Biomass Burning and Air Quality in the equatorial Southeast Asia

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Introduction

- The recurring biomass burning activities deteriorate the air quality and impact the health of the public.
- The equatorial maritime continent is characterised by light monsoon winds and calm conditions where smoke is poorly dispersed and cause transboundary haze between countries.

The 1997 El Nino event caused anomalous weak wind conditions over the equatorial Pacific and Indian Oceans, which further degraded the air quality in Sumatra and Borneo during the fire events.
Outline of presentation

- Spatial analysis distribution of the active fire counts
- Trajectory analysis
- Air quality analysis
- Dispersion analysis
Case study: Fire events during August 2004. Spatial Distributions of the Weekly Active Fire Counts from MODIS
The Kernel density of the total active fire counts (MODIS) in Sumatra and Borneo during August 2004
The distribution of active fire count densities across Sumatera, Peninsular Malaysia and Borneo on 4 separate dates a) 10th, (b) 19th, (c) 21st and (d) 24th of August 2005.
The distribution of PM$_{10}$ Concentrations on 10\textsuperscript{th}, 19\textsuperscript{th} and 20\textsuperscript{th} August 2004
The daily AOD, $\text{PM}_{10}$ concentrations, and maximum wind speed at Sri Aman, Sarawak. The active fires counts are the total for Borneo, while $\text{PM}_{10}$ concentrations are also included for the Kota Samarahan and Sibu air quality stations.
Weekly aerosol AOD distributions over equatorial Southeast Asia from (a) 1 to 7 August, (b) 8 to 14 August, (c) 15 to 21 August, and (d) 22 to 31 August 2004.
The Hovmoller representation of the (a) AOD and (b) oceanic mass concentrations (μg/cm²) over the averaged longitude of 80°E to 120°E during August 2004.
Southwest Monsoon Winds over The Region Indicating Weak winds Over the Equator
Trajectories from sources of active fire counts on 19 August 2004
Dispersion of plumes at every 12 hours starting from 12 hours until 72 hours for selected days on (a) 10 August, (b) 19 August, (c) 21 August and (d) 24 August 2004.
Comparison: 2005 event

Haze emergency at 2 locations on the western coast of Peninsular Malaysia
Emissions of biomass burning estimated from Sumatra during the August 2005 showed a significant amount of greenhouse gases such as CH$_4$ and CO as well as the O$_3$ precursors released to the atmosphere.
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<th>Provinsi</th>
<th>TSP (tons)</th>
<th>CO (tons)</th>
<th>NMHC (tons)</th>
<th>NOx (tons)</th>
<th>SOx (tons)</th>
<th>TSP (&lt;2.5μm) (tons)</th>
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<td>14652913</td>
<td>5816975</td>
<td>906452.3</td>
<td>1.16E+08</td>
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The dispersion analysis, which shows the merging of several puffs after a period of 48 hours from integration on 10 August 2005 (NOAA active fire counts)
2005 event:

Aerosol optical depths (AOD) from

(a) 1-31 Aug,
(b) 1-7 Aug,
(c) 8-14 Aug,
(d) 15-21 Aug.
Mass concentrations of aerosols over the ocean of Southeast Asia from

(a) 1-31 Aug,
(b) 1-7 Aug,
(c) 8-14 Aug
(d) 15-21 Aug 2005.
(a) total column CO

(b) total column O₃

(c) CH₄ volume mixing ratio

(d) Tropospheric column HCHO
Haze in June 2013

- Haze emergency declared in the state of Johor, Malaysia (neighbouring Singapore) on 23 June 2013 when the API reached 500 (hazardous).
- API in Muar reached 750 on 22 June 2013 but decreased to 148 on 24 June, while Port Dickson increased to 335.

Riau, Indonesia, 23 June 2013

Thick smoke from raging forest fires rise in Pelalawan regency in Riau on June 21, 2013
Haze in June 2013

22 June 2013

23 June 2013

Singapore

Melaka
CONCLUSION

• The recurrence of the large-scale biogenic fires and the resulted transboundary haze is one of the most serious environmental issues facing SEA today.

• Fires are deliberately set alight to clear forests and land, over the last few decades which had led to repeated air pollution episodes within the neighbouring countries such as Malaysia, Singapore and Brunei.

• Clearly the transboundary haze problem must be solved and controlled to cope with the negative impacts to the population of the neighbouring countries.
Terima Kasih
Thank You