Transboundary Air Pollution in Asia

Yun-Chul Hong

Seoul National University College of Medicine
Republic of Korea
Transboundary air pollution in Asia

- Transboundary air pollution (generated in one country and impacting in others)

- These pollutants can be transported thousands of kilometres.

- Different sources (Urban air pollution, Forest or Peatland fire, Dust & Sandstorm)

- ASEAN Haze
- Dust and Sand storm in East Asia
- Indo-Gangetic Plain Haze
Transboundary Air Pollution in East Asia

This January 27, 2006, MODIS/Terra Real-Time image shows the effects of prevailing west winds during the winter. Smog is being pushed by the winds across the eastern coastal plains of China, and over the Yellow Sea to the Korea Peninsula and Japan. Note the ground fog below the haze in the southern portion of the coastal plains. Fog forms when warm moist air flows over colder air near the ground. The fog, and the associated humidity, tend to concentrate air pollution near the ground.

Taken the same day as the previous image, this January 27, 2006, MODIS/Aqua image of the Korean Peninsula shows the dramatic influence that Chinese air pollution has on its neighbors to the east. The Japanese island of Kyushu can just be seen in the bottom right corner of the image, just across the Korean Strait from the South Korean city of Busan. China's Shandong Peninsula, which is covered with thick smog, is just above center on the left edge of the image.
Backward trajectories of Dust and Sandstorm arriving at Seoul in May, 2007
Issues of desert dust

Double role of Asian dust as a direct cause and as an effect modifier

Origin of dust
(Gobi desert)

Desert dust

long journey

Local Air pollution

★ Direct Effects of Asian dust

Asian local cities

(dirty) Asian dust

Air pollutant

Local Air pollution

★ Effect modifier on the effects of anthropogenic air pollution

Adverse health effects
Daily contribution of PM$_{2.5}$ in Seoul by China, South Korea, and North Korea (2016)
Source country-specific attributable mortality to PM$_{2.5}$ and morality contribution ratio during episodic days in 2016

<table>
<thead>
<tr>
<th></th>
<th>Attributable mortality (N)</th>
<th>Contribution ratio (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>China</td>
</tr>
<tr>
<td>All</td>
<td>415</td>
<td>238</td>
</tr>
<tr>
<td>CVD</td>
<td>106</td>
<td>60</td>
</tr>
<tr>
<td>RSP</td>
<td>128</td>
<td>75</td>
</tr>
</tbody>
</table>

SK: South Korea; NK: North Korea
CVD: Cardiovascular; RSP: Respiratory
Haze Air Pollution in Southeast Asian Countries

- Landscape fires are common in Southeast Asian countries
- Peatland, a type of wetland ≈ 300,000 km² in Indonesia and Malaysia – 56 million football fields
- Become prone to fire (especially dry season)

Haze episode at Southeast Asia in 2015

A NASA satellite image showing the extent of the haze on 24 September 2015
Figure 2. September–October total emissions of organic and black carbon (OC+ BC) from GFAS during 2006 and 2015. The top panel shows 2006, the middle panel shows 2015, and the bottom panel shows the difference (2015−2006). Province boundaries are shown in the bottom panel by colored lines, corresponding to Jambi in coral, South Sumatra and Bangka-Belitung in green, West Kalimantan in blue, and Central Kalimantan in purple.

Figure 3. Contributions by province to average regional population-weighted smoke exposures (left) and total Indonesian fire emissions of OC+BC (right) during July–October 2006 and 2015. The island province of Bangka-Belitung is included with South Sumatra. Province boundaries are shown in figure 2 and supplement figure S2.
Results: Annual average PM$_{10}$ concentrations

2011*

- None of the stations in NT exceeded the standard, due to the La Niña event
- La Niña is a natural event that produces increased precipitation in NT and reduced emissions during the biomass burning season

*La Niña Year

- A natural event produces induced precipitation anomalies over Southeast Asia, Australia, and Northern South America
- Rainfall increases over Indonesia and decreases over the central tropical Pacific

Source: NOAA

2012-2015**

- 4 sites exceeded the standard
- During biomass burning season, the large number of high concentrations made a significant contribution to the annual average

**Normal Years

Kevin Hicks, SEI
Results: The contribution of hourly PM$_{10}$ concentration to the annual average

Country contribution

March

March

Ratchaburi et al (in prep.)
Transboundary Air Pollution in IGP
Where does the pollution in Lumbini, Nepal, come from?
How do we address?
Win-Win strategy

1. Scientific evidence first
2. No blaming policy
3. Capacity building
4. International Collaboration
THANK YOU!

TWG-AQ Workshop for Transboundary Air Pollution, 2018