Low-Cost Method to Measure Black Carbon with a Cell Phone

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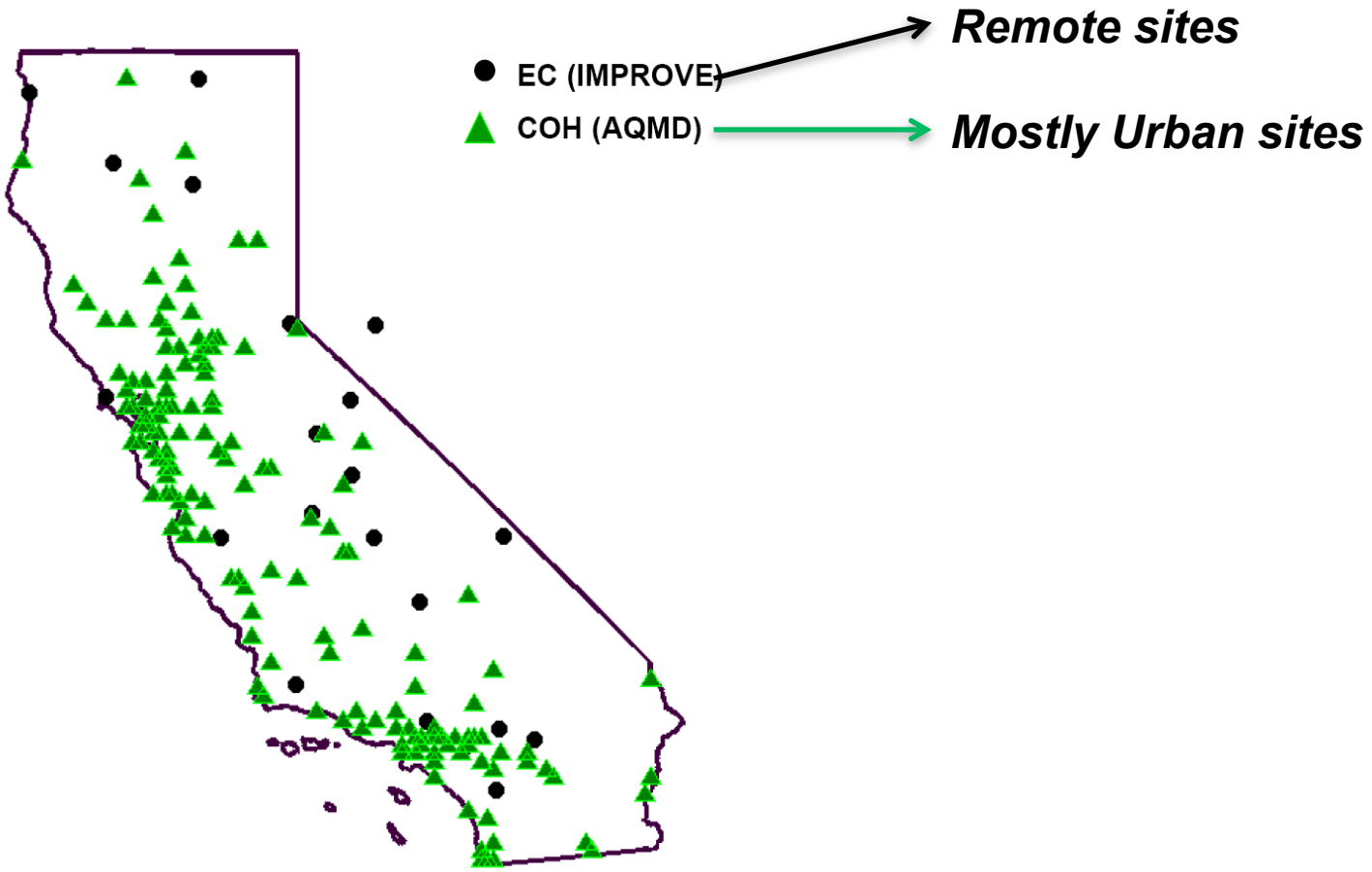
NEXLEAF ANALYTICS

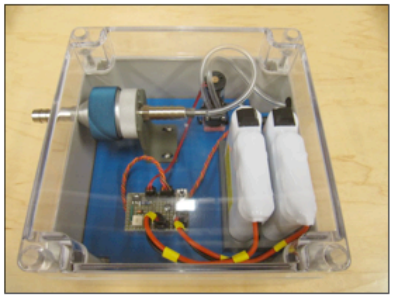
Black Carbon Trends in California: Detection



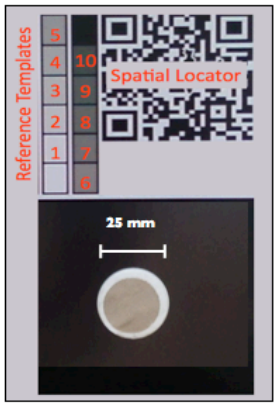
Ramanathan et al, 2013: CARB 08-323

Monitoring Black Carbon (BC) Using Mobile Phones

Micro-Pump and Filter



Filter, placed on reference template



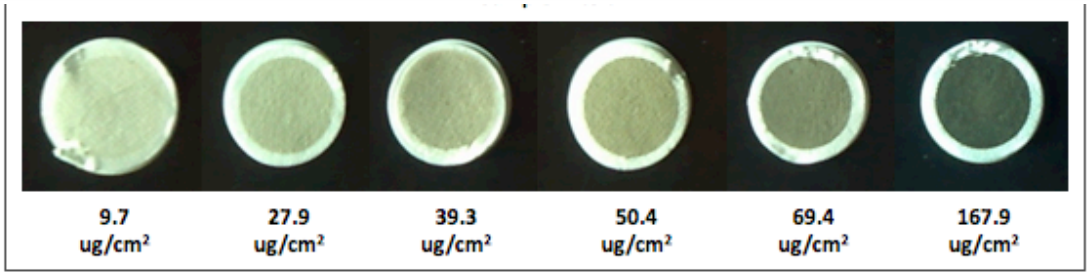
Picture sent to server

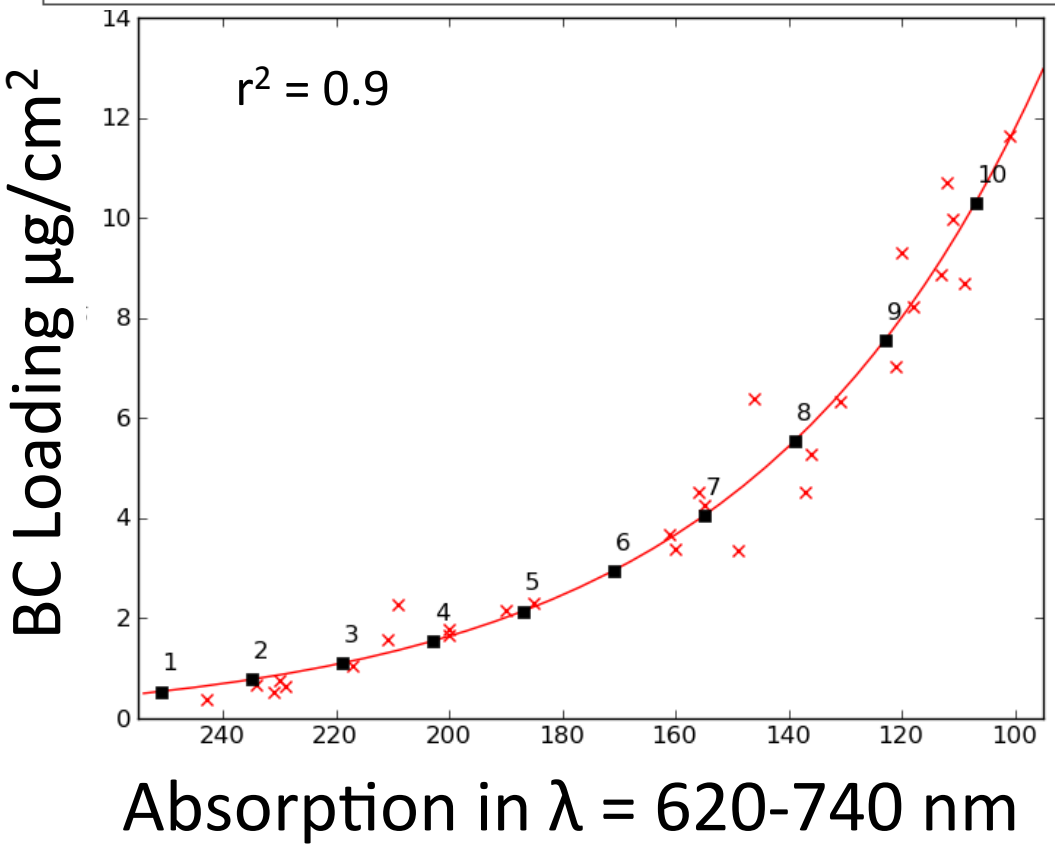
Results sent back via SMS

Innovations

- Low-cost
- Works with any camera cellphone.
- Real-time reporting.

Why it Works: Filter color correlated to BC

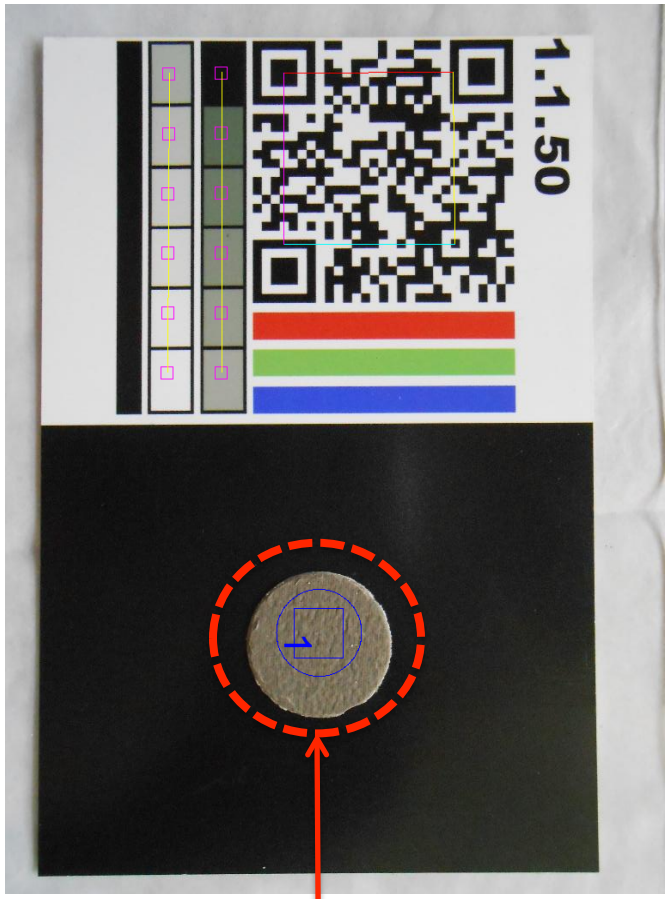




Collected in: California and India

[1] Ramanathan et al. *Atmospheric Environment 45(2011).*

Adjusts for Different Lighting and Cameras



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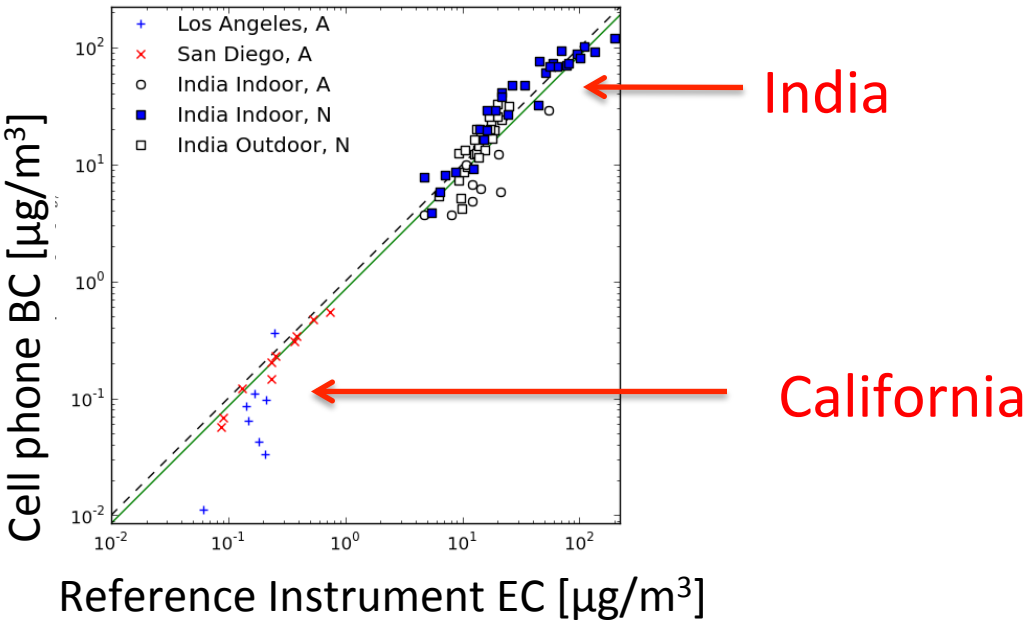
Validation Study 1

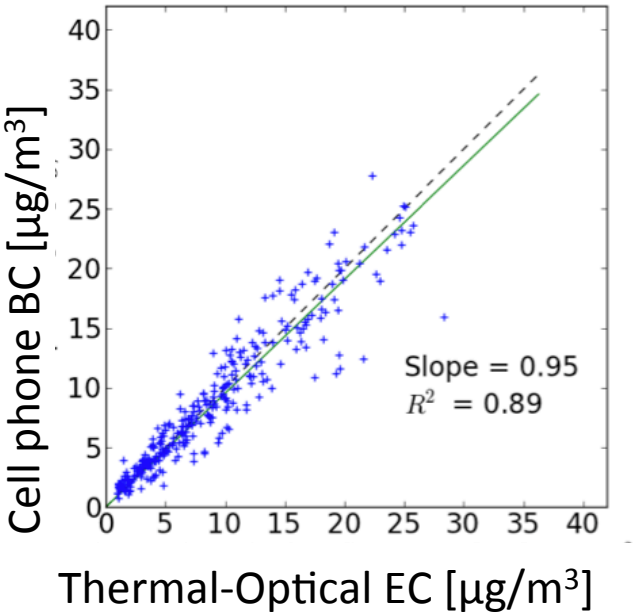
India and California:
Comparison with Thermal Optical
Average error within 25%



Ramanathan, N., Lukac, M., Ahmed, T., Kar, A., Siva, P., Honles, T., Leong, I., Rehman, I. H., Schauer, J., Ramanathan, V. A cellphone based system for large scale monitoring of black carbon. *Atmospheric Environment 45(2011) 4481-4487.*

Validation Study 2

Comparison with 2 Thermal Optical Protocols (NIOSH, IMPROVE), Average error within 25%



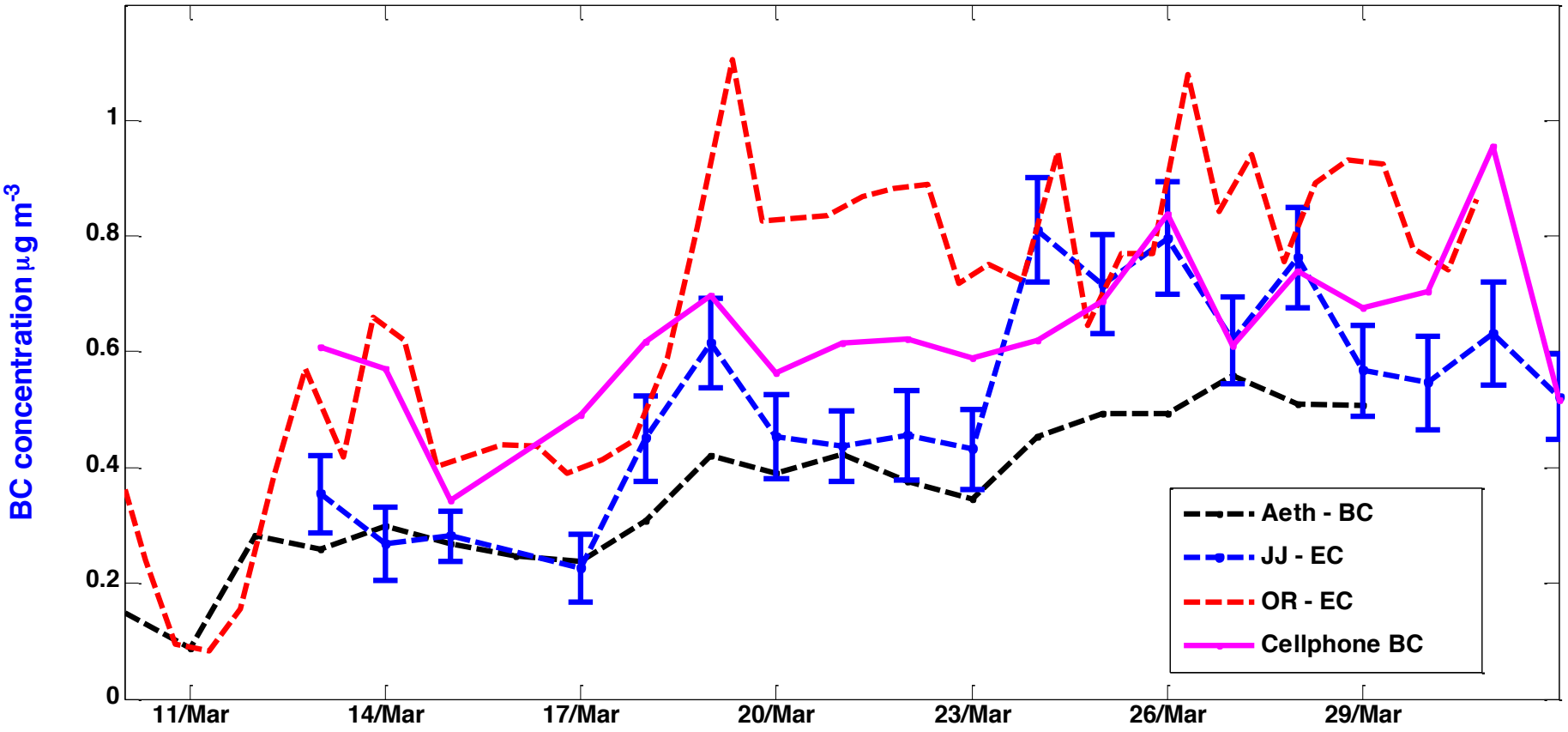
Collected in:
EPA Laboratory

EPA

Ramanathan, N., Khan, B., Leong, I., Lukac, M. Comparison Between Elemental Carbon Measured Using Thermal-Optical Analysis and Black Carbon Measurements Using a Novel Cellphone-Based System. *American Geophysical Union 2011,* San Francisco, CA.

Validation 3 (Blind Test)

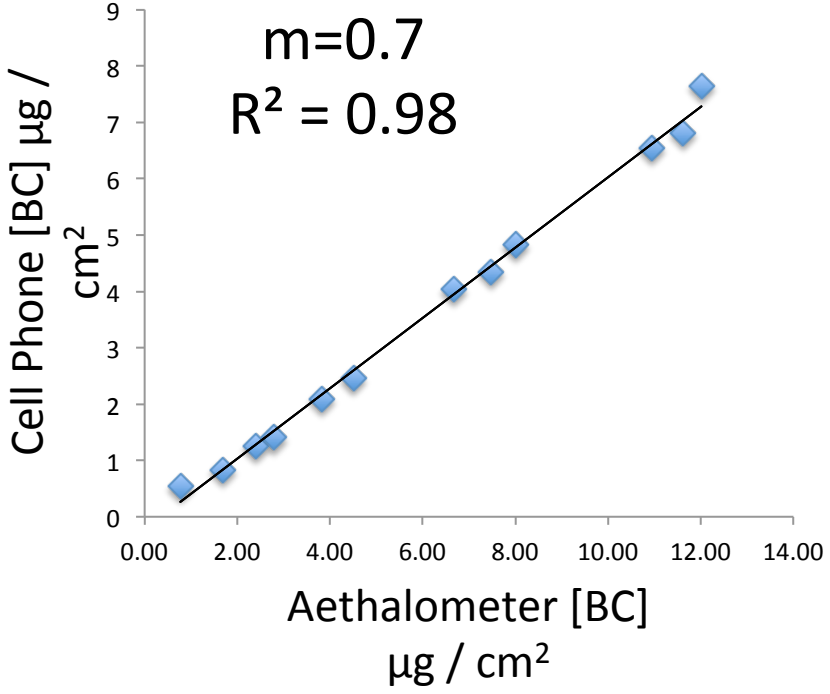
Maldives, March 2012: Comparison with Aethalometer and 2 Thermal Optical Methods

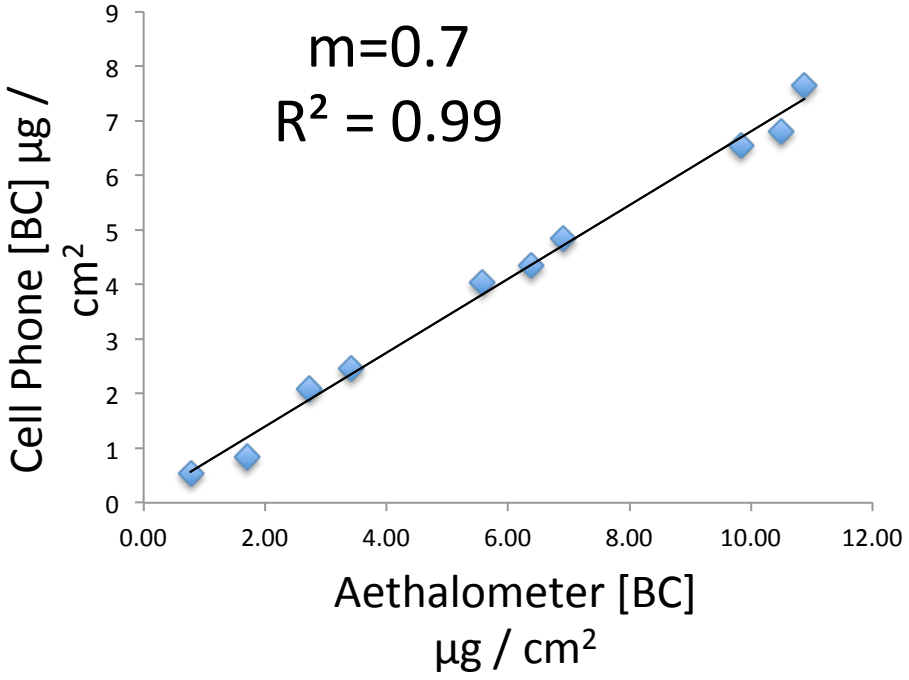


P. Siva et al. Unpublished.

Validation Study 4 (Blind Test)

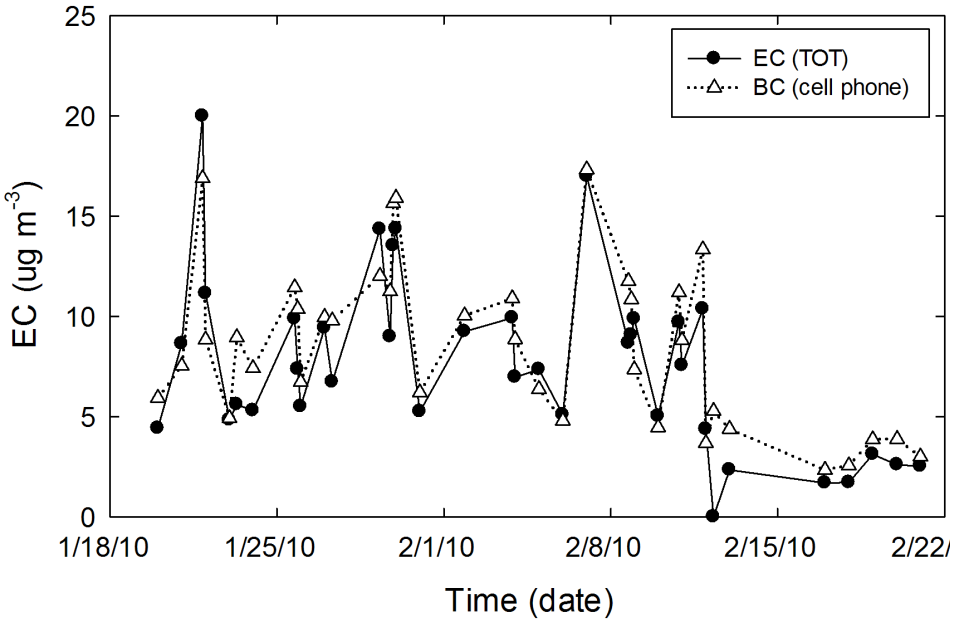
Los Angeles (Fall, 2012): Comparison with Aethalometer

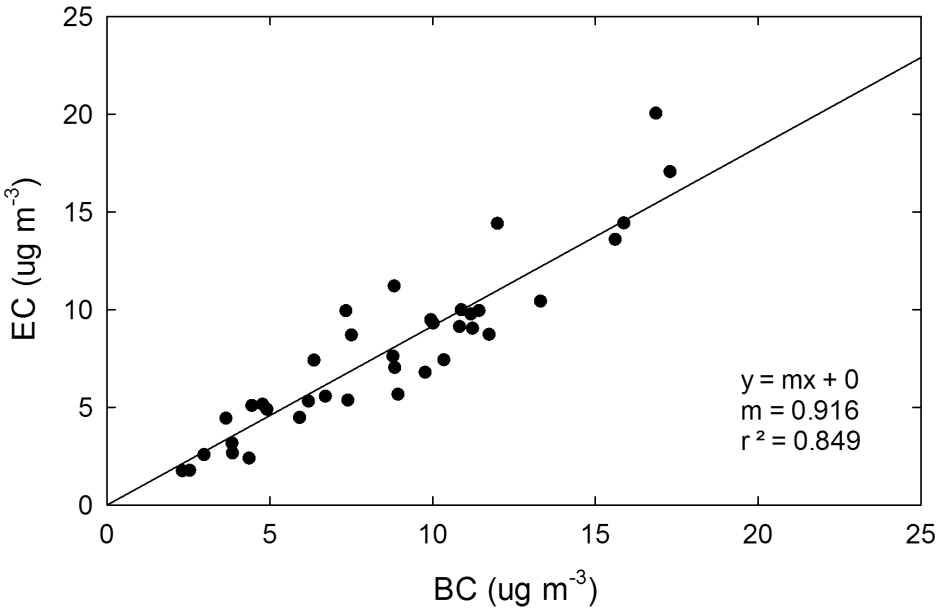




Validation Study 5 (Blind Test)

India:
Comparison with Thermal Optical (NIOSH)
Average error within 20%

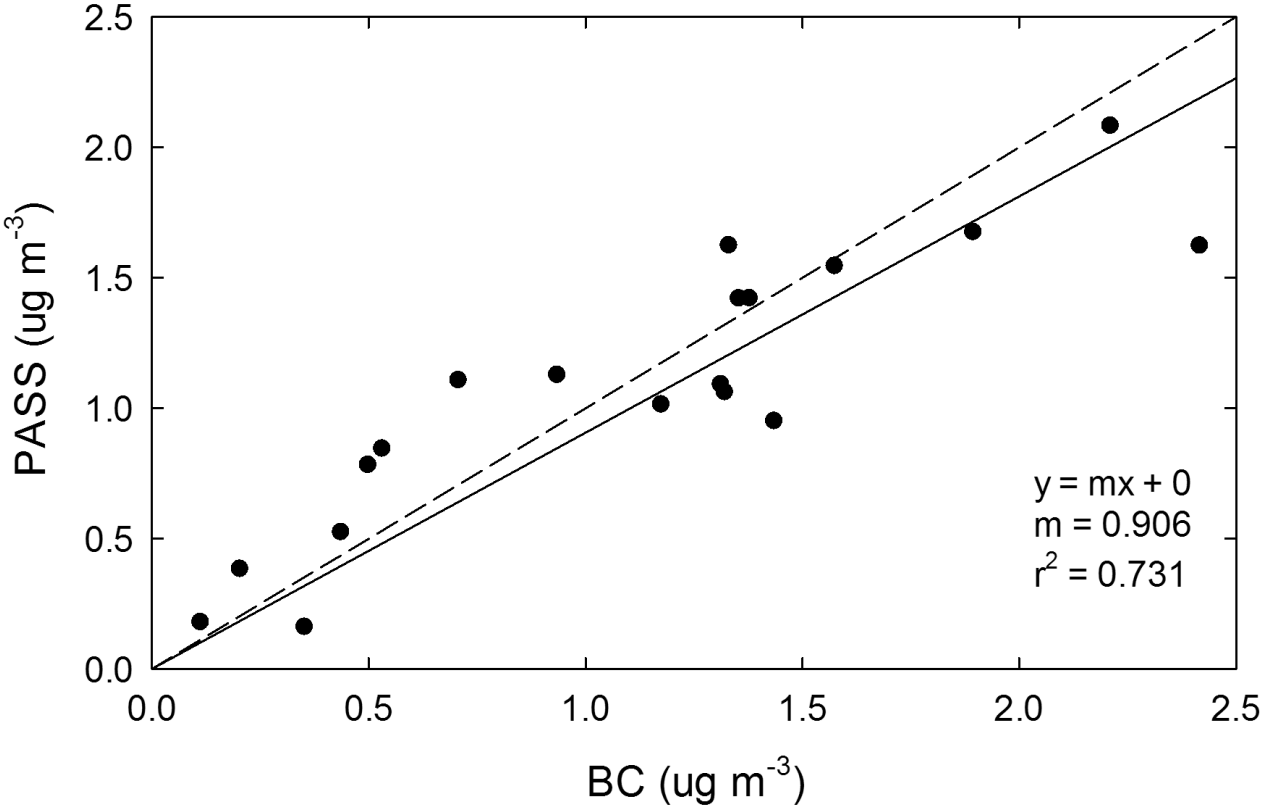




S. Tripathi et al. To be submitted.

Validation Study 6 (Blind Test)

India:
Comparison with PASS



S. Tripathi et al. To be submitted.

Validation Studies

Different sites/sources/locations:

- Laboratory setting: Cookstoves
- Kanpur, India: Highway Traffic, Power Plant, Biomass Burning
- Maldives: South Asian plume
- California: Urban outdoors
- Jagdishpur, India: Indoor biomass burning, outdoors

Comparison with different methods:

- Aethalometer
- Thermal Optical (NIOSH, IMPROVE)
- PASS

project surya
Fighting Climate Change Now

Measuring Black Carbon in Rural Kitchens in India

Monitoring Cookstoves and Vaccines

Global Monitoring Networks

Thanks to our collaborators

- Environmental Protection Agency
- Indian Institute of Technology, Kanpur
- Scripps Institute of Oceanography
- University of Southern California, Global Health Institute
- University of Wisconsin, Madison

Contact Information

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Funders: National Science Foundation, Department of Energy, United Nations Environment Programme, Qualcomm

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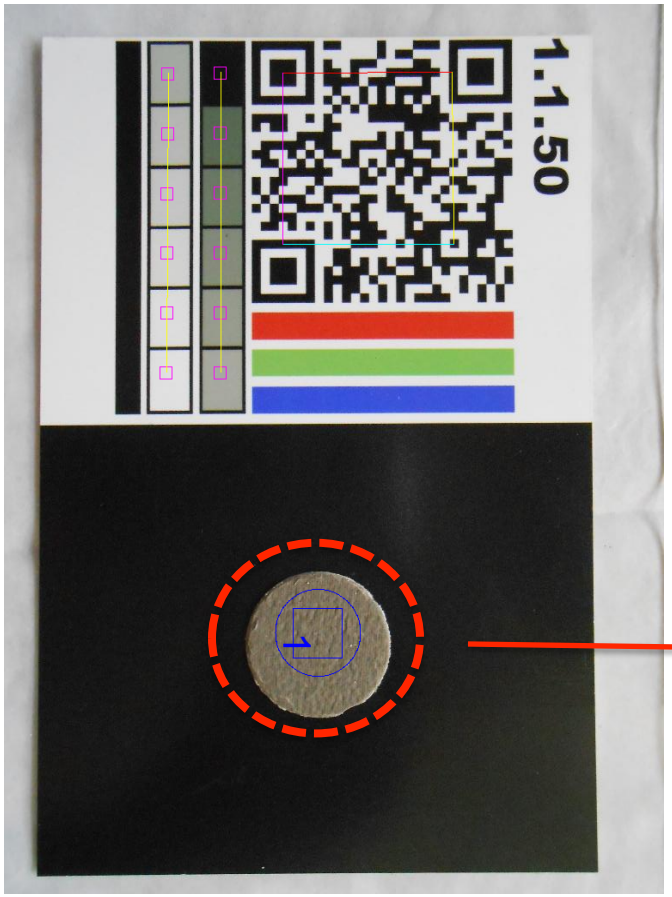
Conversion



Filter Size cm^2

×

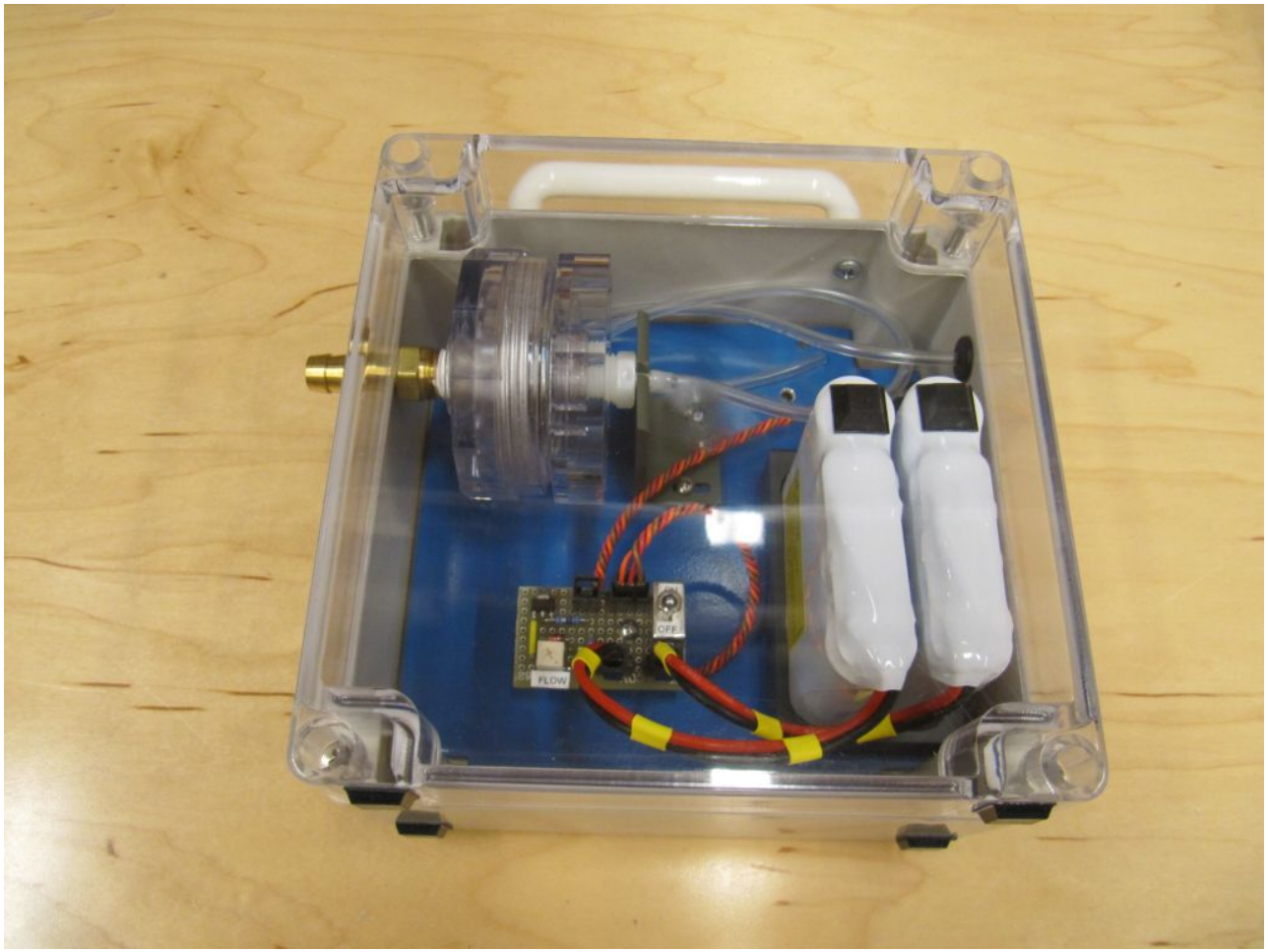
Loading $\mu g/cm^2$ → Concentration $\mu g/m^3$

÷

Volume Air m^3

18

Sampler



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