PM2.5 Carbonaceous species and BC Emitted from Peat Land burning in Riau Sumatera

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Java Sea
Jakarta
Bandung
Indian Ocean
BRUNEI DARUSSALAM
MALAYSIA
MALAYSIA
PACIFIC OCEAN
KALIMANTAN
SUMATERA
Sulawesi
java sea
JAVA
PAPUA NEW GUINEA
TIMOR LESTE
Map of Indonesia

Background: Why PM2.5 ?

- According to the Global Fire Emissions Database (GFED), average PM2.5 emissions from fire (including deforestation, savanna, forest, agricultural waste, and peat fires) from 1997 to 2010 in Indonesia are accounting for 9.2% of global fire PM2.5 emissions and 62% of Southeast Asian fire emissions
- Peatland fire is a dominant source of PM2.5 emissions, accounting for 55% of all fire sources
- Riau Province in Sumatra is one of the primary hotspots for peatland fire during the dry season, and the smoke aerosol generated there cause haze in Riau and in neighboring countries such as Malaysia and Singapore
- Limited data exist regarding the chemical characteristics of these smoke aerosols

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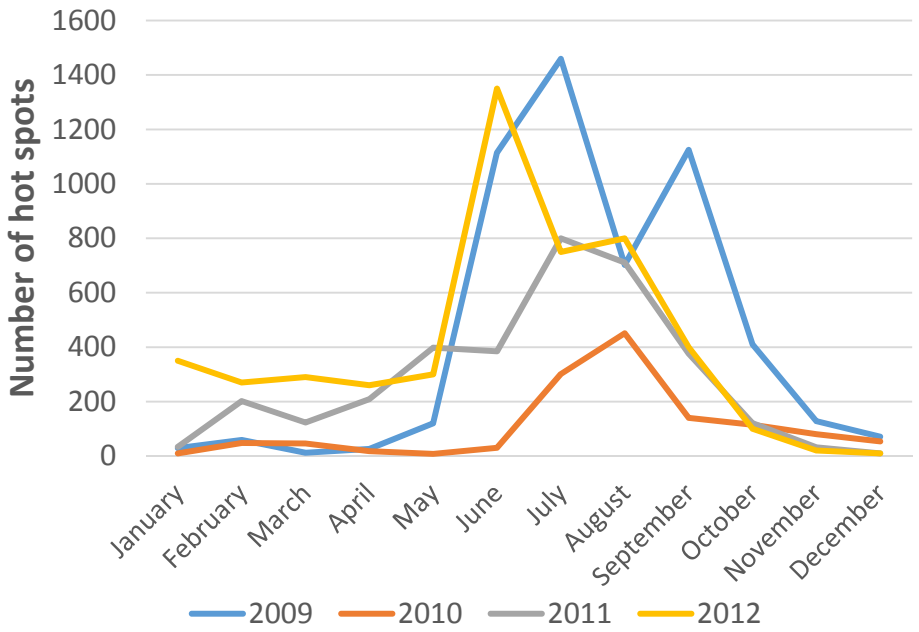
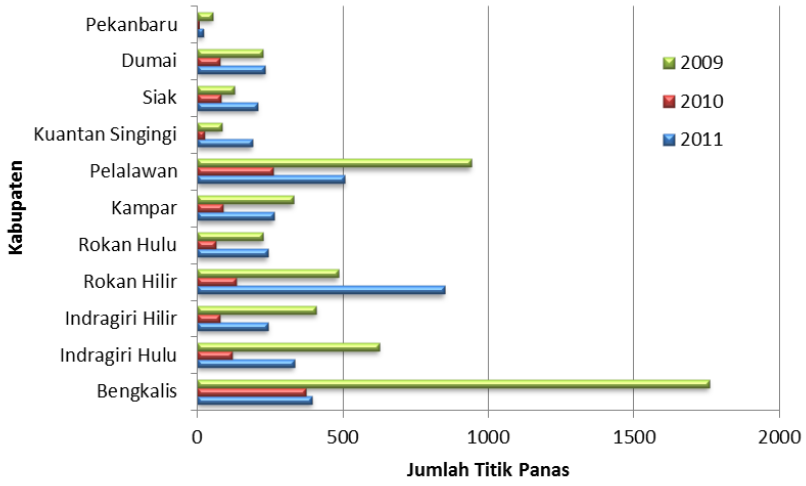
Background Information

Number of Hot Spot in Riau



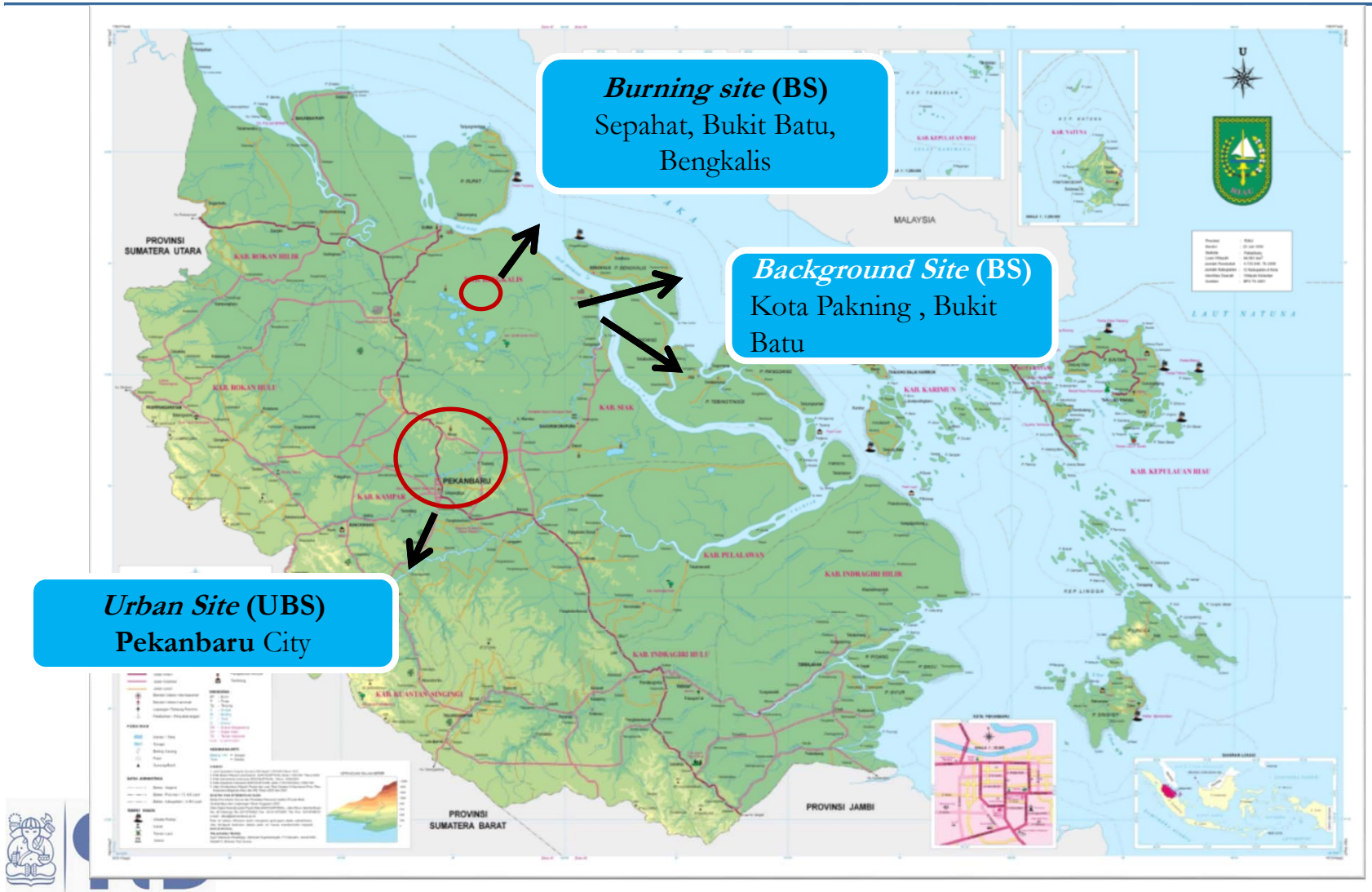
Number of Hot Spot in Different area



Objectives of the study

- To analyze carbonaneous particulate $PM_{2.5}$ emission from peat land fires in Riau, Sumatera.
- To Quantitatively characterized carbon fraction of Organic Carbon (OC) and Elemental Carbon (EC) of the aerosols derived from peatland fires to determine potential source profile and indicators.
- To provide useful information to evaluate the contribution of Indonesian peatland fire aerosols to the air quality in Southeast Asia

Sampling Locations: Riau Sumatra



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Sampling Collection

Background Site

- Minivolume sampler
- During burning periods
- May-June 2012

Burning Site

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Analysis

- OC and EC were analyze at Laboratory Research Institute for Advanced Science and Technology, Osaka Prefecture University, Japan (Kyoto Univ colaborator)
- The carbonaceous contents of the aerosols collected in the quartz fiber filters were quantified using a DRI Model 2001 OC/EC Carbon Analyzer, which employs thermal optical reflectance following the IMPROVE_A protocol.
- The IMPROVE_A temperature defines temperature plateaus for thermally-derived carbon fractions as follows: 140 C for OC1, 280 C for OC2, 480 C for OC3, and 580 C for OC4 in helium (He) carrier gas; 580 C for EC1, 740 C for EC2, and 840 C for EC3 in a mixture of 98% He and 2% oxygen (O2) carrier gas (Chow et al., 2007).
- BC were analyze using EEL type Smoke Stain Reflectometer
- OC, EC, and total carbon (TC) were calculated from the eight carbon fractions as follows:
- OC= OC1 + OC2 + OC3 + OC4 + OP (1)
- EC = EC1 + EC2 + EC3 - OP (2)
- TC = OC + EC

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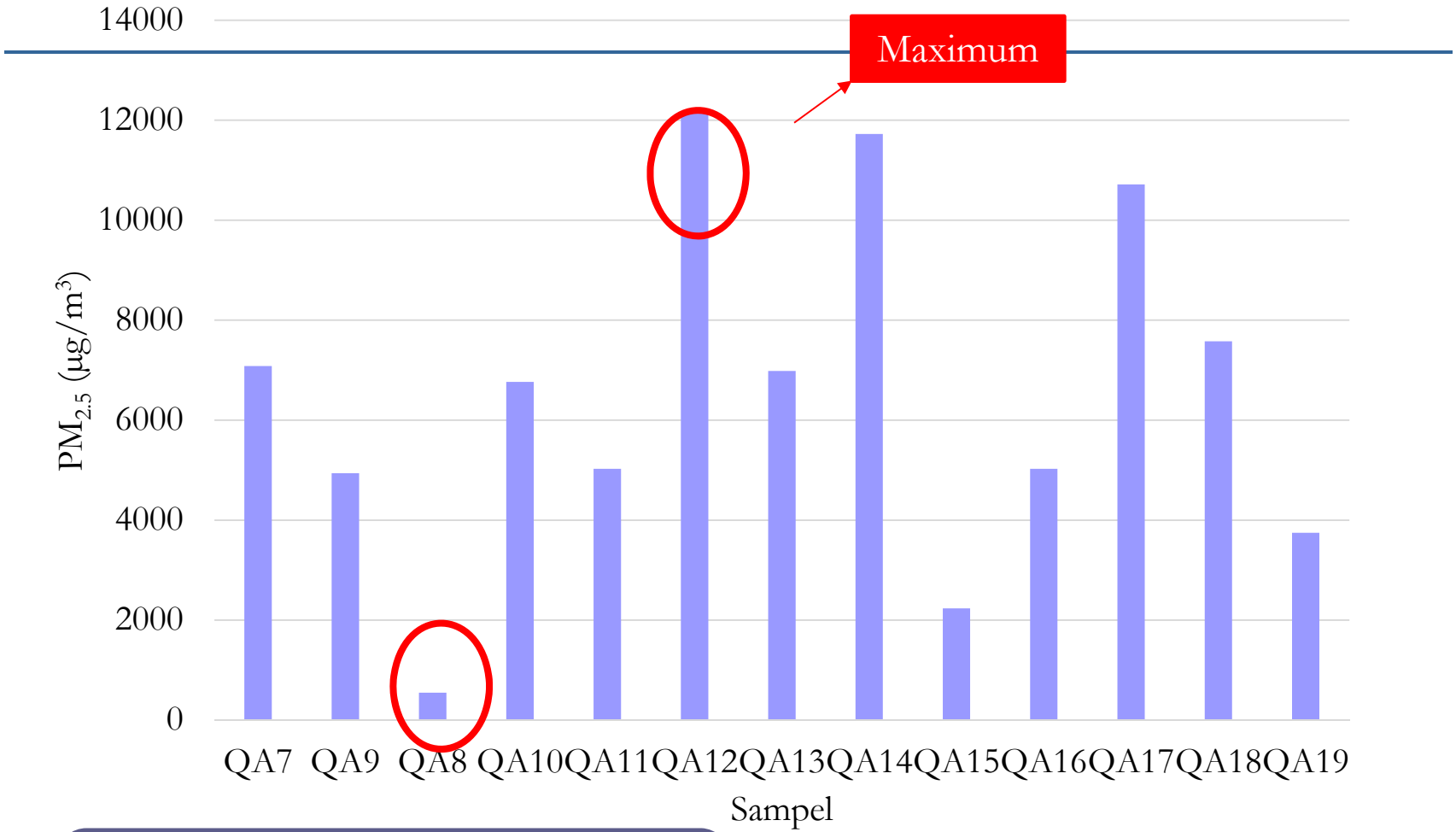
$PM_{2,5}$ Concentration in *Burning Site*

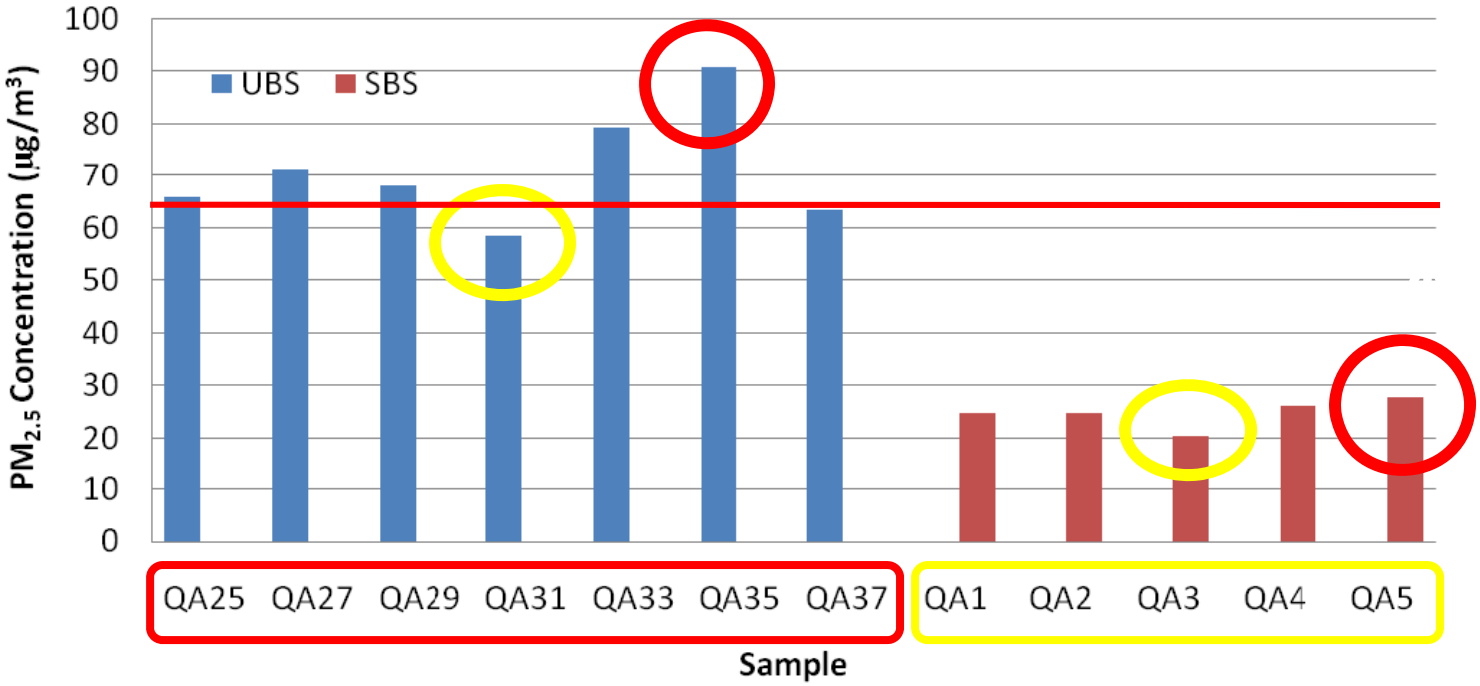


Average

7120 ± 3620 µg/m³

550-12143 µg/m³

Concentrations of PM2.5 in Urban & Background sites



AAQS

Urban site

Background site

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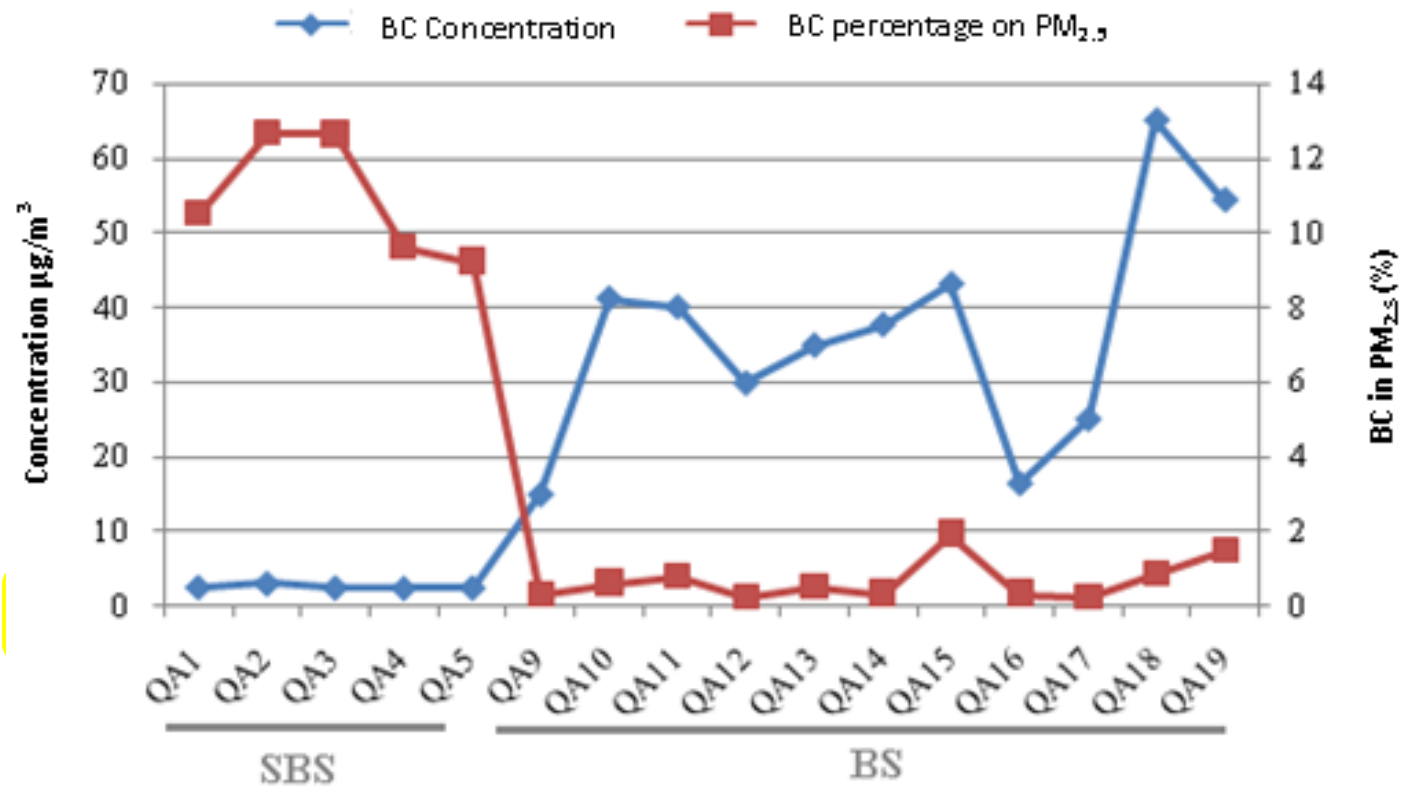
Concentration of BC at Burning Site and Background site (SBS)



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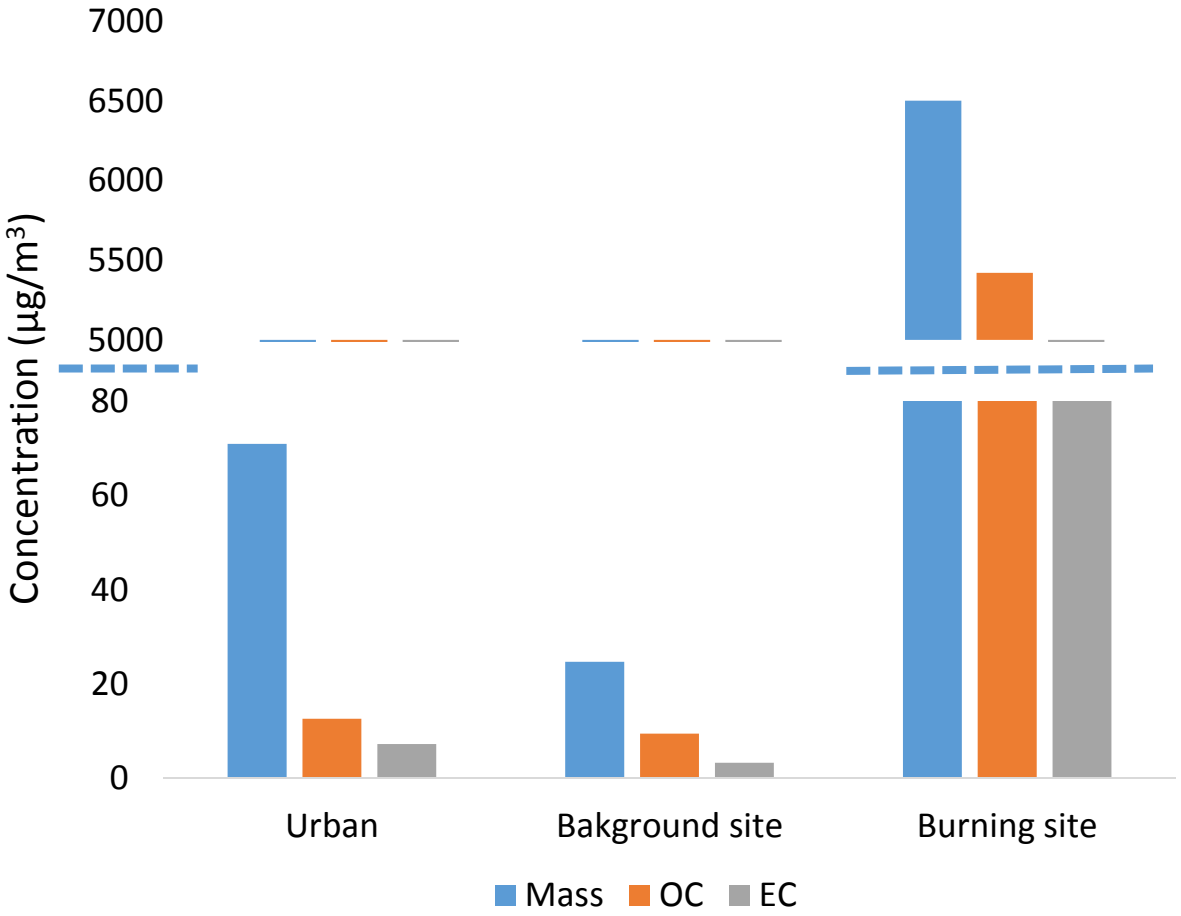
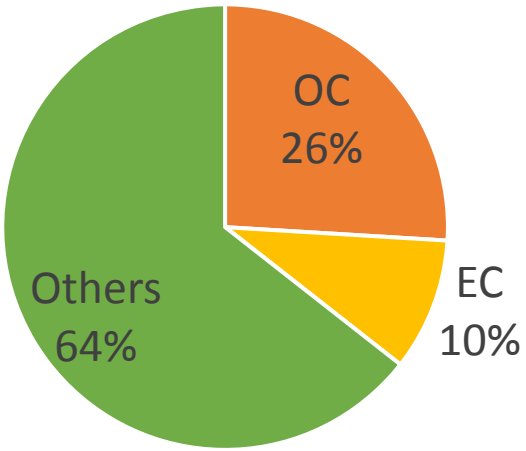
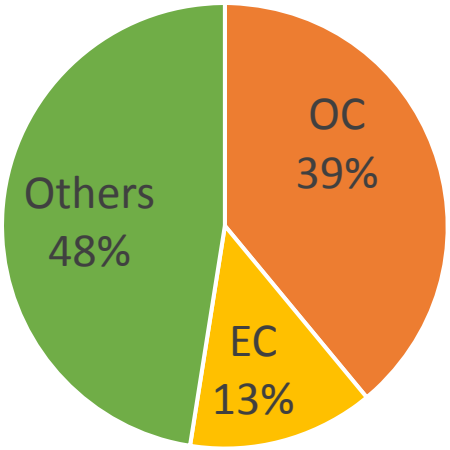
Comparison of OC/EC Concentrations in Burning, Urban and Background sites



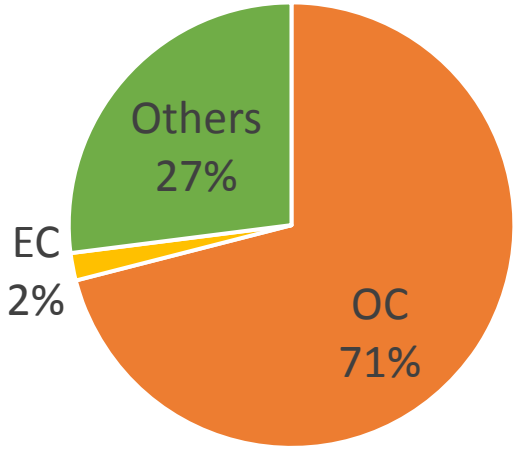
OC/EC contribution to PM2.5



Urban



Background site



Burning site

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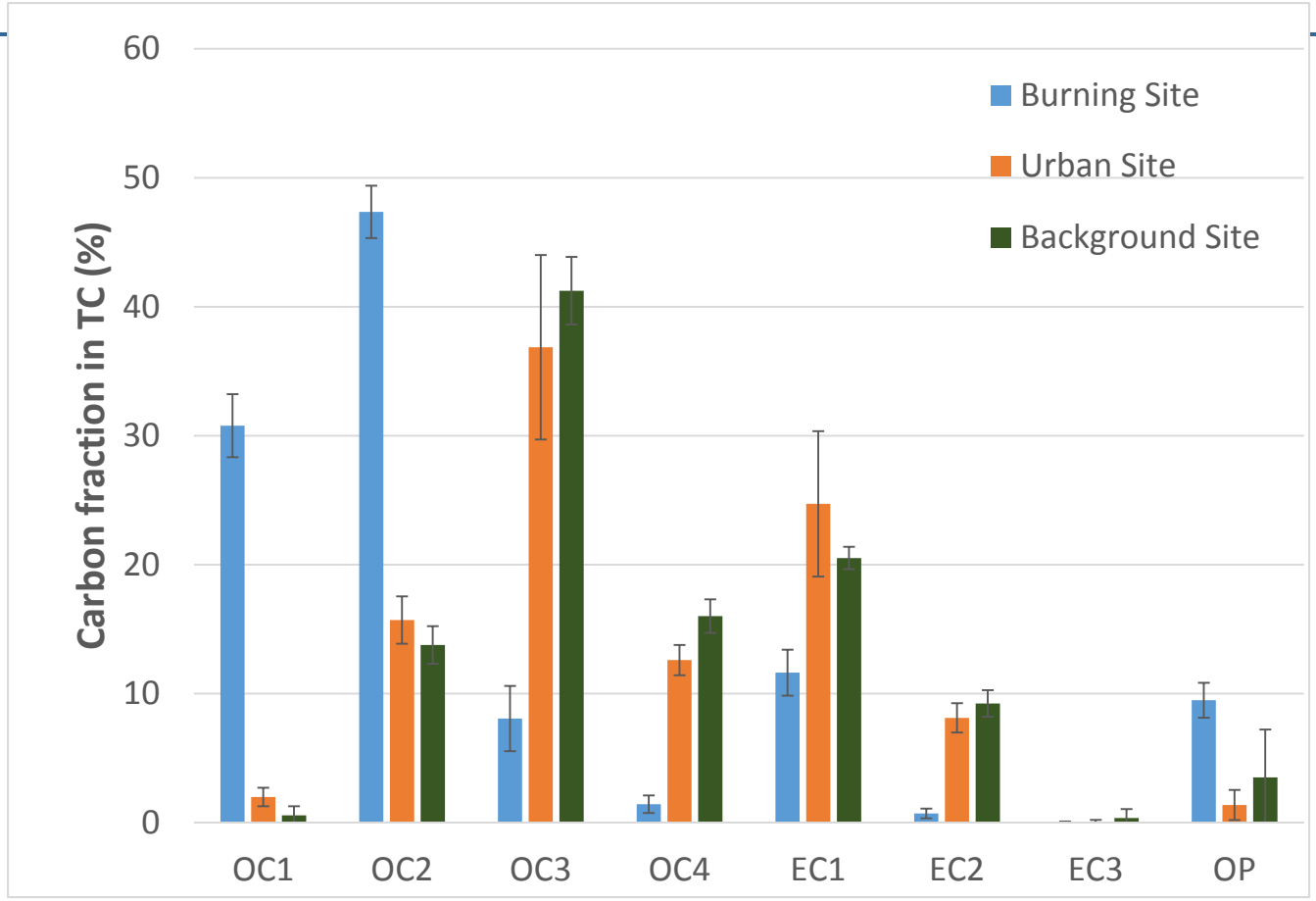
Carbon Fraction in Total Carbon

Abundances of eight thermally-derived carbon fractions differ by carbon sources



OC1 normally rich in biomass burning
OC3 and OC4 relatively came from road dust
OC2 was found in samples of coal combustion (decay plants)

EC2 and EC3 mainly emitted by motor vehicles

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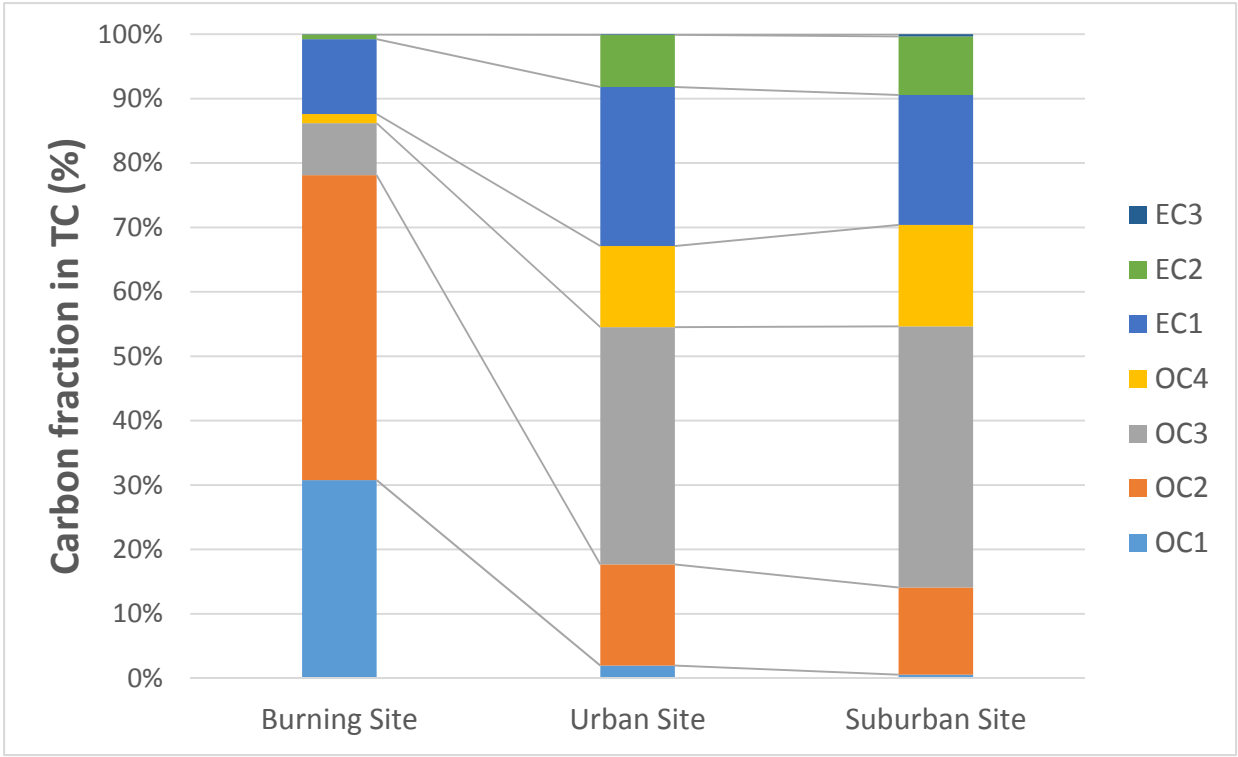
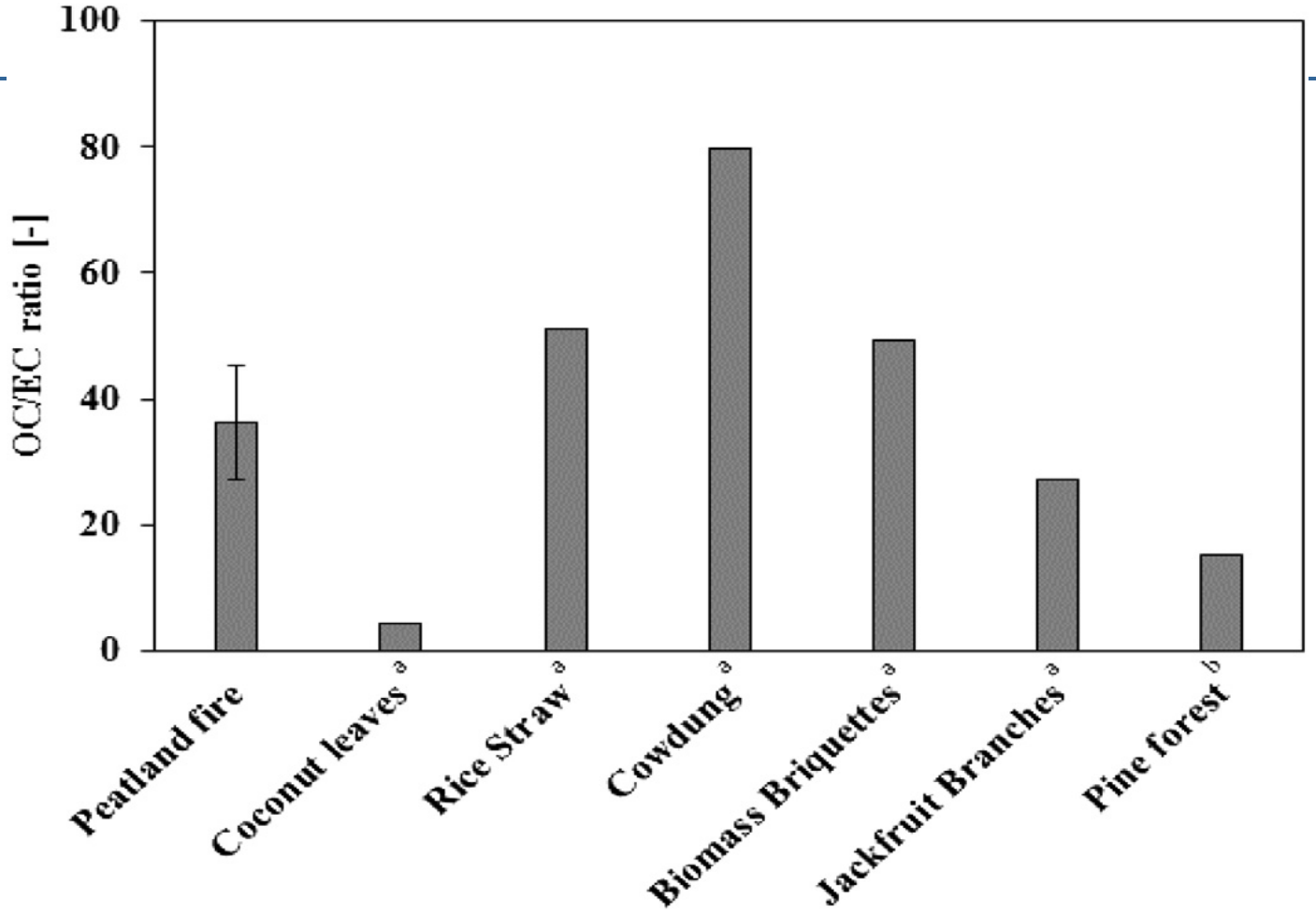
Carbon Fraction in different locations



Comparison of OC/EC ratio from PM2.5 emitted from Peat land and other burning sources (AE 87(2014) 164-169.



[a] data from Sheesley and Schauer, 2003, [b] data from Lee *et al.*, 2005.

(OC/EC) provide some indication of the origins of carbonaceous PM2.5

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Conclusions:

- PM2.5 carbonaceous aerosols collected at a peatland fire hotspots had very high concentration of about 300 and 100 times of that colected at background and an urban sites respectively.
- Average PM2.5 aerosols emitted from peatland fire were observed in very high concentrations (7120 ± 3620 ug/ m3) and were primarily composed of OC (71.0 ±5.11% of PM2.5 mass)
- The OC/EC ratios (36.4 ± 9.08 for peatland fire), abundances of eight thermally-derived carbon fractions,
- PM2.5 from peat fire emissions is characterized by an abundance of OC1 and OC2 fractions
- Emissions on burning site produces more volatile compounds with low molecular weight compared to the background site

Thank you

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