PARTICULATE MATTER IN SELECTED SITES IN LUZON PH: SOURCES AND DEPENDENCE ON METEOROLOGY

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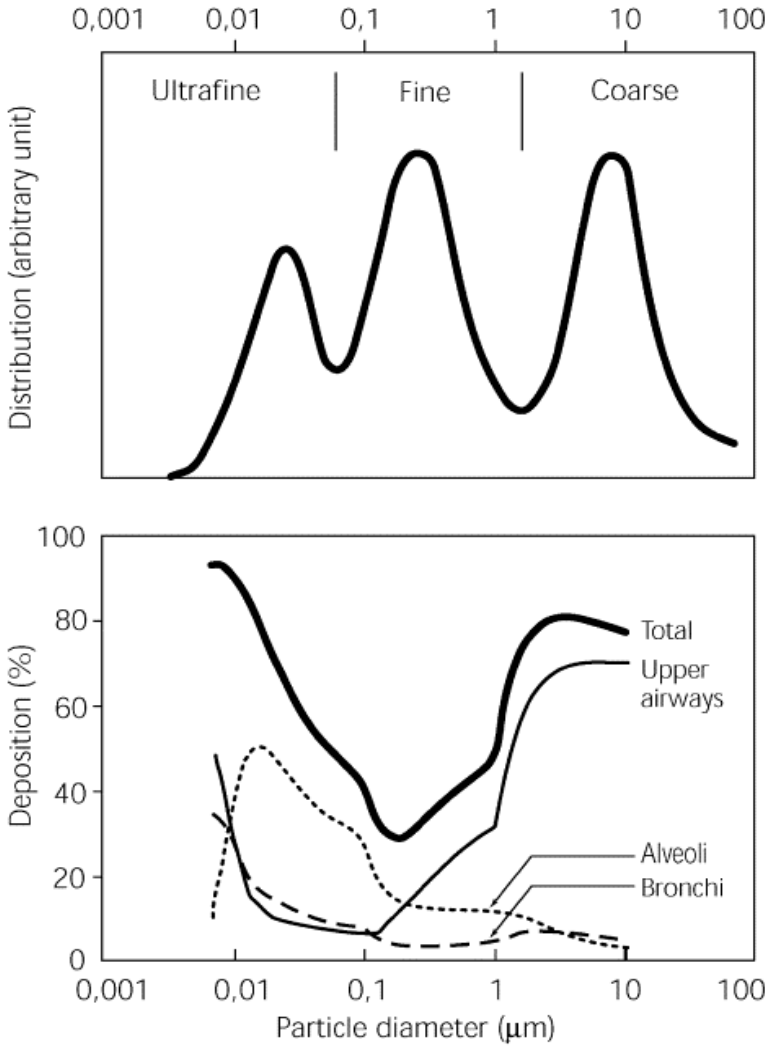
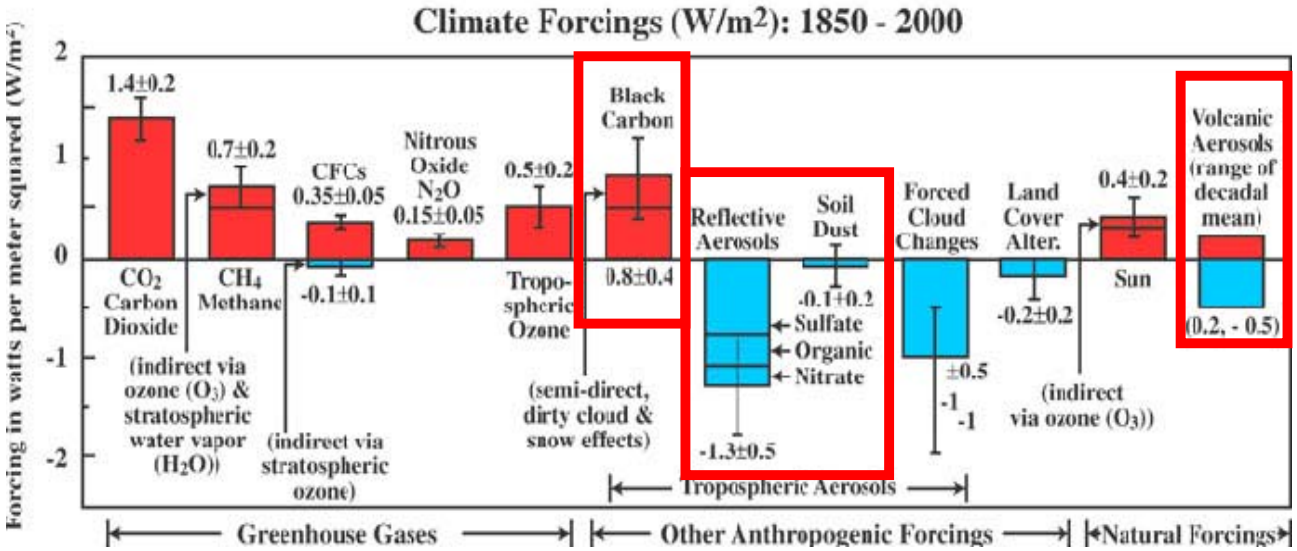
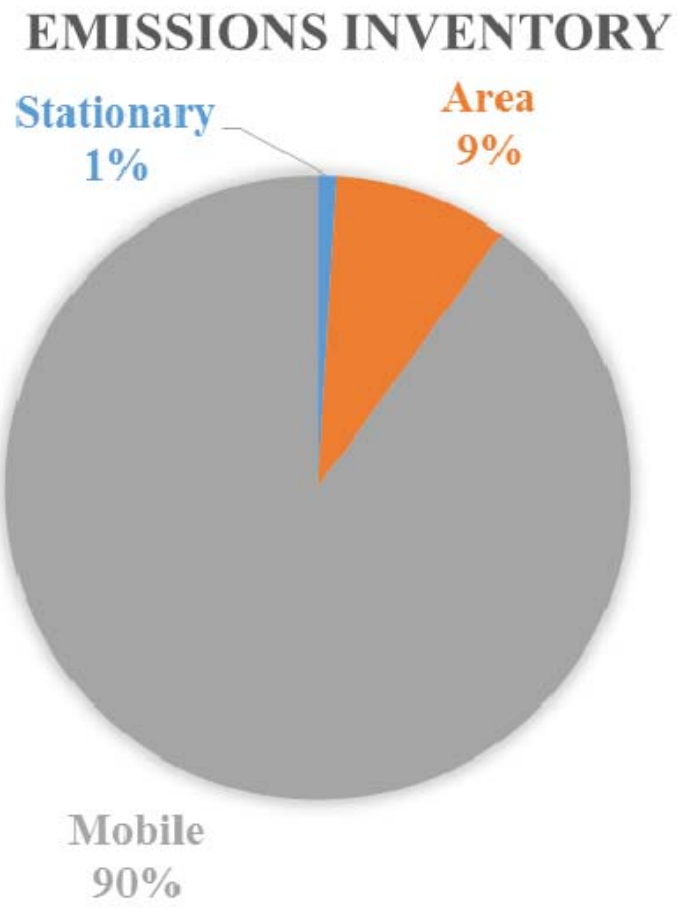
Particulate Matter (PM)





Source: James Hansen/NASA



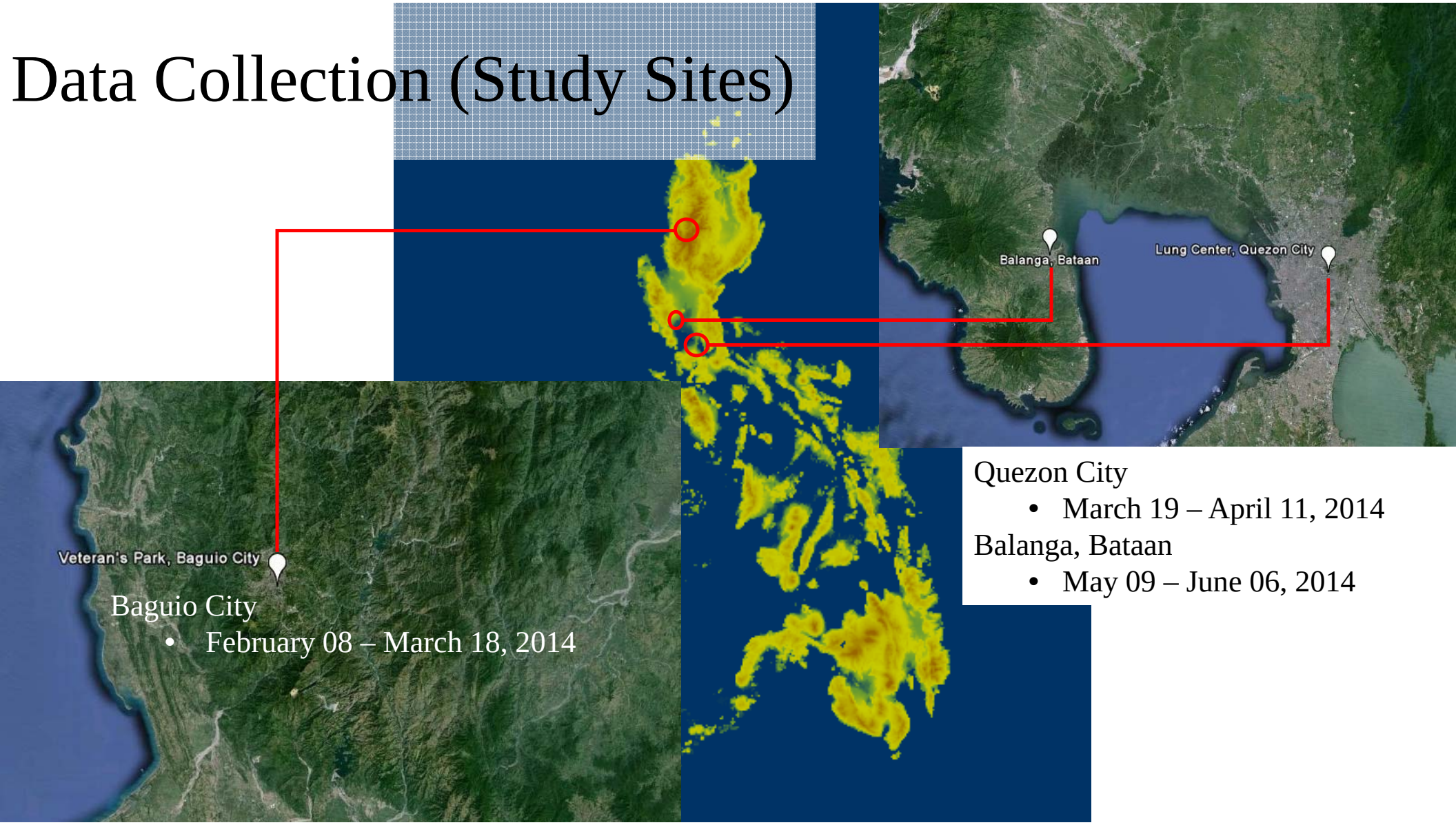
PM emission inventory result for Metro Manila for 2012 (Environmental Management Bureau, 2014)

Methodology

PM Levels	Aerosol spectrometer (0.25 µm to >30 µm) • PM_1, $PM_{2.5}$, PM_{10} • Hourly averages
Sources	Backward trajectories using Stochastic Time-Inverted Lagrangian Transport (STILT)[1] model GDAS (Global Data Assimilation System) archived met
Dependence on meteorology	Meteorological monitor • temperature, humidity, pressure, wind speed, wind direction, and rainfall. • Hourly averages except rainfall (total) Correlation analysis

[1]Lin *et al*. 2003; Gerbig *et al*. 2003; Wen *et al*, 2012; Wen *et al*, 2013; Wen *et al*, 2014

Data Collection (Study Sites)



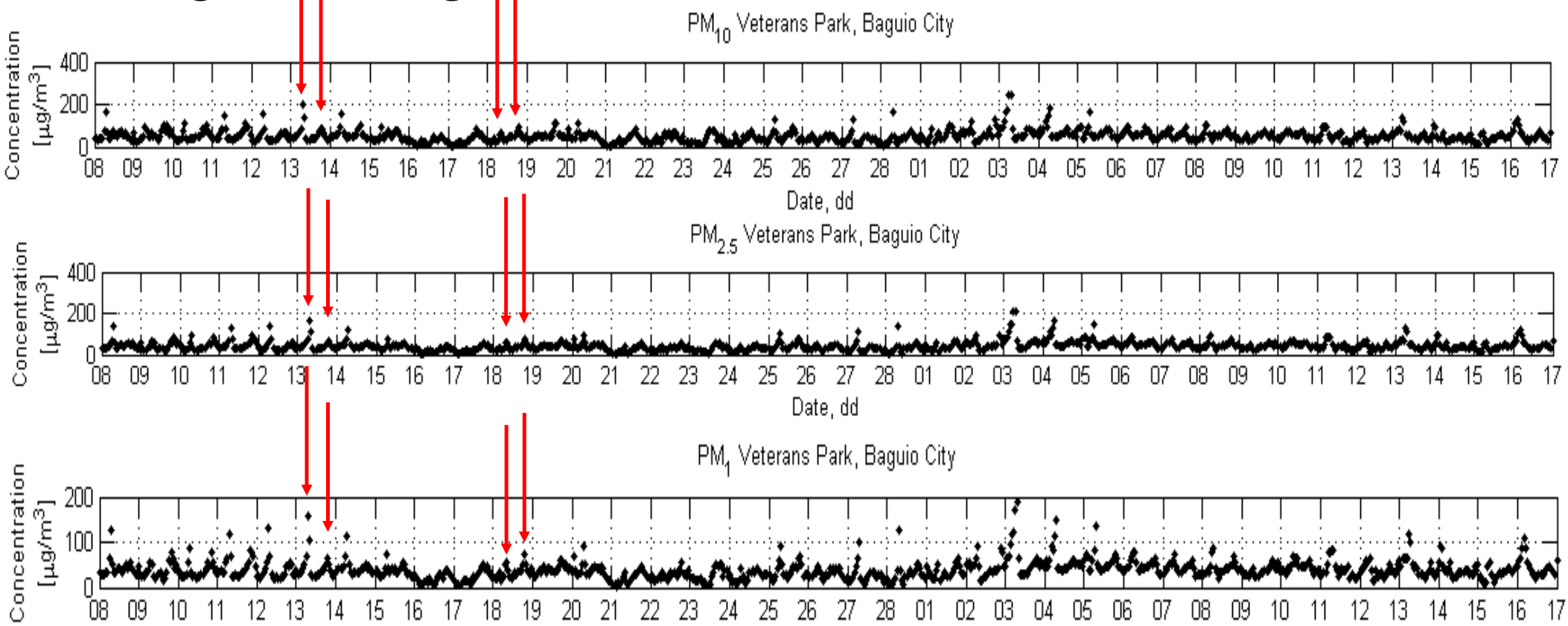
Baguio City
- February 08 – March 18, 2014

Quezon City
- March 19 – April 11, 2014

Balanga, Bataan
- May 09 – June 06, 2014

Variations due to traffic and activities

- All sites exhibit two diurnal peaks in concentrations corresponding to morning and evening rush hours



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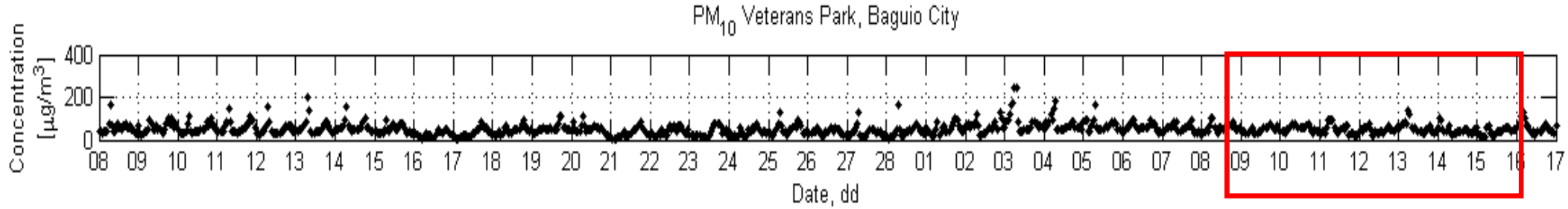

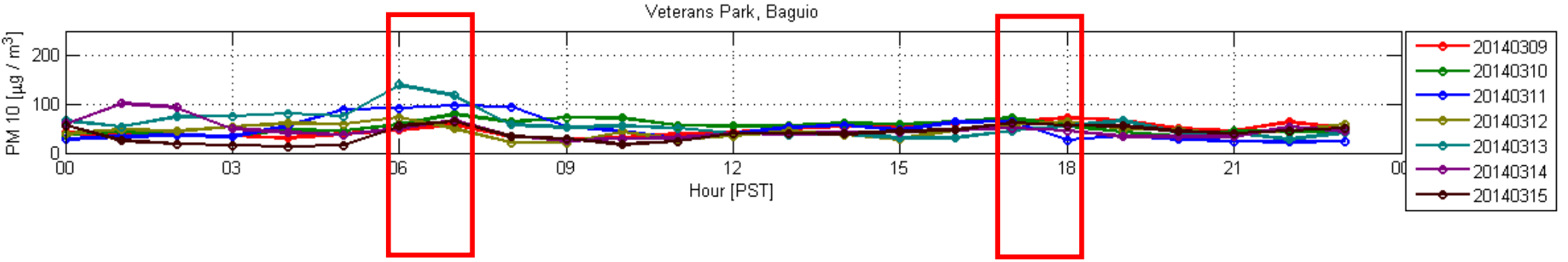

6:00 AM - 7:00 AM

5:00 PM - 6:00 PM

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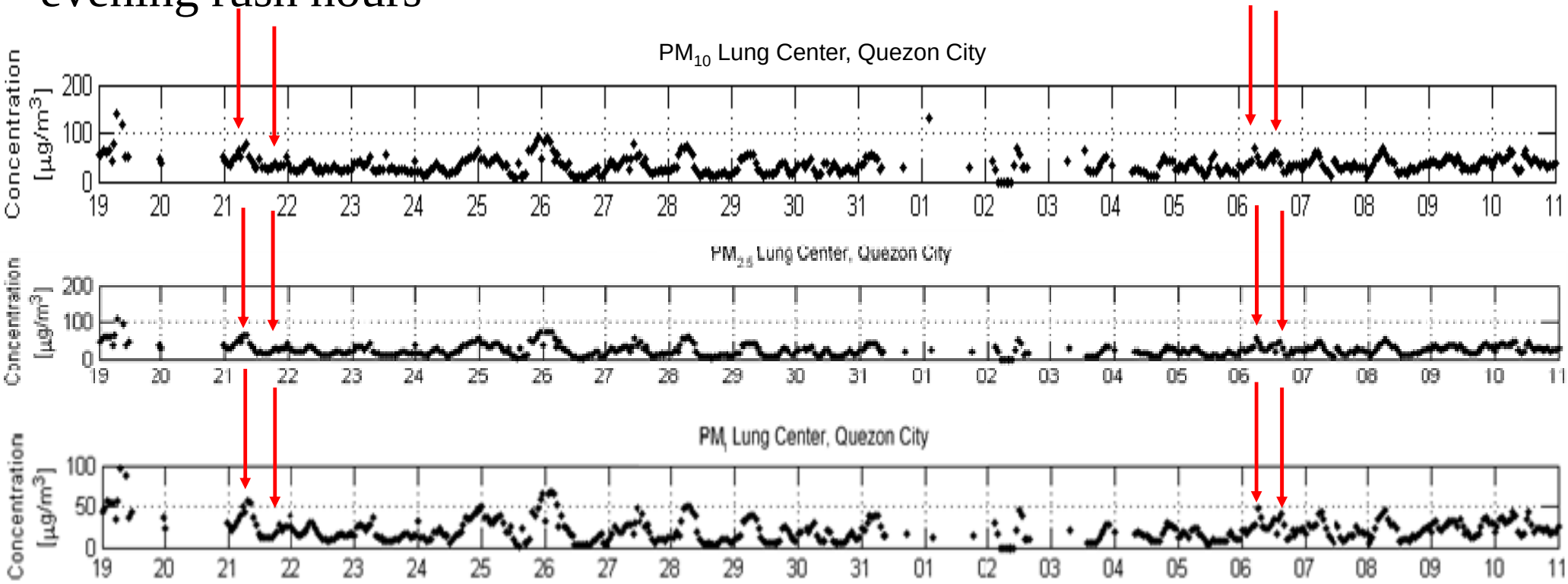

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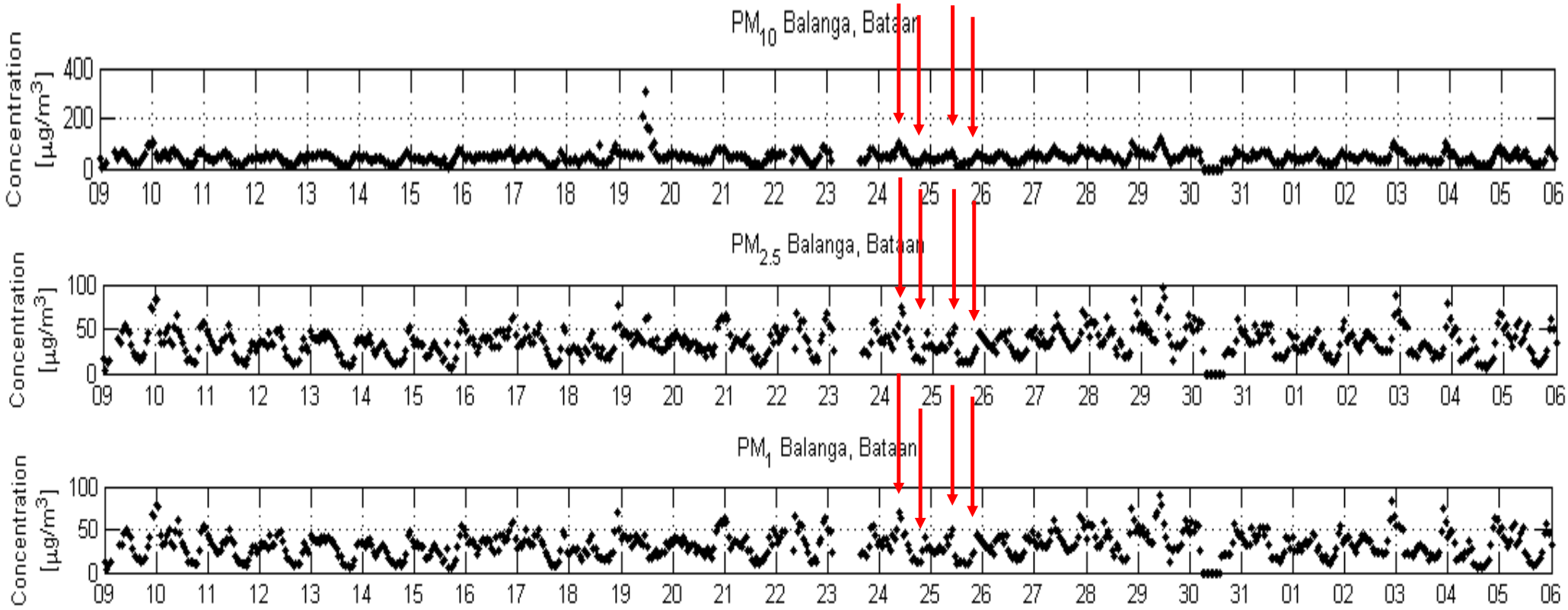


Variations due to activities and traffic

- High $PM_{2.5}$-to-PM_{10} and PM_1-to-PM_{10} ratios may be attributed to vehicular fuel emissions

Study Site	Average & Variation (± 1SD)
$PM_{2.5}$-to-PM_{10} ratio	
• Veteran's Park, Baguio	0.82±0.09
• Lung Center, Quezon City	0.70±0.14
• Balanga City, Bataan	0.78±0.08
PM_1-to-PM_{10}	
• Veteran's Park, Baguio	0.76±0.09
• Lung Center, Quezon City	0.60±0.38
• Balanga City, Bataan	0.71±0.10

Variations due to activities and traffic

- Festival related activities (e.g. closing of roads, fireworks display, grilling and cooking)

Relationship of meteorological variables to PM

Pearson coefficients - Veteran's Park, Baguio

	PM10	PM2.5	PM1
Temperature	-0.07[b]	-0.15	-0.14
Humidity	0.19	0.28	0.28
Pressure	-0.21	-0.15	-0.13
Wind Speed	-0.19	-0.28	-0.28
Rainfall	-0.13	-0.10	-0.10

All correlations are statistically significant at 99% confidence interval (unless specified).

Pearson coefficients – Balanga City, Bataan

	PM10	PM2.5	PM1
Temperature	0.14	0.17	0.20
Humidity	-0.11	-0.10[b]	-0.12
Pressure	0.03[a]	0.06[a]	0.05[a]
Wind Speed	0.06	0.00[b]	0.11
Rainfall	0.23	0.23	0.20

All correlations are statistically significant at 99% confidence interval (unless specified).

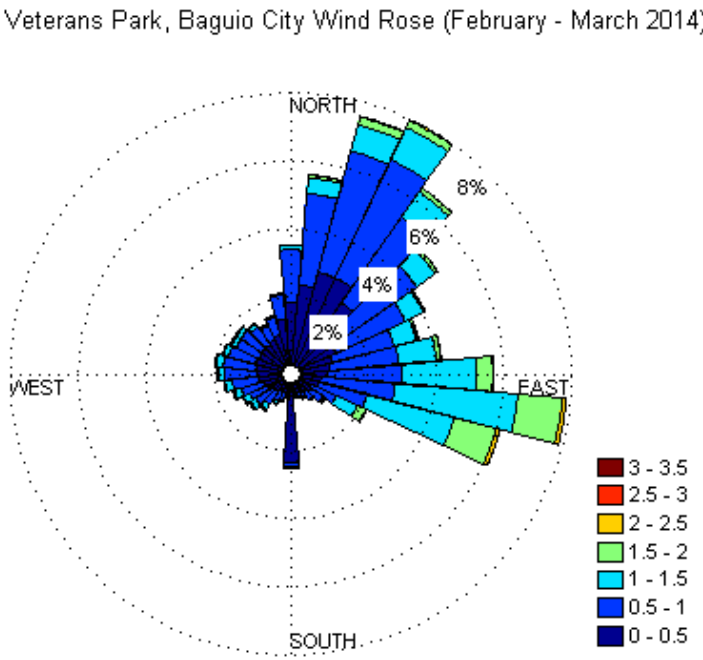
Pearson coefficients – Lung Center, Quezon City

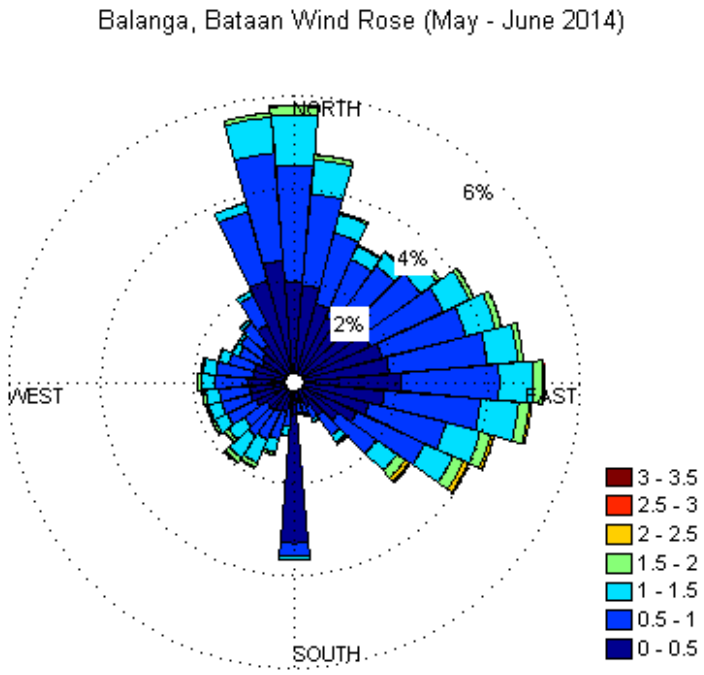
	PM10	PM2.5	PM1
Temperature	-0.14	-0.29	-0.31
Humidity	0.49	0.61	0.61
Pressure	0.16	0.11[b]	0.10[b]
Wind Speed	-0.25	-0.44	-0.44
Rainfall	0.09[a]	0.11[b]	0.11[b]

All correlations are statistically significant at 99% confidence interval (unless specified).

Relationship of meteorological variables to PM

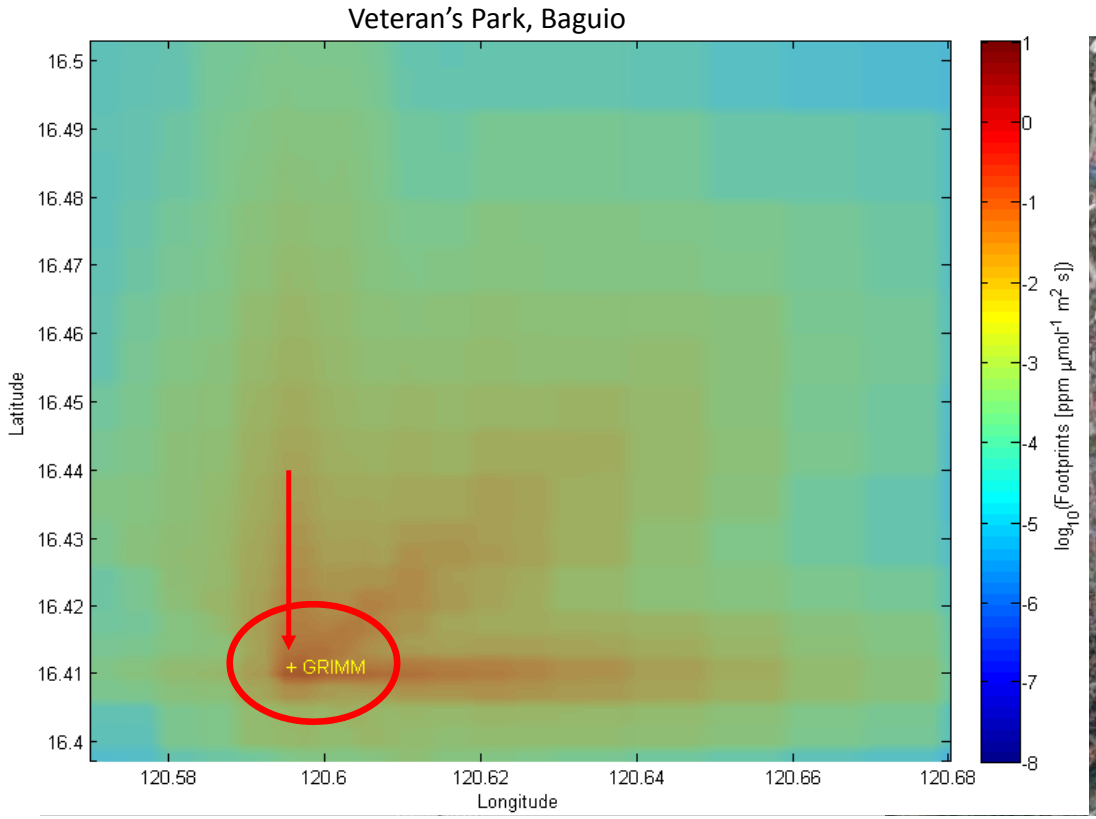
- Wind directions are due to northeast monsoon (*Amihan)*





Particulate Matter Sources

- Sources nearest the measurement sites contribute to PM concentrations significantly than far sources



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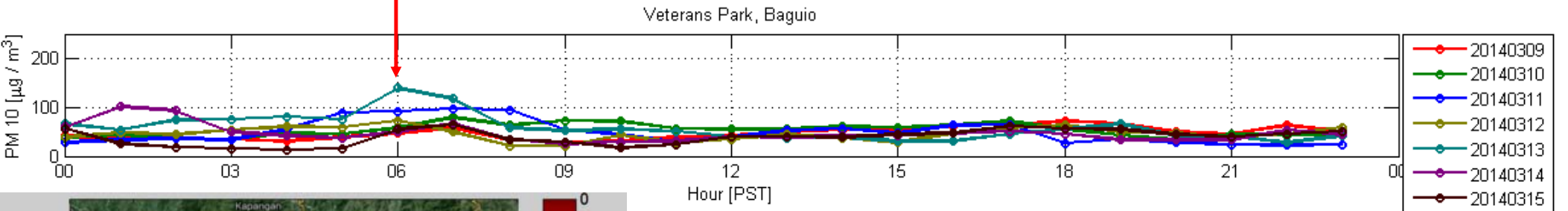

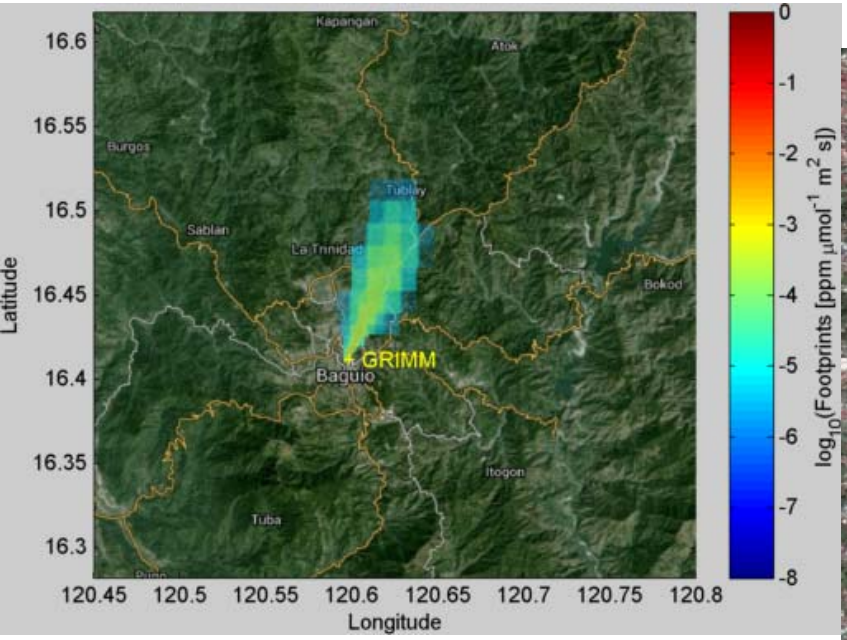

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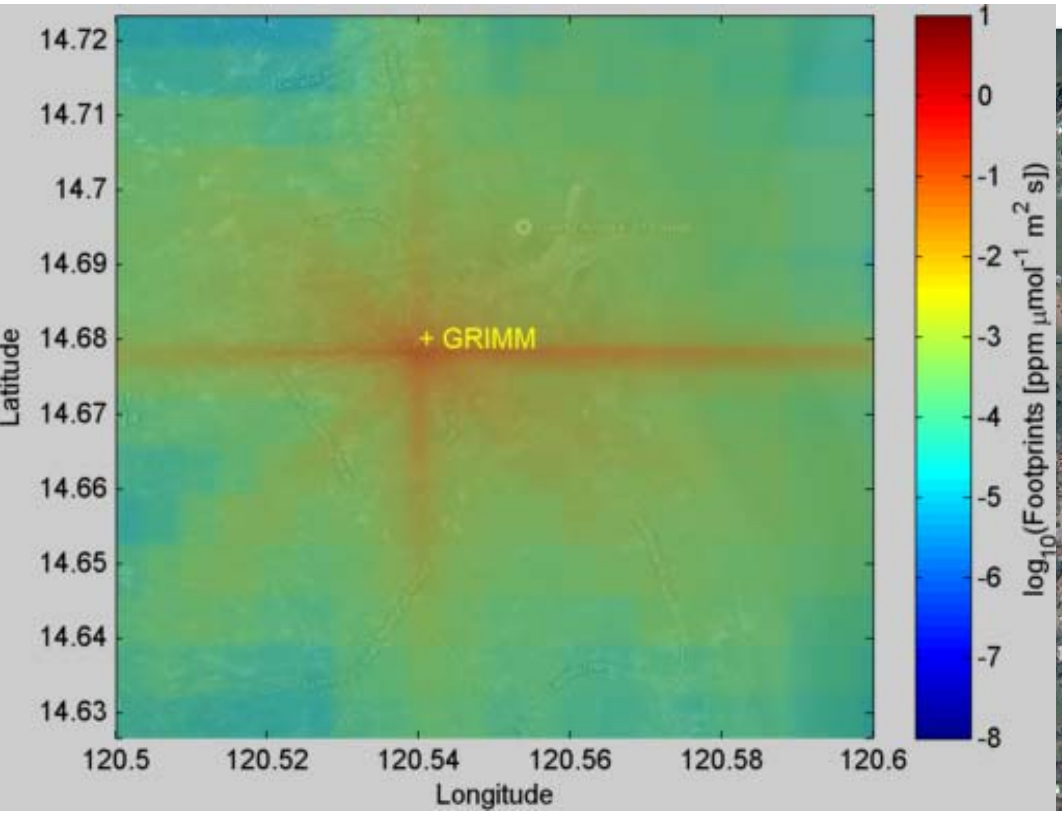

Summary

- Mobile emissions primarily affect PM levels in the sites. Human cultural activities also affect the variations.
- Although the three sites are urban areas, they still differ in meteorology due to their location and this affect PM concentrations at each site.
- Backward trajectories can be used to infer the probable sources of emissions.
- Sources nearest the measurement sites contribute to PM concentrations significantly than far sources
- Quantification of emission source influence using footprints

Outlook

- Examine sensitivity of particles numbers
- Produce data-weighted footprints
- Simulate using chemistry model


Thank you!