

LTP Expert Meeting since 1996

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Outline

1. Objectives of LTP Project
2. The history and Organization of LTP
3. LTP Activities
4. Summary

Objectives of LTP

- The Long-range Transboundary Air Pollutants in Northeast Asia (LTP)

: International joint research project among Korea, Japan, and China



started as a government-based air pollution research framework

- Main objectives

- contribute to laying a foundation for the research on LTP
- improve our scientific understanding of LTP
- provide science-based information to policy-makers

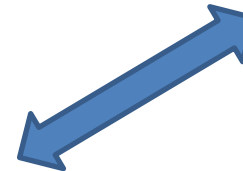
Monitoring

state of long-range air pollution
transport rate estimation
model validation

Modeling

long-range transport patterns
source-receptor relationship
high concentration episodes forecasting

Emission inventories



The history of LTP meeting

- 1) 1995: Workshop in Seoul, Korea and initially discussed on LTP
- 2) 1996: - Tripartite Environment Ministers Meeting (TEMM)
 - 1st Expert LTP meeting (Joint research activity)
- 3) 1997: - 2nd Expert Meeting : Sub-working Groups (Monitoring, Modeling) established
- 4) 1999: - 1st Sub-working Group Meeting
- 5) 2000-2017: 1st – 4th stage LTP activity

The history of LTP meeting

| Research Stage | Expert Meeting No. | Place | Period | Annual Report No. |
|----------------------|--------------------|--------------------|----------------------|-------------------|
| Planning and startup | 1 st | Seoul, Korea | July 4-5, 1996 | |
| | 2 nd | Seoul, Korea | November 18-20, 1997 | |
| 1 st | 3 rd | Seoul, Korea | August 22-24, 2000 | 1 st |
| | 4 th | Seoul, Korea | August 22-24, 2001 | 2 nd |
| | 5 th | Gyeongju, Korea | August 27-29, 2002 | 3 rd |
| | 6 th | Jeju, Korea | November 4-6, 2003 | 4 th |
| | 7 th | Xiamen, China | October 28-30, 2004 | 5 th |
| 2 nd | 8 th | Jeju, Korea | November 8-10, 2005 | 6 th |
| | 9 th | Daegu, Korea | November 7-9, 2006 | 7 th |
| | 10 th | Busan, Korea | November 6-8, 2007 | 8 th |
| 3 rd | 11 th | Incheon, Korea | November 11-13, 2008 | 9 th |
| | 12 th | Jeju, Korea | November 10-12, 2009 | 10 th |
| | 13 th | Zhuhai, China | November 9-11, 2010 | 11 th |
| | 14 th | Pyeongchang, Korea | November 8-10, 2011 | 12 th |
| | 15 th | Pusan, Korea | November 14-16, 2012 | 13 th |
| 4 th | 16 th | Seoul, Korea | May 14, 2013 | 14 th |
| | 17 th | Yeosu, China | November 19-21, 2014 | 15 th |
| | 18 th | Incheon, Korea | November 18-20, 2015 | 16 th |
| | 19 th | Seoul, Korea | November 16-18, 2016 | 17 th |

LTP Activities

Phase of LTP project

International cooperation for
improving air quality in Northeast Asia

The 1st phase (2000 - 2004)

- Establish foundation for joint research
- Establish LTP concentration and emissions databases
- Develop a modeling system for Collaboration

The 2nd phase (2005 - 2007)

- Estimate emissions from three countries
- Monitoring and modeling study
- S-R relationships Calculation for Sulfur among three countries

LTP Activities

Phase of LTP project

International cooperation for
improving air quality in Northeast Asia

The 3rd phase (2008 - 2012)

- Research on the impacts of SO₂, Total nitrate, and ozone
- Update the emission data of major air pollutants
(SO₂, NO_x, NH₃, CO, VOCs, PM₁₀)
- Sulfur and Total nitrate S-R calculation

The 4th phase (2013 - 2017)

- Monitoring and modeling of PM_{2.5} and its precursors
- Intensive campaigns (2015 – 2017)
- S-R calculation for PM_{2.5}
- Summary report for policy makers

History & Organization

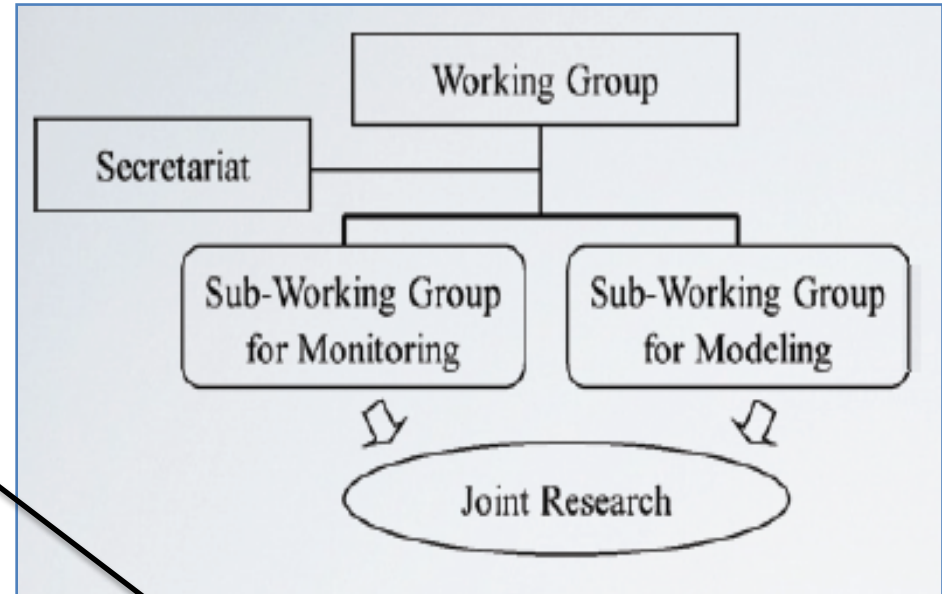
1999: The 1st Sub-working group meeting
Launching the LTP project

2000–2004 : The 1st stage LTP activity
Building an International Co-operation Platform

2005–2007 : The 2nd stage LTP activity
Transboundary transport of Sulfur

2008–2012 : The 3rd stage LTP activity
Transboundary transport of Nitrate +
Model intercomparison

2013–2017 : The 4th stage LTP activity
Transboundary transport of PM_{2.5}



Sulfur S-R

Total nitrate S-R

PM_{2.5} S-R

Organization

Supported by [National Institute of Environmental Research \(NIER\)](#), Korea

LTP Expert Meeting

Secretariat

Working group

**Sub-working group
for **Monitoring****

ground-based measurement
continuous and intensive
advanced monitoring

**Sub-working group
for **Modeling****

SR Modeling
estimation of emissions

LTP Modeling System

- Air quality models – CADM, CMAQ, and RAQM, in general
- Meteorological models – MM5, WRF, and RAMS
- Emission data – mostly prepared by the LTP project

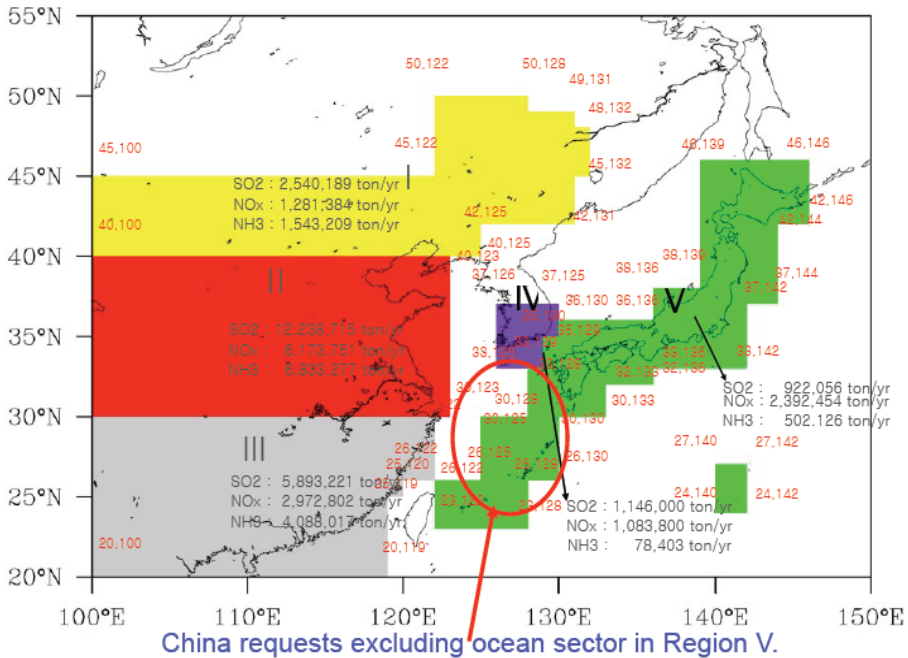
Air Quality Model

| | | | | |
|-------|-----------------------------------|---------------------|-----------|--|
| Korea | CADM-II, STEM-II, SADM, YU-SADM | CADM | CMAQ | |
| China | RADM, SAQM, TAQM, CRAES_Sulfur | CMAQ | | |
| Japan | EA Model, GERF Model, ADORC Model | RAQM | RAQM2 | |
| | 2000 2001 2002 2003 | 2005 2006 2007 2008 | 2009 2010 | |

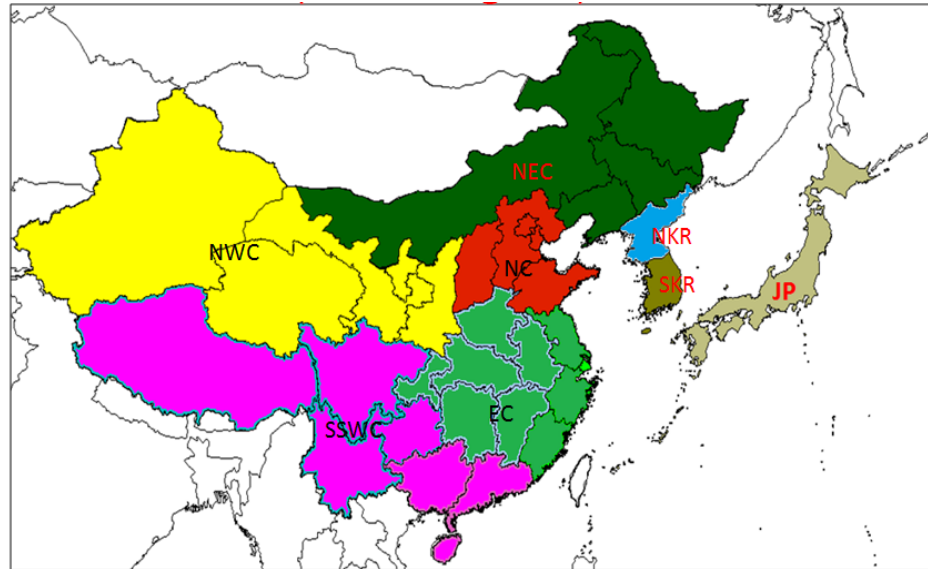
Meteorological Model

| | | | | |
|-------|---------------------|---------------------|-----------|-----|
| Korea | CSU-RAMS, MM5 | RAMS | MM5 | |
| China | MM4, MM5 | MM5 | | |
| Japan | MM5 | | | WRF |
| | 2000 2001 2002 2003 | 2005 2006 2007 2008 | 2009 2010 | |

Modeling Domain



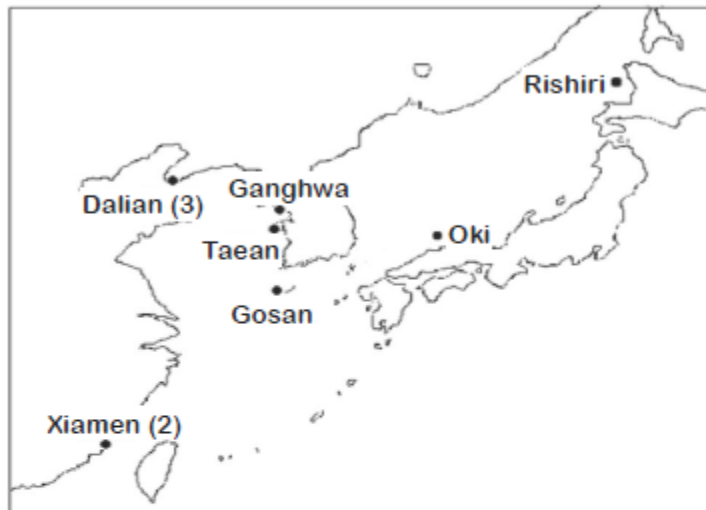
The 3rd phase
(5 Regions)



The 4th phase
China 5: NEC, NC, EC, SSWC, NWC
Korea 2 : S. Korea, N. Korea
Japan 1 : Japan
(8 Regions)

[Results form Monitoring Group]

Long-term Monitoring



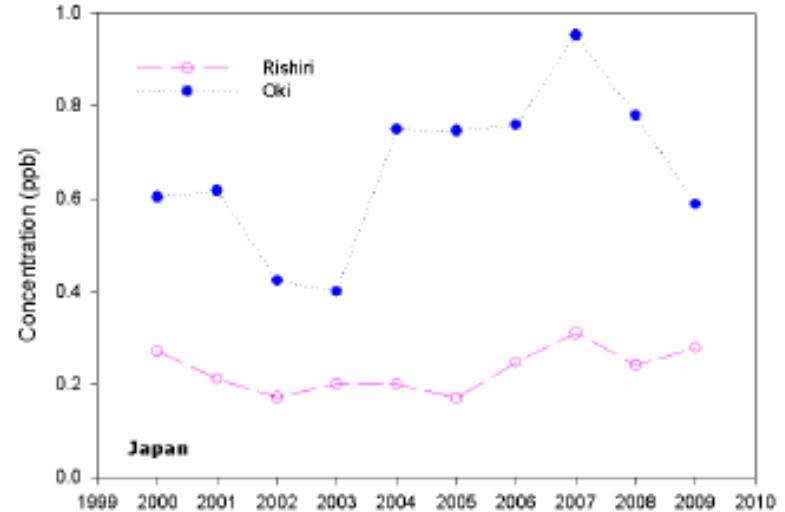
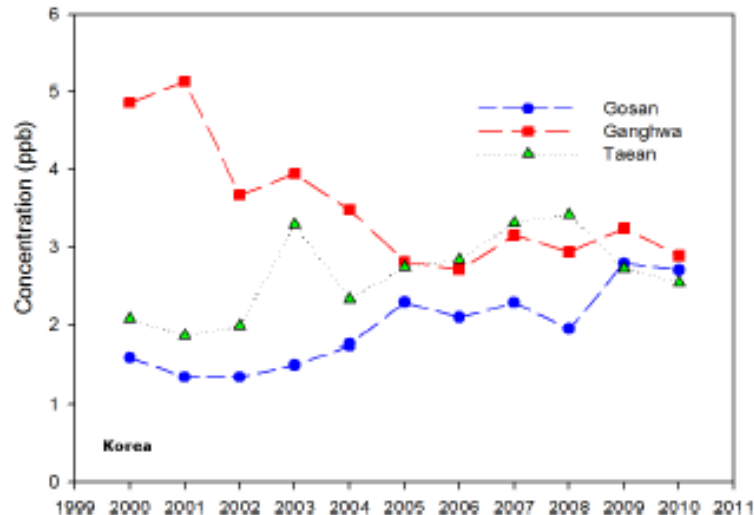
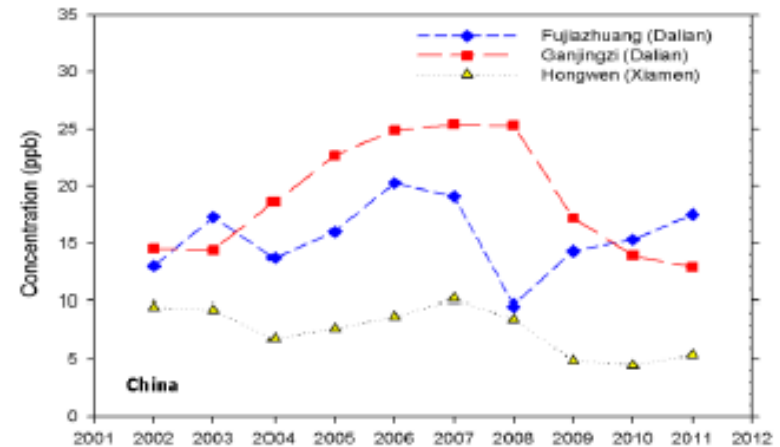
- SO_2 , NO_2 , O_3 , PM_{10}
- Depositions

| Item | Parameter | Frequency |
|---------------------------|------------------|-----------------------------|
| Wet Deposition Monitoring | pH | Daily or when precipitation |
| | Conductivity | |
| | Rain amount | |
| | Anions | |
| | Cations | |
| Dry Deposition Monitoring | SO_2 | Continuous |
| | NO_2 | |
| | PM_{10} | |

[Results Monitoring Group]

Long-term Monitoring of SO₂

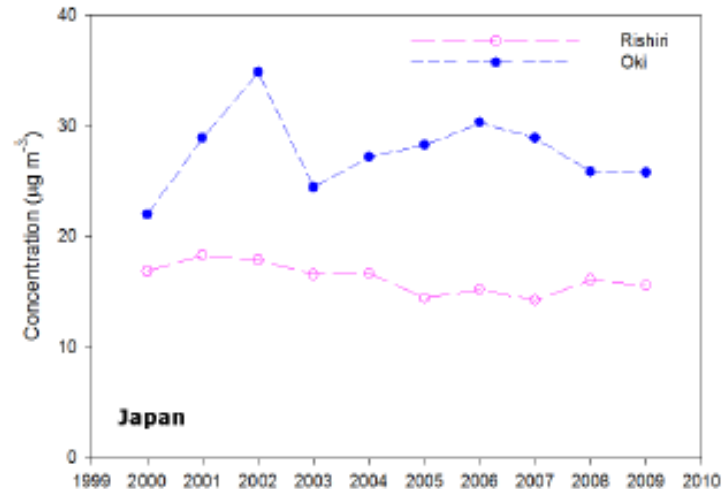
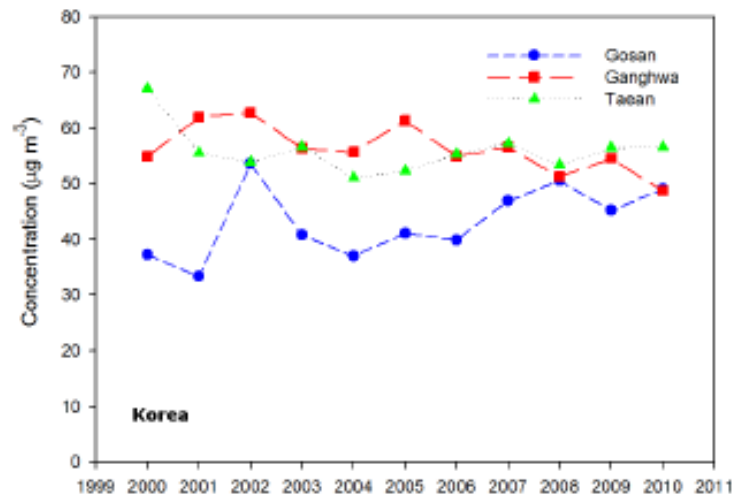
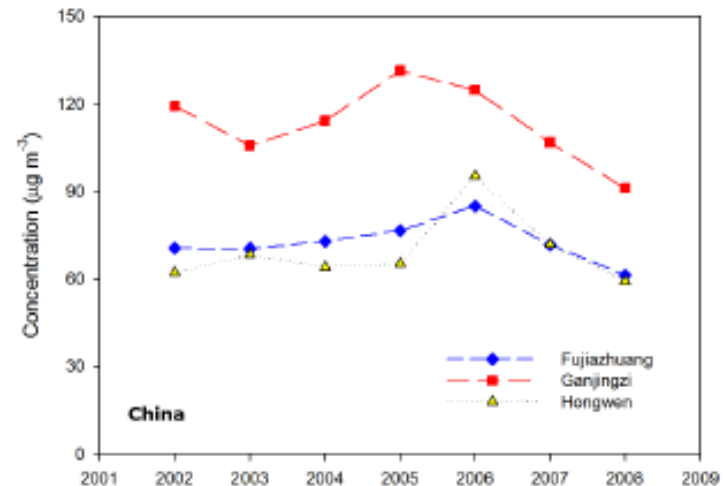
- **China:** Decreased during the past several years except Fujiyazhuang
- **Korea:** Increased at two sites with lower concentrations but decreased at a site with higher concentrations
- **Japan:** Lower levels but increasing trend since the early 2000s



[Results from Monitoring Group]

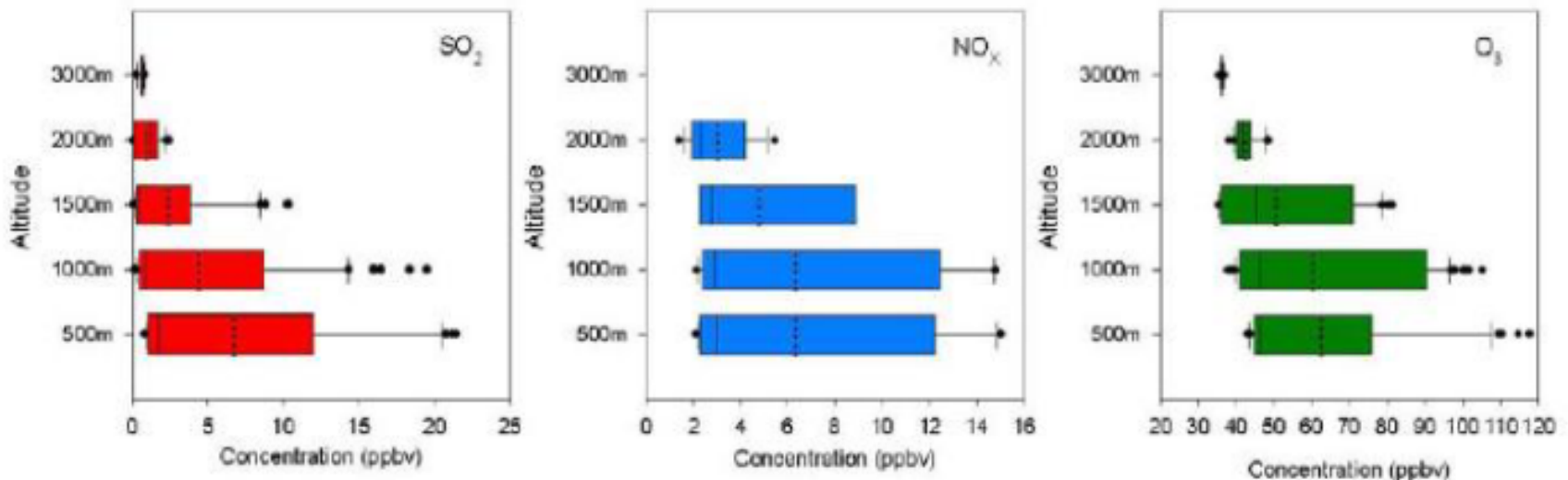
Long-term Monitoring of PM₁₀

- China: Decreased during the past several years
- Korea: Increased at a site with lower concentrations but decreased at two sites with higher concentrations
- Japan: Lower levels without distinct trends in the 2000s



[Results from Monitoring Group]

Aircraft Measurements in Korea (April 2005)



- **SO₂:** Decreased with altitude
- **O₃:** Peak at ~1 km and lower at ~500 m due to titration with fresh NO
- **NO_x:** In between
 - Model analysis could be helpful to understand the variation in detail.

The 8th phase of joint research (2005)



The 9th phase of joint research (2006)



The 10th phase of joint research (2007)



November, 6, 2007
Paradise Hotel, Busan, Korea

Agreements on the 4th Phase of joint research

The 17th Expert Meeting on LTP project (2014)



[19-21 November 2014, Yeosu, Korea]

LTP project since 1996



- a) **Contribute to laying a foundation for the research on LTP**
- b) **Improve our scientific understanding of LTP**
- c) **Provide science-based information to policy-makers**

