

Outcomes of small meetings on MICS-Asia activity  
held in Tokyo and Hanoi  
and  
Overview of EANET air concentration data  
from 2001 to 2007

*11th Workshop on the Model Intercomparison Study  
for Asia (MICS-Asia)*

Laxenburg, Austria, February 26-27, 2009

Keiichi Sato

Acid Deposition and Oxidant Research Center (ADORC)

# Outline of Today's Talk

## 1. Outcomes of small meetings on MICS-Asia activity

- Meeting in Tokyo (September 4, 2008)
- Meeting in Hanoi (October 14, 2008)

## 2. Overview of EANET air concentration data

- Monitoring sites and methods
- Seasonal trends of SO<sub>2</sub> and SO<sub>4</sub> in PM
- Long-term trends of gases and particles
- Meteorological parameters

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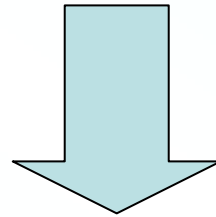
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# Meeting in Tokyo

Tripartite Workshop on Scientific Research of Photochemical Oxidant

Venue: Tokyo, Date: September 5, 2008



Since some participants of the workshop are contributing MICS-Asia activities, a small meeting to discuss ongoing modeling activities was arranged by ADORC.

Date: September 4, 2008

## Participants (Meeting in Tokyo)

- Prof. Yuanhang Zhang (Peking Univ., China)
- Prof. Zifa Wang (Institute of Applied Physics, China)
- Prof. Soon-Ung Park (Seoul Natinal Univ., Korea)
- Prof. Toshihiro Kitada (Toyohashi Inst. of  
Tech., Japan)
- Dr. Hiroshi Hayami (CRIEPI, Japan)
- Dr. Mizuo Kajino (Univ. of Tokyo, Japan)
- Dr. Hiromasa Ueda (ADORC, Japan)
- Dr. Keiichi Sato (ADORC, Japan)

# Major discussions (Meeting in Tokyo)

## i) Plans of presentations at the Workshop in Hanoi

- Regional monitoring result in China (Prof. Zhang)
- GOES-chem and IAP-Global/Regional model (Prof. Wang)
- Regional model (Prof. Park)

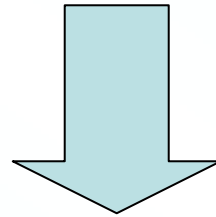
## ii) Contributions of MICS-Asia activities to TF HTAP

- Connection between regional scale to global scale
- Inter regional S-R relationship (for O<sub>3</sub> and Particulate Matter)
- Fate of air pollutant with different lifetime in Megacity
- Inter-regional transportation between South Asia, Southeast Asia and East Asia

## Meeting in Hanoi

International Workshop on Regional and Intercontinental Transport of Air Pollution

Venue: Hanoi, Date: October 13-14, 2008



MICS-Asia active members got together at lunchtime, and discussed on the activities during Phase 2.X (currently in progress) and Phase 3.

Date: October 14, 2008

## Participants (Meeting in Hanoi)

- Prof. Gregory Carmichel (Univ. of Iowa, USA)
- Prof. Joshua Fu (Univ. of Tennessee, USA)
- Dr. Sunling Gong (Environment Canada, Canada)
- Prof. Makoto Koike (Univ. of Tokyo, Japan)
- Prof. Jerry Lin (Lamar Univ., USA)
- Dr. Meiyun Lin (Univ. of Wisconsin, USA)
- Dr. Vanisa Surapipith (PCD, Thailand)
- Dr. Hiromasa Ueda (ADORC, Japan)
- Dr. Keiichi Sato (ADORC, Japan)



# Major discussions (Meeting in Hanoi) (1)

## i) Review on current progress on the activities of MICS-Asia 2.X

### i.1. Research interest in Phase 2.X

- From the flux data from the specified domain, cross section should be calculated.
- HTAP database can provide air concentration data on the monthly basis
- How much mass of air pollutants will contribute cross boundary air pollution?
- What kind of mass process will most influence air concentration and flux?
- Sulfate should be used for evaluation of modeling performance
- Consideration of eastern boundary
- In the modeling result in 2001, respective resolution should be considered.

# Major discussions (Meeting in Hanoi) (2)

## i) Review on current progress on the activities of MICS-Asia 2.X

### i.2. Performed modeling research activities in Phase 2.X

- Modeling result in 2001 and 2002 (Prof. Fu)
- Chemical Weather Forecast (Prof. Gong)
- Modeling result in 2001 using MOZART (Dr. Lin)

### i.3. What has to be done in Phase 2.X

- Contribution of MICS Asia to HTAP
- Framework of modeling results in 2001
- Further analysis on an individual basis
- Calling for comments for the results
- Present new findings after Phase 2

# Major discussions (Meeting in Hanoi) (3)

## i) Review on current progress on the activities of MICS-Asia 2.X

### i.4. Timeline for the activities in Phase 2.X)

To be proceeded in accordance with HTAP relevant schedule

1. Submit the current outcomes of MICS activities to ADORC  
[as soon as possible]
2. Upload the outcomes on the ADORC Web site and share the information to other regional modeling study (e.g. Africa)  
[as soon as possible]
3. 11th Workshop at IIASA. To be presented some results for one task  
[February 2009]
4. Propose the activities for Phase 3.

# Major discussions (Meeting in Hanoi) (4)

## ii) What has to be done in Phase 3 (start in 2009 or 2010)

- Mainly focus on regional contribution
- Evaluation of impact from megacities
- Focus on urban or regional scale
- Air quality impact: Evaluation should be performed in a manner of Chemical Weather Forecast system.

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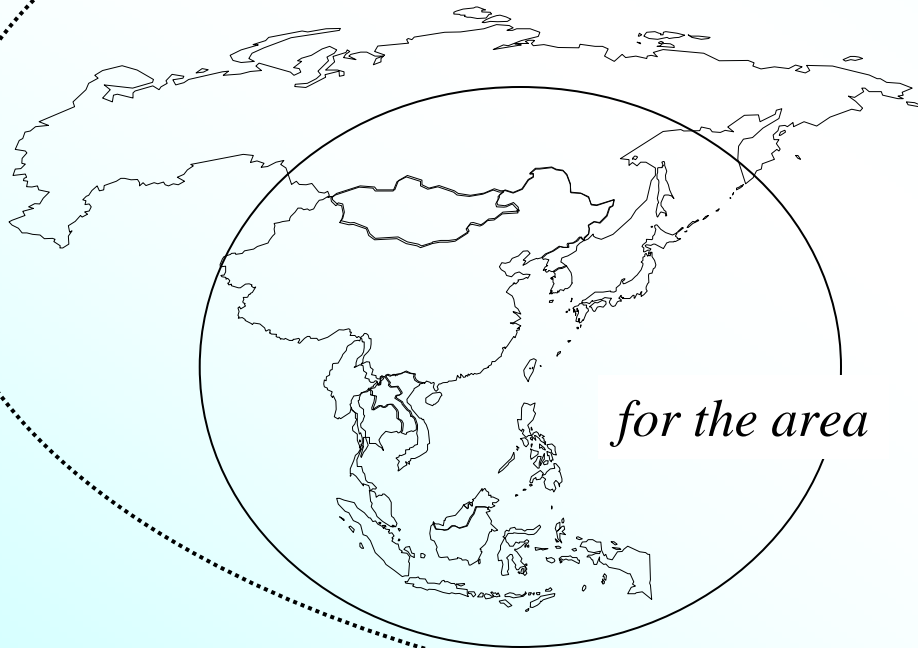
## 2. Overview of EANET air concentration data

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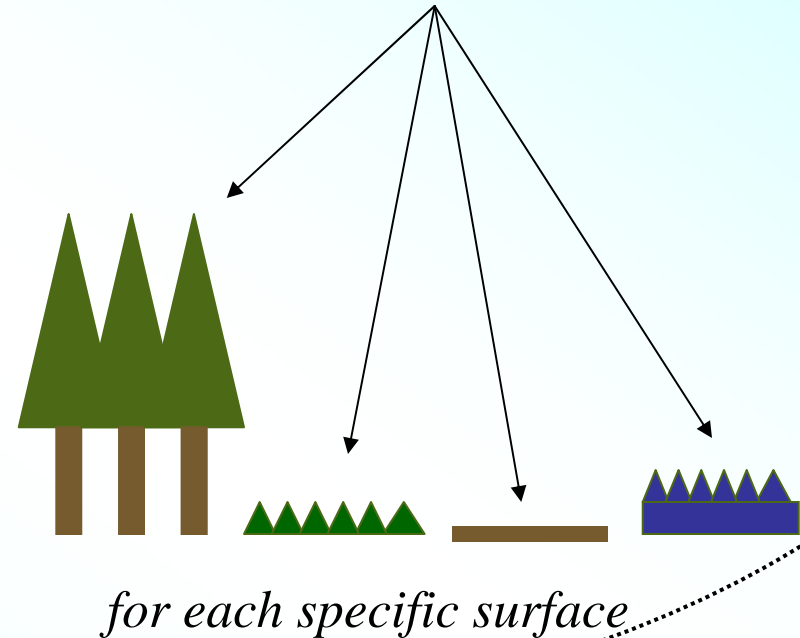
# Objectives of air concentration monitoring in EANET

- **Dry deposition monitoring**

**Concentration monitoring ( $C_a$ )**



**Deposition velocity research ( $V_d$ )**



1. Estimation of Dry Deposition Flux  $F = C_a \times V_d$
2. Clarification of the State of Air Quality

# Historical background

- ISAG1 (12-14 Oct. 1998, Yokohama)
  - The identification of **the priority chemical species**
  - The establishment of **Task Force on Dry Deposition Monitoring**
    - Strategy paper for future direction of dry deposition monitoring of EANET  
*endorsed by ISAG in September 1999*  
*revised in **September 2005***
    - QA/QC program for the air concentration monitoring in East Asia (for 1st priority)  
*endorsed by SAC in November 2001*

# Priority chemical species for dry deposition monitoring in EANET

Strategy paper for future direction of dry deposition monitoring of EANET, 2nd Edition (2005)

- 1st priority

- SO<sub>2</sub>, O<sub>3</sub>, NO, NO<sub>2</sub> (urban), HNO<sub>3</sub>, HCl, NH<sub>3</sub>, PM<sub>10</sub>
- Particle component:  
(SO<sub>4</sub><sup>2-</sup>, NO<sub>3</sub><sup>-</sup>, Cl<sup>-</sup>, NH<sub>4</sub><sup>+</sup>, Na<sup>+</sup>, Mg<sup>2+</sup>, Ca<sup>2+</sup>  
K<sup>+</sup> and Ca<sup>2+</sup>)

- 2nd priority

- NO<sub>2</sub> (rural, remote), PM<sub>2.5</sub>



# Monitoring methods applied in EANET

- **Automatic monitoring method (since 2000)**

(hourly, daily or monthly data)

UVF (SO<sub>2</sub>) , CLD (NO, NO<sub>2</sub>), DOAS (NO<sub>2</sub>),  
UV photometric (O<sub>3</sub>), TEOM, β-ray (PM) etc.

→ ***China, Japan, Malaysia, ROK,  
Russia, Thailand***

- **Filter pack method (since 2000)**

(weekly or bi-weekly data)

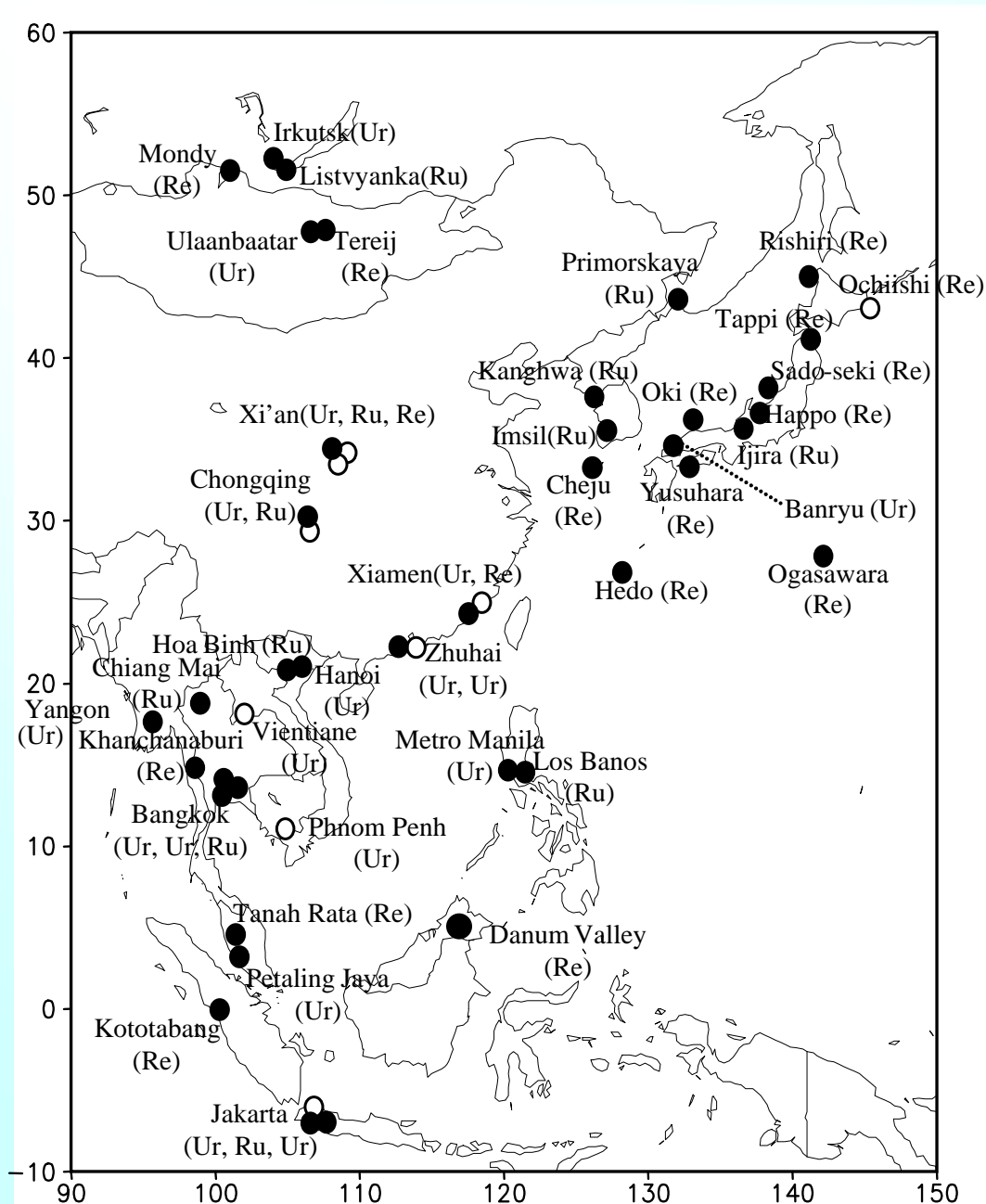
4-stage filter pack method

→ ***Indonesia, Japan, Malaysia, Mongolia,  
Philippines, ROK, Russia, Thailand,  
Vietnam***

# Items of the monitoring in EANET (2007)

	SO <sub>2</sub>	NO, NO <sub>2</sub> , NO <sub>x</sub> *	O <sub>3</sub>	HNO <sub>3</sub> , HCl, NH <sub>3</sub>	PM <sub>10</sub> , PM <sub>2.5</sub>	PMC
Cambodia	○			○		○
China	○	NO, NO <sub>2</sub> , NO <sub>x</sub> *			PM <sub>10</sub>	○
Indonesia	○			○		○
Japan	○	NO, NO <sub>2</sub> , NO <sub>x</sub> *	○	○	PM <sub>10</sub> , PM <sub>2.5</sub>	○
Lao	○			○		○
Malaysia	○	NO, NO <sub>2</sub> , NO <sub>x</sub> *		○		○
Mongolia	○			○		○
Philippines	○			○		○
Korea	○	NO, NO <sub>2</sub> , NO <sub>x</sub> *	○	○	PM <sub>10</sub> , PM <sub>2.5</sub>	○
Russia	○		○	○		○
Thailand	○	NO, NO <sub>2</sub> , NO <sub>x</sub> *	○	○	PM <sub>10</sub>	○
Vietnam	○			○		○

# Location of monitoring sites in EANET (2007)



## 50 sites in EANET

- Dry and Wet (40 sites)
- Wet only (10 sites)

## Dry dep. (Air conc.) monitoring

Filter Pack	34 sites
Automatic	22 sites
Passive sampler	2 sites

# Site number for monitoring species in 2007

- SO<sub>2</sub> (Auto + FP): 40 sites by 10 countries
- HNO<sub>3</sub>, NH<sub>3</sub>, HCl, PMC (FP) 34 sites by 10 countries
- NO, NO<sub>x</sub>/NO<sub>x</sub>\* (Auto) 16 sites by 4 countries
- NO<sub>2</sub> only (Auto) 2 sites by China (by DOAS)
- O<sub>3</sub> (Auto) 15 sites by 4 countries
- PM<sub>10</sub> (Auto) 19 sites by 4 countries
- PM<sub>2.5</sub> (Auto) 2 sites by Japan

# Picture of an automatic monitoring site (1)



# Picture of an automatic monitoring site (2)



# Picture of an filter pack monitoring site (1)



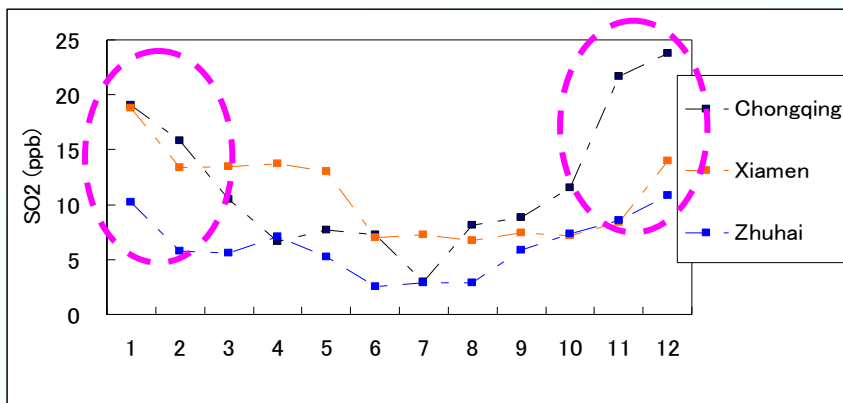
# Picture of an filter pack monitoring site (2)



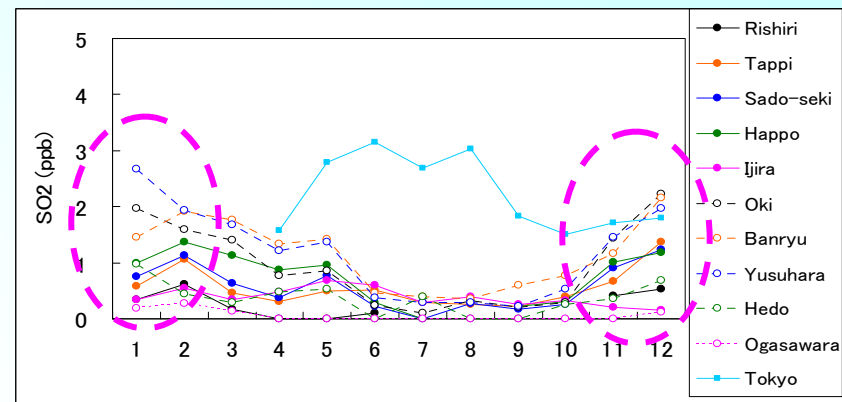


# Monthly average of SO<sub>2</sub> in 2007

## China

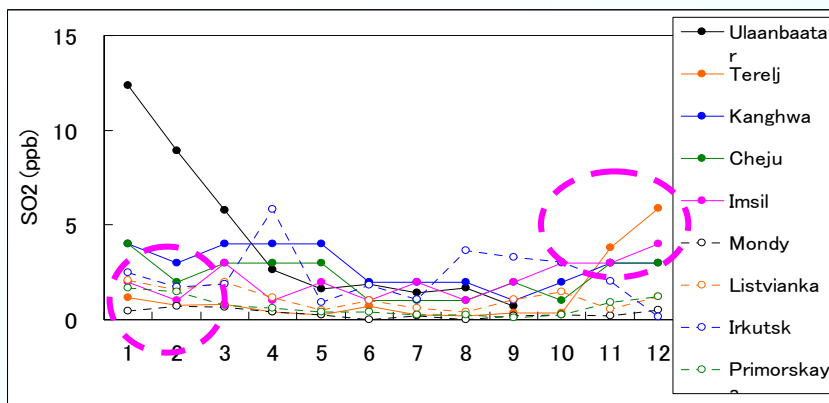


## Japan



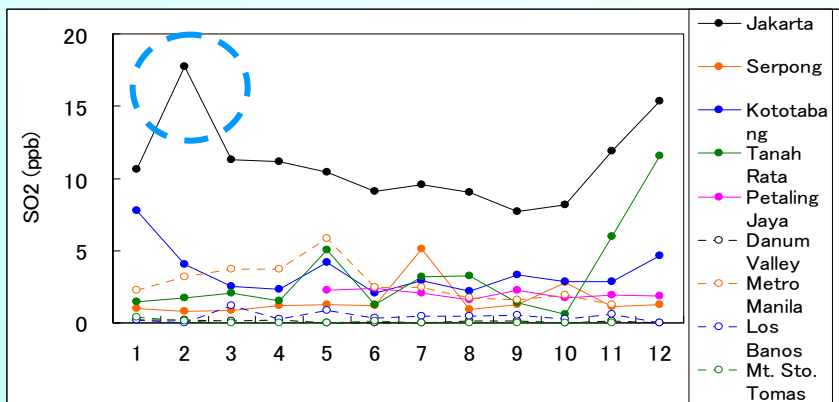
## Mongolia, R.Korea, Russia

Higher at Urban sites

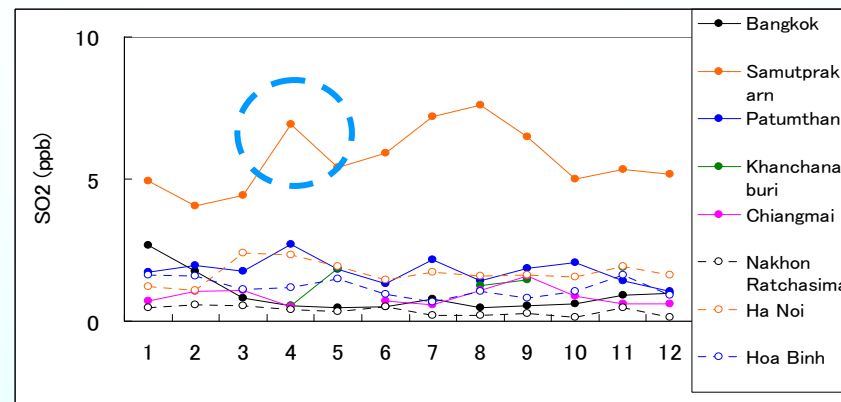


Higher in Winter

## Indonesia, Malaysia, Philippines

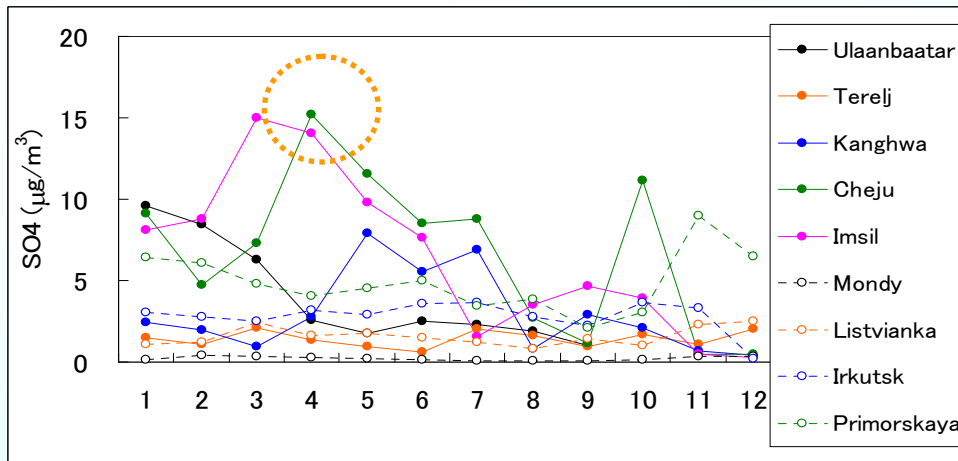


## Thailand, Viet Nam

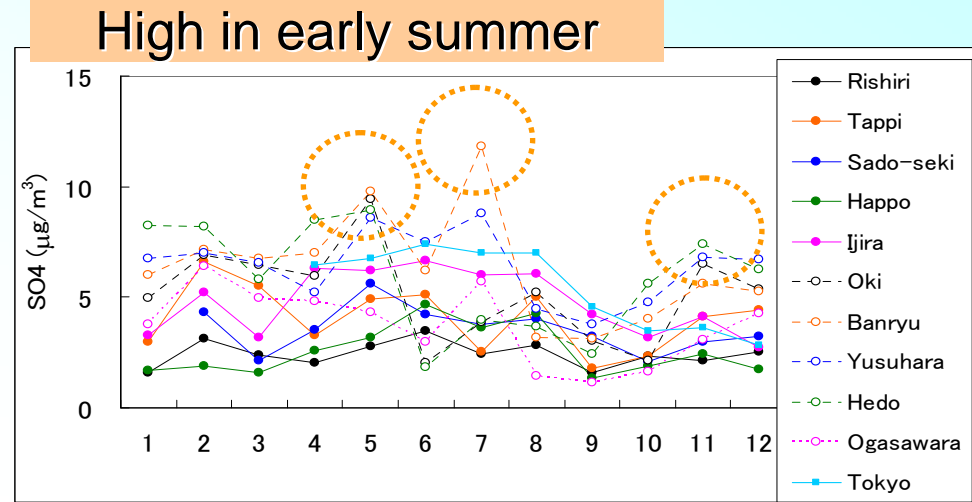


# Monthly average of particulate SO<sub>4</sub><sup>2-</sup> in 2007

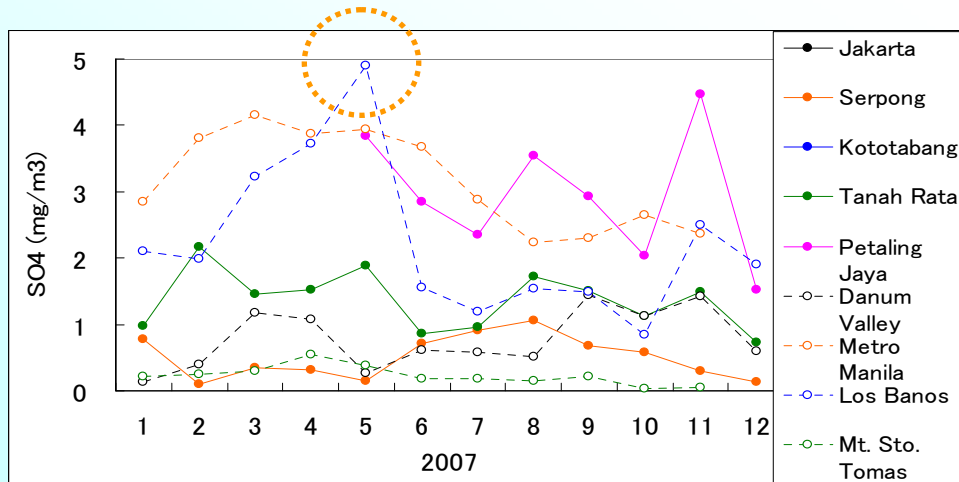
## Mongolia, R.Korea, Russia



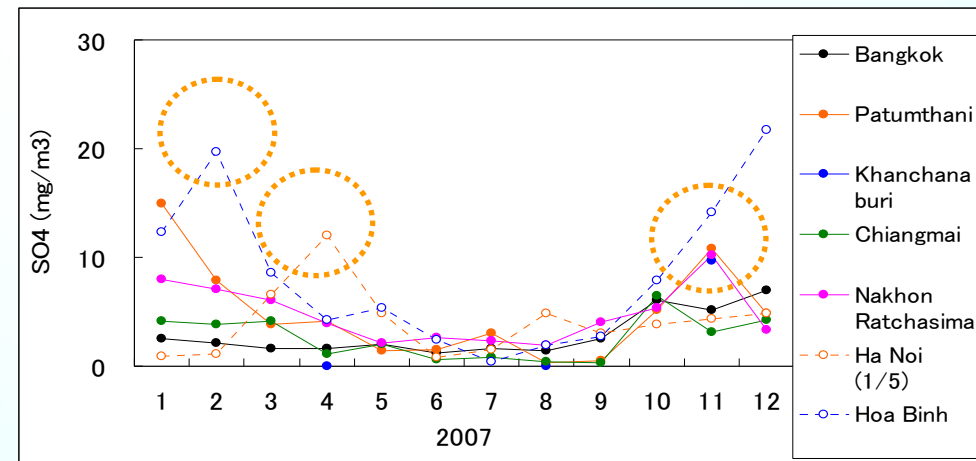
## Japan



## Indonesia, Malaysia, Philippines



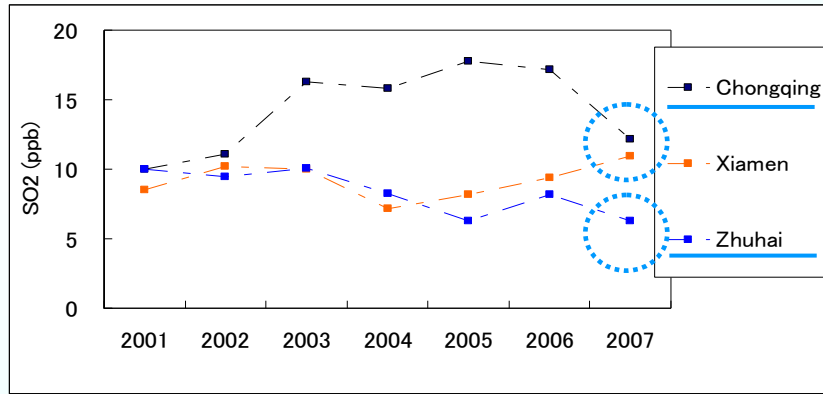
## Thailand, Viet Nam



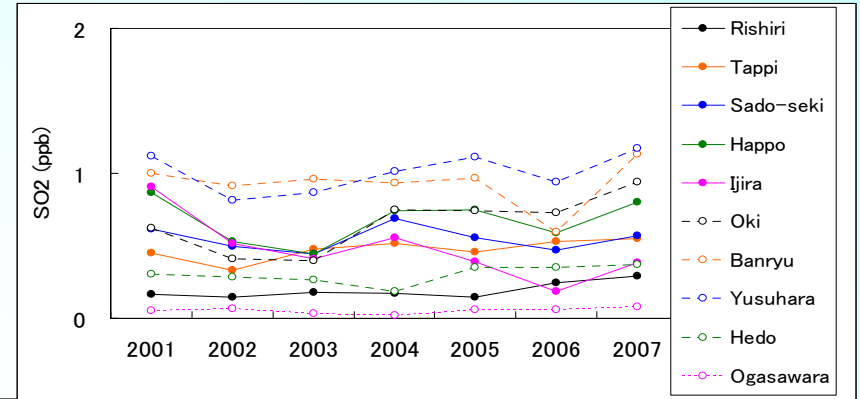
Some peaks were observed.

# Annual trend in 2001-2007 (SO<sub>2</sub>)

## China

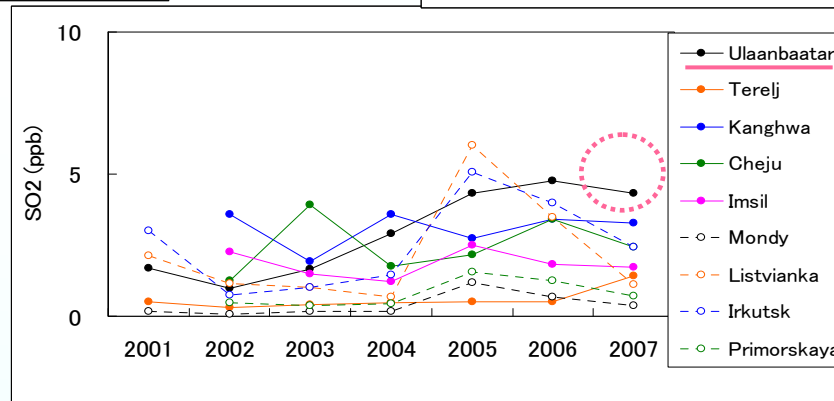


## Japan



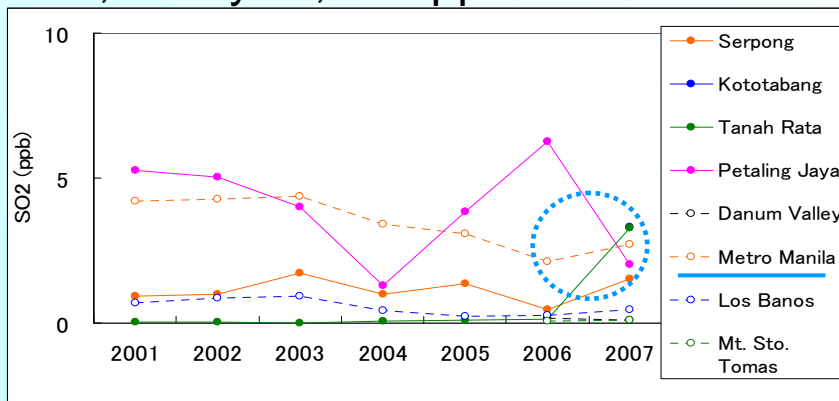
## Mongolia, R.Korea, Russia

Decreasing

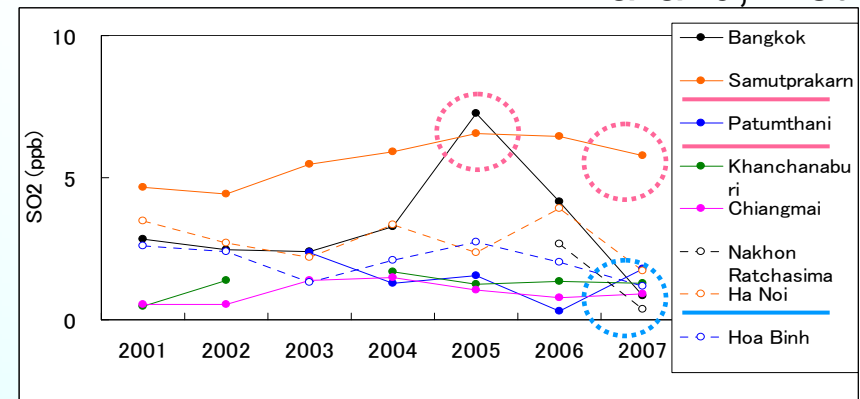


Increasing

## Indonesia, Malaysia, Philippines

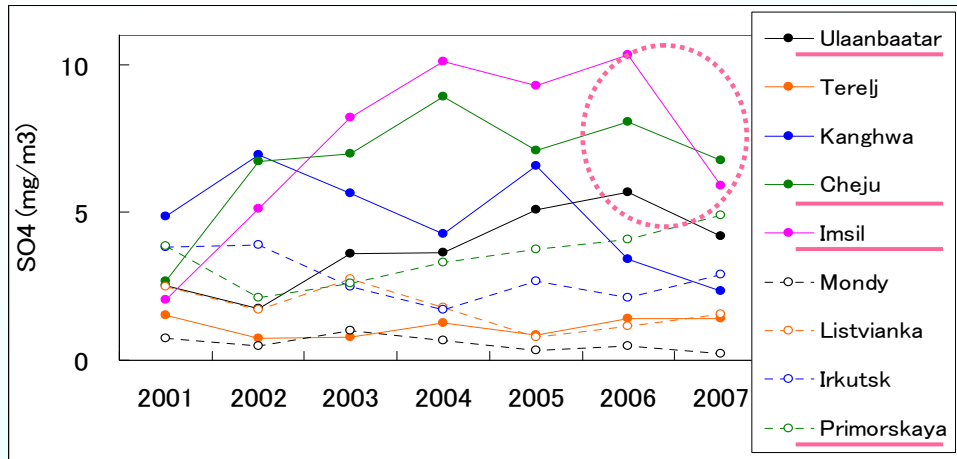


## Thailand, Viet Nam

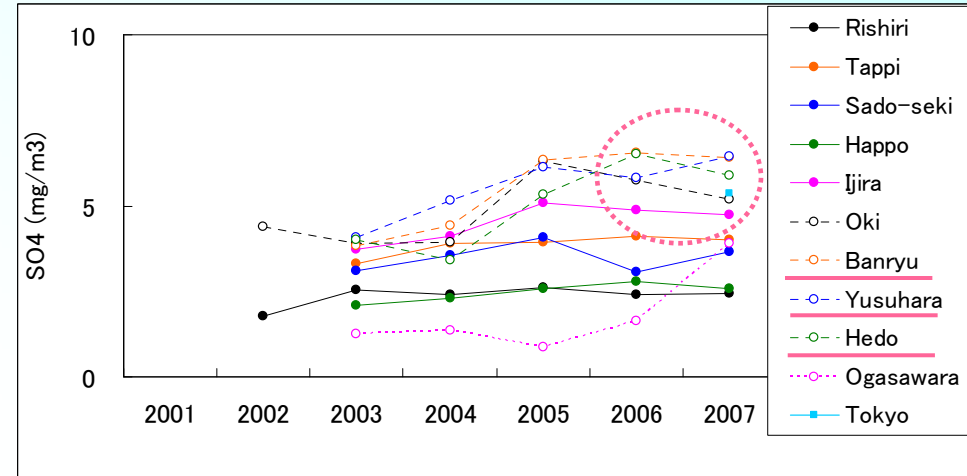


# Annual trend in 2001-2007 (SO<sub>4</sub><sup>2-</sup> in PM)

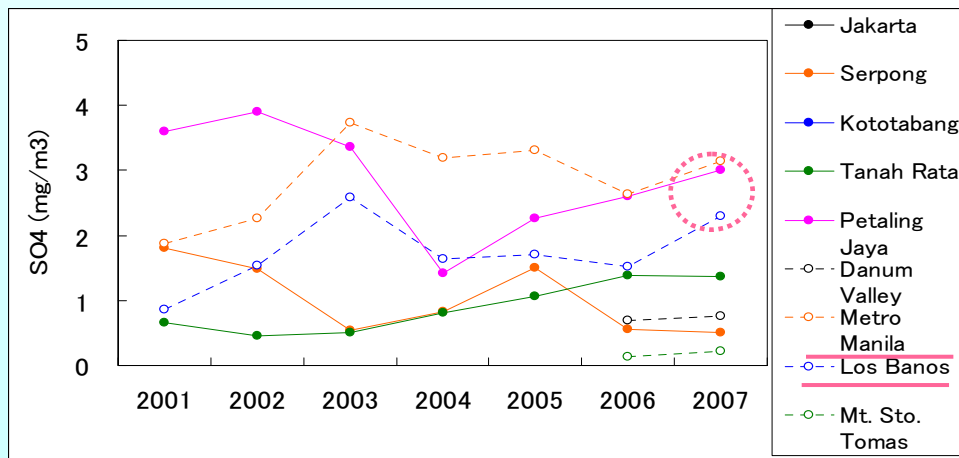
## Mongolia, R.Korea, Russia



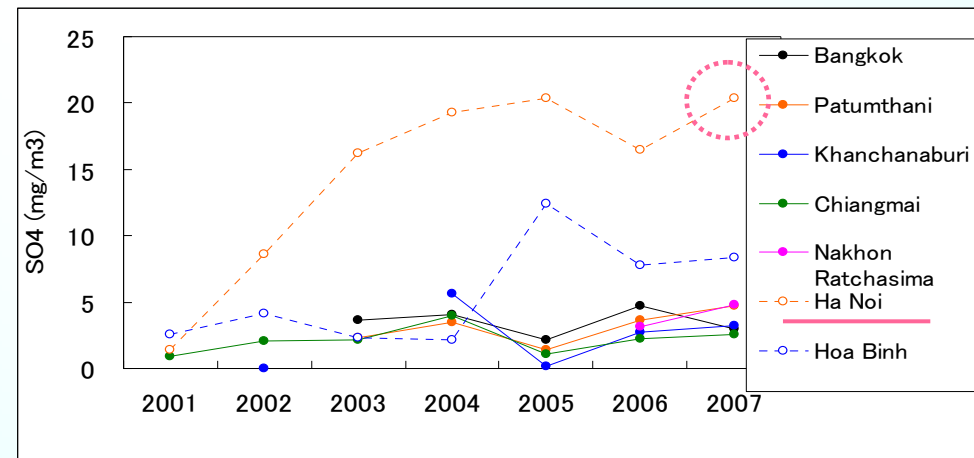
## Japan



## Indonesia, Malaysia, Philippines



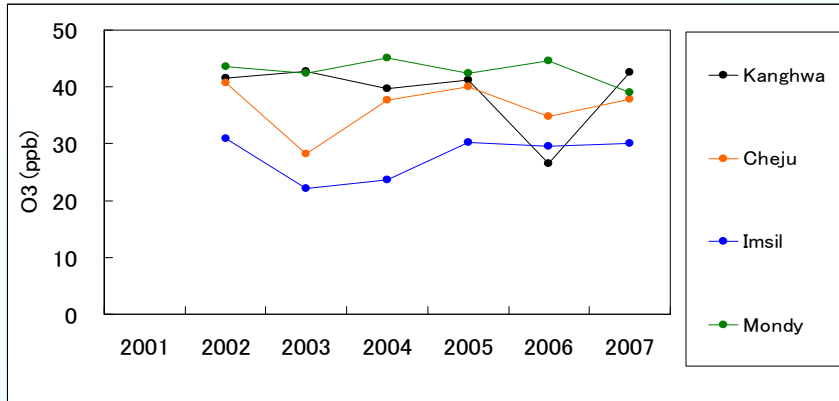
## Thailand, Viet Nam



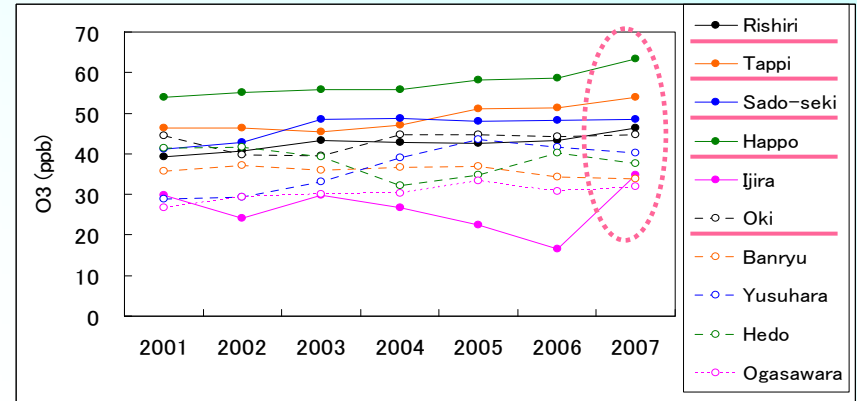
Increasing

# Annual trend in 2001-2007 (O<sub>3</sub>)

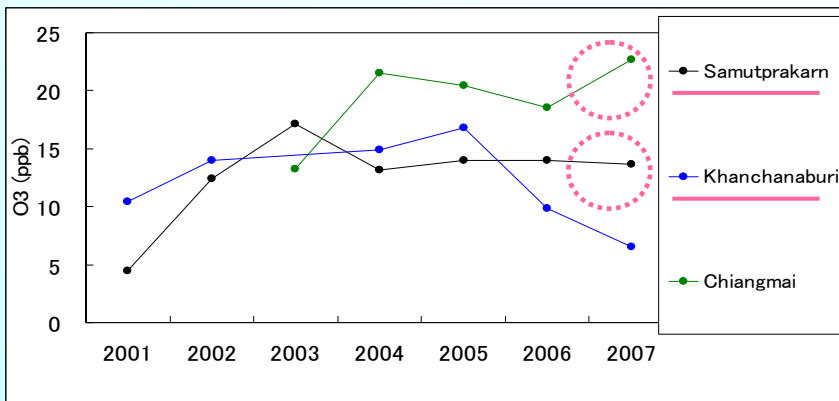
## R.Korea, Russia



## Japan



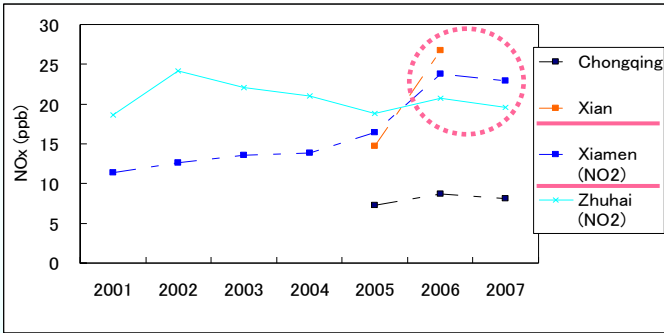
## Thailand



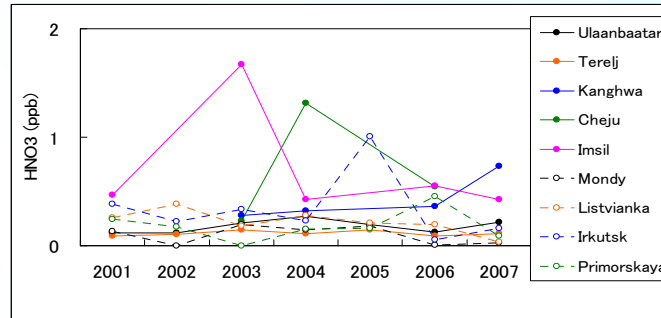
Increasing

# Annual trend in 2001-2007 (NO<sub>x</sub>, HNO<sub>3</sub>, NO<sub>3</sub><sup>-</sup>)

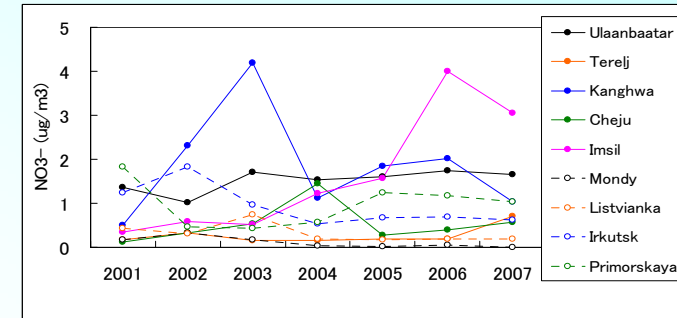
## China (NO<sub>x</sub>, NO<sub>2</sub>)



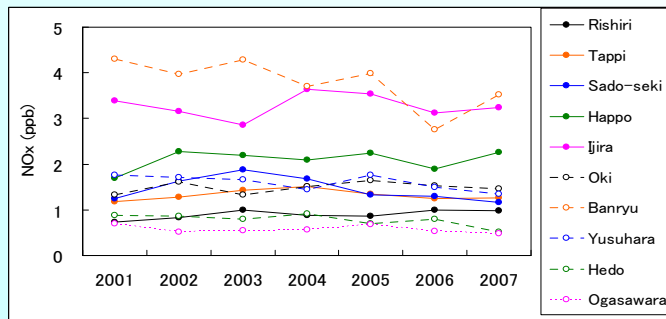
## Mongolia, R.Korea, Russia (HNO<sub>3</sub>)



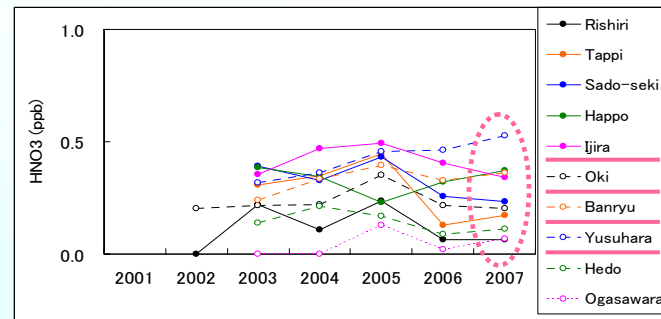
## Mongolia, R.Korea, Russia (NO<sub>3</sub><sup>-</sup> in PM)



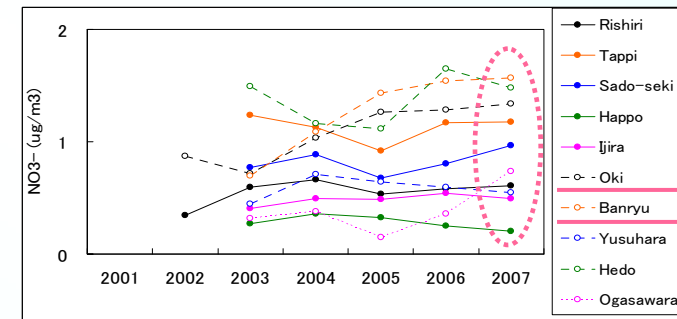
## Japan (NO<sub>x</sub>)



## Japan (HNO<sub>3</sub>)



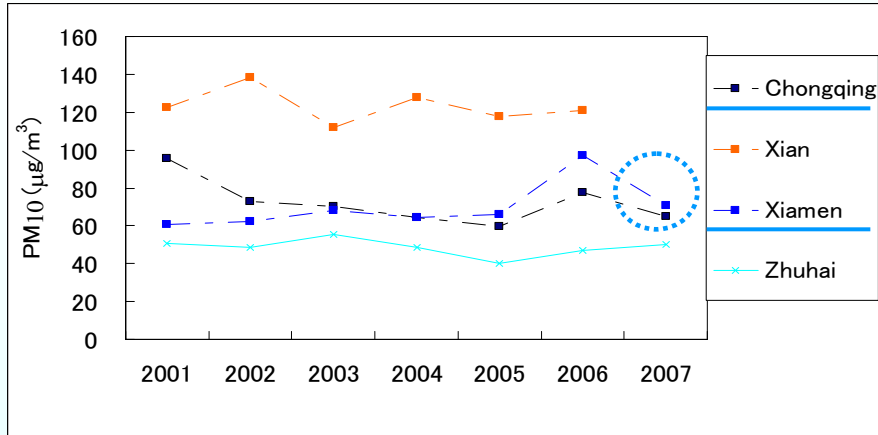
## Japan (NO<sub>3</sub><sup>-</sup> in PM)



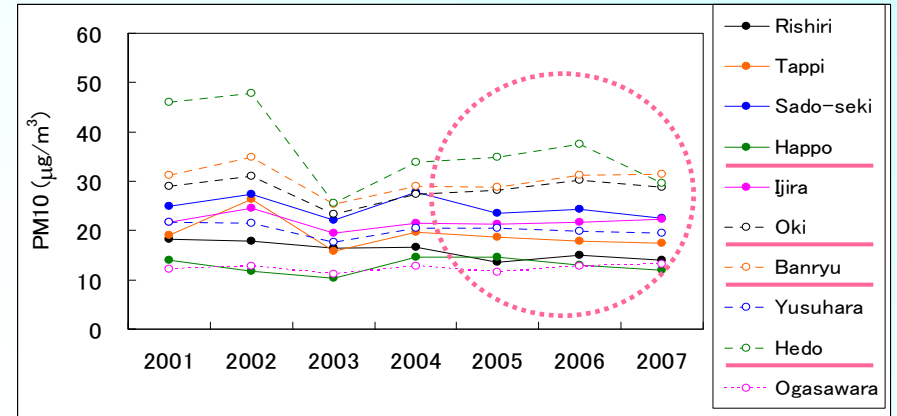
Increasing

# Annual trend in 2001-2007 (PM<sub>10</sub>)

## China

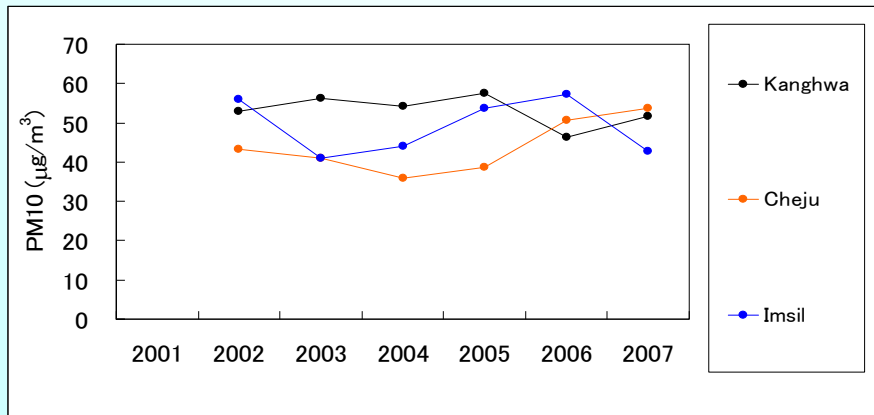


## Japan



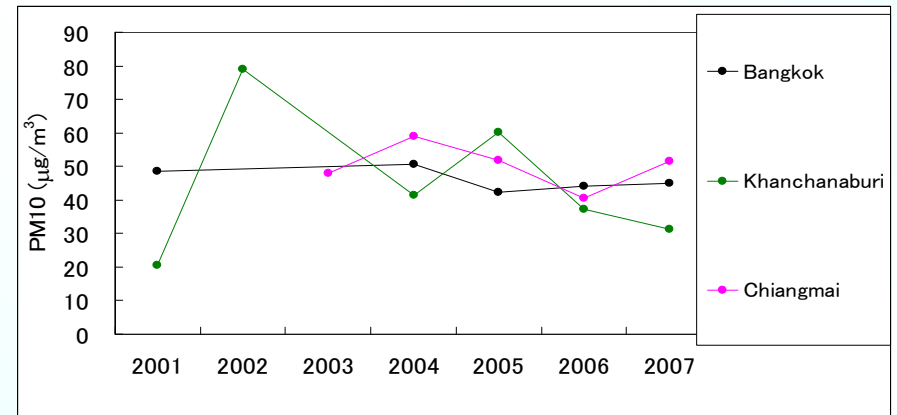
Decreasing

## R.Korea



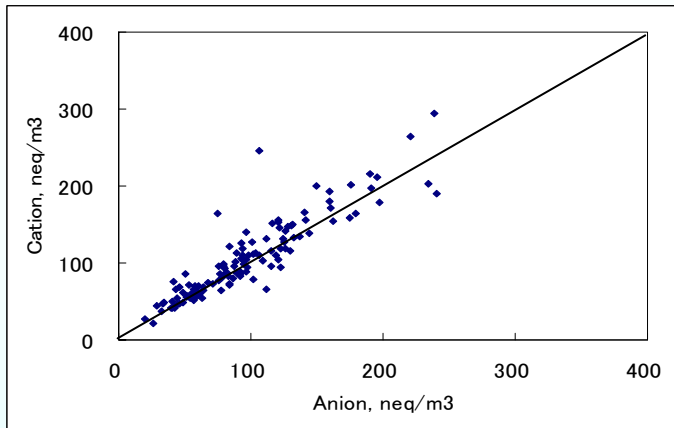
Increasing

## Thailand

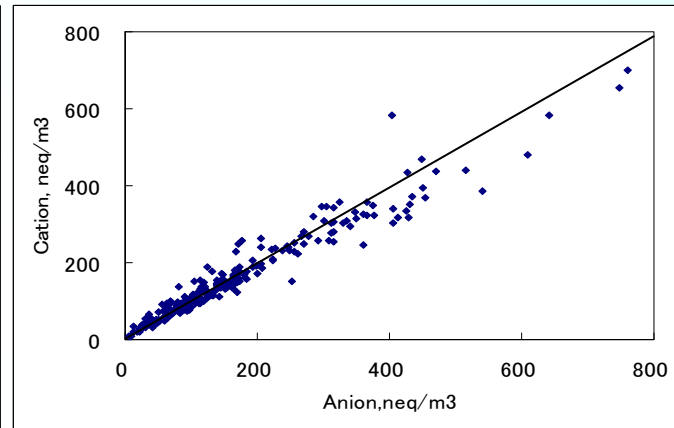


# Ionic Balance of Particulate Matter (2003-2007)

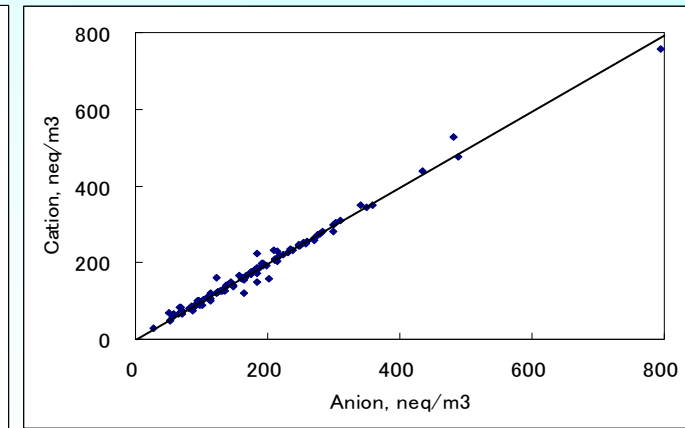
Primorskaya (Russia)



Cheju (R of Korea)

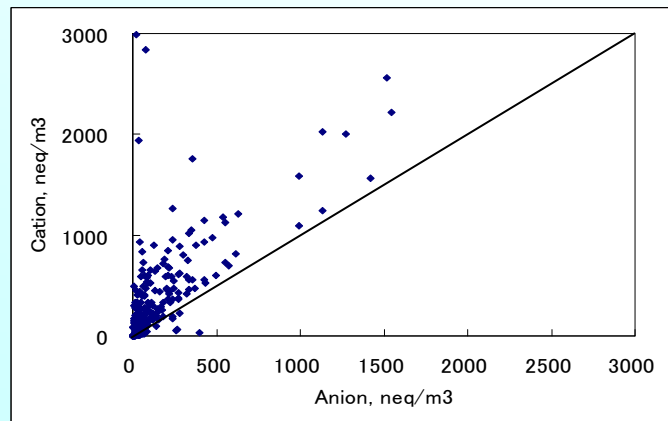


Sadoseki (Japan)

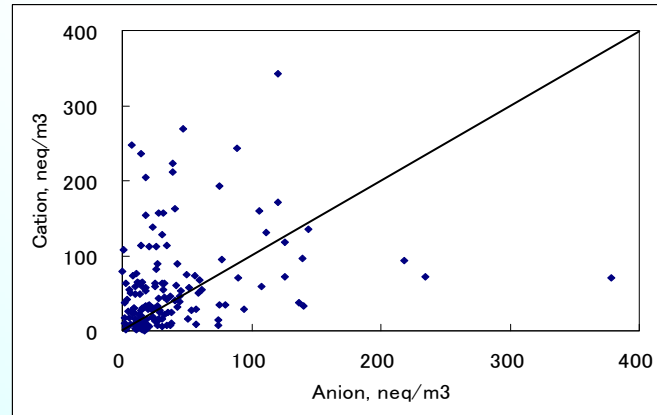


Northern part → Ionic balance were retained.

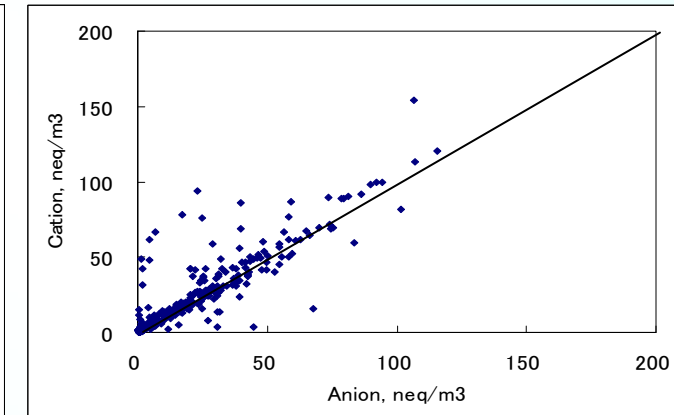
HoaBinh (Vietnam)



Serpong (Indonesia)



TanahRata (Malaysia)



Sothern part → Ionic balance did not established.  
Existence of unanalyzed species?



# Monitoring for Meteorological Parameters in EANET

- Monitoring Item

Temperature (°C), Relative Humidity (%),  
Wind Speed (m/s), Wind Direction, Precipitation (mm),  
Sunshine Duration (hrs), Solar Radiation (MJ/m<sup>2</sup>)

- Reported countries (No. of sites) in 2007

Cambodia (1), China (4), Indonesia (2), Japan (10),  
Malaysia (3), Mongolia (2), ROK (2), Russia (1),  
Thailand (6), Vietnam (2)

Many sites did not provide all items shown above.  
In order to calculate dry deposition flux, establishment  
of meteorological monitoring is required.

# Summary

- Informal and small meetings were held in Tokyo and Hanoi last autumn in order to share the information of ongoing modeling research activities. Outcomes of these meetings will provide useful information on MICS-Asia Phase 2.X and Phase 3 activities.
- Air concentrations monitoring covering the whole EANET region is establishing step by step. From the air concentration monitoring data, transboundary air pollution affecting Japan is observed.

**Thank you for your attention.**