Sensors and Smart Cities - An EPA Perspective

NACAA

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Disclaimer: Material presented is for informational purposes only. EPA does not recommend nor endorse any particular sensor product or data management platform.

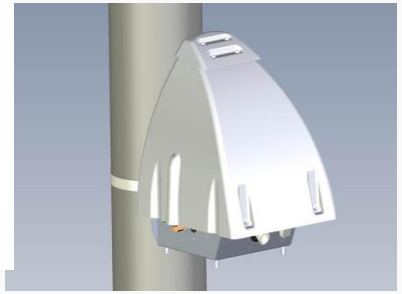
Disruptive Technology

Clayton Christensen coined the term in "The Innovator's Dilemma"[1,2]

- Lacks refinement
- Often has performance problems because it is new
- Appeals to a limited audience and may not yet have a proven practical application

http://money.cnn.com/2018/05/10/news/companies/alexa-amazon-smart-speakers-voice-shopping/index.html

Proliferation of Sensors & Real-time Data

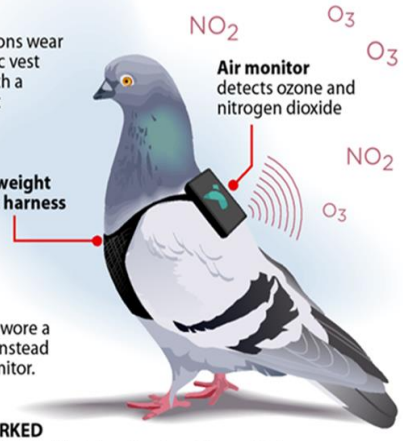


21st Century 'Canary in a Coal Mine'

The Pigeon Air Patrol — a joint project by tech companies Plume Labs and DigitasLBi — released pigeons outfitted with air-monitoring packs to record and report real-time air pollution levels in London. This three-day venture was used to spread awareness on London's smog problem.

WHAT IT IS

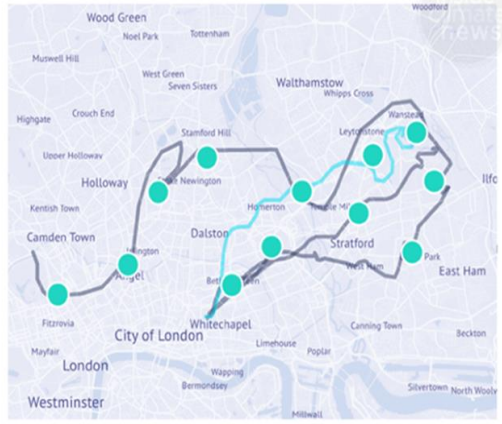
Racing pigeons wear a small fabric vest outfitted with a feather-light backpack.



One pigeon wore a GPS device instead of an air monitor.

HOW IT WORKED

Londoners Tweeted their location to a Pigeon Air team member and received real-time results (via Twitter) of air quality in their area.

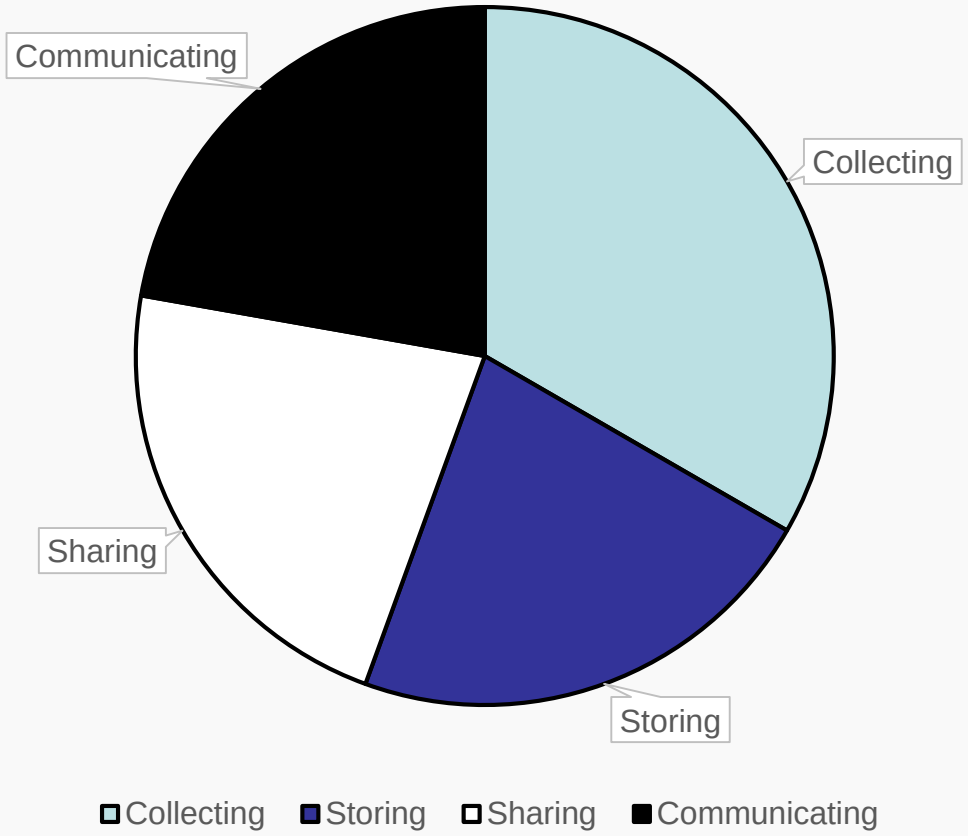


SOURCE: DigitasLBi

PAUL HORN / InsideClimate News

Collection of Air Data

Air Quality - Traditional Government Role



Air Quality – Complex Current State

Data Sets
Sensors
Satellites
Monitoring networks

Participants
Citizens/Communities
Researchers/Academics
Nonprofits
Businesses
Governments

Information Technology
Cloud storage
Data access
Advanced analytics
Visualizations
Consumer products

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Advancing Sensors

Where can EPA have an impact in this space?

Advancing Sensors

1. Data Quality
2. Data Interpretation
3. Data Management

(Select) Sensor Data Quality Questions

1. What are the necessary measurement parameters, targets, ranges, and bounds for various end applications?
    - How do these vary by pollutant?
2. Duration of measurement for various end uses?
    - Indicative vs. continuous
3. Sensor performance characterization
    - Initial vs. ongoing requirements?
4. Consideration of non-traditional ways of accomplishing measurement goals
    - Example: Algorithm pre-calibration techniques https://pubs.acs.org/doi/full/10.1021/acs.est.8b01826

Performance Benchmarks Deliberations

Announcing the "Deliberating Performance Targets for Air Quality Sensors" Workshop

June 25 and 26, 2018

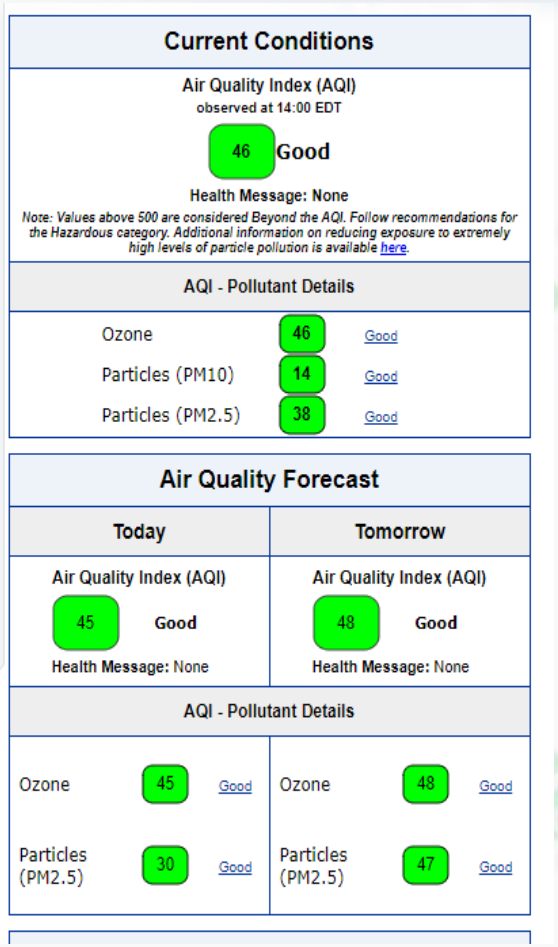
EPA Research Triangle Park Campus in Durham, NC

Register to attend (in-person or webinar)

Registration is now OPEN

Register via the Air Sensor Toolbox website: https://www.epa.gov/air-sensor-toolbox

Data Interpretation



Current Conditions

Air Quality Index (AQI)
observed at 14:00 EDT

46 Good

Health Message: None

Note: Values above 500 are considered Beyond the AQI. Follow recommendations for the Hazardous category. Additional information on reducing exposure to extremely high levels of particle pollution is available here.

AQI - Pollutant Details

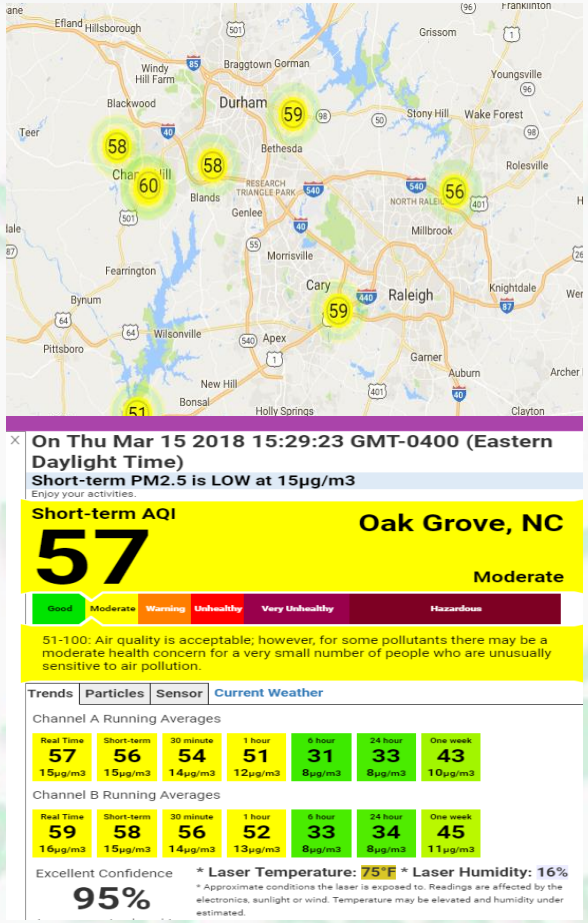
Ozone	46	Good
Particles (PM10)	14	Good
Particles (PM2.5)	38	Good

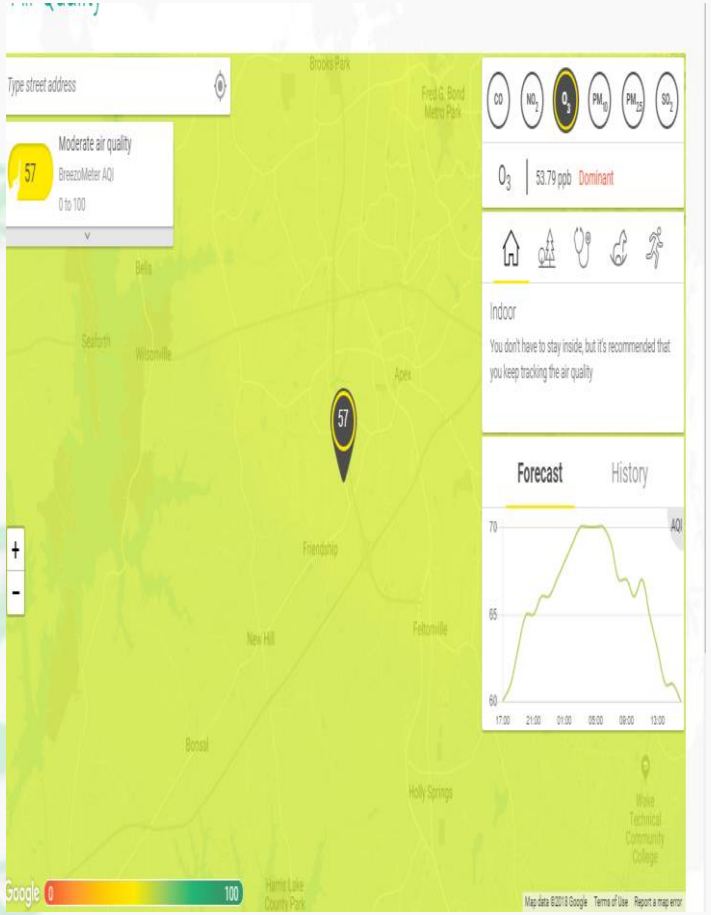
Air Quality Forecast

Today	Tomorrow
Air Quality Index (AQI)	Air Quality Index (AQI)
45 Good	48 Good
Health Message: None	Health Message: None

AQI - Pollutant Details

Today			Tomorrow		
Ozone	45	Good	Ozone	48	Good
Particles (PM2.5)	30	Good	Particles (PM2.5)	47	Good



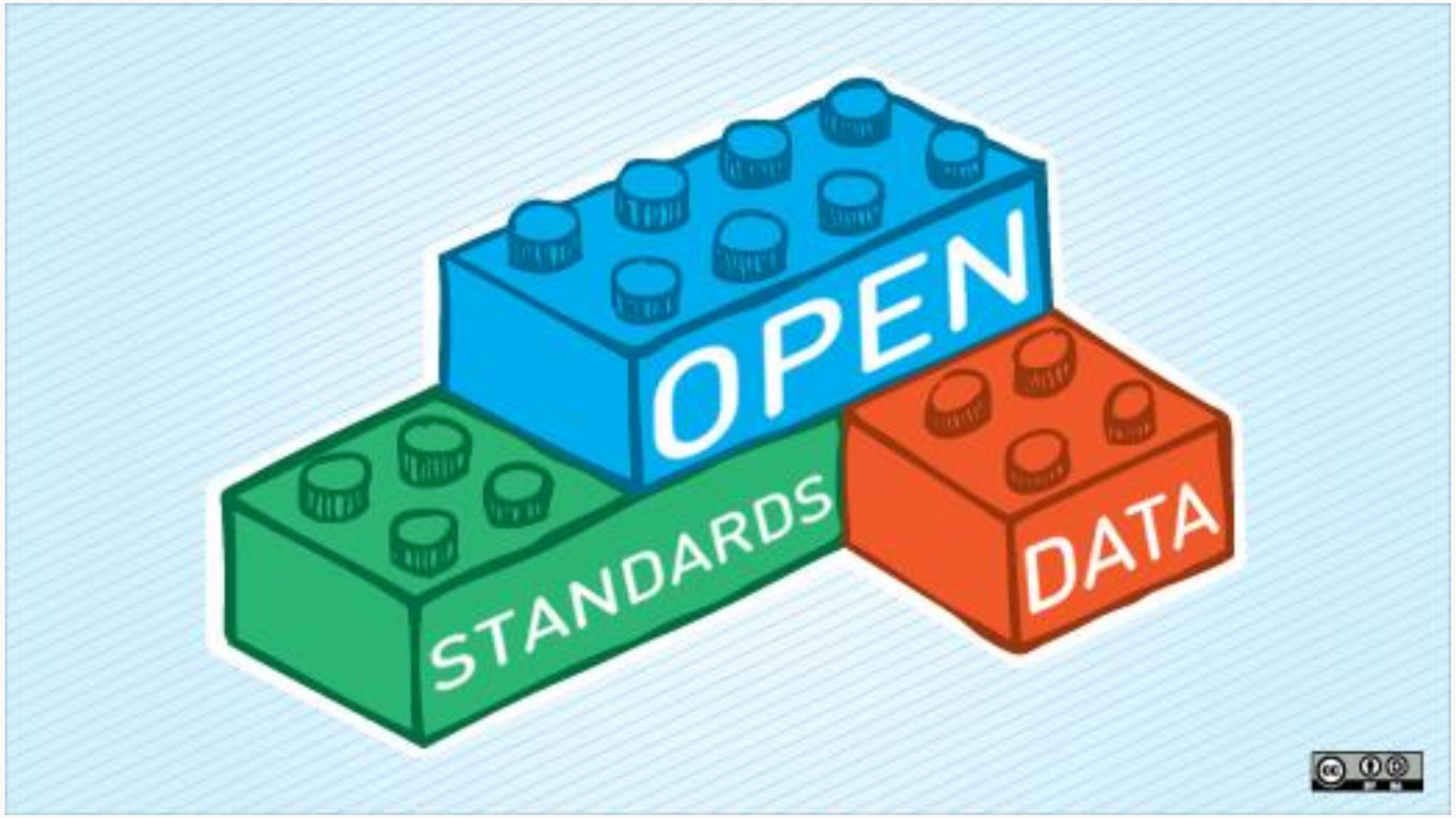


Current Conditions in Durham, NC ~3:30pm on 3/15/18

Data Interpretation Considerations

- Current state of monitoring **and** health science
- Interpretation varies by pollutant
- Displaying variable datasets & use of “stoplight” colors

Data Management – Current State



Data Management Questions

1. Ownership - Who owns the data?
2. Standardized formats and exchange
   - Facilitation of data from different devices
3. Security – FedRAMP approval?
4. Privacy – Tracking individuals
5. Fusion – How are different data sets being merged together?
6. Algorithms/Assumptions/Models – What adjustments are being made on raw measurements, are the corrections ‘proprietary’?

Air Sensors International Conference

September 12-14th, 2018
Oakland Convention Center

https://asic.aqrc.ucdavis.edu/register

“Change” Loves Company

https://www.nytimes.com/2017/08/09/business/heart-and-asthma-monitors-theres-an-app-for-that.html?emc=eta1

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Citations

Slide 3 –

1. Hagler, G. Disruptive Innovation in Air Measurement Technology: Reality or Hype? Presented at AWMA Measurements Conference, Chapel Hill, NC, March 15 - 17, 2016.
2. http://whatis.techtarget.com/definition/disruptive-technology