



air&health
Air Pollution and Health Effect Research Center



Characteristics of $PM_{0.1}$ and carbon components in the southern Thailand

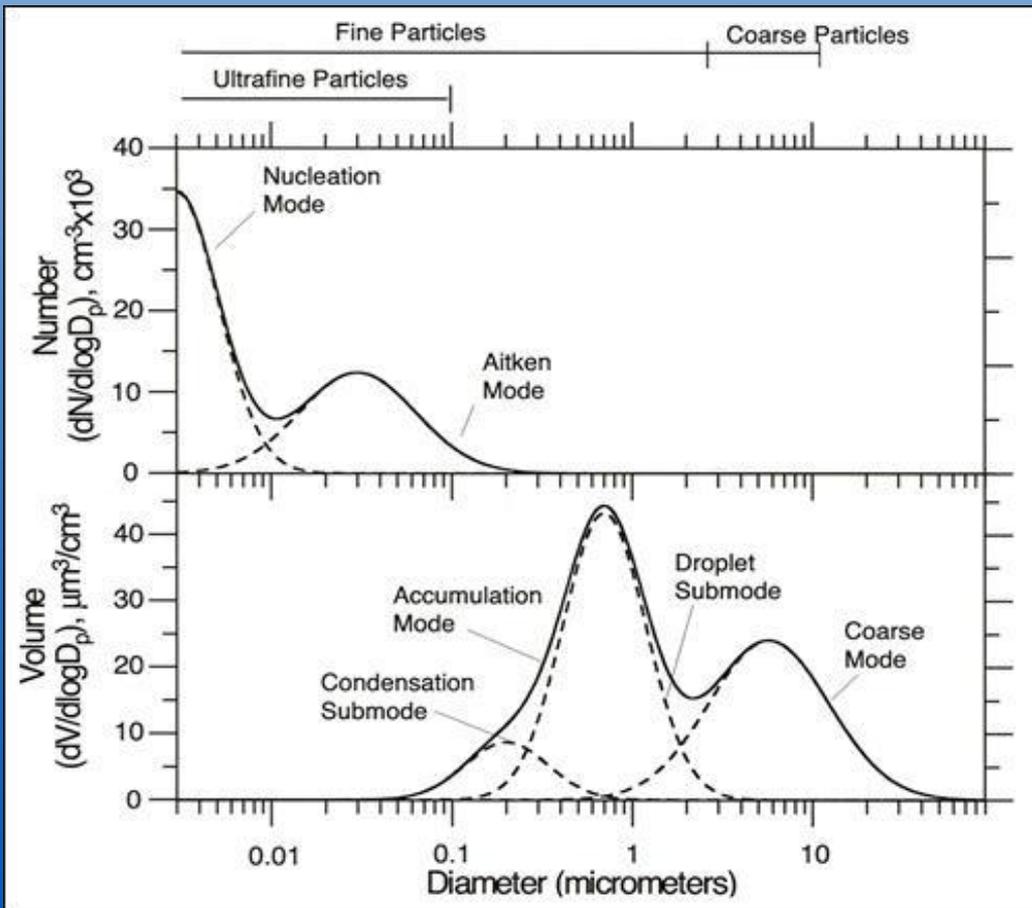
Worradorn Phairuang
Air Pollution and Health Effect Research Center,
Prince of Songkla University, Thailand

ขอให้ผลประโยชน์ส่วนตัว เป็นที่สอง
ประโยชน์ของเพื่อนมนุษย์ เป็นกิจที่หนึ่ง
ลากิ ทรัพย์ และเกียรติยศ จะตกมาแก่ท่านเอง
ถ้าท่านทรงธรรมะแห่งอาชีพ ไว้ให้บริสุทธิ์

1

พระราชปณิธานของสมเด็จพระบรมราชชนก

Why nanoparticles (PM_{0.1})?

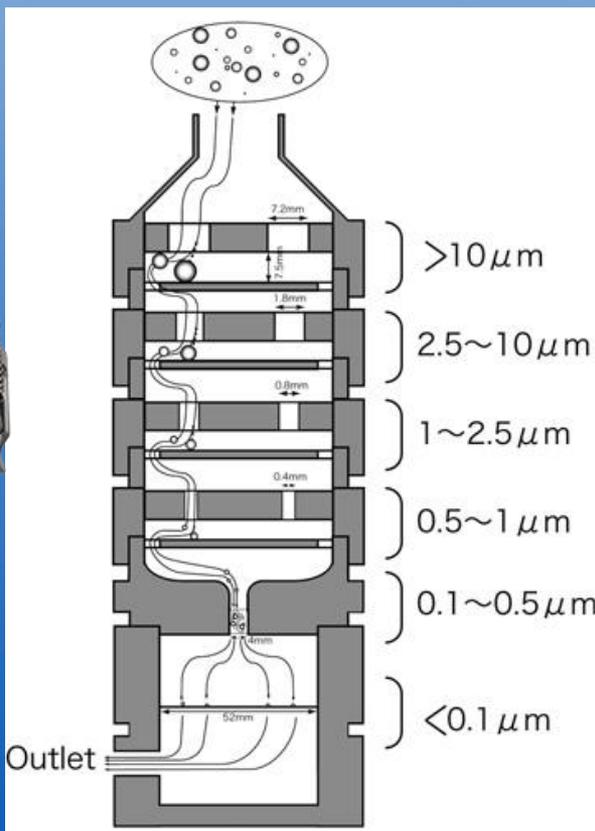


- Ambient particles smaller than **100 nm** dominates the number concentration.
- Health risk is not only by mass but possibly also by number: “Need to monitor the size distribution and number concentrations of particles, in addition to mass, in ambient air.” (Pasi Penttinen et al., Environmental Health Perspectives, 109. 4, 2001.)

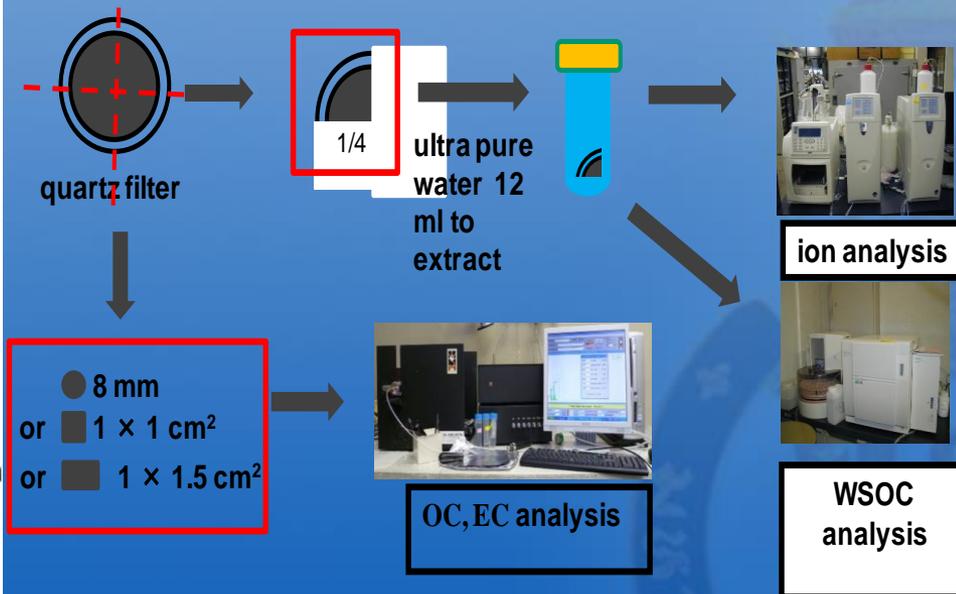


Nano-sampler

Ambient nano-particle sampling



Chemical analysis



East Asia Nanoparticle Monitoring Network:EA-nanonet

11 countries, 23 universities, 4 institutes, 1 governmental agency and 1 company
(April, 2018)

China (3)

Northeastern-U,
Dongguan-U of
Tech., Wuhan-U
of Sci. & Tech.

Laos (1)

N. U. of Laos

Vietnam (2)

Hanoi-U of Tech.,
Ho Chi Min C-U

Cambodia (2)

ITC, APSARA

Korea (1)

KIST(Seoul)

Malaysia (1)

N. U. of
Malaysia

Singapore (1)

Nanyang
Tech.-U

Japan (6)

Kanazawa-U, Saitama-U,
Toyama National-C of Tech.,
Nagoya Env. Sic. Center, Osaka
Pref. Inst. Env. Agri. and Fishery,
Kyuden-Sangyo Co. Ltd

Thailand (8)

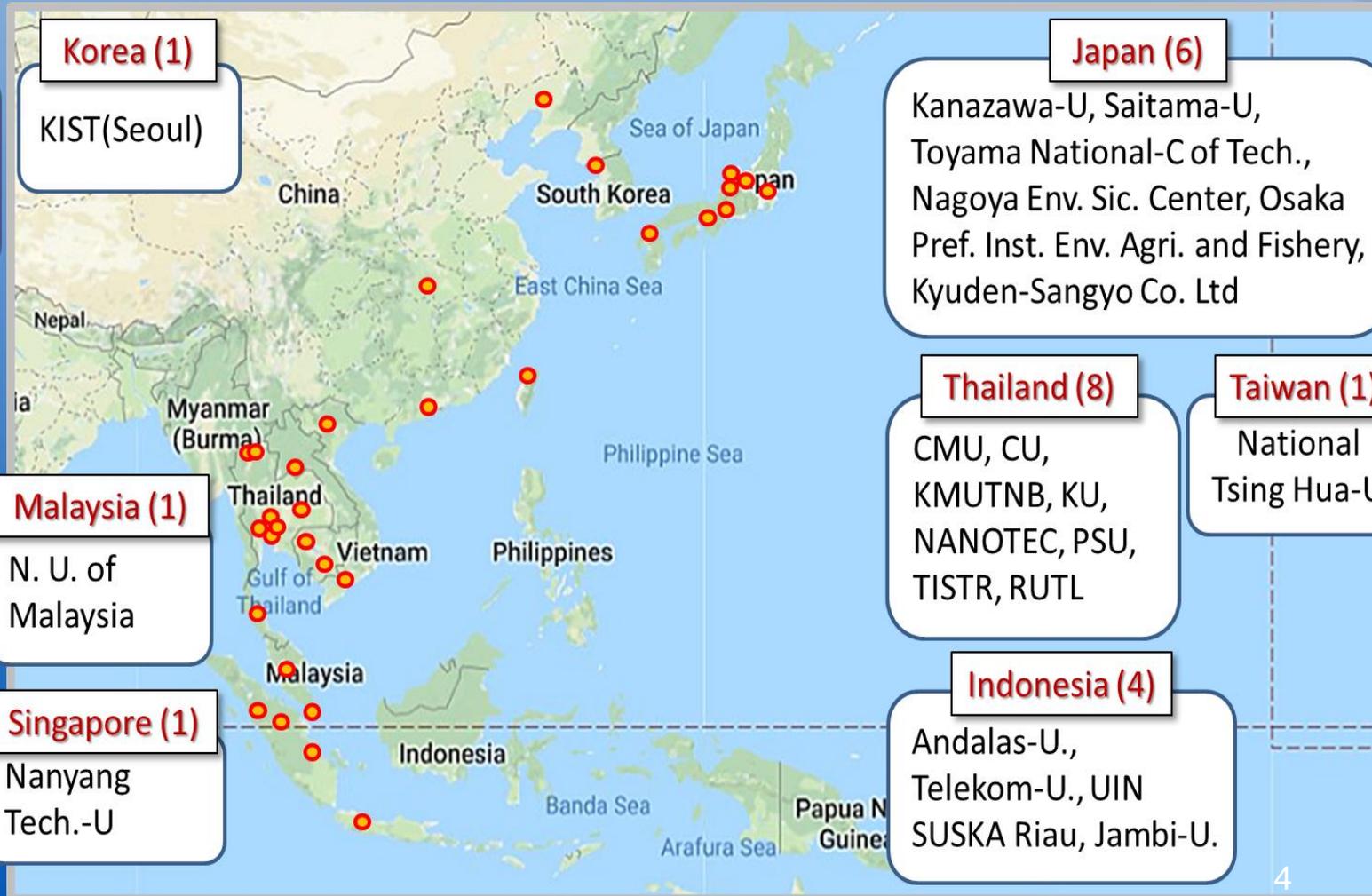
CMU, CU,
KMUTNB, KU,
NANOTEC, PSU,
TISTR, RUTL

Taiwan (1)

National
Tsing Hua-U

Indonesia (4)

Andalas-U.,
Telekom-U., UIN
SUSKA Riau, Jambi-U.

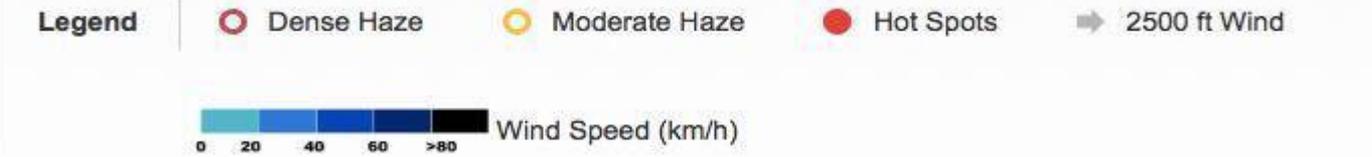
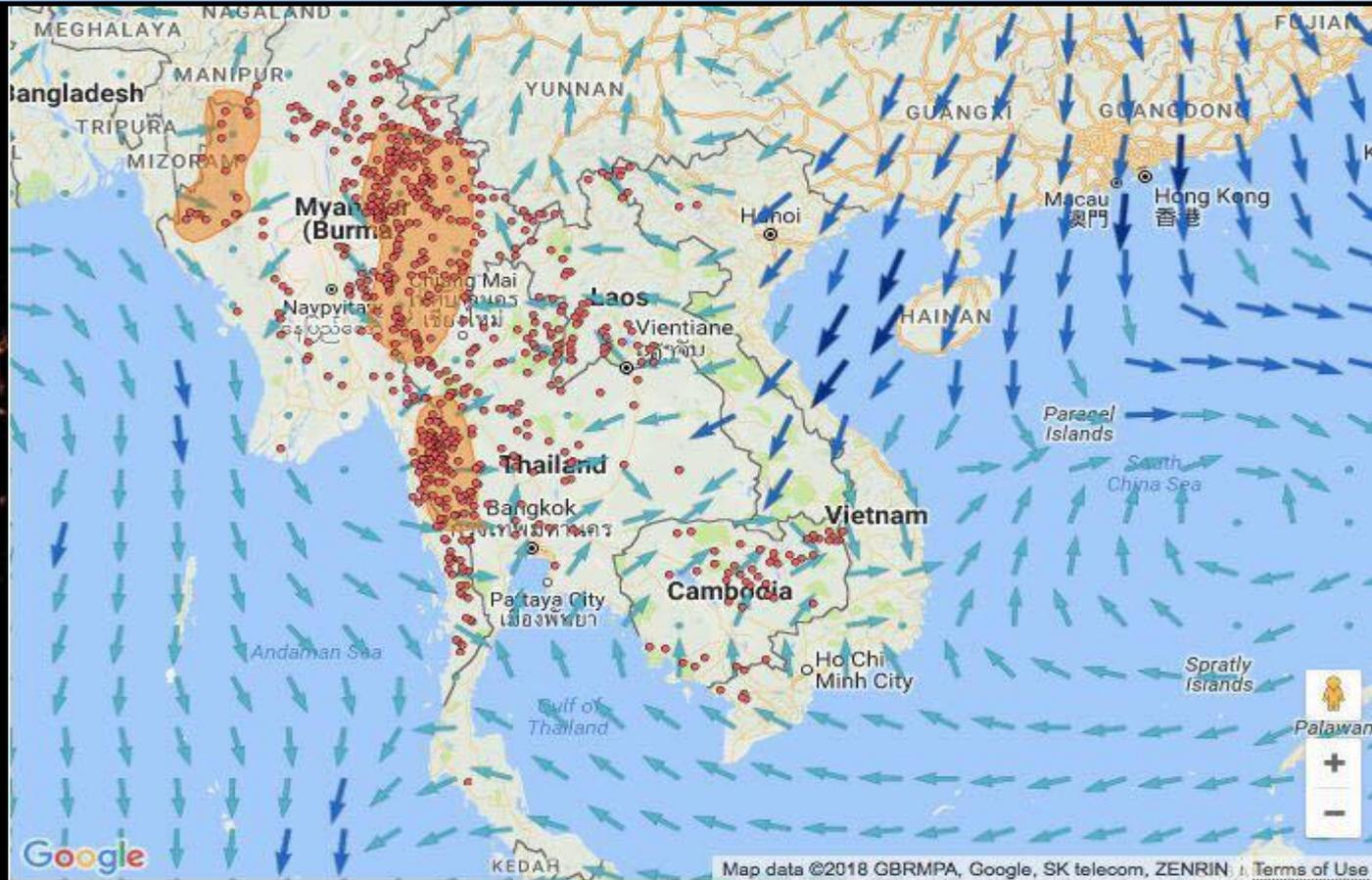


EA-nanonet+2 (Sites in Austria and Nigeria)

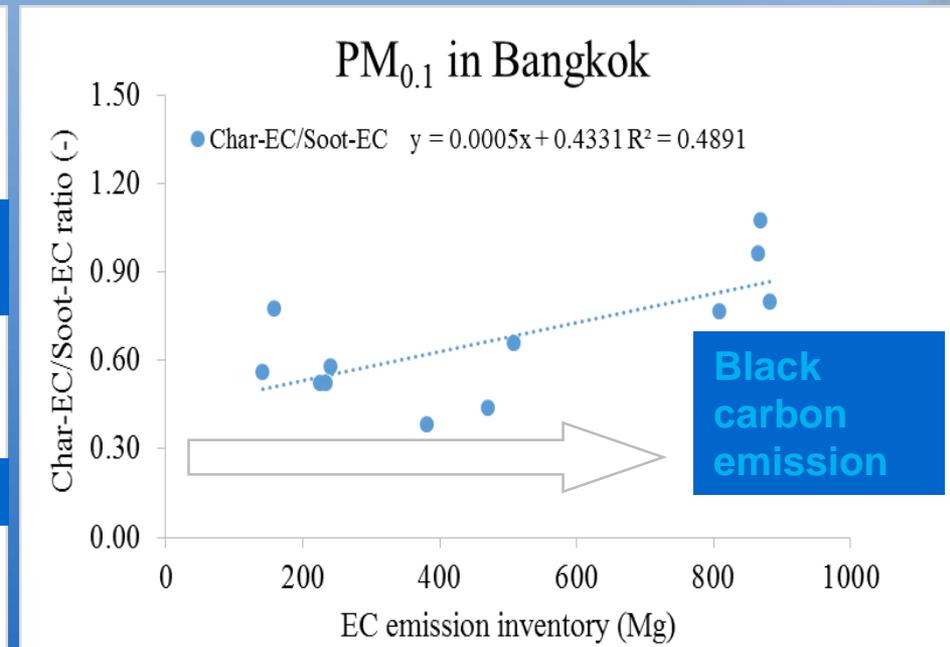
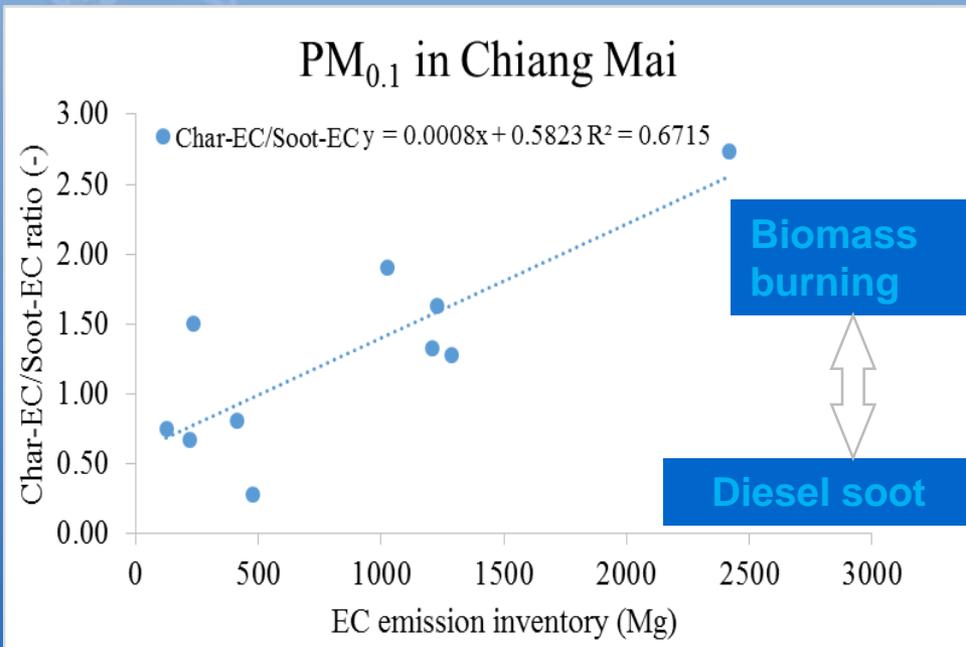


ACTIVE FIRES (1 MONTH - TERRA/MODIS)

March 2018



Influence of biomass burning on carbons in nanoaerosol



Carbon index of biomass burning in PM_{0.1} is very sensitive to carbon emission from agricultural residue burning.

Nano-particle monitoring campaign



Sites in SE Asia Sites in Japan

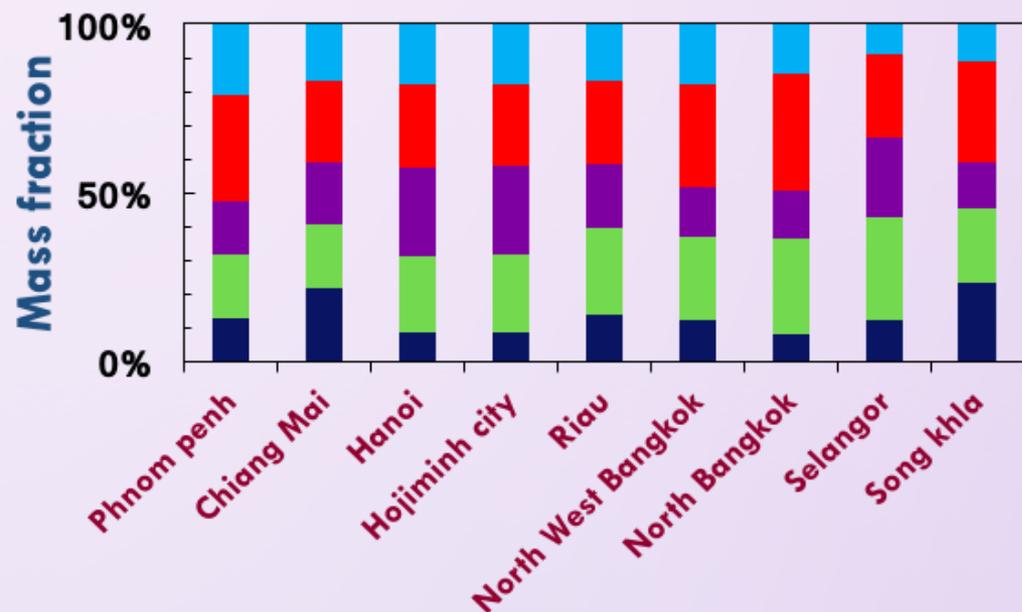
- Cambodia-Phnom Penh
- Vietnam-Hanoi
- Vietnam-Ho Chi Minh City
- Thailand - Bangkok (3 sites)
- Thailand - Songkhla (PSU)
- Thailand Chiang Mai (CMU)
- Malaysia-Bangi
- Indonesia-Riau
- Kanazawa
- Toyama
- Suzu
- Nagoya
- Osaka
- Saitama

1st term: 3/28-4/19, 2016

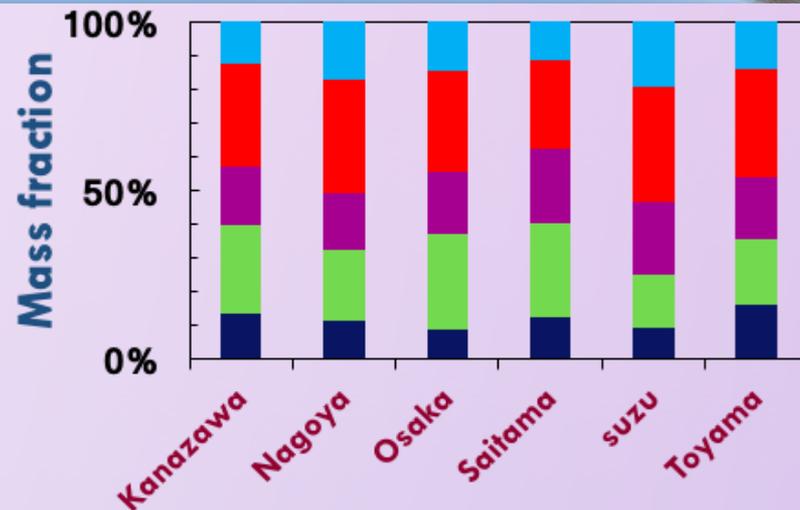
2nd term: Indonesia Forest Fire 2017

3rd term: Chiang Mai Forest fire 2018

Results and Discussion



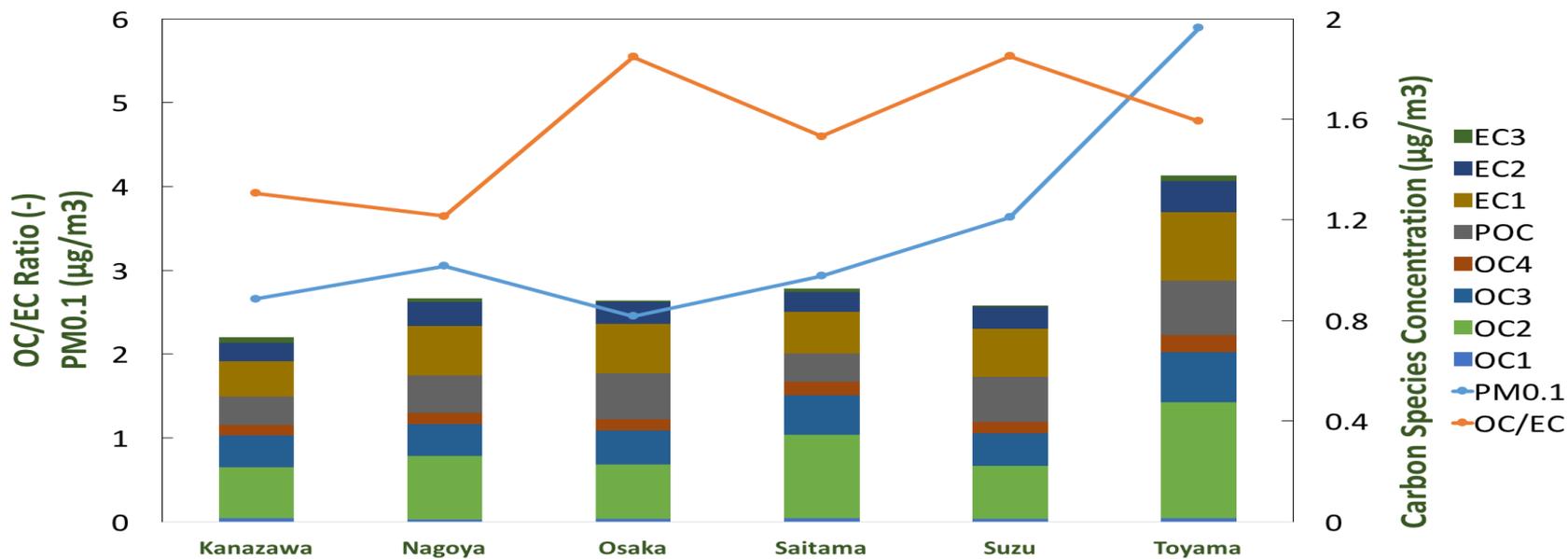
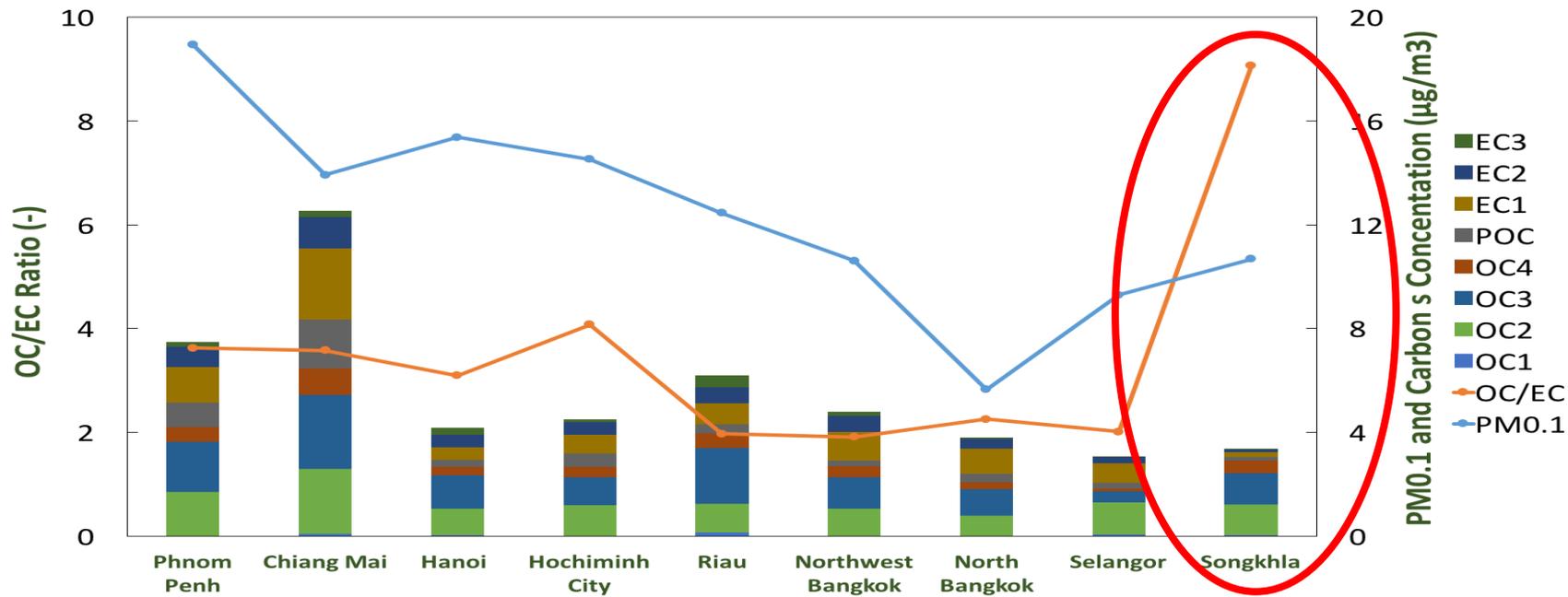
■ <0.1 ■ 0.5-1.0 ■ 1.0-2.5 ■ 2.5-10 ■ >10
Average mass concentrations of size segregated particles (South East Asia)



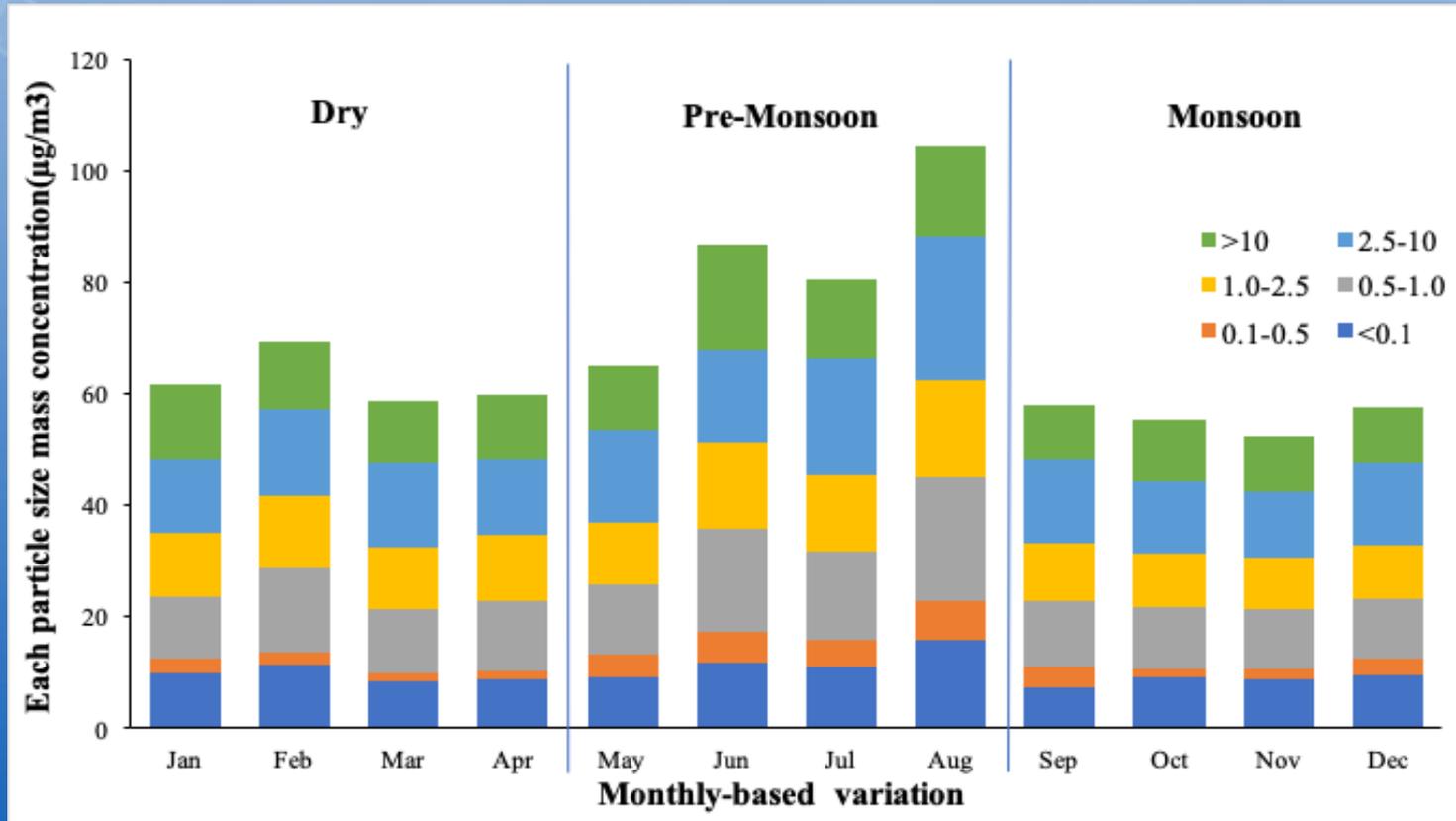
■ <0.1 ■ 0.5-1.0 ■ 1.0-2.5 ■ 2.5-10 ■ >10
Average mass concentrations of size segregated particles (Japan)

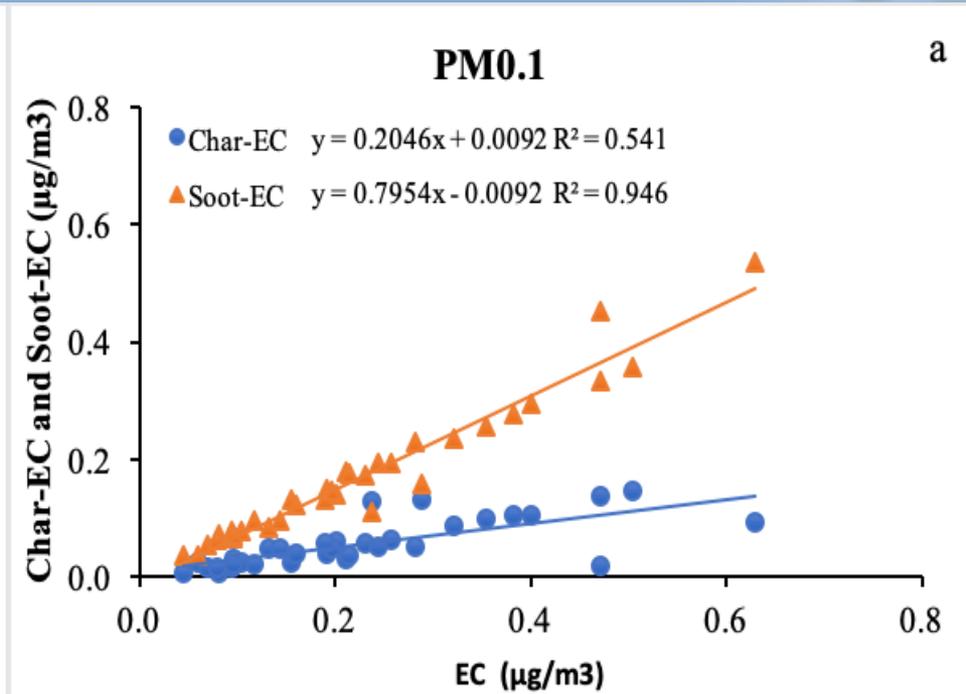
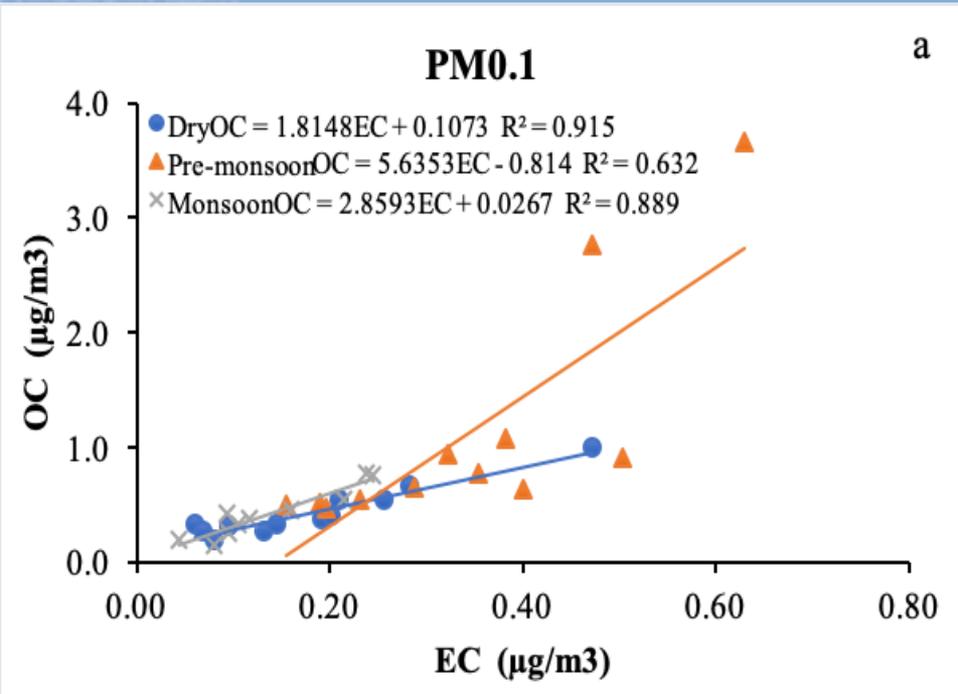
- $PM_{0.1}$ mass concentration ranged 2.7 - 5.9 $\mu\text{g m}^{-3}$ in Japan while 5.7 - 18.9 $\mu\text{g m}^{-3}$ in Southeast Asian (SEA) countries, or, 2 - 3 times larger in Southeast Asia.
- 2.5 - 10 μm was dominate in Japan and Southeast Asia.

Carbon Species Concentration and OC/EC ratio (South East Asia) and (Japan)



Monthly and Seasonal variation of size-fractionated particles mass concentration in Songkhla, southern Thailand, 2018





Correlation between OC and EC

EC and Char-EC,
EC and Soot-EC

PM_{0.1} and carbon components in the southern Thailand



Carbonaceous Aerosol
in southern Thailand

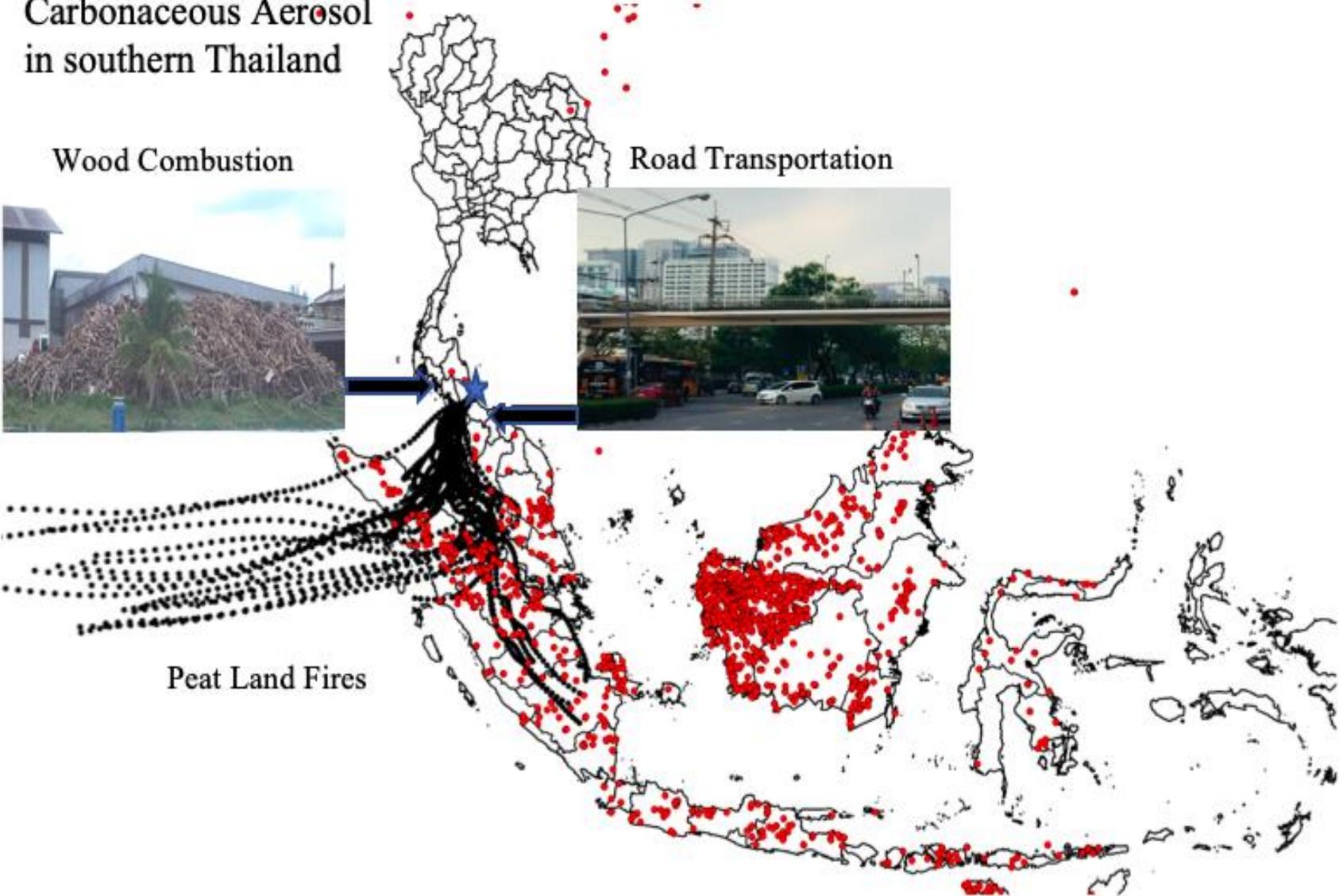
Wood Combustion



Road Transportation



Peat Land Fires



Carbonaceous Aerosol



- The OC fraction in the $PM_{0.1}$ was also shown to be significantly affected by the transported plumes during a pre-monsoon.
- The results showed that motor vehicle emissions, biomass burning and secondary organic aerosols all contributed to the $PM_{0.1}$.
- Characteristics of $PM_{0.1}$ will be discussed in detail based also on other chemicals (i.e. WSOC, WSI, and PAHs)

Ongoing and Future activities



- ✓ Evaluation of $PM_{0.1}$: Present status and characteristics, comparison between sites. Discussion on events.
- ✓ Information of $PM_{0.1}$ emission sources: Emission factor on PM mass, mass of chemicals (especially on biomass burning)
- ✓ Development and application of new $PM_{0.1}$ tools: 1) $PM_{0.1}$ sensor of IoT monitoring network (big data), 2) A High-Volume $PM_{0.1}$ air sampler for toxicity evaluation
- ✓ Health risk assessment of $PM_{0.1}$: 1) Risk of chemicals, 2) A new discipline of evaluation of “Dynamic Environmental Health Risk” of $PM_{0.1}$, 3) Epidemiological survey
- ✓ Investigations on local issues: forest fires, agricultural open burning (pre and post harvest), peat land fire, volcano etc.
- ✓ Summarize facts on $PM_{0.1}$ for policy making

Thank you for your attention



Hat Yai atmosphere, September 2015