Network status and methodological advancements

Chris Oxford

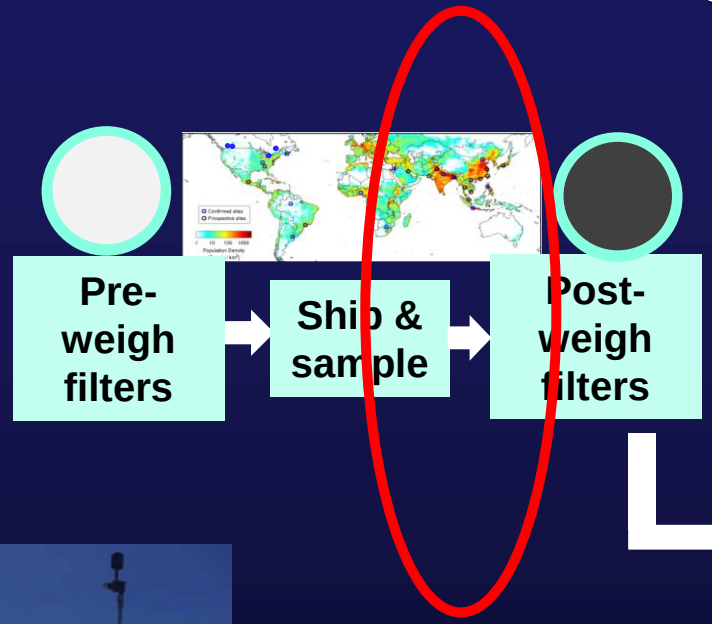
Post-doc

SPARTAN laboratory operations

Network status
our world in April 2018

SPARTAN: Maximizing Information from Each Filter

Continue to Develop Analysis Stream



Pre-weigh filters → Ship & sample → Post-weigh filters

Black carbon and organics (HIPS and FTIR)

Partnership with UC Davis (Ann Dillner and Nicole Hyslop)

Trace elements (XRF)

Led by Xuan Liu in partnership with Jay Turner (WashU) & UC Davis (Jason Giacomo)

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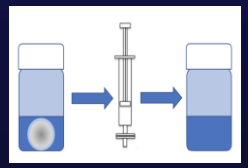


Organics (AMS)

Led by Yuxuan Ren in partnership with Jhao-Hong Chen and Brent Williams (WashU)

Oxidative potential?

Led by Vishal Verma (UIUC)

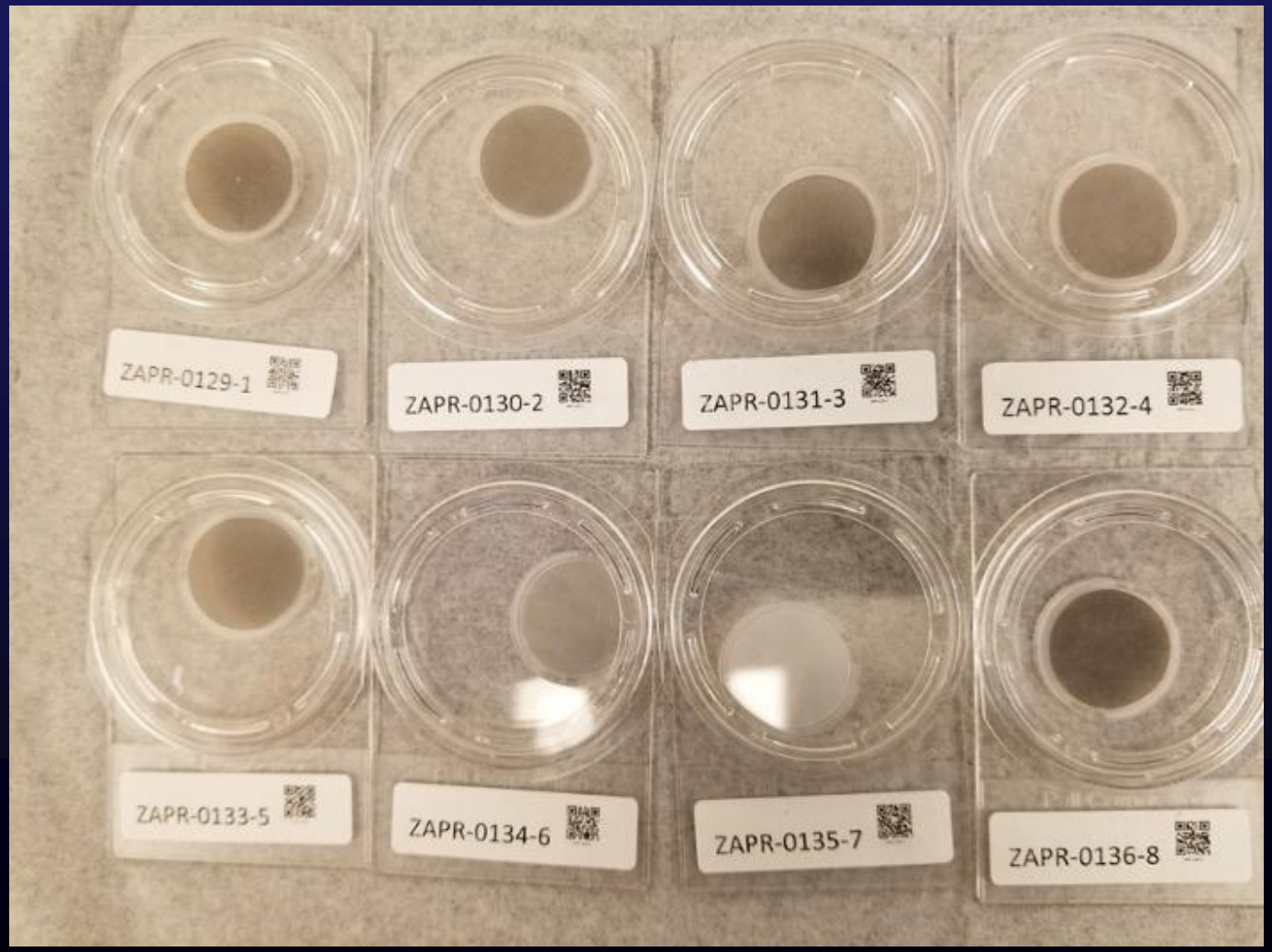
www.spartan-network.org

Overall operations led by Chris Oxford

Supported by Summer Liu, Zilin Wei, Kyla Fung, Haihui Zhu

Methodological advancements
documenting returning cartridges

- In the past, we tried to write in words our observations
- Picture of all filters with field blank taken of every cartridge
- Can help trouble shoot errors that can occur with wrong filters in petri dishes…
- Nice visual record of all sampled filters.



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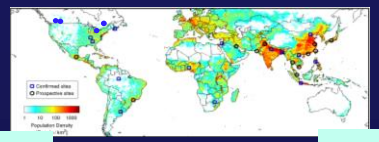

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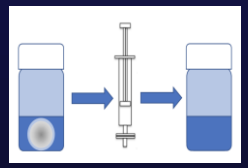

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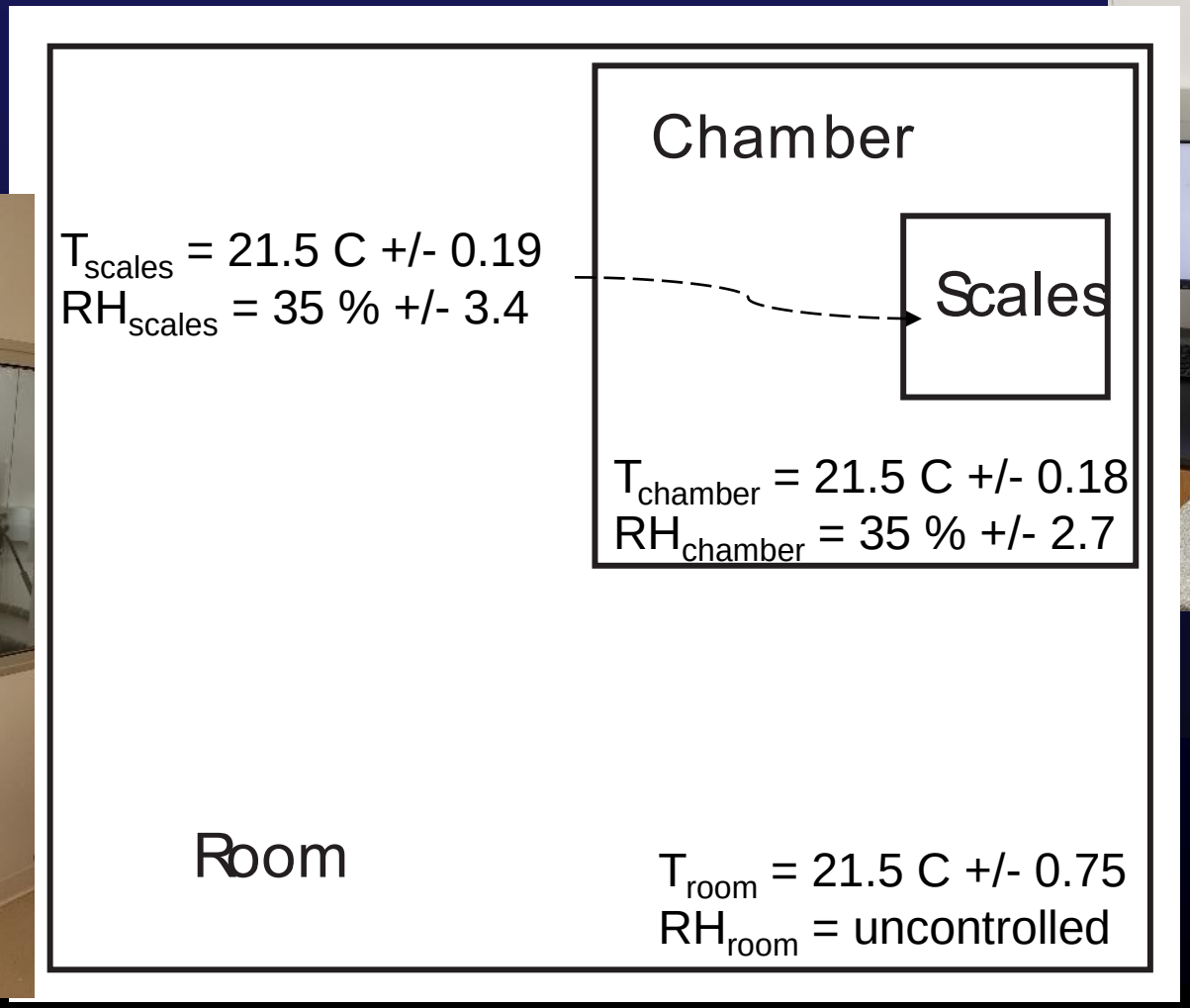
Methodological advancements
Weighing chamber

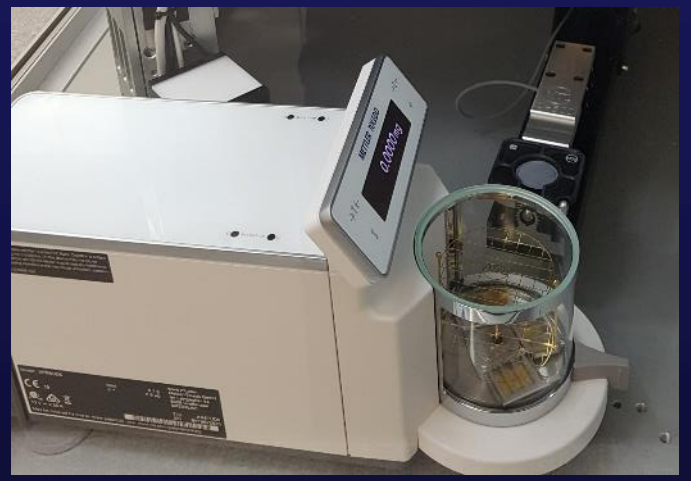


Methodological advancements
Weighing chamber

For each filter
- Tare
- 3 measures of filter mass
- 4 measures of empty pan mass

Additionally, each weighing session includes
- On initiation and ending plus every 4 hours
  - calibration of scales
  - weighing of working standards (100, 200, and 400 µg)
  - weighing of reference filters (3)

RH and T recorded at all times including when not weighing



Net weight precision
σ = 0.657 µg

Field blank (N = 102)
µ(net) = +2.15 µg

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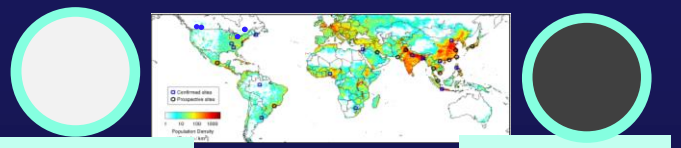

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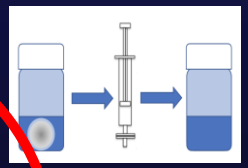

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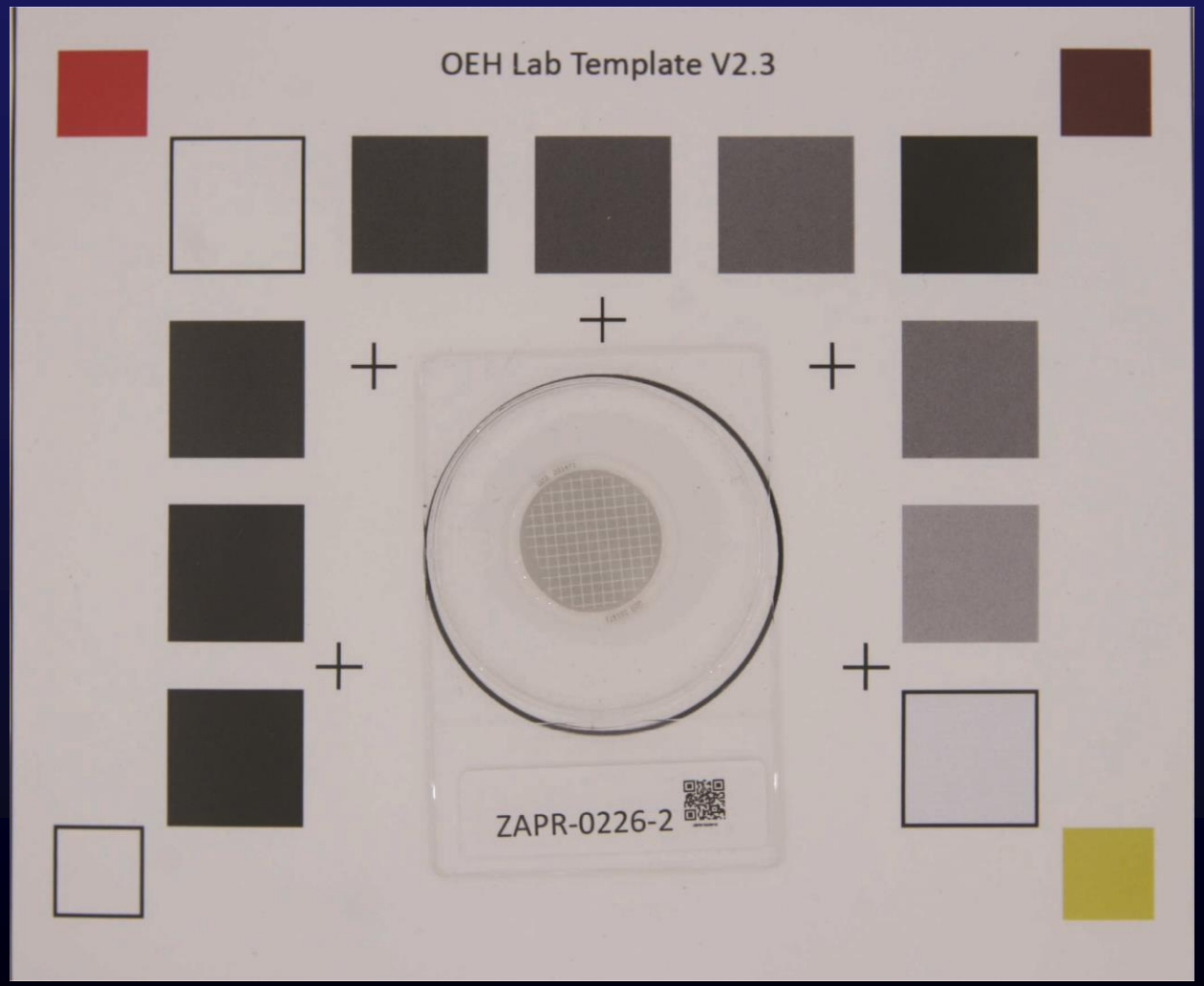
Methodological advancements
Image based reflectance

- Now record Image based reflectance
- Every filter photographed with standard background
- Reflectance measurements possible
- Provides a nice visual record of each sampled filter



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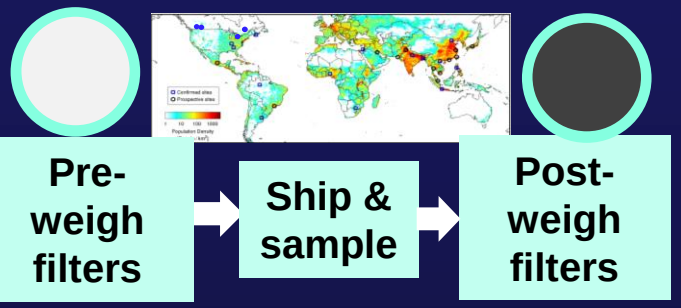

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Post-weigh filters → Black carbon and organics (HIPS and FTIR)

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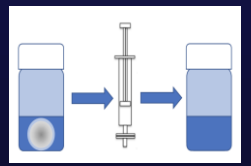
Black carbon (IBR) → Soluble ions (IC), Organics (AMS), Oxidative potential?



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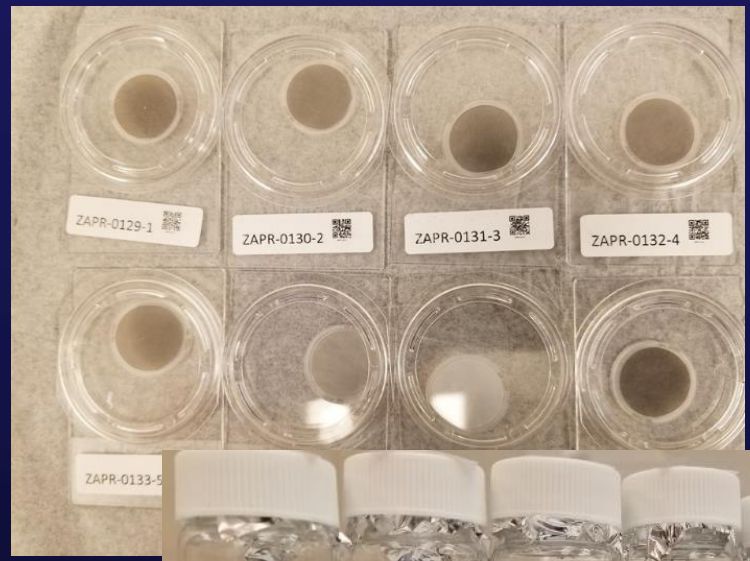
Methodological advancements
extractions and Ion Chromatography (IC)

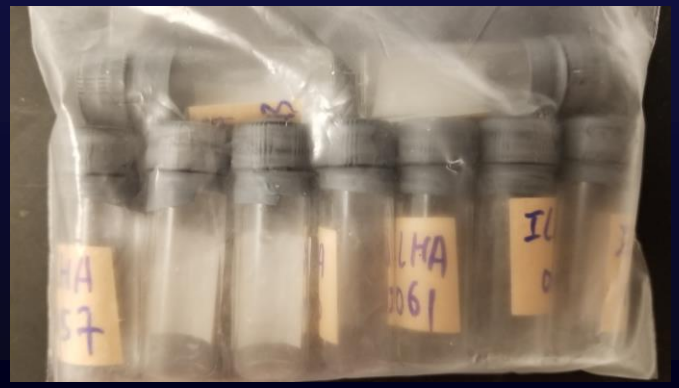
- Old sonication method had residual filters for ICP-MS

- New sonication method
  - Place filter in 5.8 ml water; 0.2 ml Methanol
  - Sonicate; filter destroyed; aerosol suspended in extract
  - Syringe filter removes suspension



Methodological advancements
extractions and Ion Chromatography (IC)

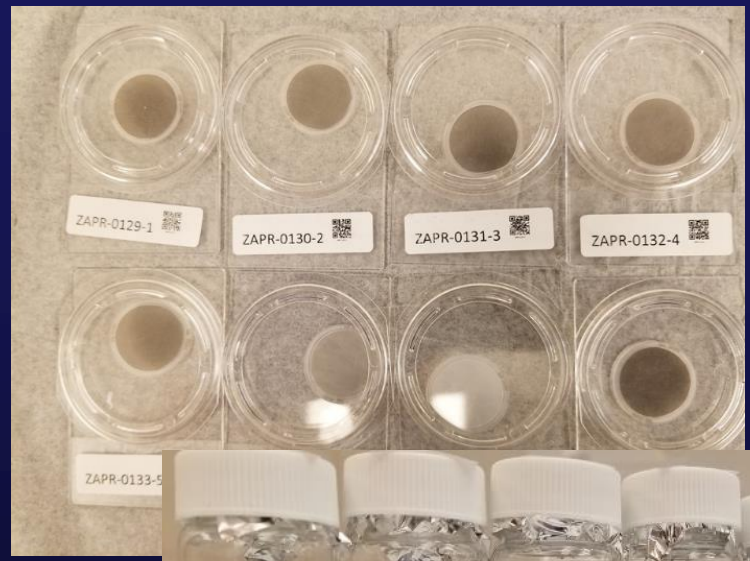
- Extractions create
  - 4 ml extractant in plastic vial for IC
  - 2 ml extractant in glass vial for AMS
  - Syringe filter
- IC uses 1 ml to 1.5 ml. remaining extract is placed in refrigerated storage
- AMS has 2 ml for analysis
- Syringe filter in frozen storage
- Can we do more?



Methodological advancements
extractions and Ion Chromatography (IC)

- All glassware and plasticware
  - Single methanol rinse
  - (3x) DI water rinse
  - Tamp dry before allowing to fully dry

- Extraction vials and AMS vials
  - 24 hours in nitric acid
  - 5 hours in oven at 500 C



Methodological advancements
extractions and Ion Chromatography (IC)

Dual Integrion IC system:

dedicated anion and cation systems run simultaneously (3 cartridges) per day

Anions detected: Cl^-, NO^-, Br^-, NO_3^-, SO_4^{2-}
Cations detected: Na^+, NH_4^+, K^+, Mg^{2+}, Ca^{2+}

8 level standards (anion, cation) are made bi-weekly for calibration

Methodological advancements
extractions and Ion Chromatography (IC)

- Manual QC checks
  - Is the correct background subtraction used?
  - Are all curves integrated correctly?
  - Are all curves correctly assigned to components?
  - Are R^2 above 0.995 for all components?

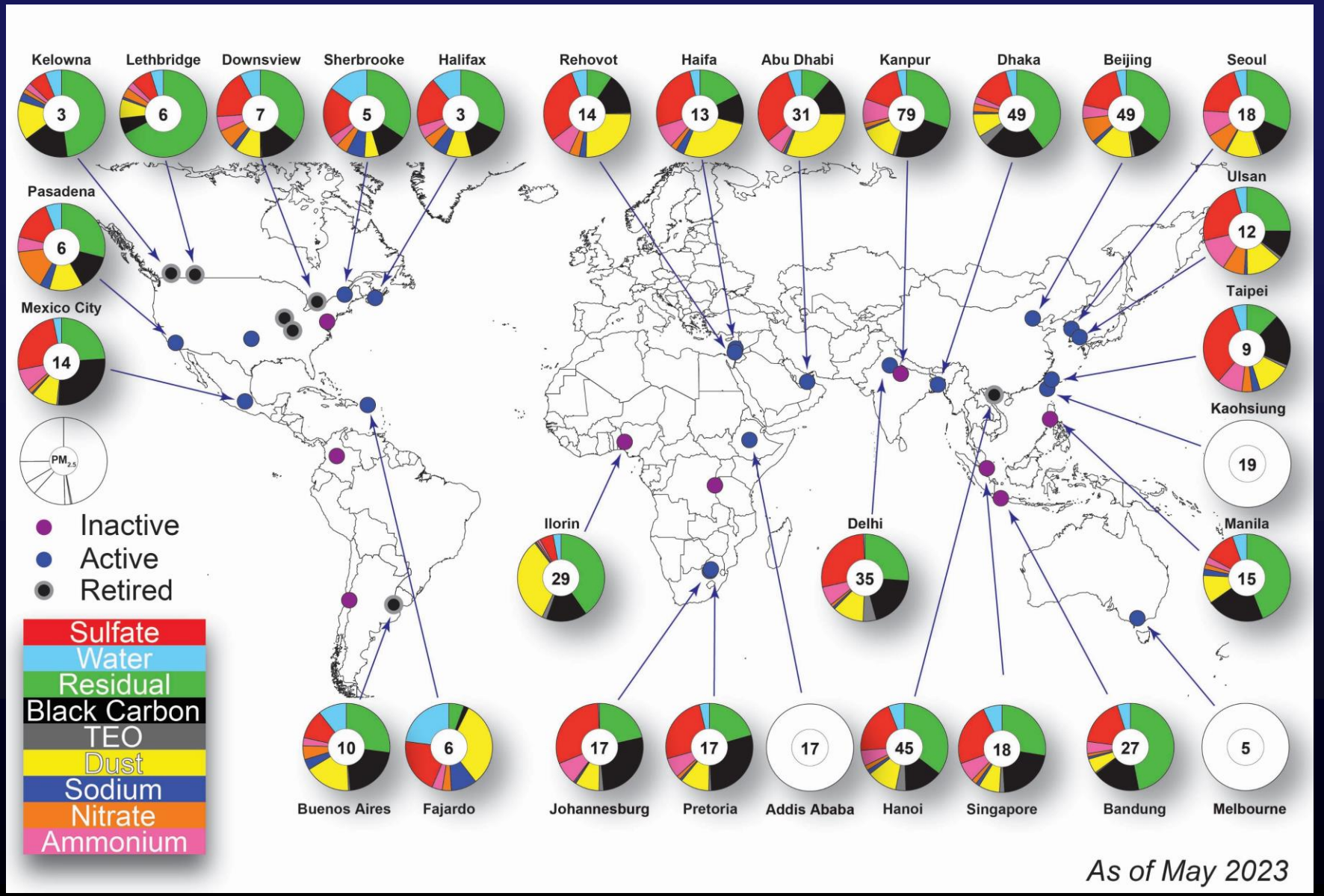
- Automated QC checks
  - Are water concentrations below 10*MDL?
  - Are the QC concentrations within +/- 10%?
  - Is R^2 above 0.995 for all components?

Sodium	0.62 µg (95%)
Ammonium	0.37 µg (95%)
Nitrate	2.4 µg (95%)
Sulfate	0.96 µg (92%)

Network status
our world in April 2018

Network status
our world in 2023

- Our world is growing!
  - Most active sites
- Active/Inactive
  - Room to grow
- Pie charts
  - Colors changing
  - Component based



Methodological advancements
extractions and Ion Chromatography (IC)

- Improvements with new chamber and scales
- Photographic documentation of filters, including on calibrated backgrounds
- Dedicated IC with quality checks
- Growing network