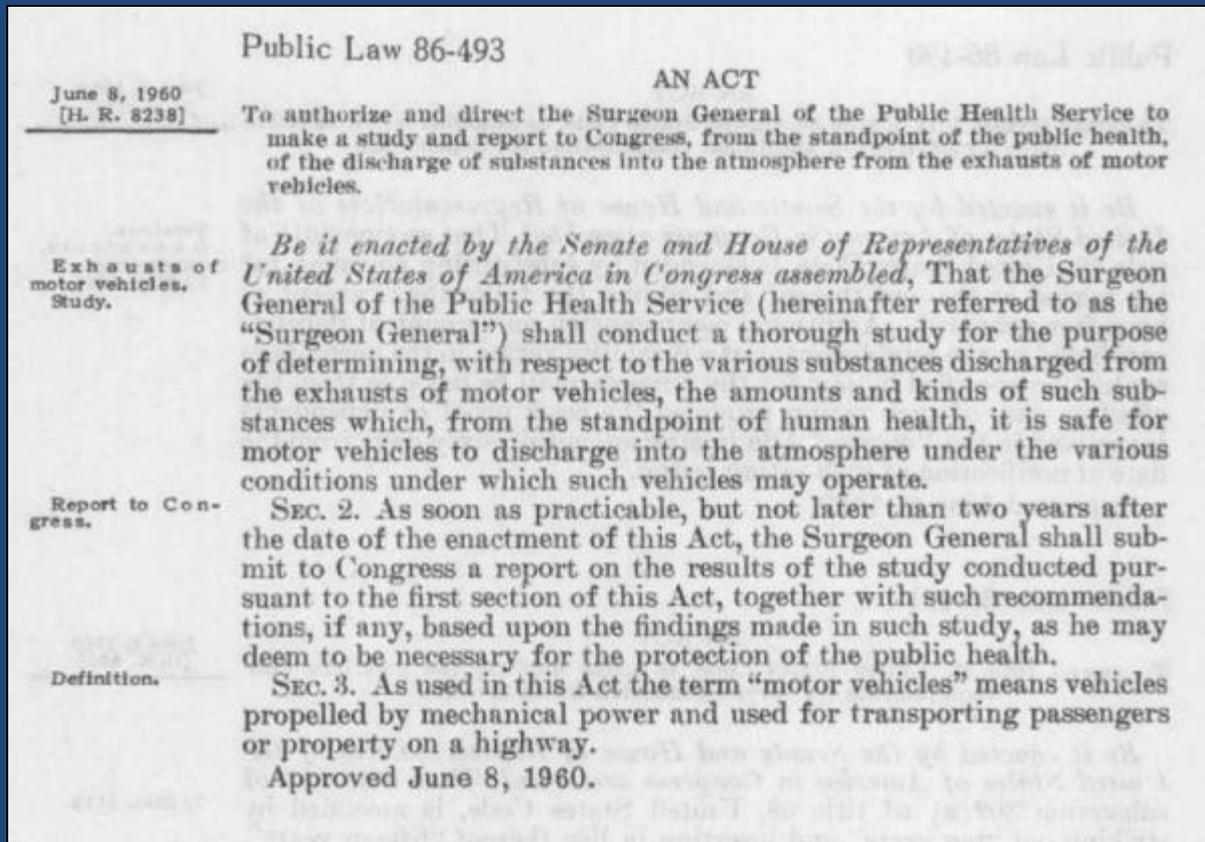


# Investigating Personal Exposures of Traffic Police in Kathmandu, Nepal: High Concentrations in the Himalayas

Richard E Peltier and Kabindra M Shakya  
Environmental Health Sciences  
University of Massachusetts  
*rpeltier@umass.edu*

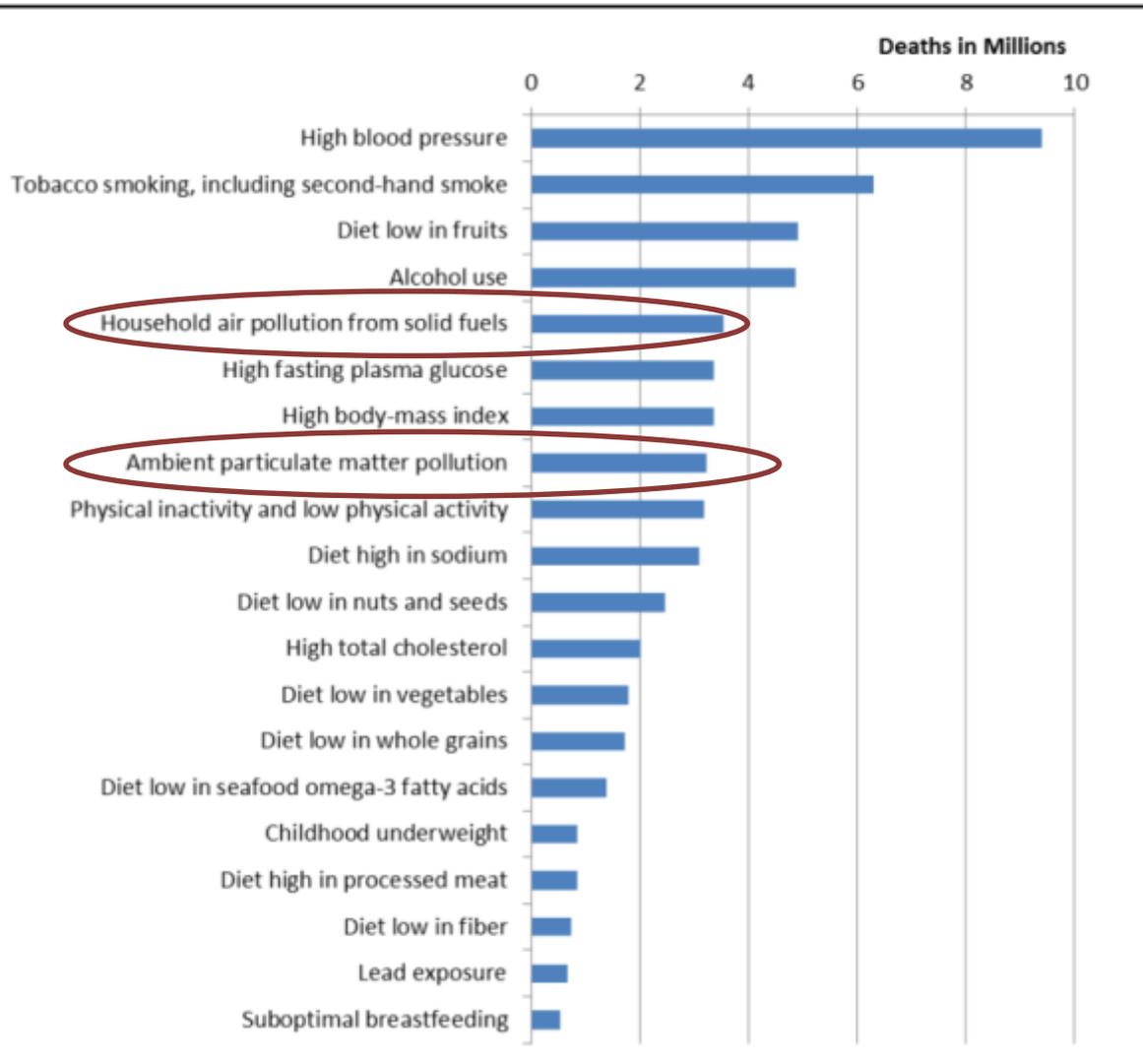
# We still haven't found what we're looking for.



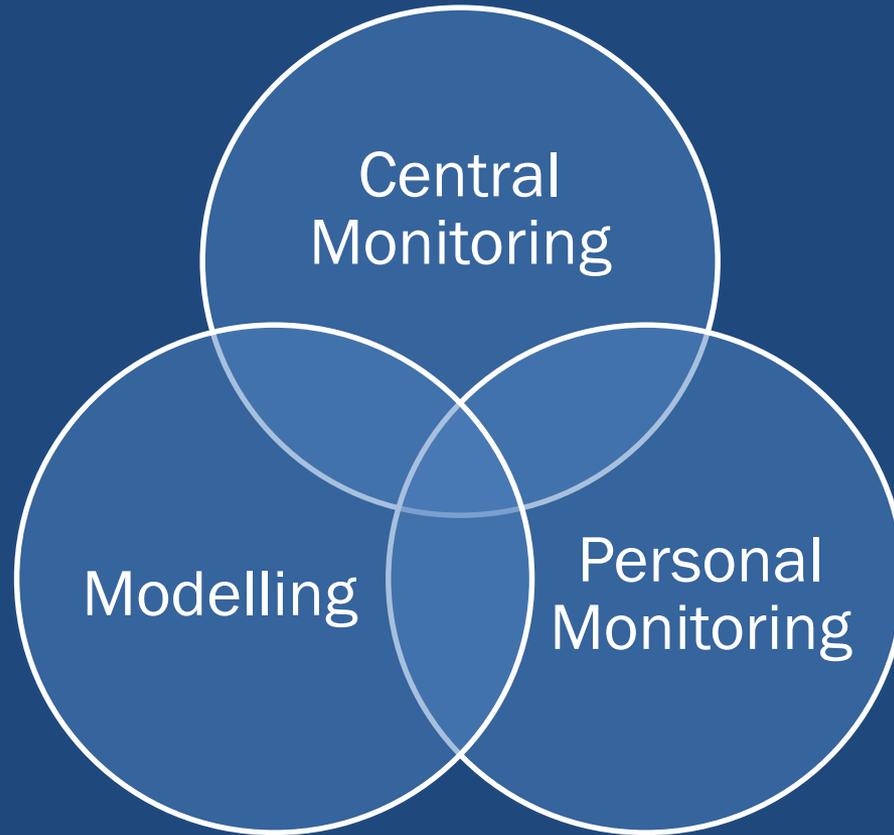
US P.L. 86-493, June 1960.

# Why?

## Global Deaths Attributable to 20 Leading Risk Factors 2010



# Traditional Measures of Exposure

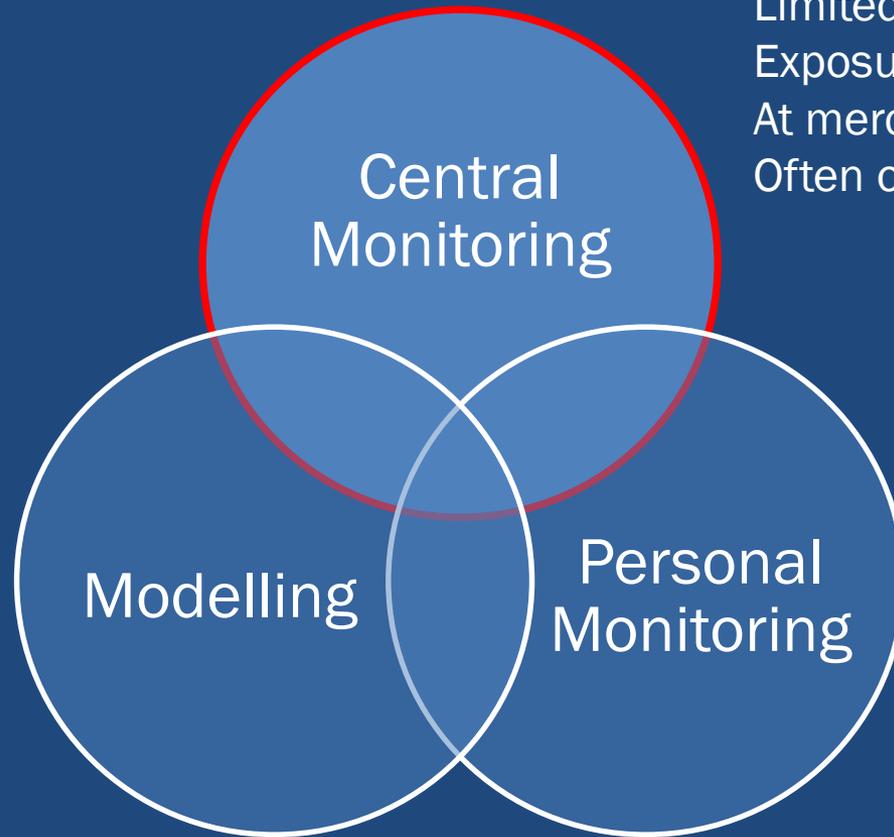


# Traditional Measures of Exposure

Lots of sites in urban locations  
Data often free (!)  
High quality, validated



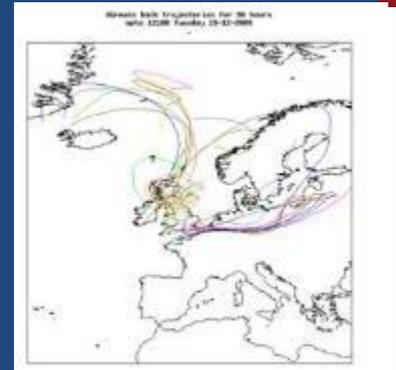
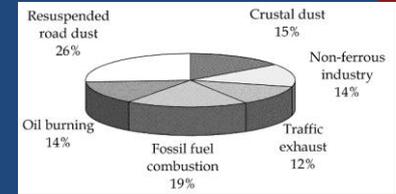
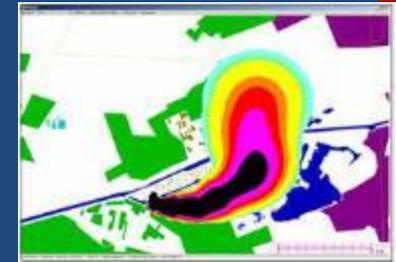
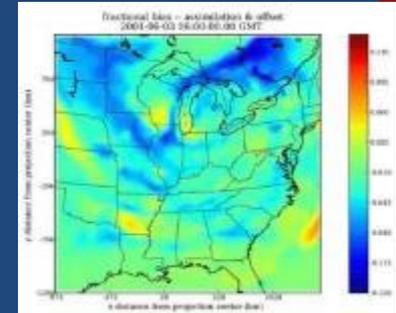
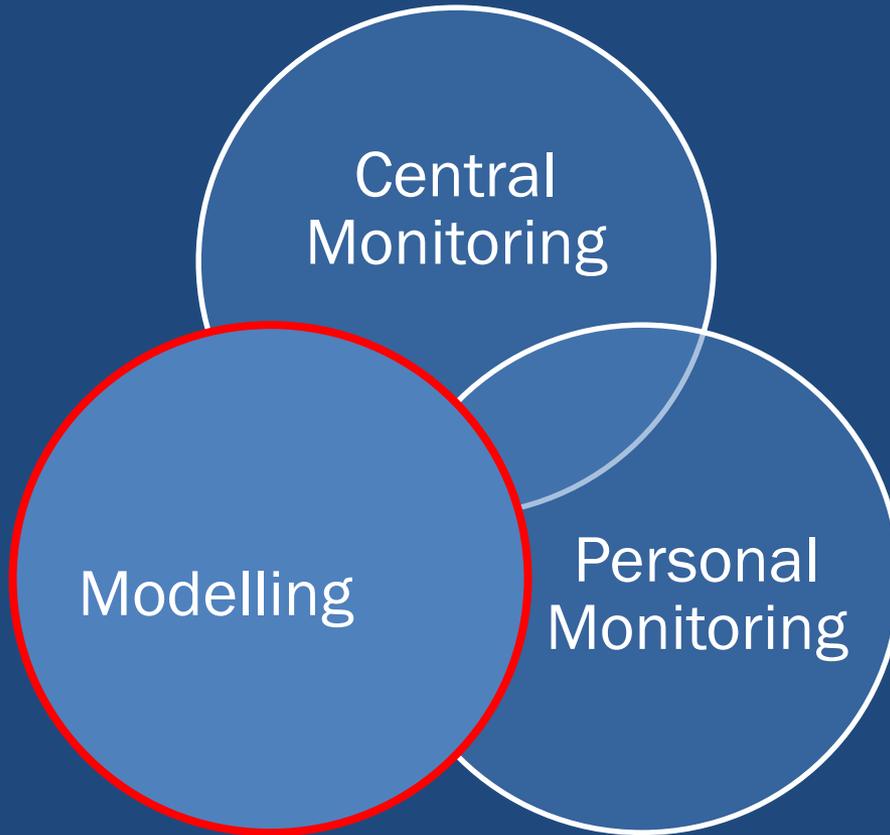
Limited data  
Exposure misclassification  
At mercy of operators  
Often older technology



# Traditional Measures of Exposure



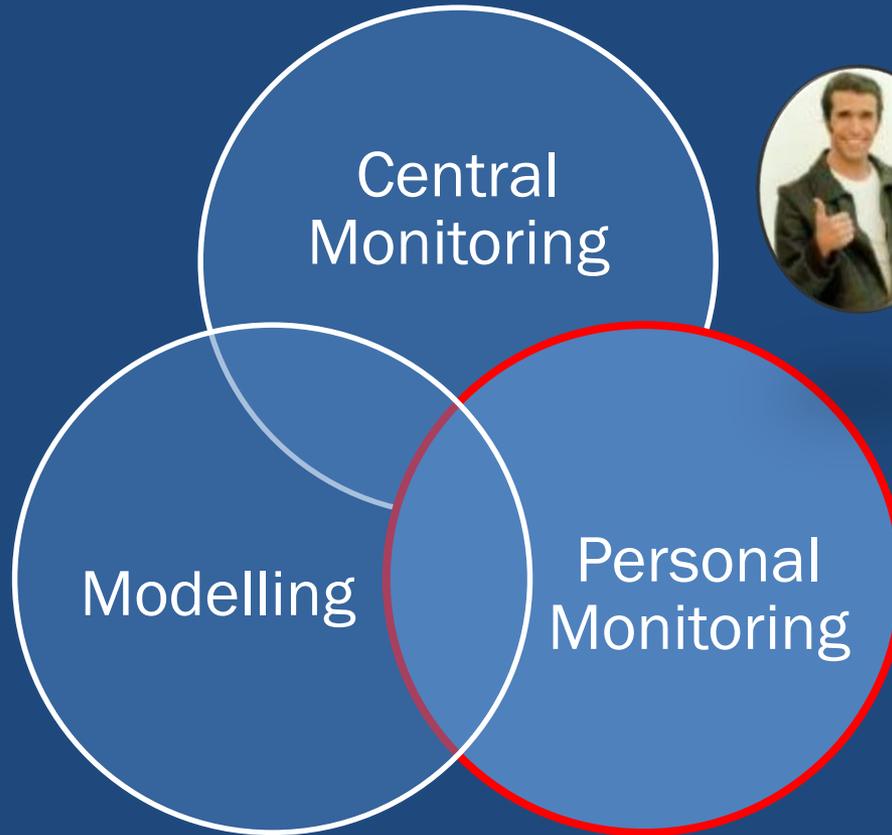
Tremendous power  
Chemistry, physics  
Comparatively  
inexpensive



Limited spatial resolution  
Science fiction (until proven  
otherwise)  
Incredibly complex



# Traditional Measures of Exposure

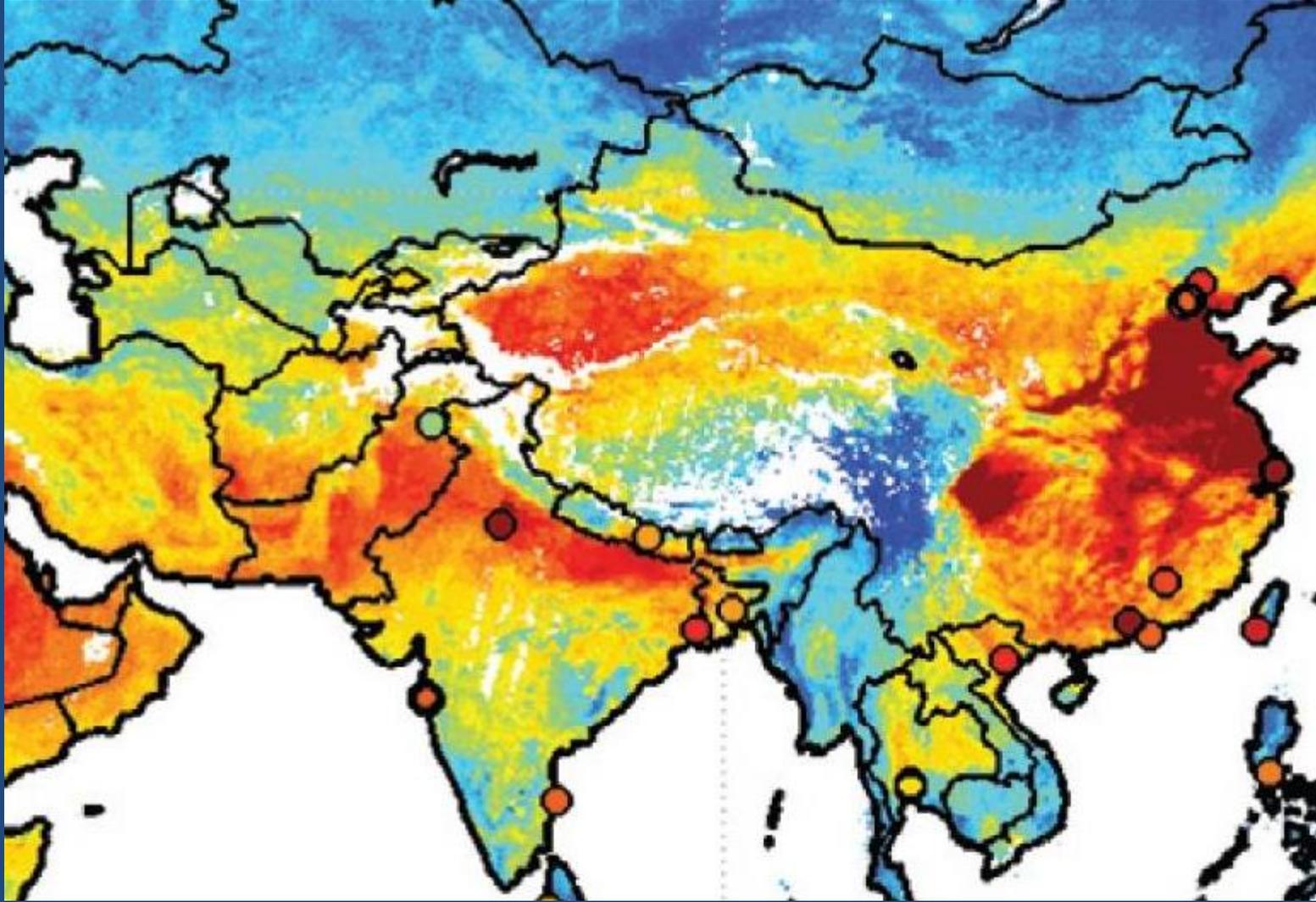


Excellent measure of 'true' exposure  
Latest and greatest technology  
Mobile, highly temporal



Pricy  
Requires skilled technicians  
Limited sensitivity

# Hindu Kush Himalayan region



Von Donkelaar et al, EHP, 2010

# Kathmandu, Nepal



# Analytical Schematic



pDR-1500  
Nephelometer



Micro  
aethelometer

5 minute RH-  
adjusted  
PM2.5

24 hour filter  
sample

5 minute BC

24 hour  
integrated filter  
strip – future GC  
work?

XRF  
Na-U

EC &  
OC



Position and  
Activity



IC

1s  
Lat/Lon/  
Alt

Hourly  
Activity

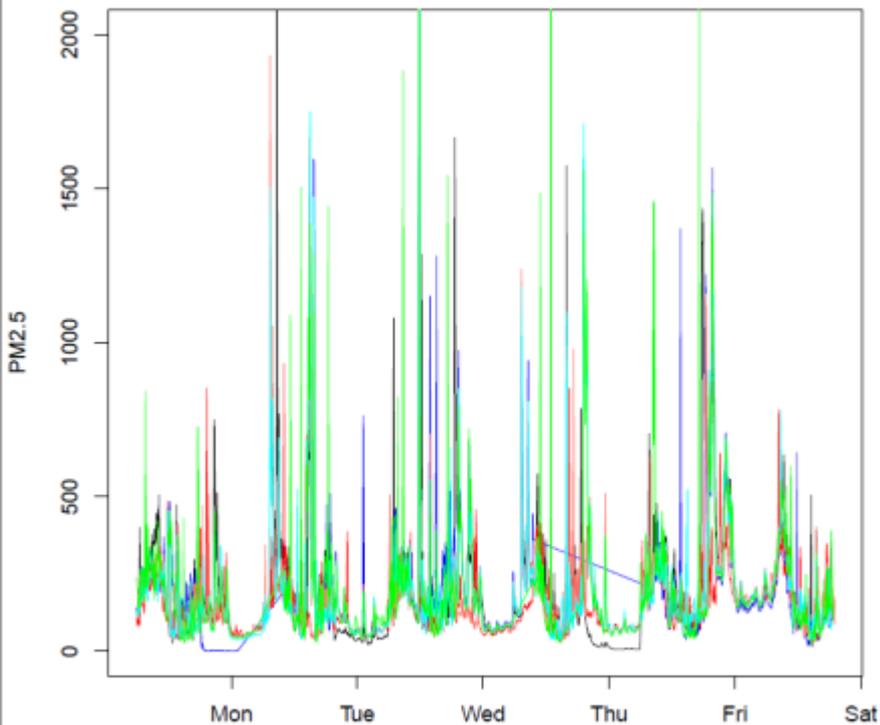


# Study Design

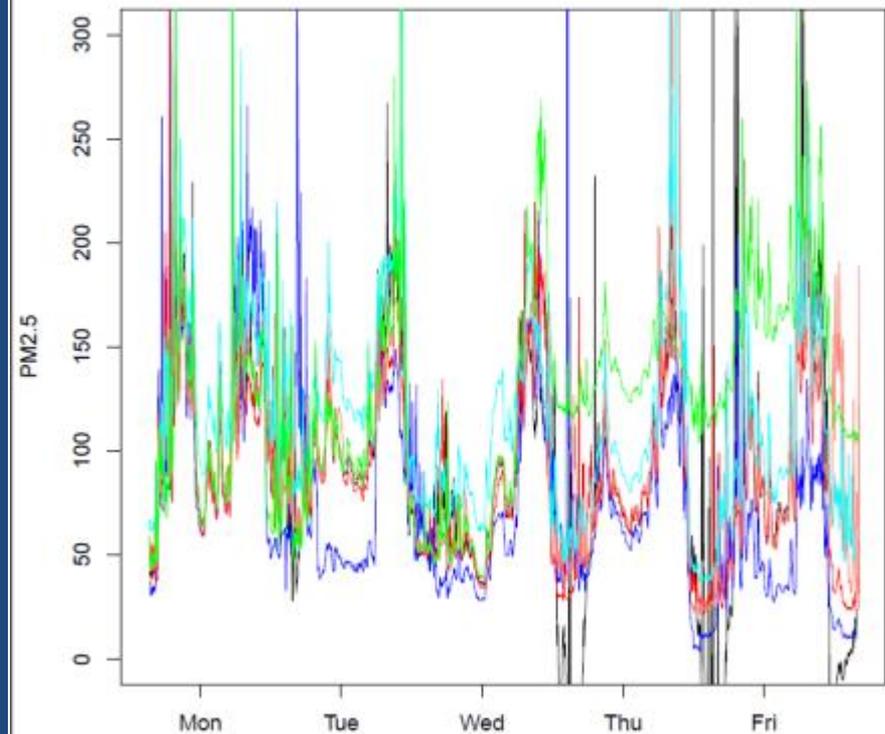
- Two parts:
  - Phase I (completed) in Jan-Mar 2014 to characterize most polluted conditions.
  - Phase II (ongoing) in July-Aug 2014 to characterize cleanest conditions due to annual monsoons.
- Intervention with N95 masks
- Large health component (not really discussed here)

# The first look at measurements

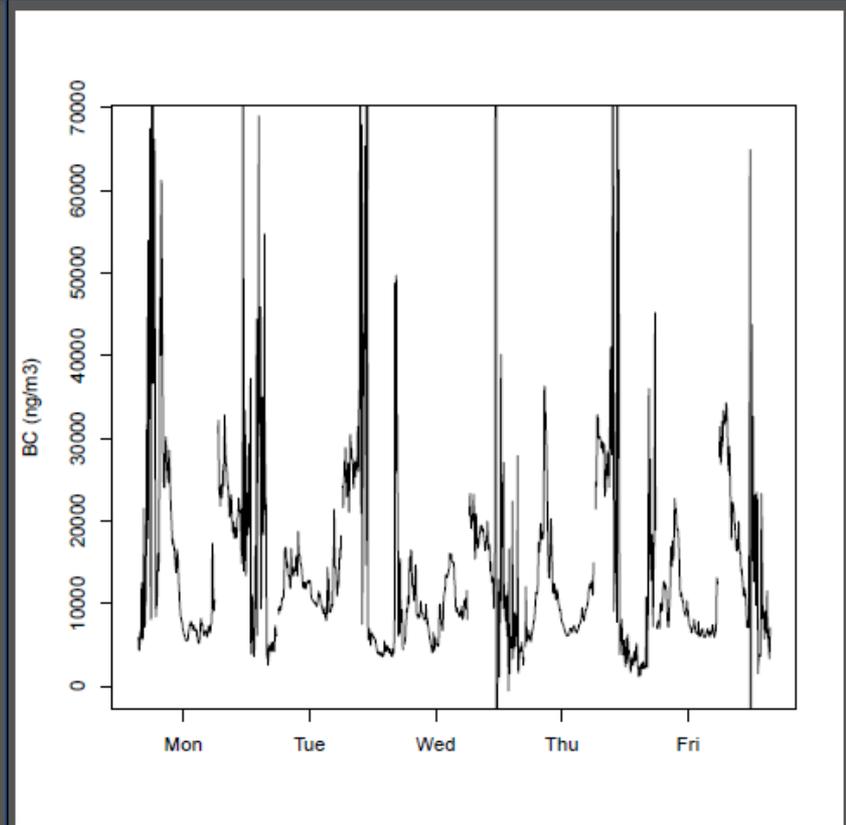
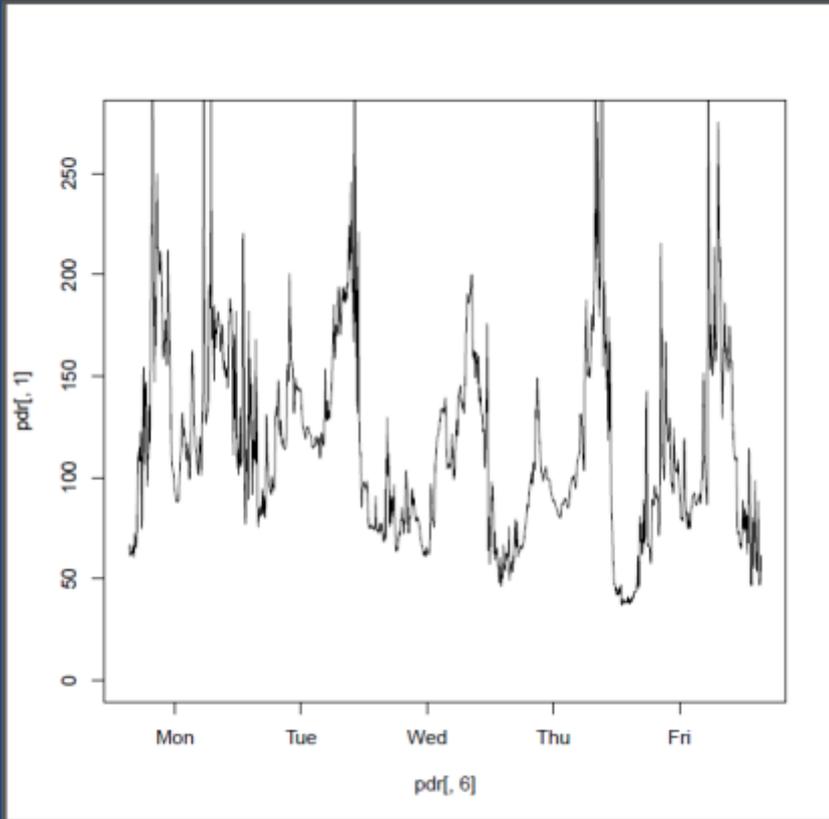
Balaju/Gongabu (February 23–28, 2014)



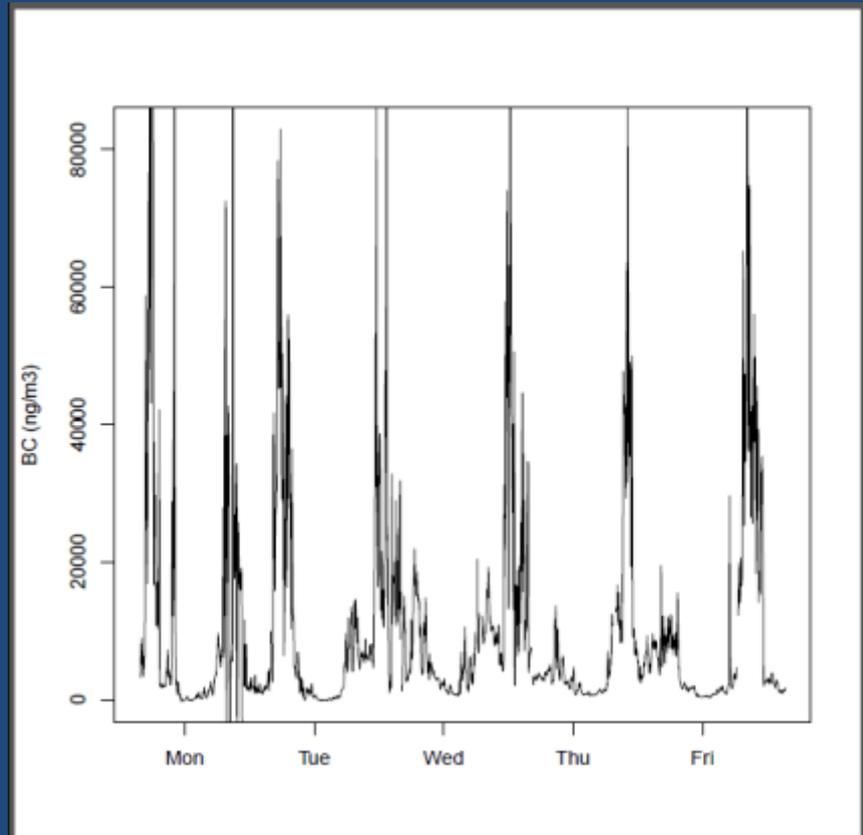
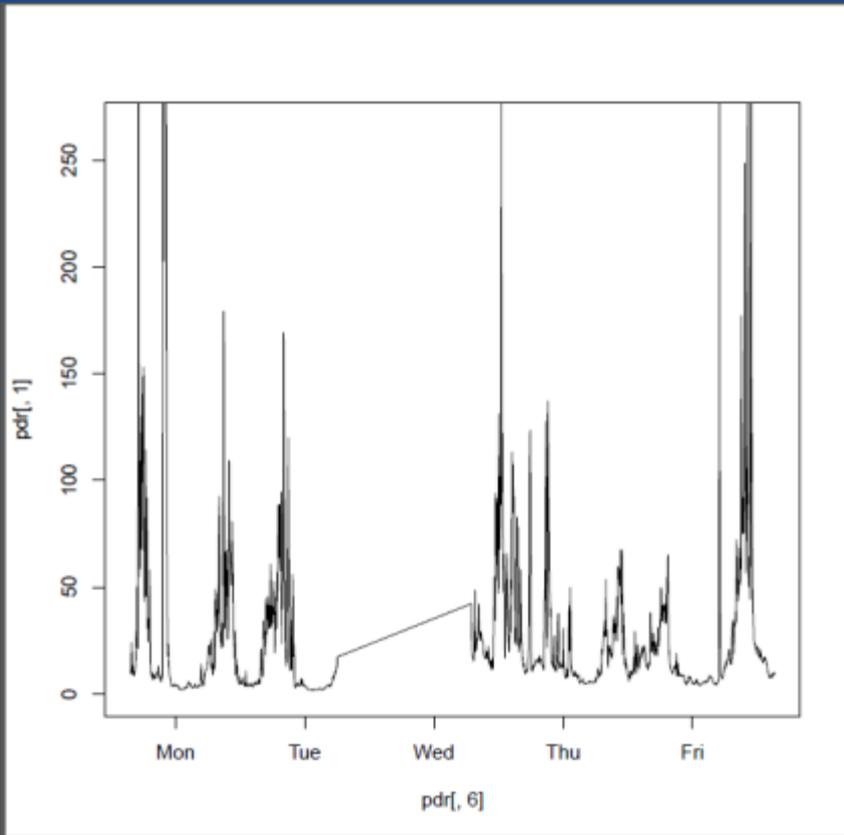
Thapathali (March 23–28, 2014)



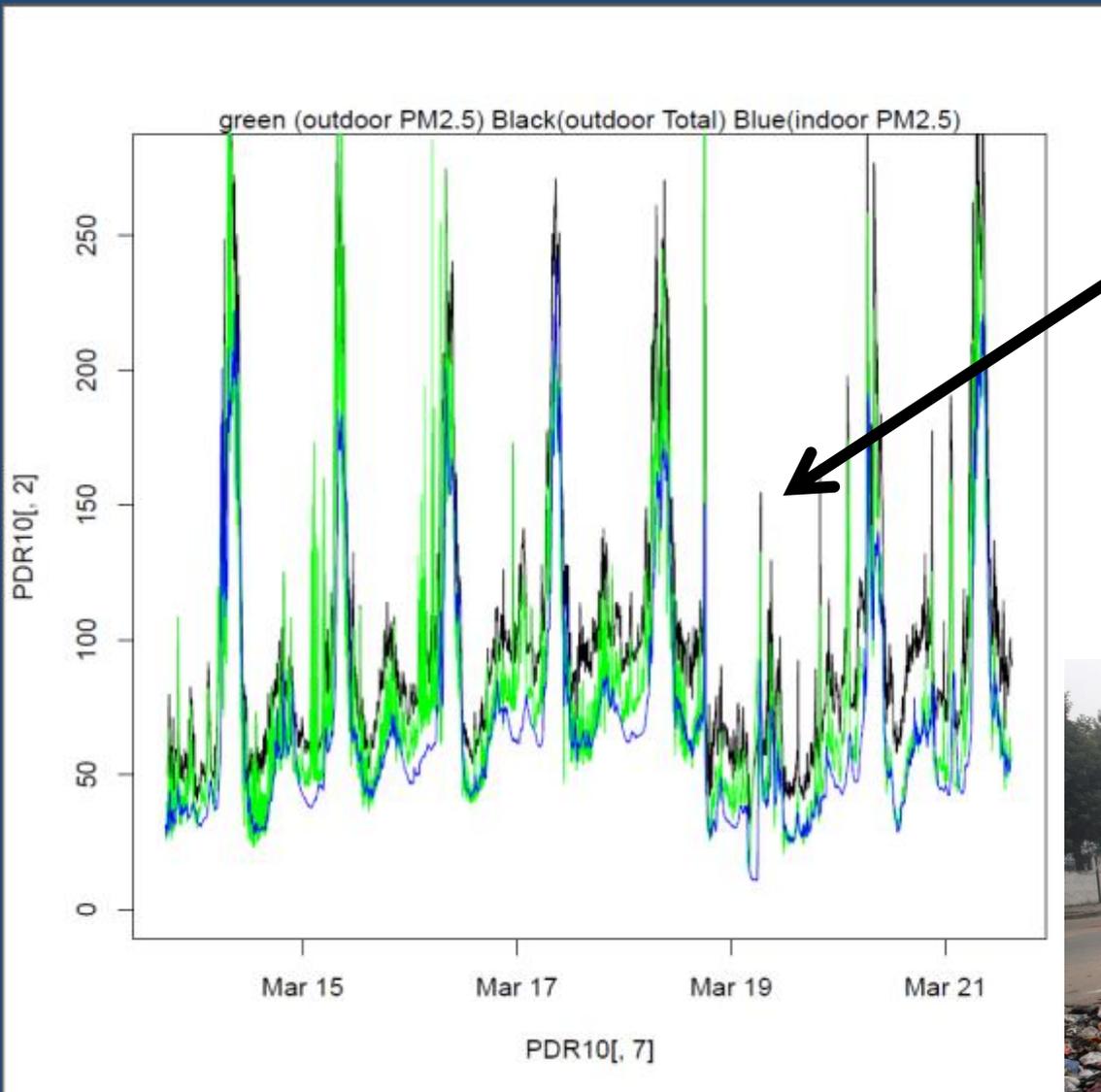
# Phase I (Jan-Mar 2014)



# Phase II (July 20-26, 2014)



# Near Road, 5<sup>th</sup> floor

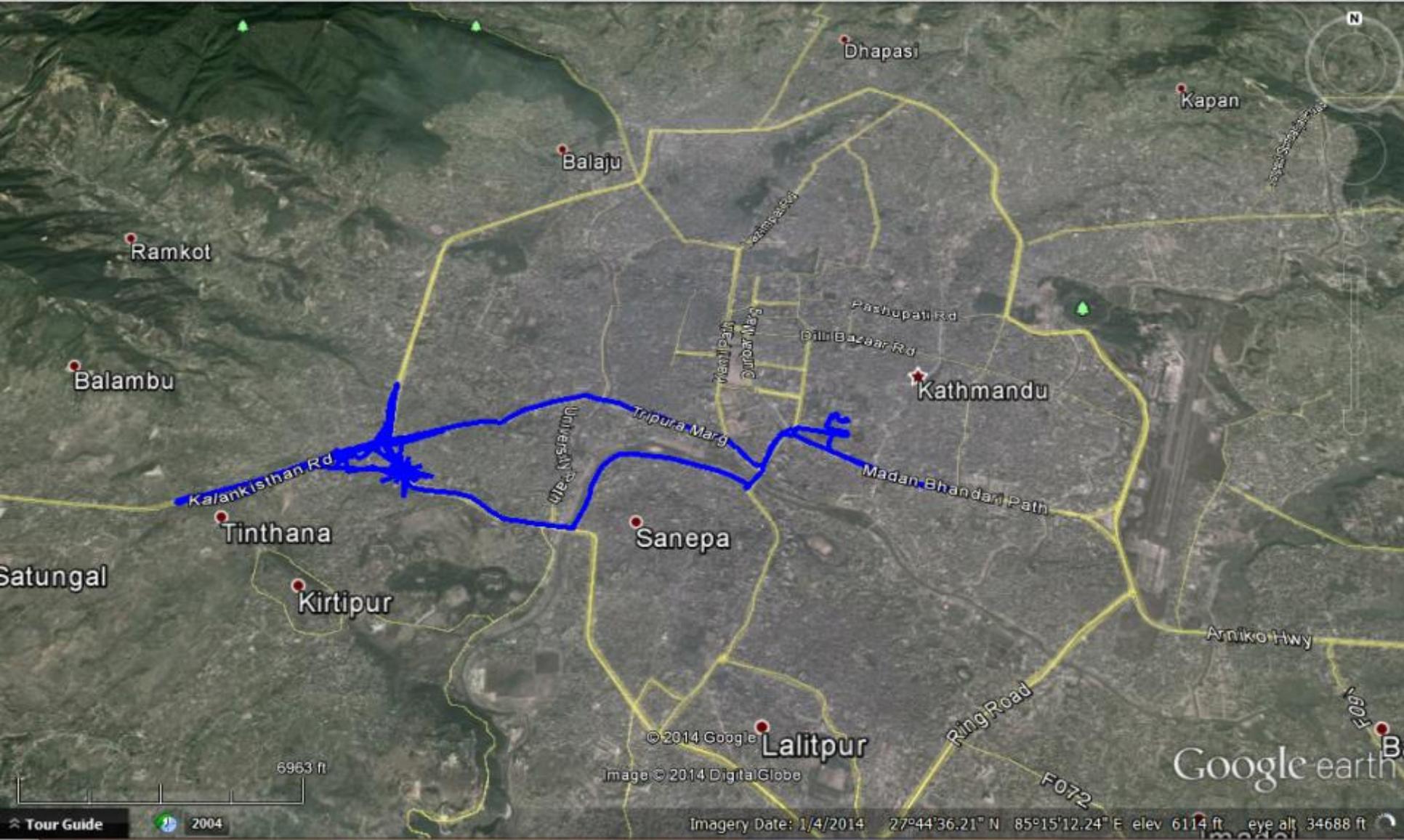


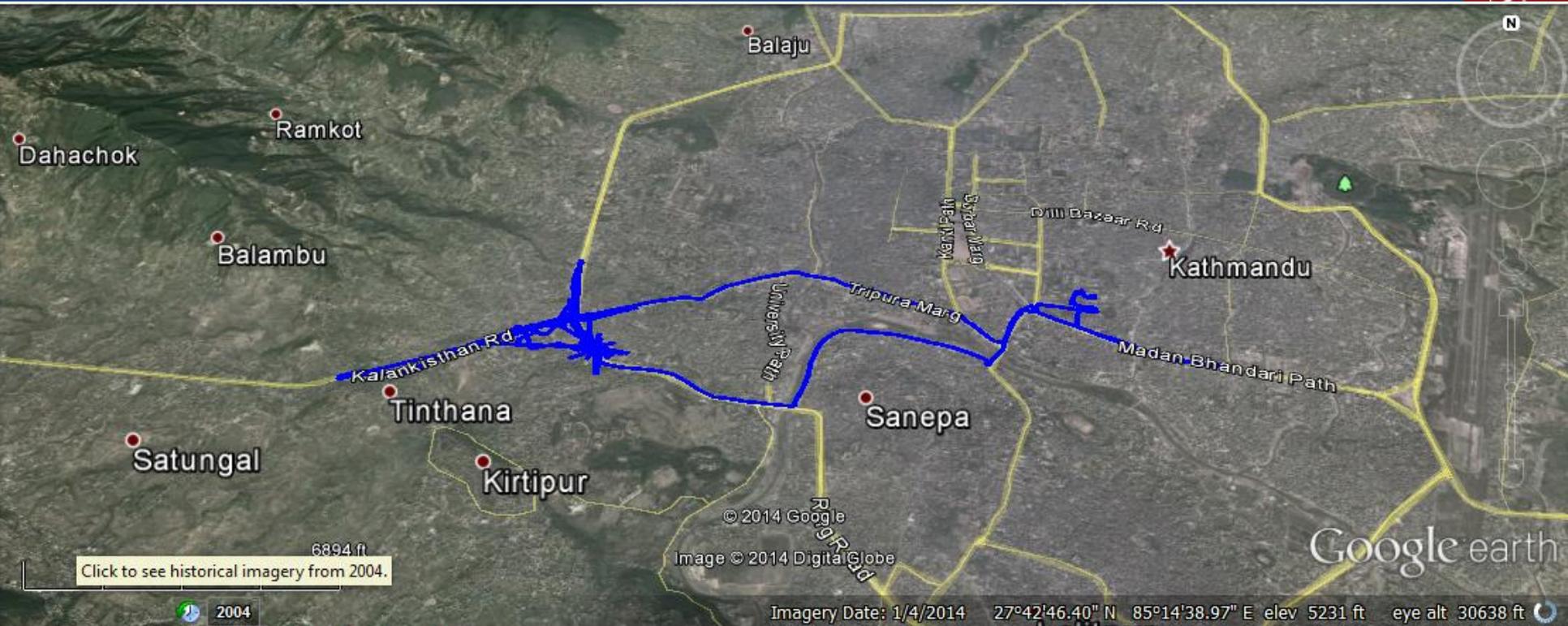
1-day Bandh



# Simple GPS provides context

- Facilitate gridding of data, exclusion of data, measurement compliance (accelerometry also useful).
- Huge amount of hidden (but useful) data





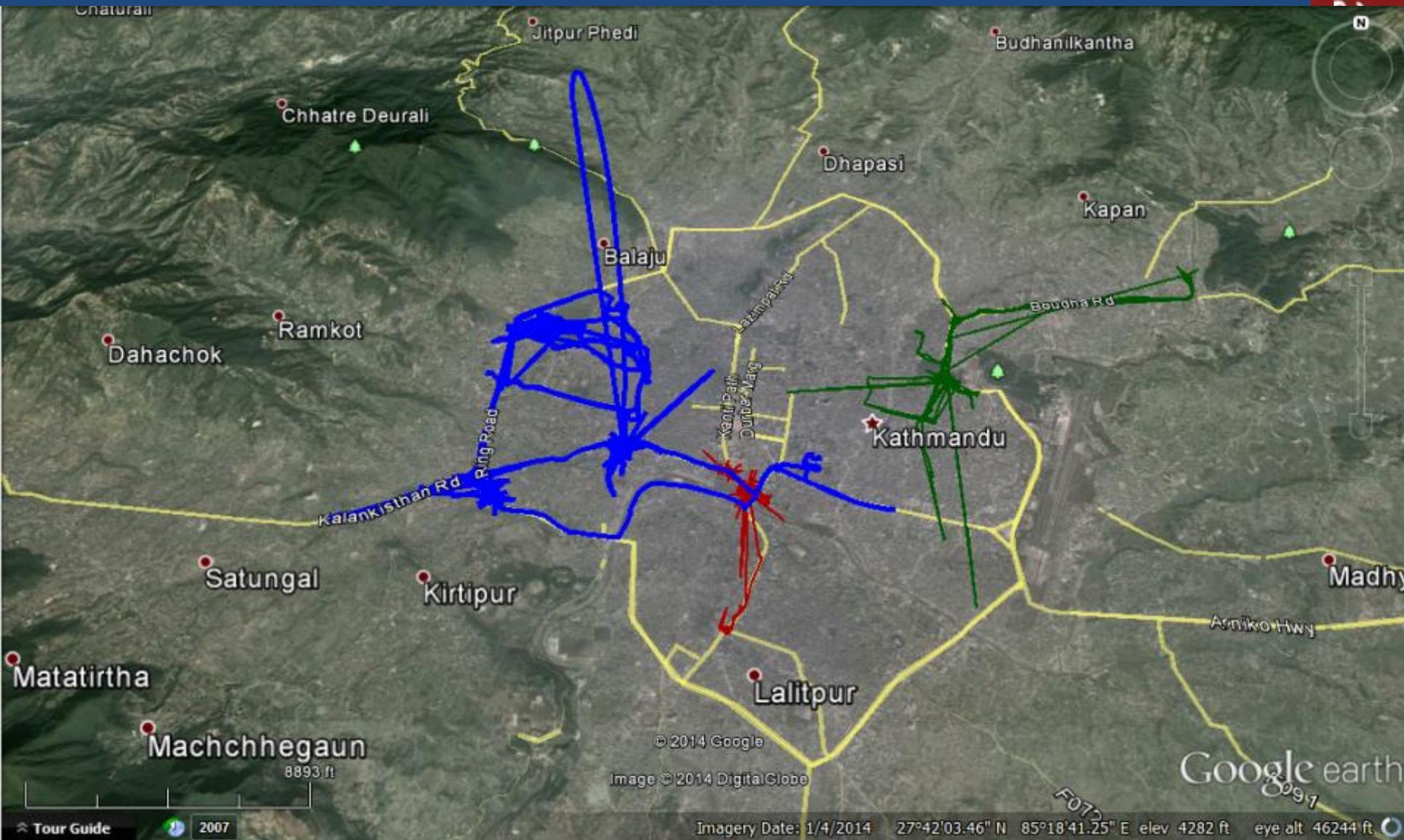
Graph: Min, Avg, Max	Elevation: 4213, 4282, 4522 ft			
Range Totals	Distance: 55.9 mi	Elev Gain/Loss: 4448 ft, -4484 ft	Max Slope: 7.4%, -9.8%	Avg Slope: 1.7%, -1.6%





© 2014 Google  
Image Landsat  
Image © 2014 DigitalGlobe

Google earth



# Qualitative summary: Phase I

- Typical daily average:  $90\mu\text{g}/\text{m}^3$  of  $\text{PM}_{2.5}$
- On roadway PM 10-50 times higher than evening concentrations.

- Daily respired dose to PM: (making loads of assumptions)

*10-15mg of PM*

- Lots of mobility

Element	Est Conc (ug/m3)	Element	Est Conc (ug/m3)
Si	4.0	Zn	0.3
S	1.6	Mg	0.3
Ca	1.6	U	0.2
Fe	1.5	Cs	0.2
K	1.5	Ti	0.1
Al	1.5	Sc	0.1
Pd	1.4	I	0.1
Cl	1.0	Hf	0.1
Na	0.4	Lu	0.1
Ba	0.4	Tb	0.1

# Lessons Learned

- People don't like wearing anything weird.
- Instrument security is a significant concern
- Our assumptions on measurements can be way off
  - → implications on how we conduct our methods (consumable swaps, power maintenance).
  - → instrument sensitivity works both ways

# Acknowledgements

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# Happy to answer any questions!

