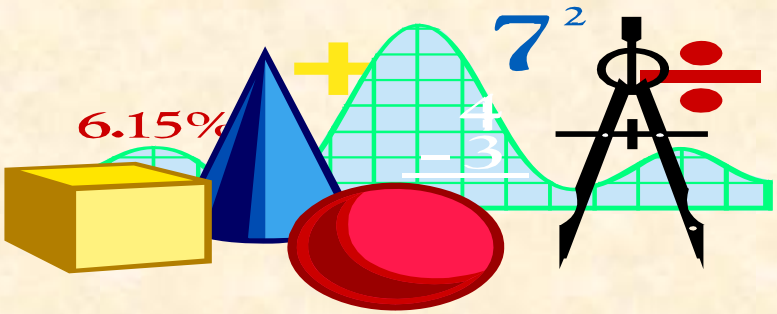
AIRPET integrated monitoring and modeling for air quality management in Asian urban areas



Colombo
August 19-20, 2008

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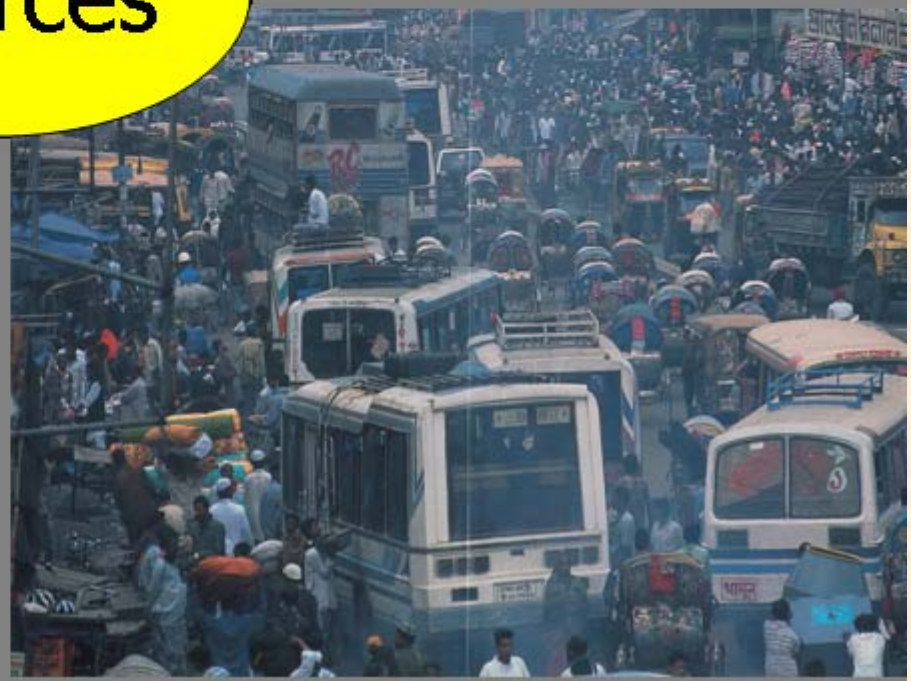
Highlights

1. Asian air pollution: status and challenge
2. AIRPET project: phase 1-2 activities and findings
3. Phase 3 activities: continued and new research activities

PM Air pollution in Asia

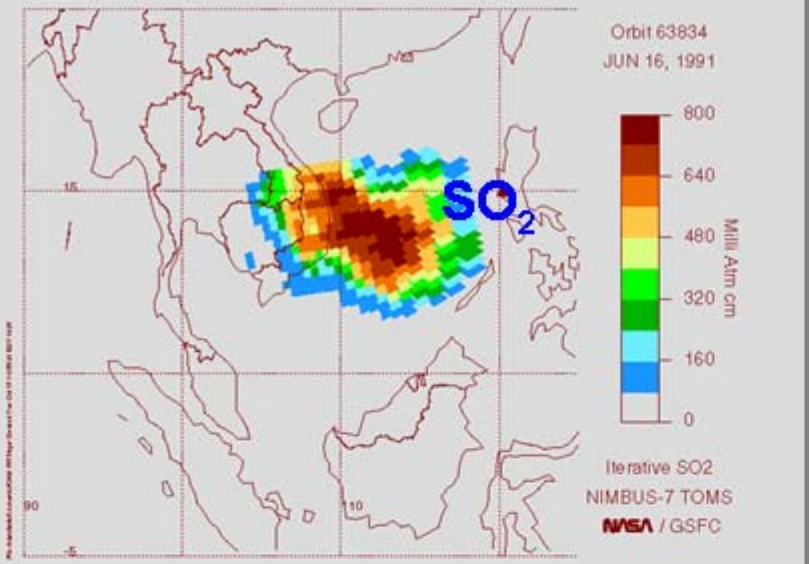
- High pollution and air quality is worsening in urban areas with PM (TSP, PM10) is most significant
- No systematic records on PM2.5
- Fast increase in emission sources and intensity: traffic, industry, utility
- Increase in precursors emission to form secondary PM and ozone
- Impact on human health, crops/ecosystem ➔ economical effect is serious but not well studied
- Indoor air pollution is serious
- Trans-boundary issues: Acid rain, ABC, regional haze from biomass burning, dust storm, etc.

Sources



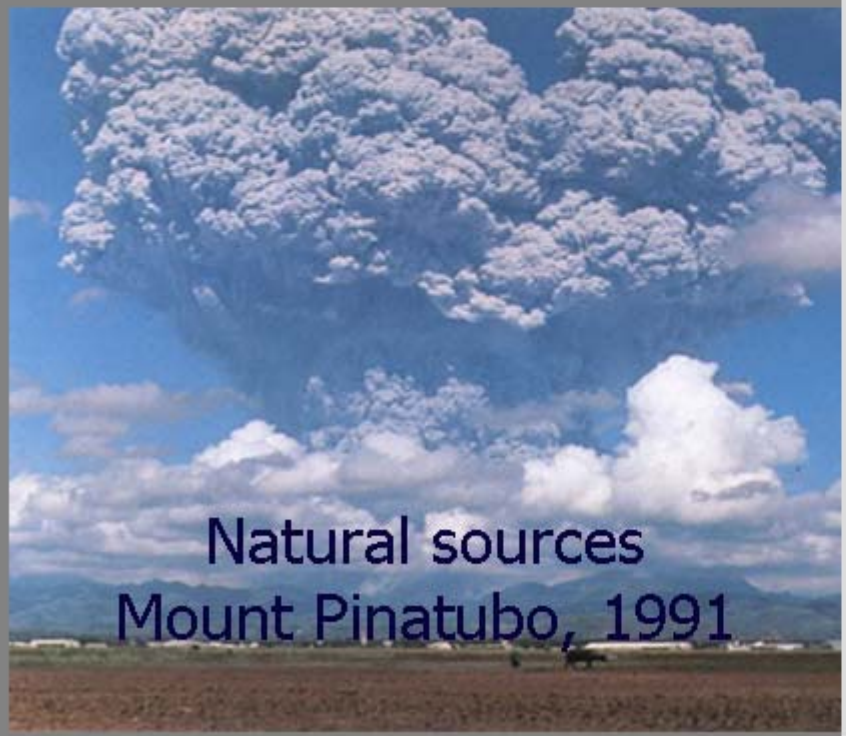

Sources

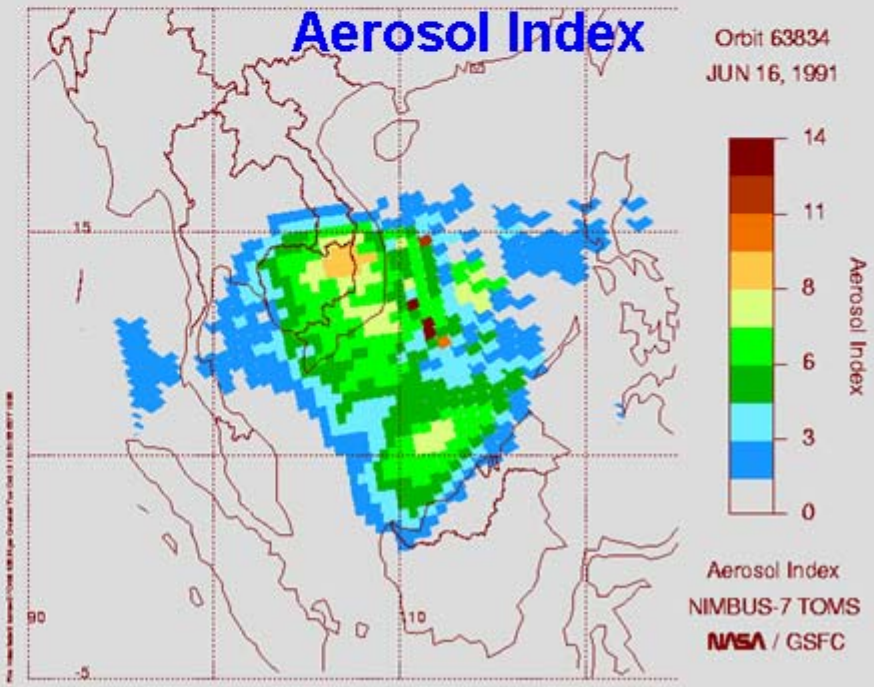

Forest fire
Sources
Dust storm
Natural source: Mount Merapi (Indonesia) 2006



TOMS - Mt. Pinatubo Volcanic Eruption, 1991

Swietlicki (2006):
AQM-Sida training



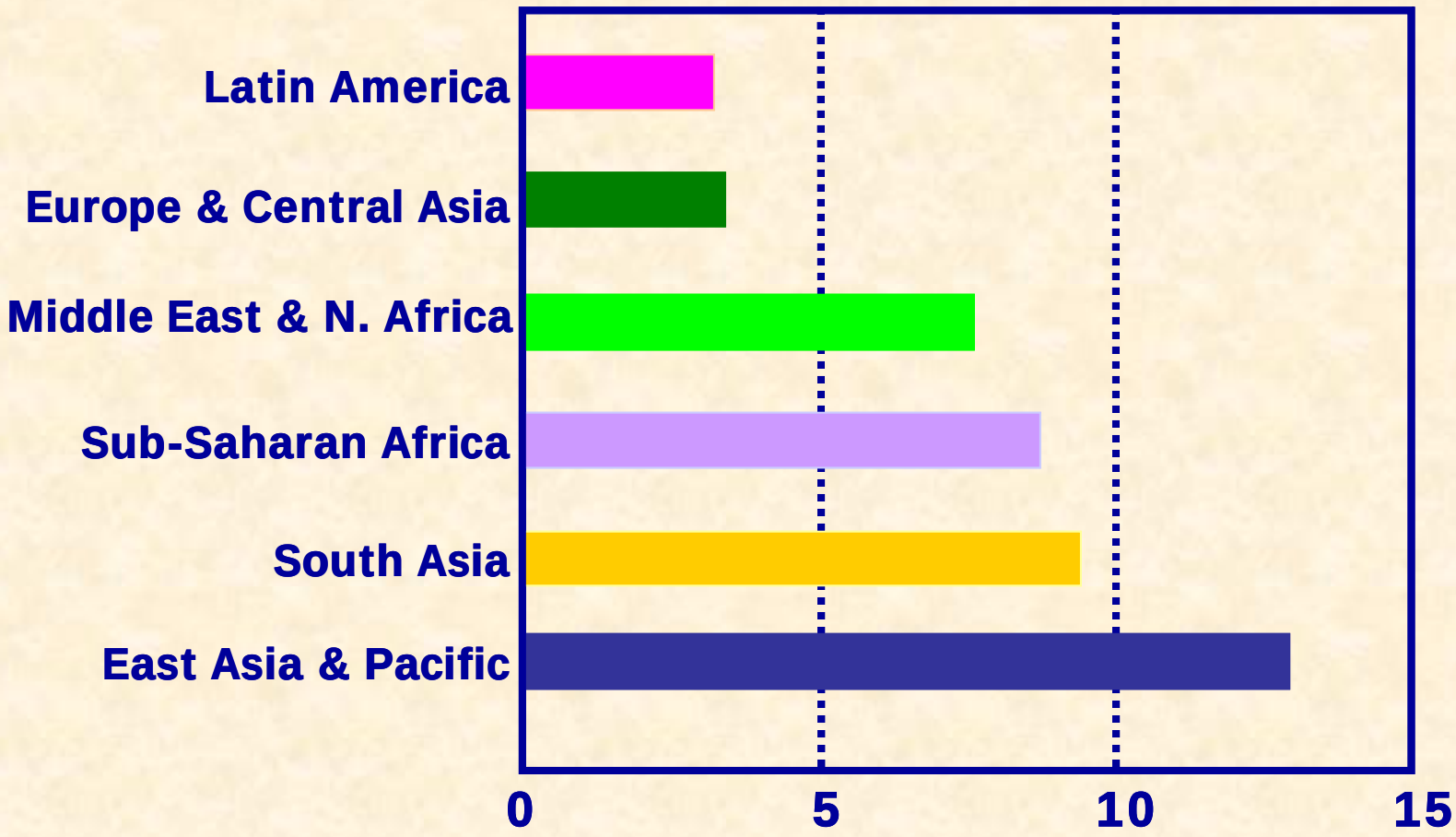


Regional/trans-boundary issues in Asia

ASEAN Haze

Burden of Urban Air Pollution (PM)

disability adjusted life-years per 1000 people



Source: Lvovsky, 2002

Asian Regional Research Program on Environmental Technology (ARRPET)

Sponsored by Sida, Coordinated by AIT

http://www.arrpet.ait.ac.th/

Four projects in ARRPET:

- Air pollution (AIRPET)
- Solid waste
- Hazardous waste
- Wastewater

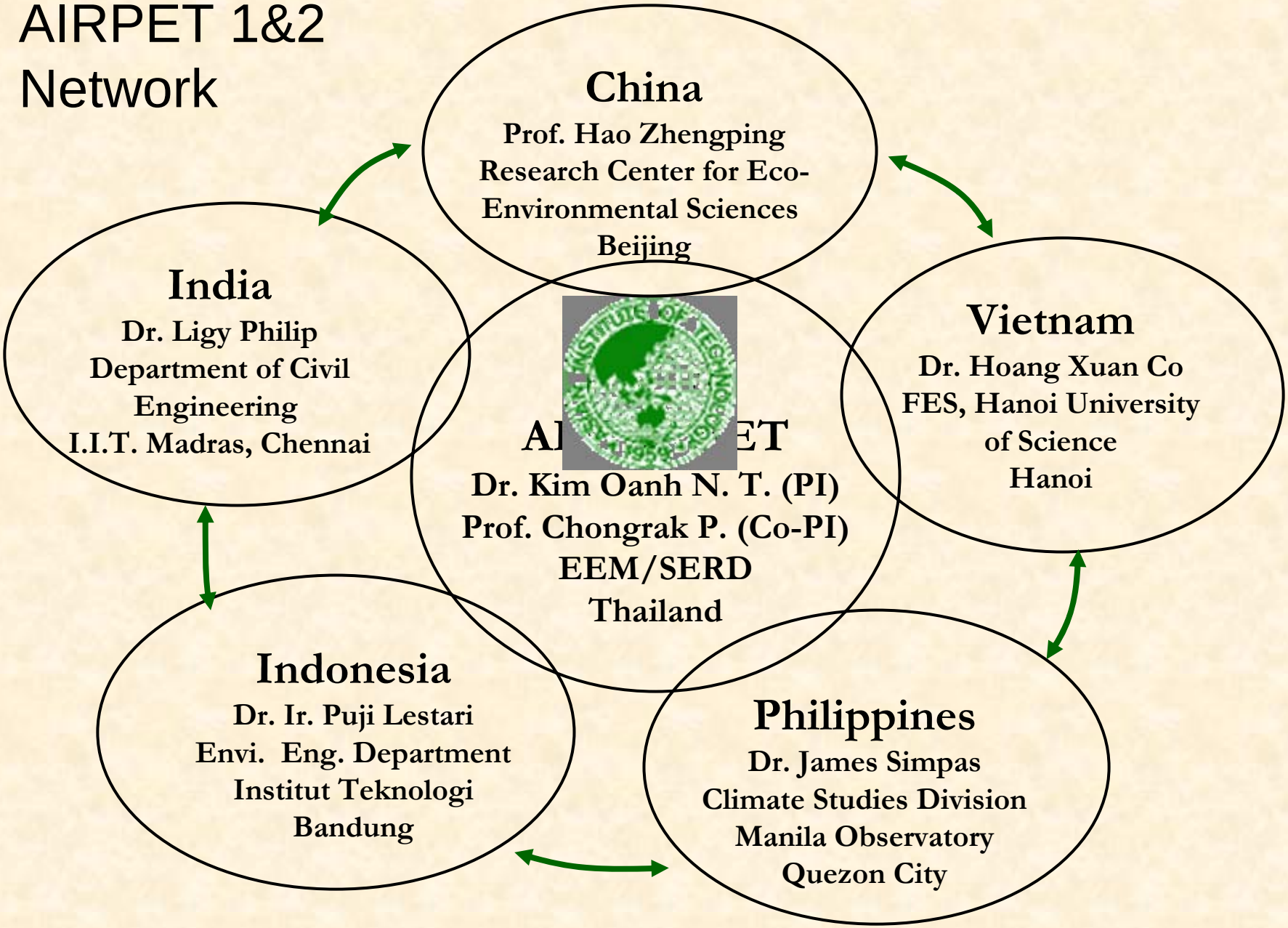
18 NRIs from 8 Countries

Phase 1: 2001-2003

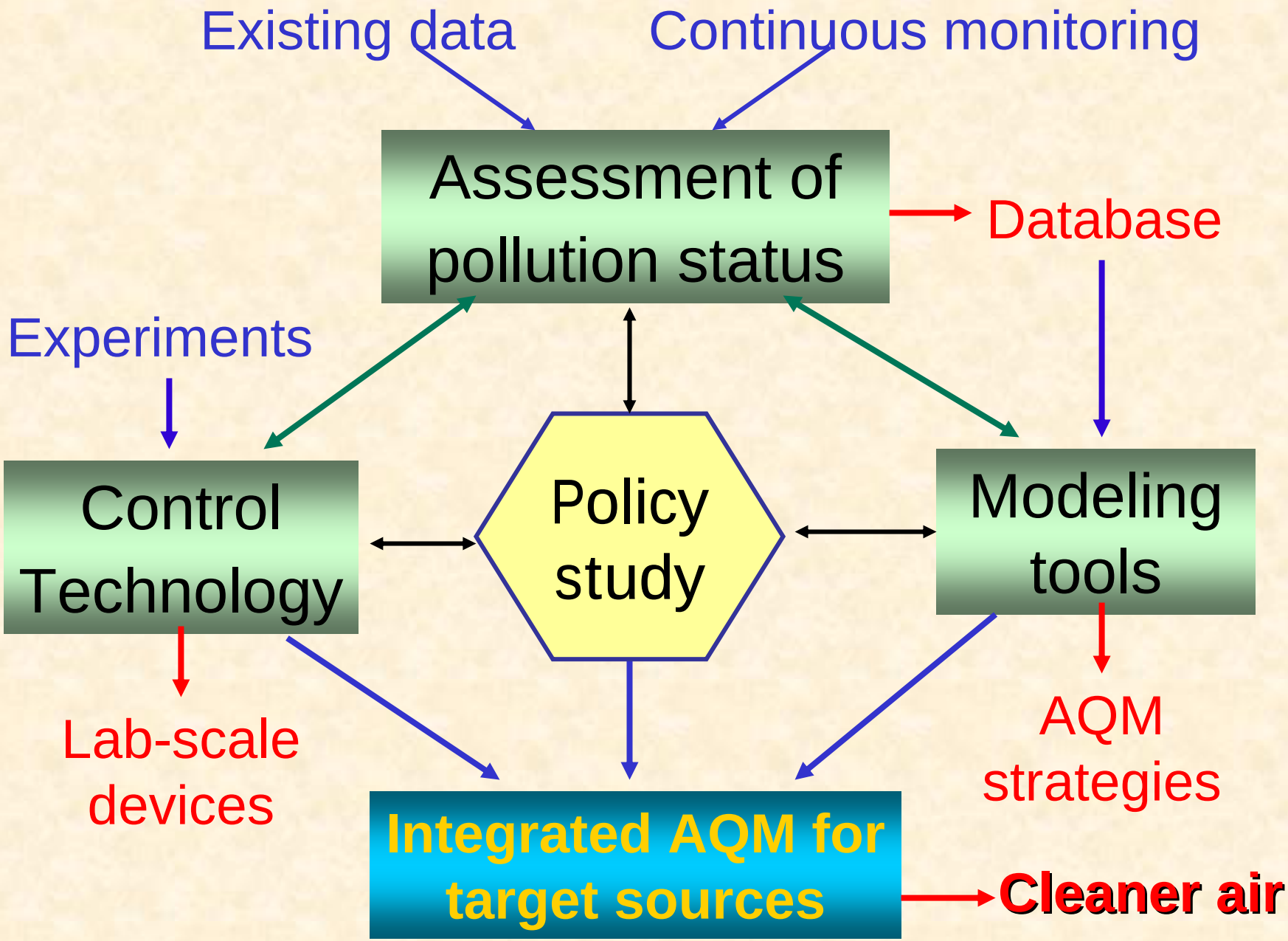
Phase 2: 2004-2007

Phase 3-bridging: 2008-09

AIRPET 1&2 Network



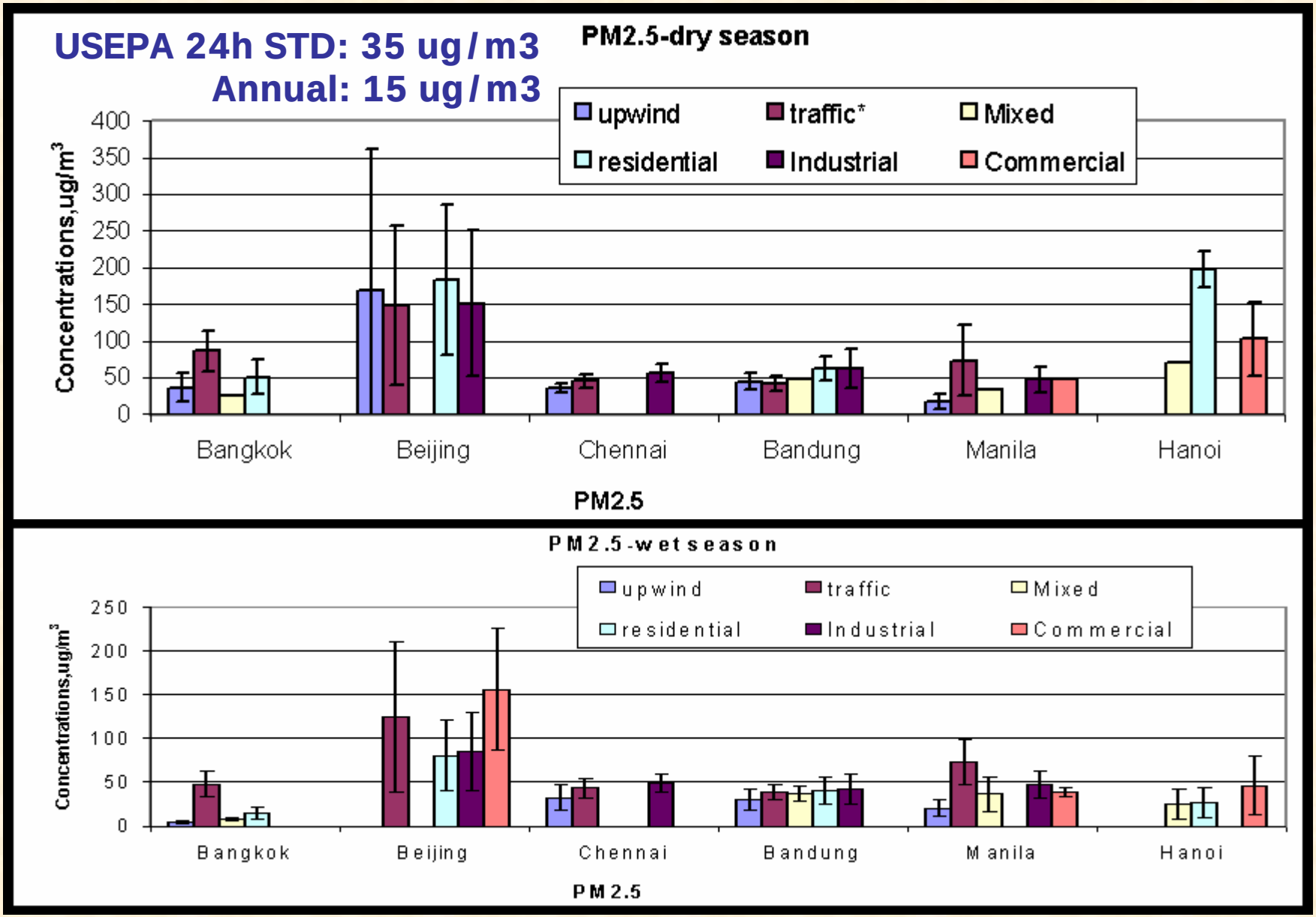
Project website http://www.serd.ait.ac.th/airpet/


Existing data
Continuous monitoring
Assessment of pollution status
Database
Experiments
Control Technology
Policy study
Modeling tools
Lab-scale devices
AQM strategies
Integrated AQM for target sources
Cleaner air

Activities in Phase 1-2 (2002-2007)

NRIs	Monitoring	Modeling	Control	Integ. AQM
AIT	PM2.5, PM10 BTEX, POP	Receptor Dispersion	-	Agroresidue burning
China	PM2.5, PM10 TSP	Receptor	Cat-oxidation (VOC)	Integrated VOC control
India	PM2.5, PM10 O_3, SOx, NOx	Receptor	Bio-system (NOx, SOx)	-
Indo	PM2.5, PM10 Pb in blood	Receptor	Photo-cat (NOx, CO, SO_2)	Vehicle emission
Phil	PM2.5, PM10	Receptor Dispersion	-	
VN	PM2.5, PM10 BTEX	Receptor Dispersion	-	Brick manufacture

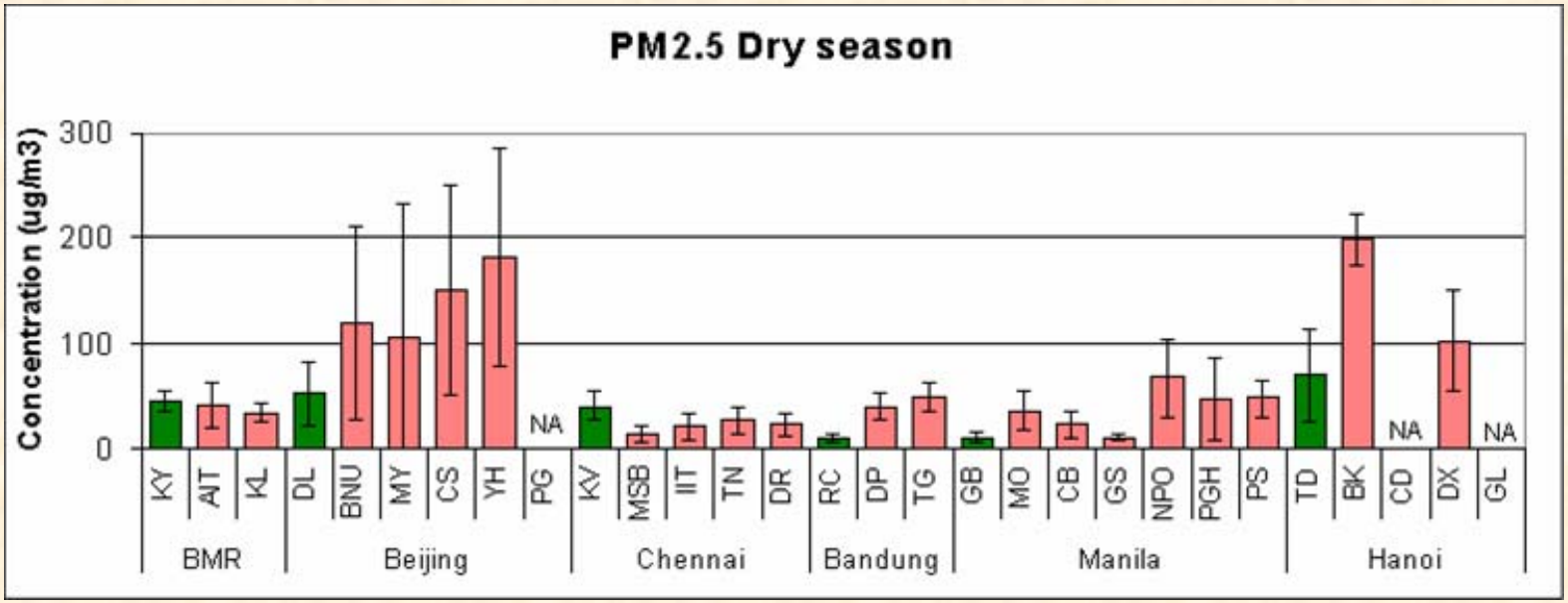
PM2.5 in 6 AIRPET cities (2001-2004), phase 1

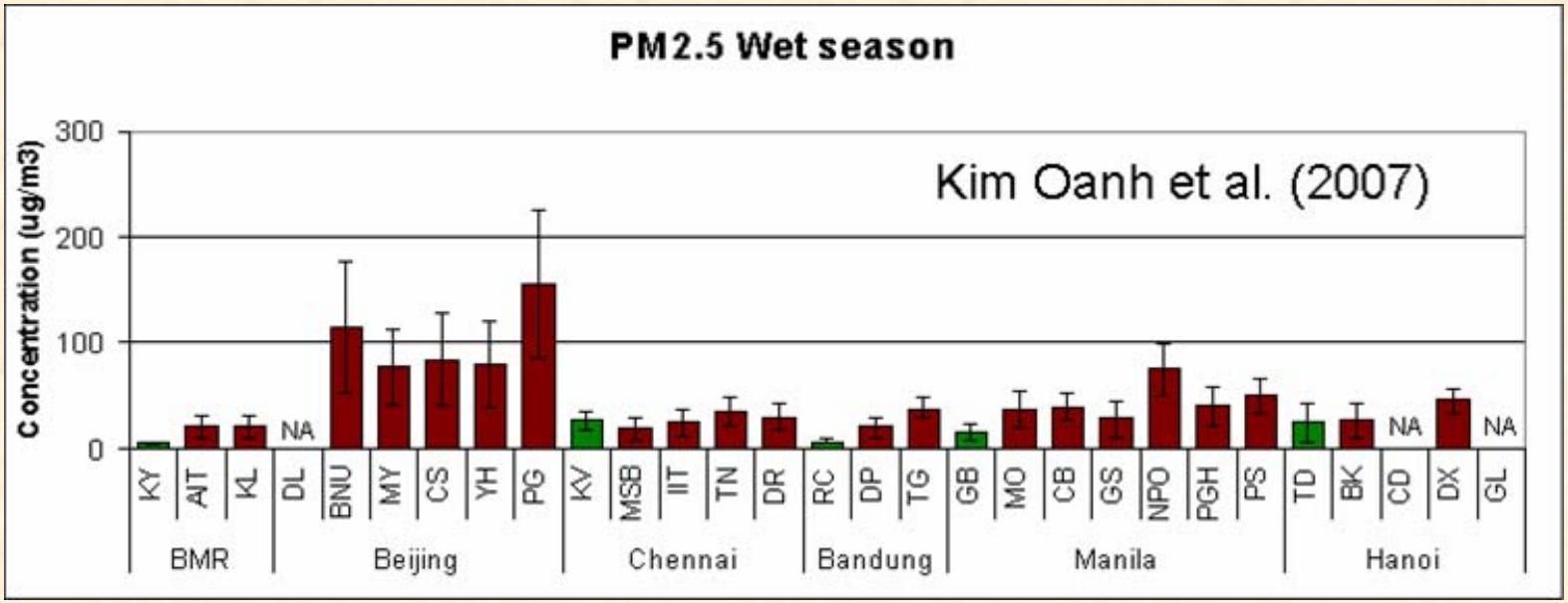


Kim Oanh et al, 2006

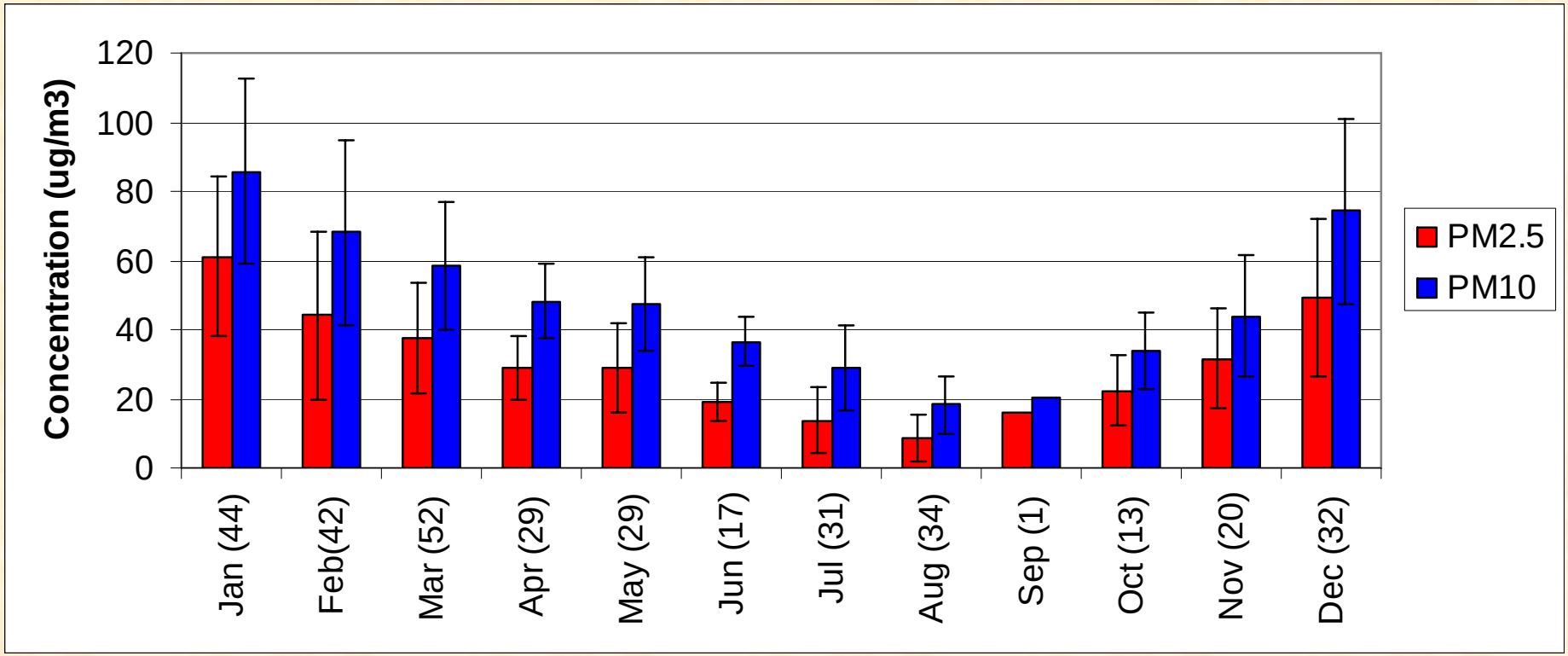
AIRPET phase 2 data with remote sites

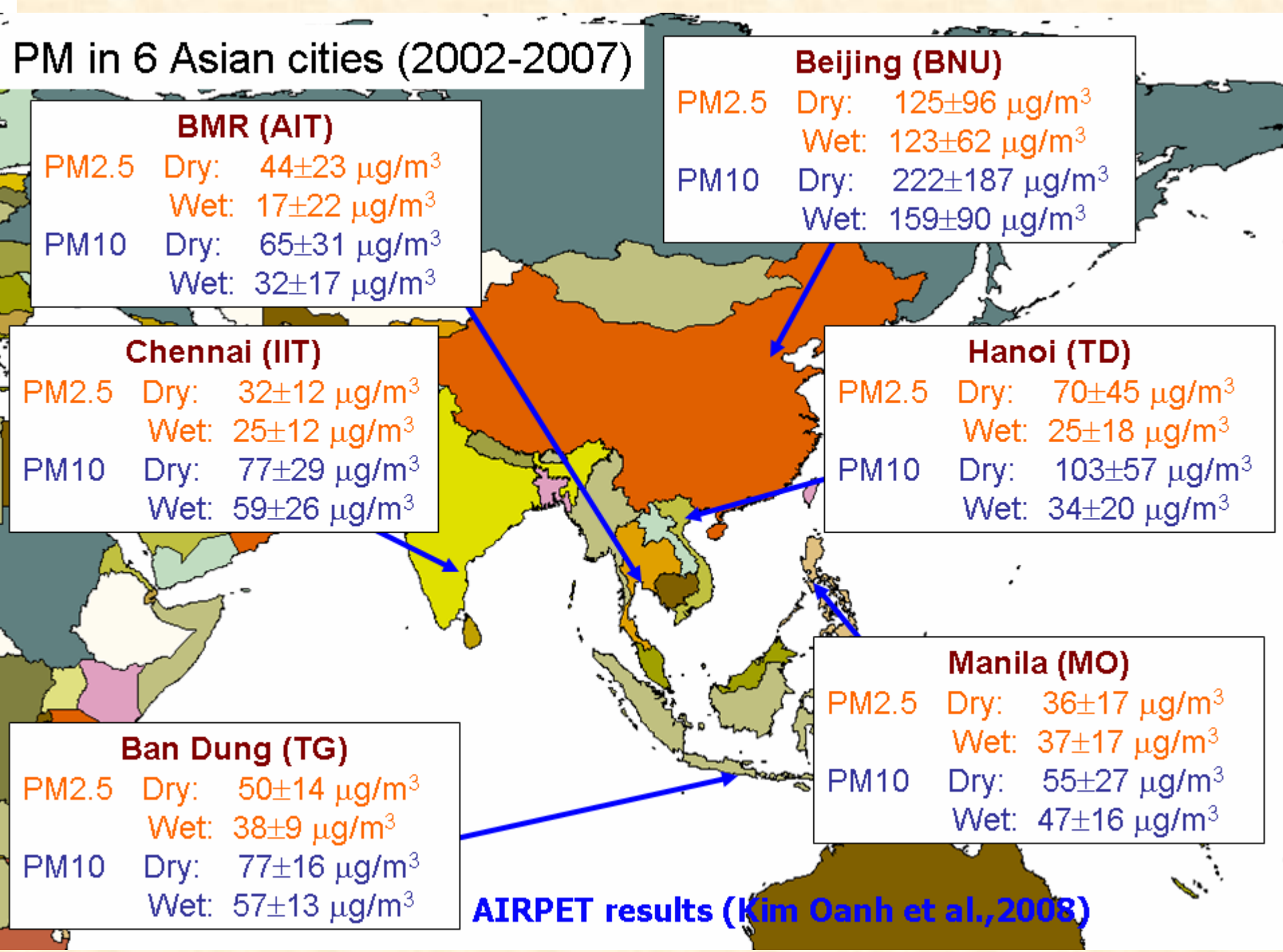
WHO guideline annual average 10 µg/m³



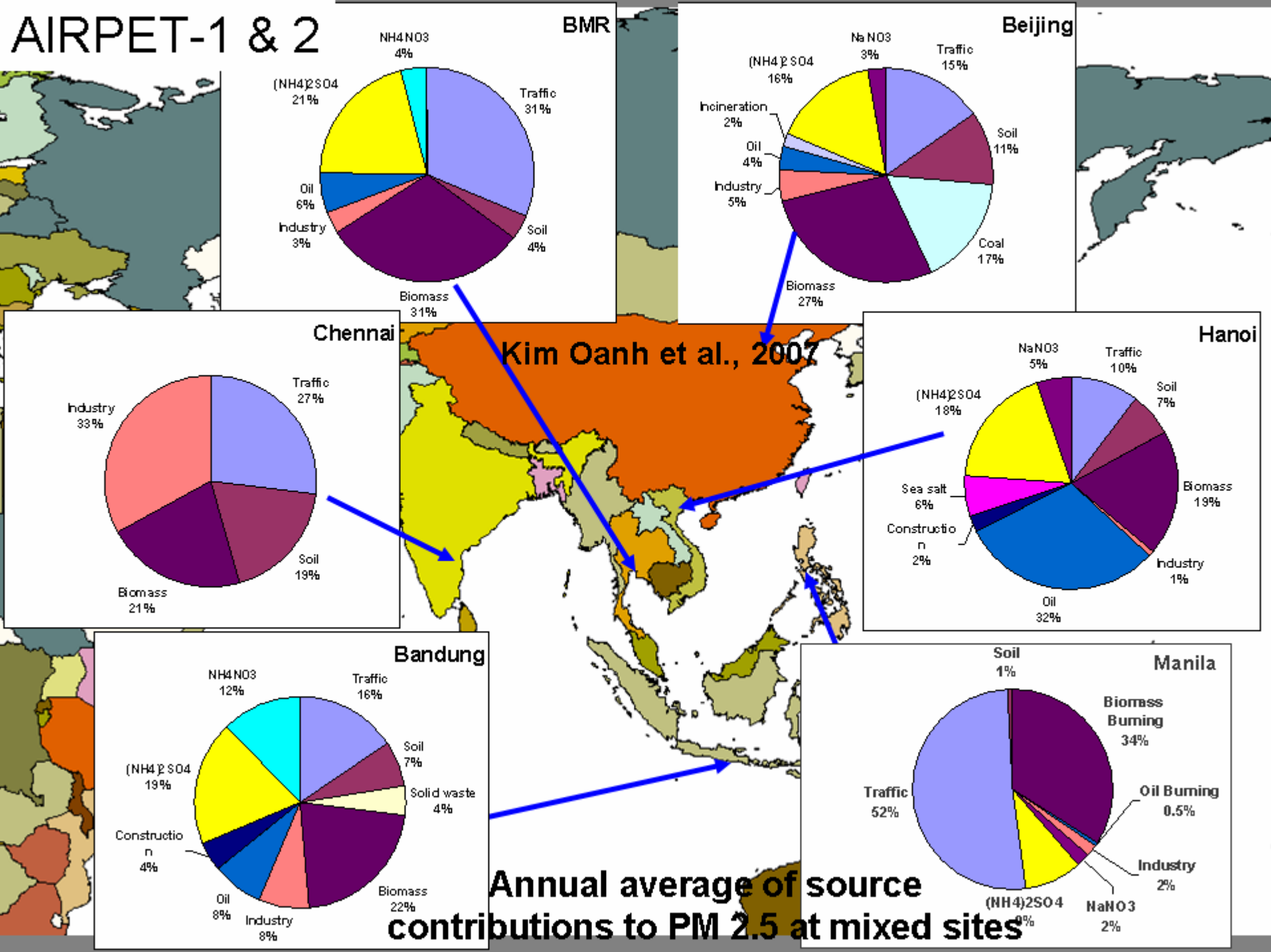


PM monthly variation at AIT site
(Kim Oanh et al., 2008)




PM in 6 Asian cities (2002-2007)
Beijing (BNU)
PM2.5 Dry: 125±96 μg/m3
Wet: 123±62 μg/m3
PM10 Dry: 222±187 μg/m3
Wet: 159±90 μg/m3
BMR (AIT)
PM2.5 Dry: 44±23 μg/m3
Wet: 17±22 μg/m3
PM10 Dry: 65±31 μg/m3
Wet: 32±17 μg/m3
Chennai (IIT)
PM2.5 Dry: 32±12 μg/m3
Wet: 25±12 μg/m3
PM10 Dry: 77±29 μg/m3
Wet: 59±26 μg/m3
Hanoi (TD)
PM2.5 Dry: 70±45 μg/m3
Wet: 25±18 μg/m3
PM10 Dry: 103±57 μg/m3
Wet: 34±20 μg/m3
Manila (MO)
PM2.5 Dry: 36±17 μg/m3
Wet: 37±17 μg/m3
PM10 Dry: 55±27 μg/m3
Wet: 47±16 μg/m3
Ban Dung (TG)
PM2.5 Dry: 50±14 μg/m3
Wet: 38±9 μg/m3
PM10 Dry: 77±16 μg/m3
Wet: 57±13 μg/m3
AIRPET results (Kim Oanh et al.,2008)

AIRPET-1 & 2

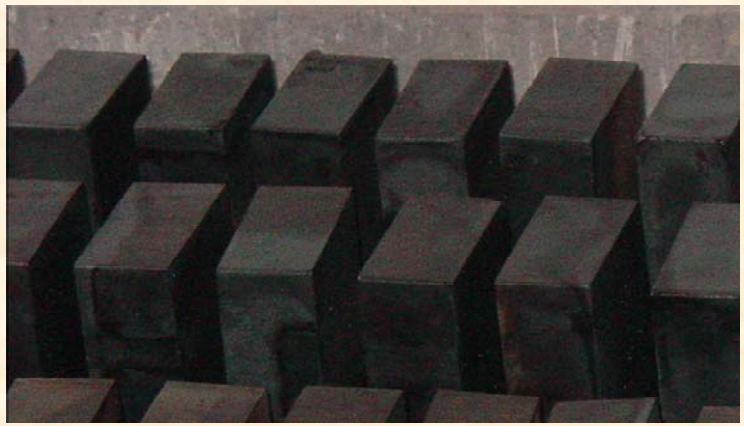


Annual average of source contributions to PM 2.5 at mixed sites

Control Devices Developed ....

India: Photo catalytic Reactor

Indonesia: A Multi Plate Reactor



China: Monolith Catalytic Materials Used for VOCs

… and Scaled up for Pilot Applications

Pilot scale of catalytic VOC control in China: meets the domestic regulation on industrial VOC emissions

Pilot Scale Reactor for SOx/NOx removal

Futura Polyesters Ltd., Manali, Chennai

Dispersion modeling: photochemical smog for ozone air quality