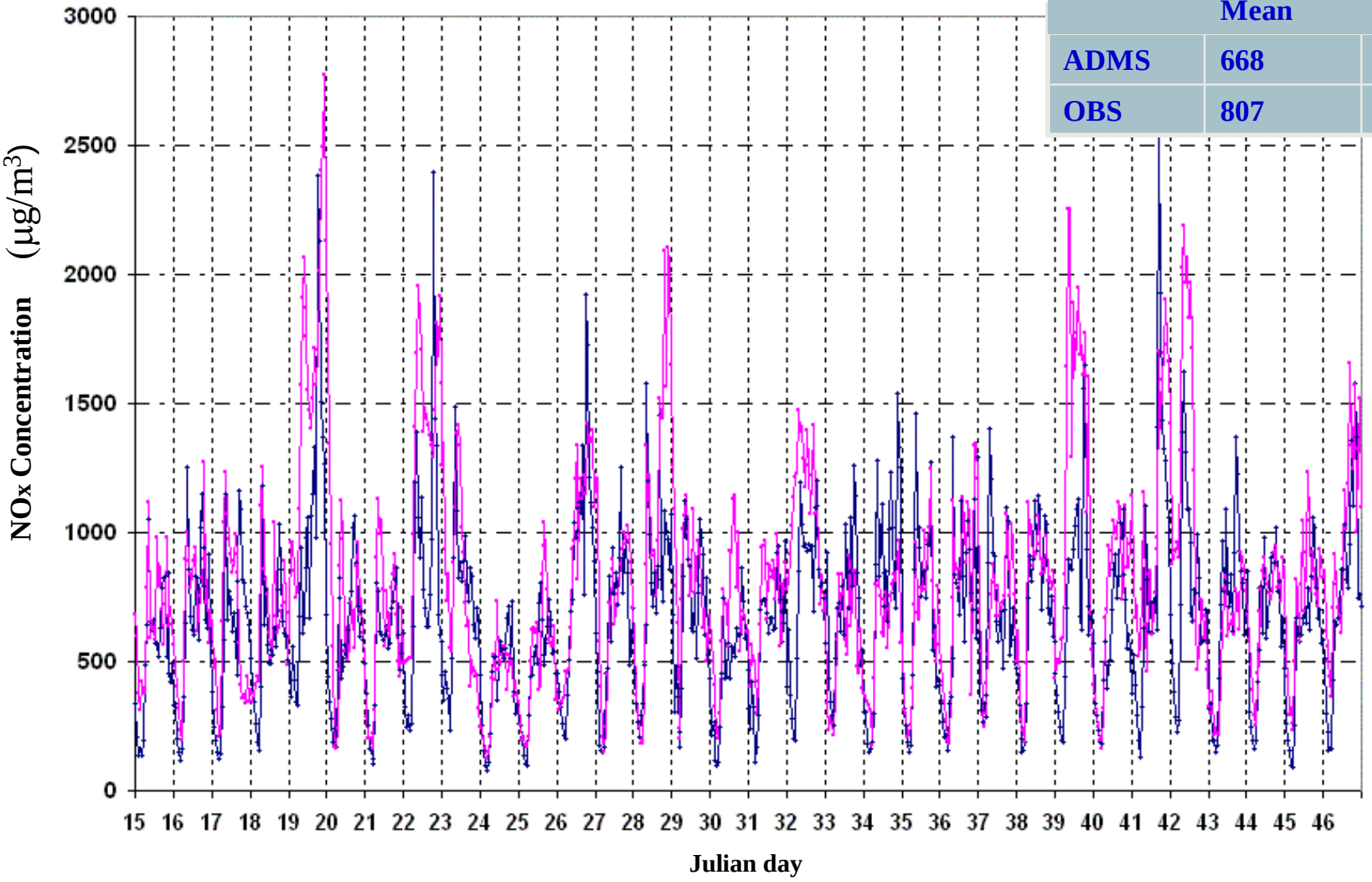

**Hourly average contour output of NOx concentration at Causeway Bay areas**

Roadside monitoring station

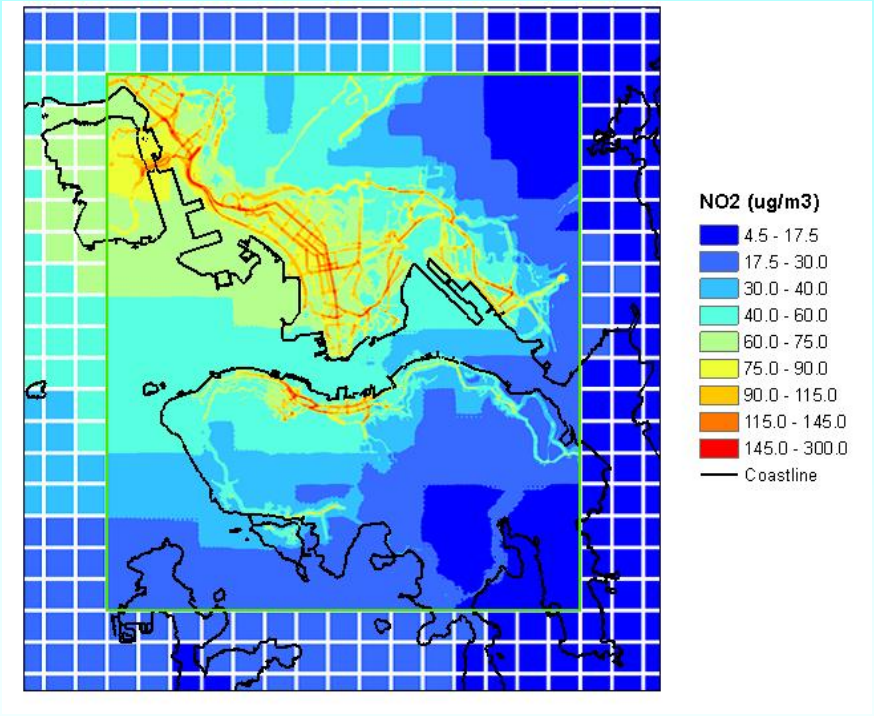
# Comparison between simulation and observational concentration of $NO_x$ at the roadside AQMS

**Causeway Bay roadside stations (15 Jan – 15 Feb 2003)**

| | Mean | RMS |
|---|---|---|
| ADMS | 668 | 350 |
| OBS | 807 | 425 |

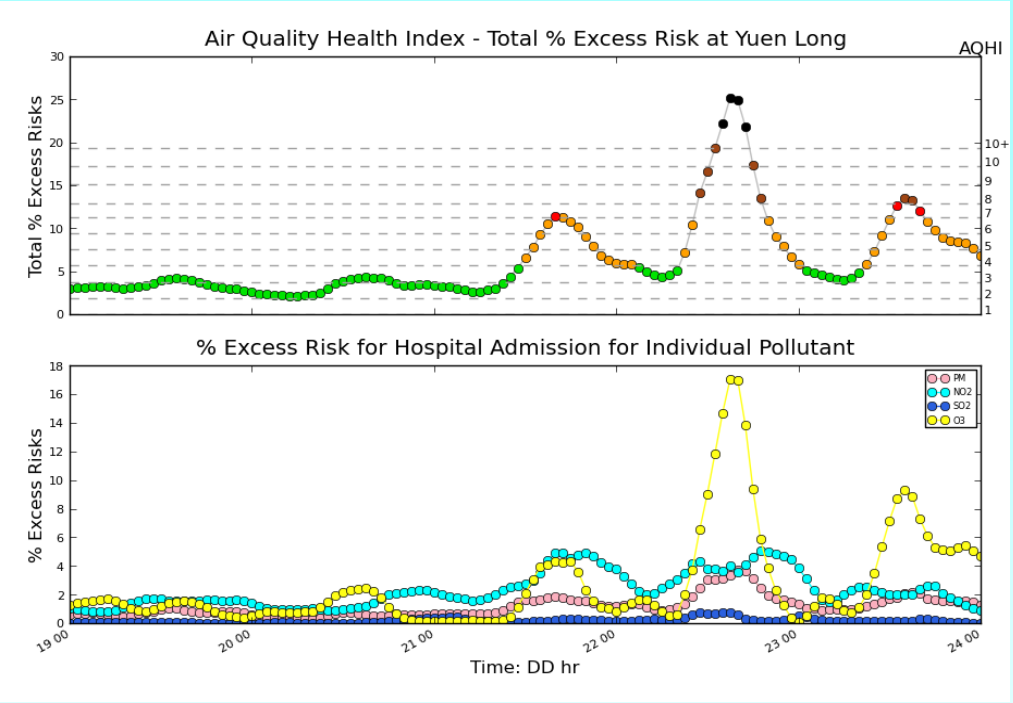


- **Real-time, urban AQ modelling system that can analyse and forecast (up to 3-day) the AQ in HK down to street levels**




- **Mobile App to allow the public to query the current and predicted AQ at their specified location(s)**

- **Personalised short-term AQ exposure and health outcome database**




- **Mobile App to allow the users to receive AQ warnings when the *pollutants they are sensitive to* are predicted to increase.**