Investigating Indoor Air Exposures from Seasonal Hunting Activities

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First Nations

Major Canadian groups: First Nations, Inuit, and Metis

First Nations

(Nations Encyclopedia,2004)

Inuit

(Icecreamnation,2013)

Metis

(First Peoples of Canada,2014)

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Ontario

Quebec

Moosonee &
Moose Factory

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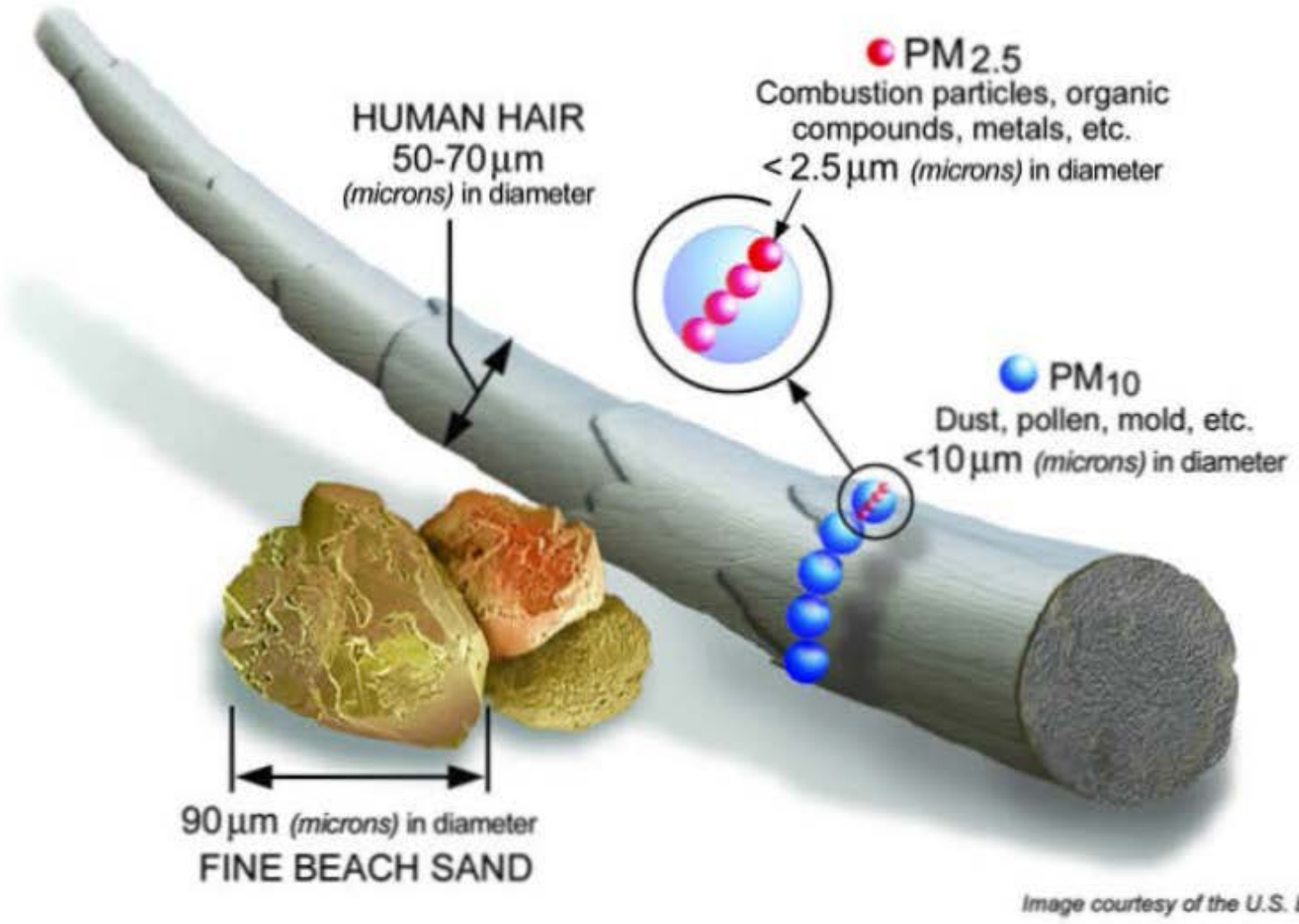
Sociocultural Importance

- **Social – family members return for the hunt**
- **Socio-cultural – intergenerational transmission of knowledge**


HUMAN HAIR
50-70 µm
(microns) in diameter
PM2.5
Combustion particles, organic compounds, metals, etc.
<2.5 µm (microns) in diameter
PM10
Dust, pollen, mold, etc.
<10 µm (microns) in diameter
90 µm (microns) in diameter
FINE BEACH SAND
Image courtesy of the U.S. EPA

Challenges

- Logistics
- Multinational IRB/Ethics
- Manual logging of data
- Willingness of participants for certain sampling approaches

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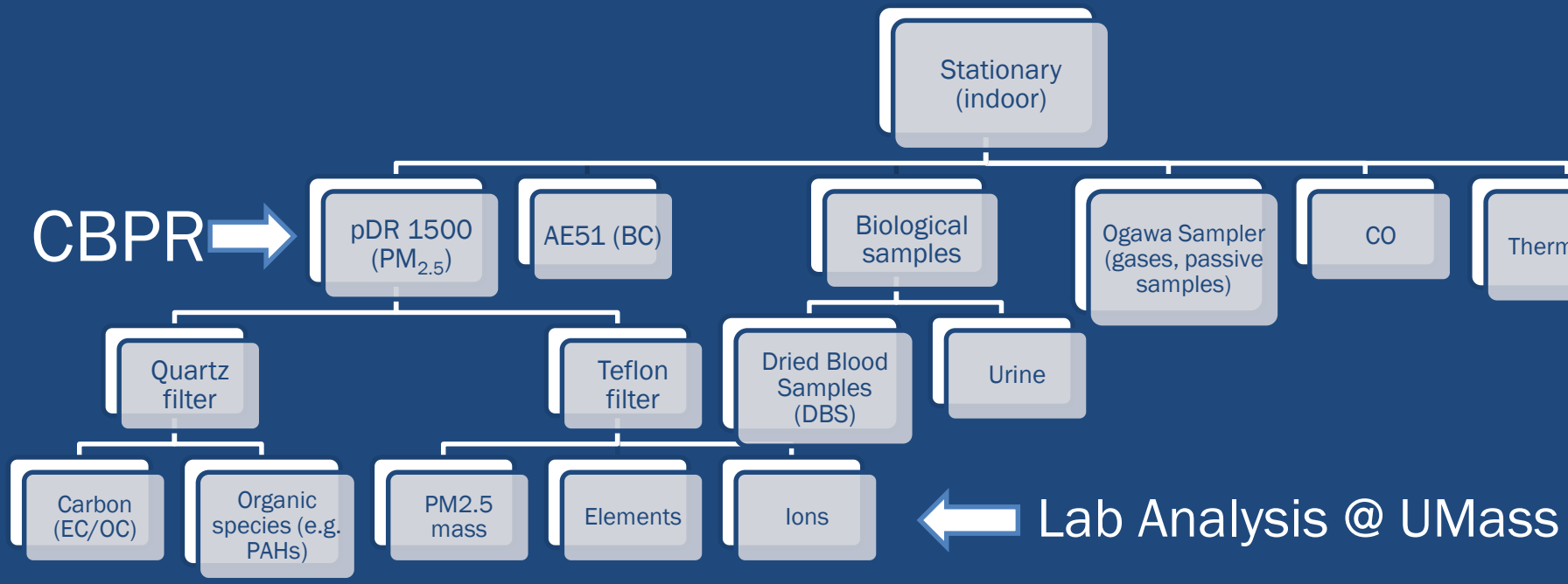
Measurement Plan




NO2
SO2

Summary Statistics, real time data

	BC				PM			
Site	N	AM ± SD	Median	Min-Max	N	AM ± SD	Median	Min-Max
3a	2373	5.54 ± 19.6	0.4	0.05-332	1329	156.9 ± 801.4	12	0.5-14870
3b	1370	8.94 ± 31.2	0.99	0.05-637.6	1230	64.9 ± 185	12.9	2.17-3105
3c	429	5.51 ± 15.2	2.59	0.05-129.7	1337	44.2 ± 150.9	10.6	0.5-1916
4					2240	43.7 ± 89.3	13.5	0.5-903.4
5					1916	125.6 ± 302.3	32.3	1.24-4620

- Data for Sites 1 and 2 not available
- For Sites 4 and 5, BC data was not available/valid

Site 3c

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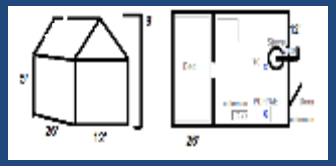
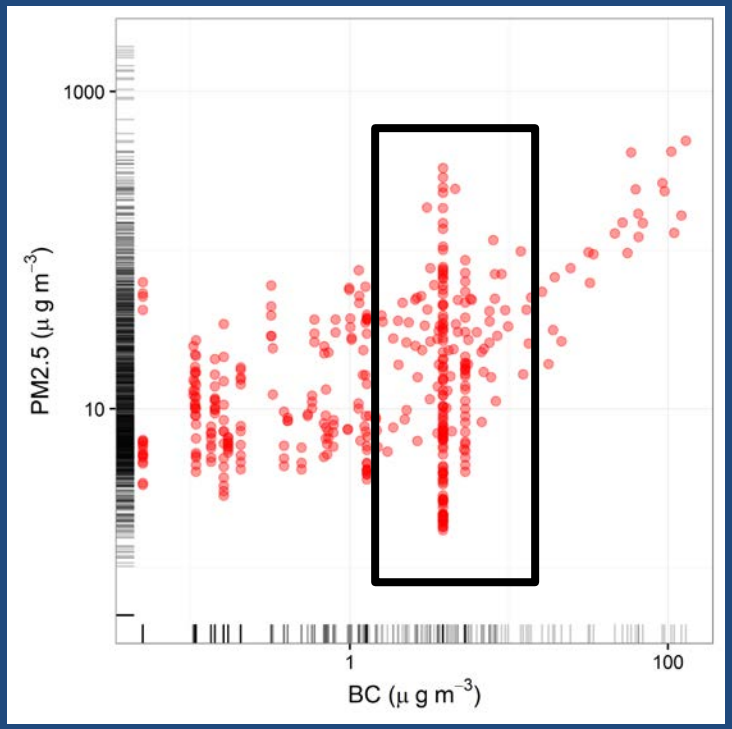
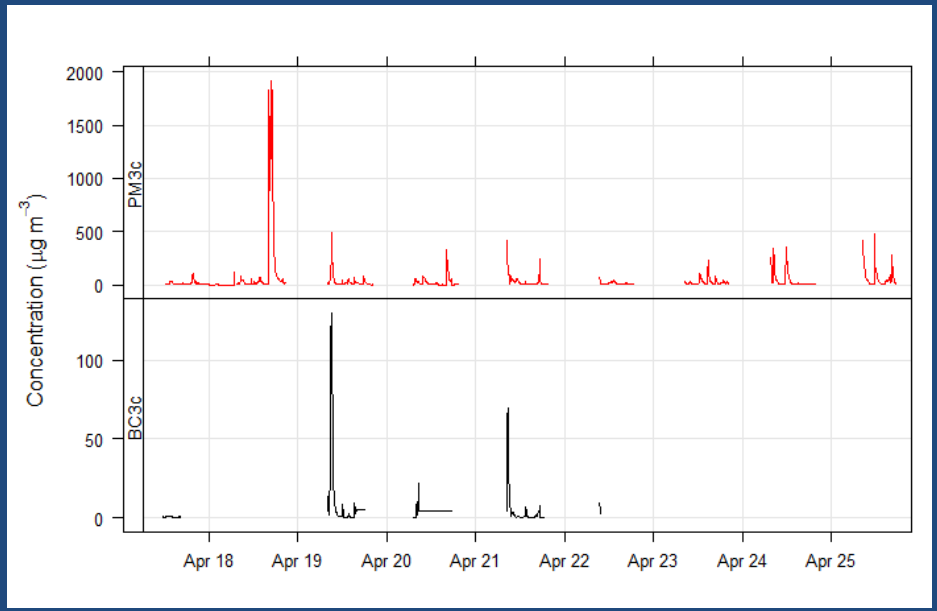
Site 3c



- Samples collected between April 17 25, 2016
- Instruments were shut down overnight, so data is available only during the day
- Average temperature and RH were 20.7°C and 40.5% respectively





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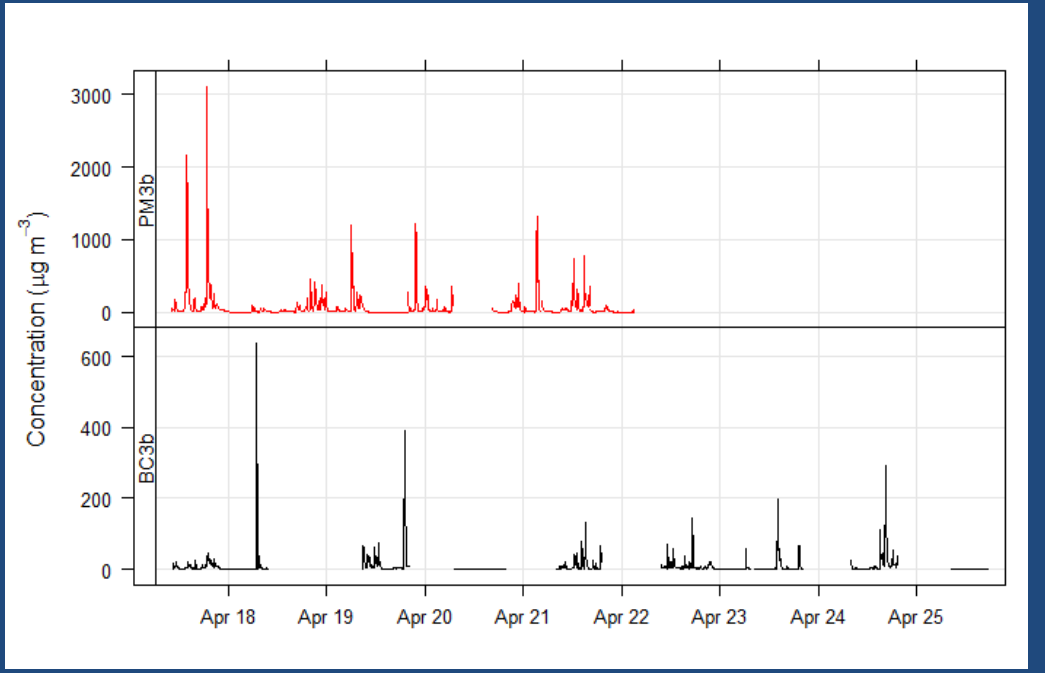
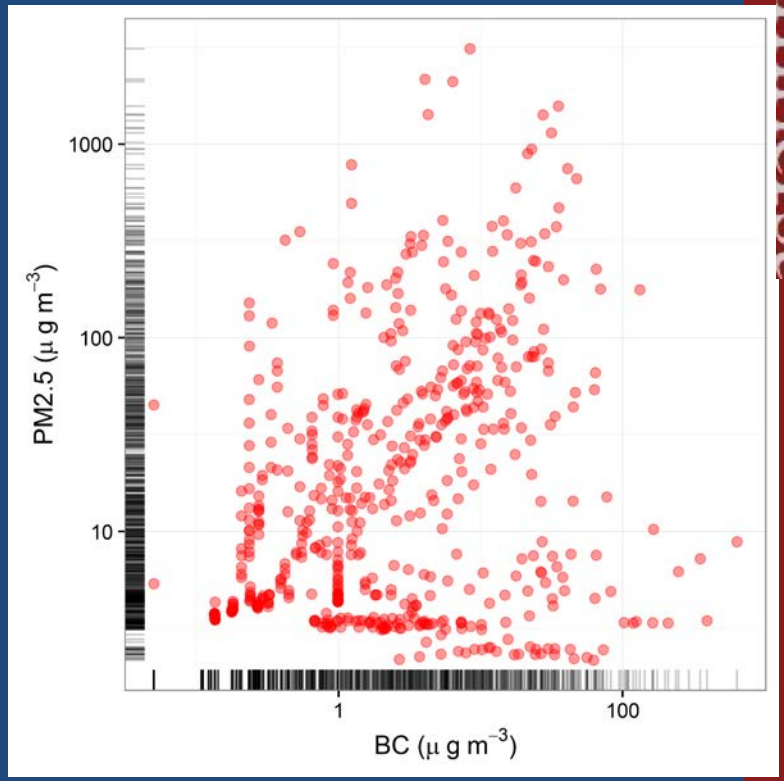
Site 3b





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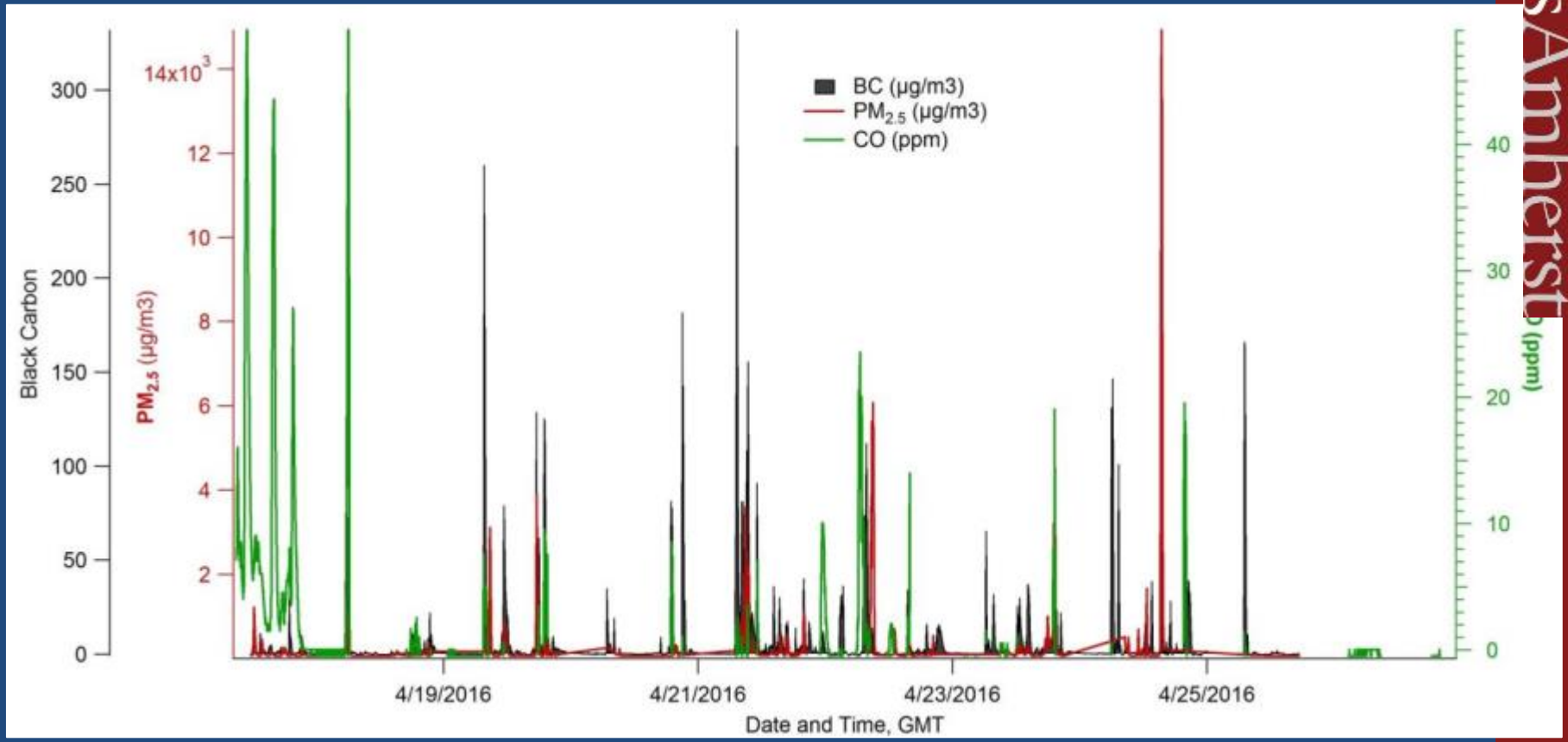
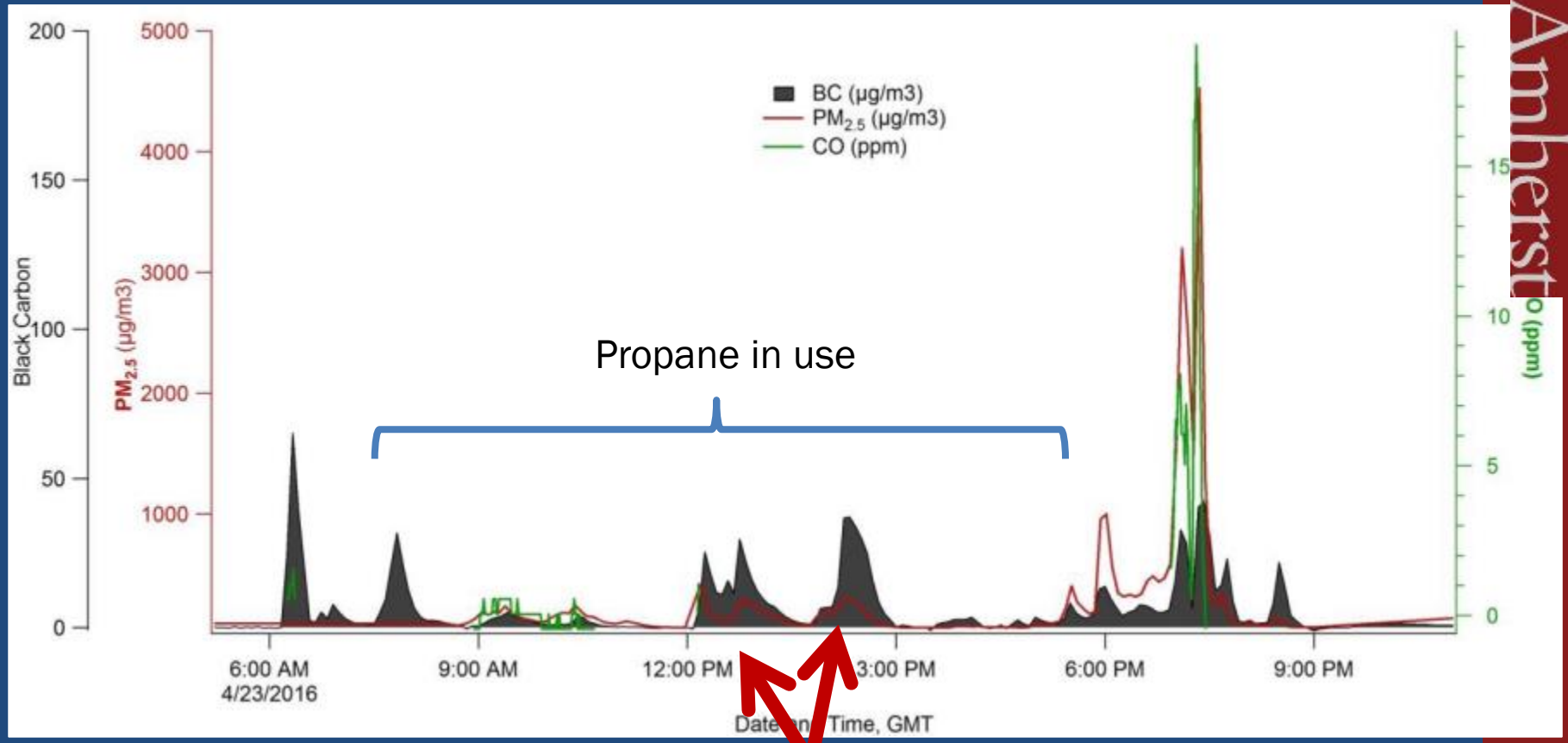
Complex data analysis

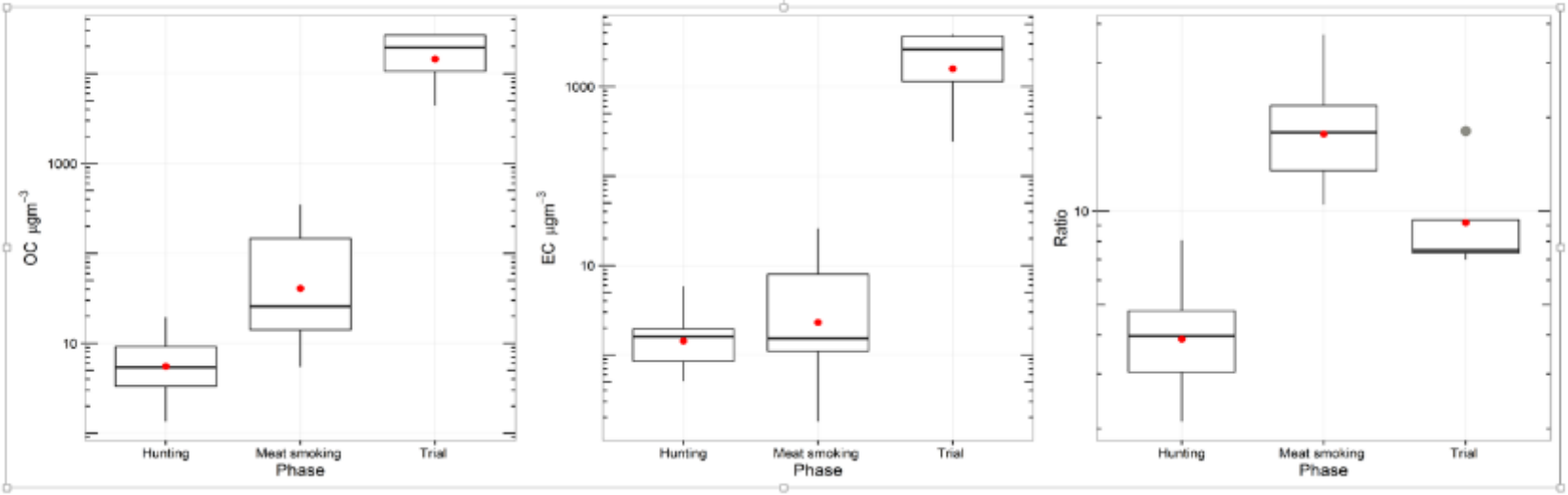


Zooming in


BC (µg/m3)
PM2.5 (µg/m3)
CO (ppm)
Black Carbon
PM2.5 (µg/m3)
CO (ppm)
200
150
100
50
0
5000
4000
3000
2000
1000
15
10
5
0
6:00 AM
4/23/2016
9:00 AM
12:00 PM
3:00 PM
6:00 PM
9:00 PM
Time, GMT
Propane in use
Cigarette
Smoking?

Hunting conditions vs others

Phase	N	OC			EC			OC/EC Ratio		
		AM ± SD	Median	Min-Max	AM ± SD	Median	Min-Max	AM ± SD	Median	Min-Max
2a	21	7.16 ± 5.44	5.42	1.35-19.5	1.71 ± 1.18	1.60	0.51-5.87	4.10 ± 1.44	3.97	2.11-8.05
1c	19	86.2 ± 97.7	25.7	5.44-347.8	4.85 ± 6.12	1.53	0.18- 25.8	18.7 ± 6.74	17.9	10.5-36.9
1b										
1a	4	2389 ±1664	2754	243.8- 3805	18090 ±10900	20440	4402-27080	10.02 ± 5.39	7.50	7-18.1
2b										



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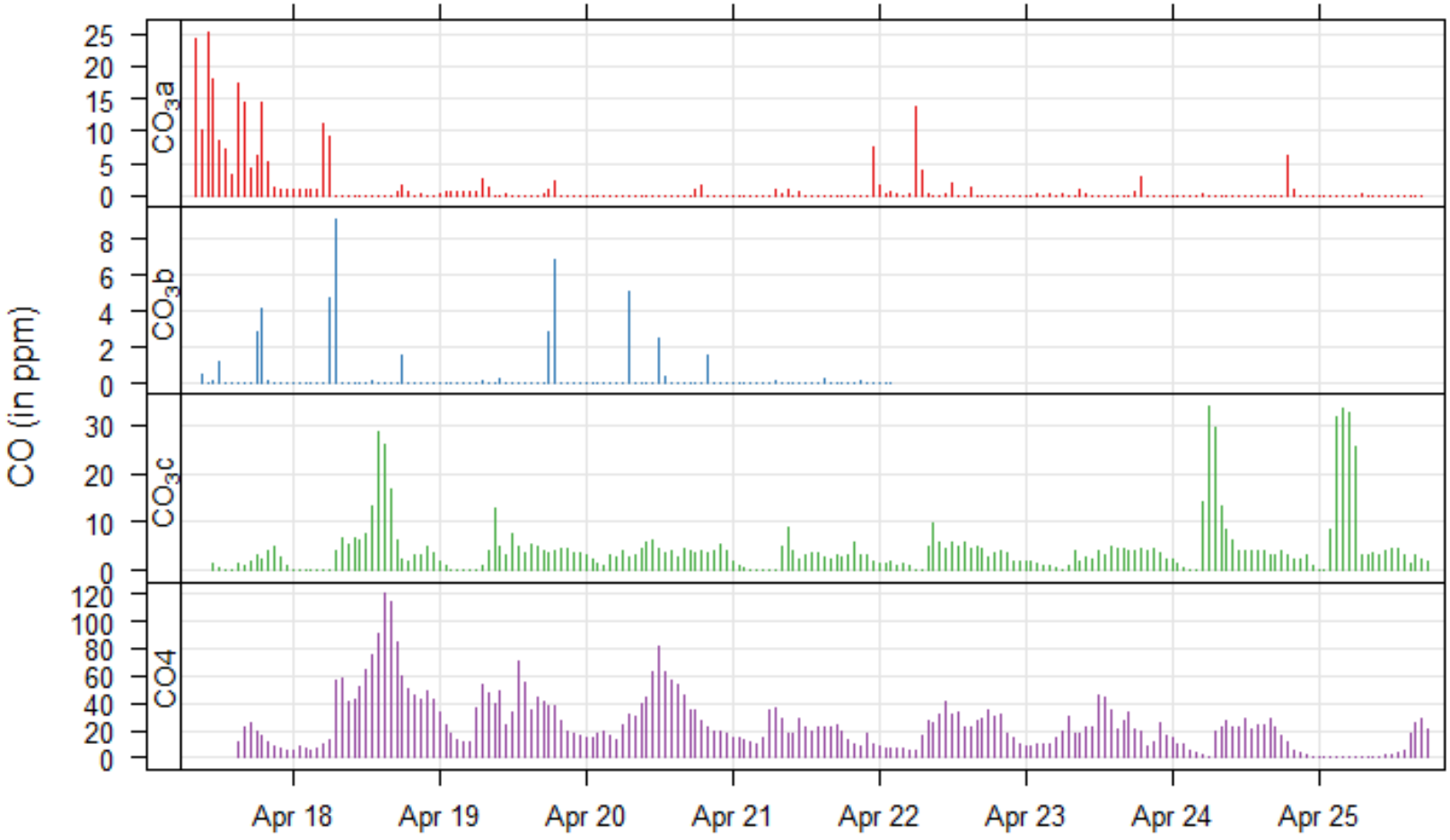
CO variability



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Propane Intervention

- *Mean* CO: 6.4ppm (propane), 9.5ppm (wood)
- *Peak* CO: 24ppm versus 50ppm

- *Mean* $PM_{2.5}$: 34μg/m3 versus 176 μg/m3
- *Peak* $PM_{2.5}$: 653 μg/m3 versus 14,868 μg/m3

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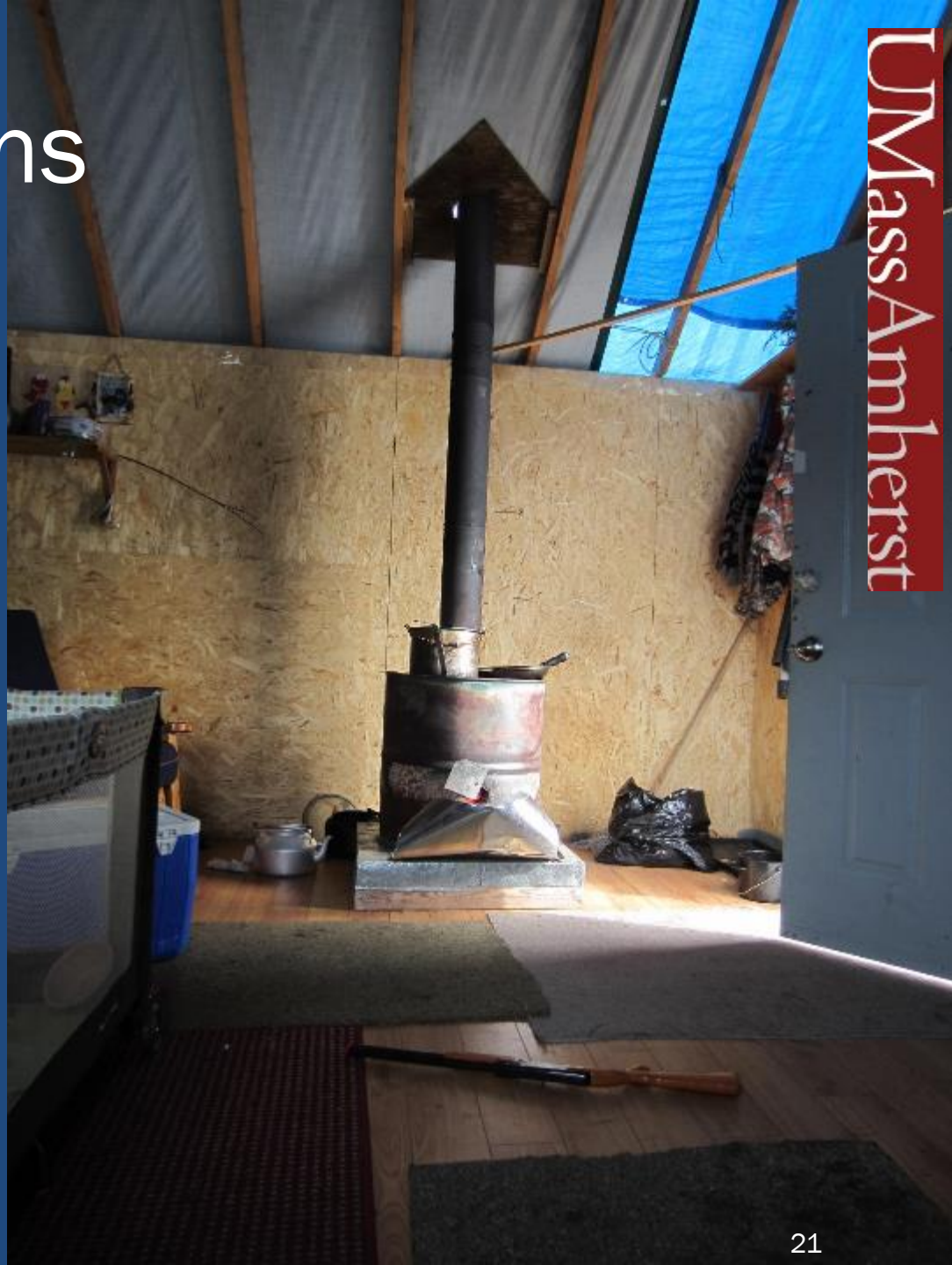
Successes (so far)

- Tribal enthusiasm
- Community engagement
- Embracing youth in a culturally-relevant context

- Identification of some clear hazards.
- Recommendations of some (somewhat straightforward) solutions.
- But, still more to do…

Early Conclusions

- Hunting activity exposes families to known hazards.
- Active aversion and intervention can reduce exposures.
- Tribal partners are willing stakeholders, and value research that considers culture.



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U of T

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	3a	3b	3c	4	5
Coordinates	52.13482 N, 81.12984 W.	52.13482 N, 81.12984 W.	52.13482 N, 81.12984 W.	52°10'32.9"N 81°51'27.4"W	
Relative location	To East - James Bay South, North, West- Muskeg			Surrounded by trees and muskeg.	
Number of people in cabin	3	2	3	1	5 (3 adults, 2 teenagers)
Cabin door	South side of cabin		South side of cabin cabin door open to open space unlike the other 2 that opened towards a tree line	South	East
Stove type	Gas Barrel stove for wood burning. but top hole for wood did not have a sturdy cover like the other cabins, just used an old frying pan	Gas Barrel Stove for wood burning			
Cooking	Propane on Coleman stove	Napatha on Coleman stove	Propane on Coleman stove	Naphtha/ Propane on Coleman stove/ wood stove	Propane on Coleman stove/ wood stove
Structure	Plywood, platform floor with plywood, canvas and tarp roof.			Plywood, fully insulated, fully sealed all weather windows with wood floor (much like a cottage).	
Wood type	Evergreen, drift, and cedar half way through # Cedar is known to be smokey			Cedar/ Spruce	
Smoke stack	Short chimney outside of cabin (< 1 m) *Used elbow to divert smoke away from cabin in south winds*	Relative medium length chimney(> 1 m outside cabin) *Utilized elbow to divert smoke away from cabin during south winds*	Relative long length chimney length (>2 m outside cabin) *Utilized elbow to divert smoke away from cabin during south winds*	Vertical pipe straight out of roof	Two 90 degree elbows (through wall) with roof clearance vertical pipe; well sealed with minor gap in wall to exterior.

Data Treatment

- For $PM_{2.5}$ data, any data points less than 1 $\mu g/m^3$ were replaced with ½ DL, i.e. 0.5 $\mu g/m^3$
- For BC data, any data points less than 100 ng/m^3 were replaced with ½ DL, i.e. 50 ng/m^3 and the data was converted to $\mu g/m^3$
- For metal and ion data, all points <DL were replaced by 0.5 DL for that element

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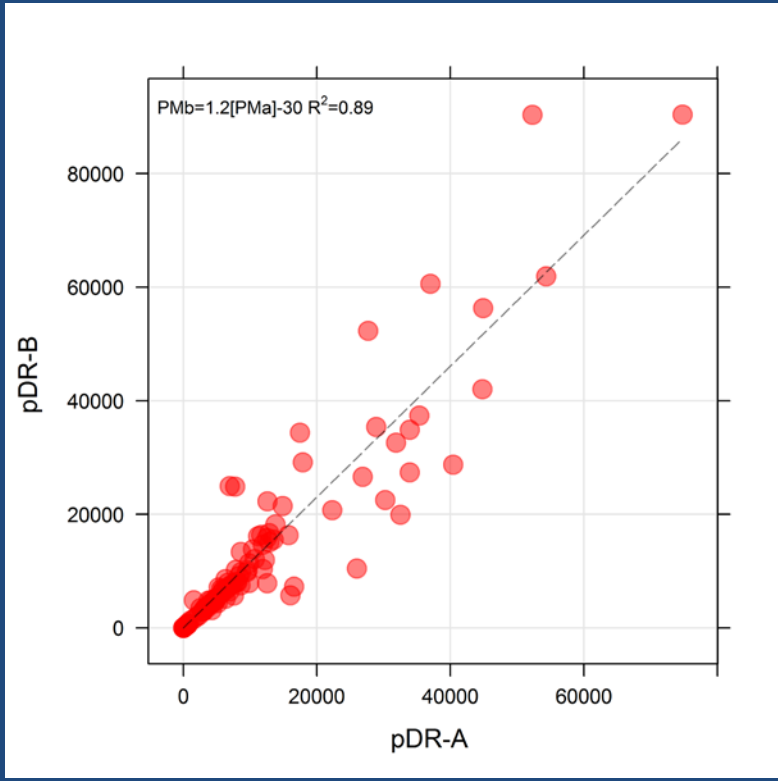
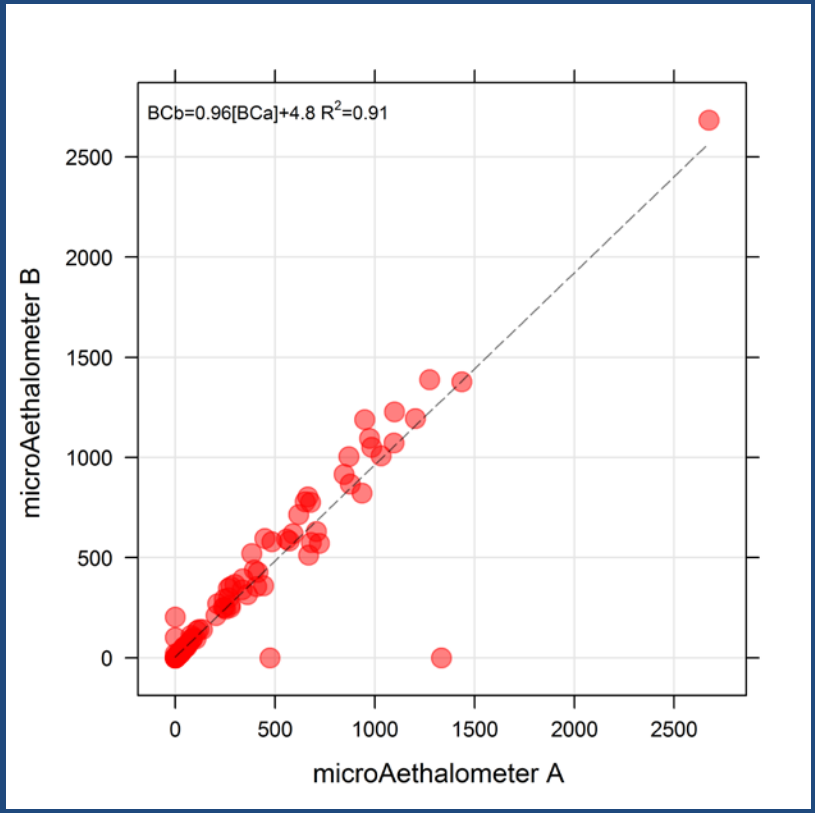
Instrument intercomparison

Comparison of $PM_{2.5}$ concentrations ($\mu g/m^3$) measured using two different pDR units



Comparison of BC concentrations ($\mu g/m^3$) measured using two different microAethalometer units



BC data is not ONA-corrected