Data Deluge

Presented at

Air Sensors International Conference, Oakland, CA

September 12, 2018

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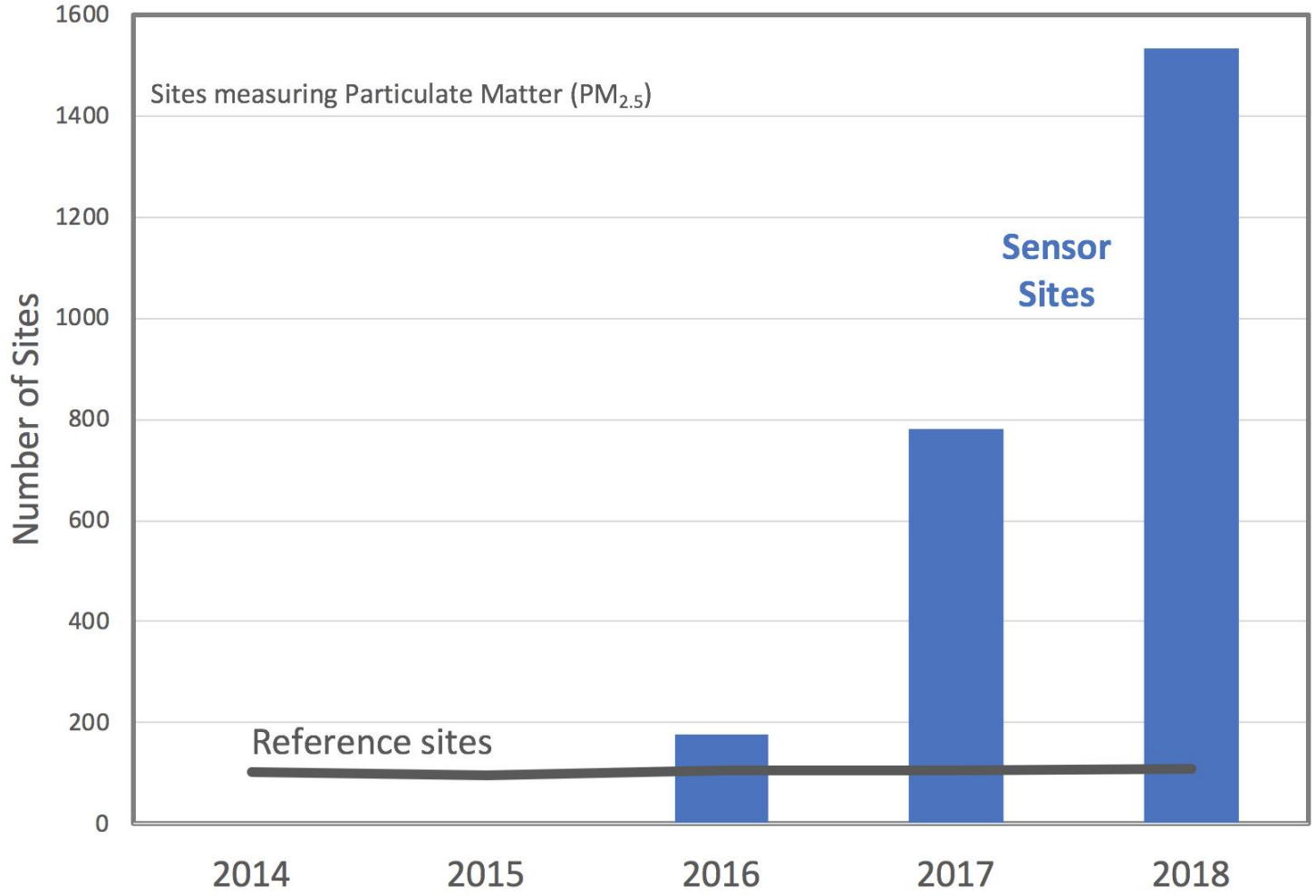
TD ENVIRONMENTAL SERVICES
Air quality sensing, analytics, and insights

Measurement Systems

Reference	Portable (“mid-cost”)	Sensors (“low-cost”)

Growth of Sensors Outpaces Reference Sites



Sensors include Aeroqual, AirBeam, Clarity, PurpleAir, and Safecast $PM_{2.5}$ sensor systems - August 2018
Reference stations include permanent sites run by local air districts and the California Air Resources Board

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Messy Air Sensor Data

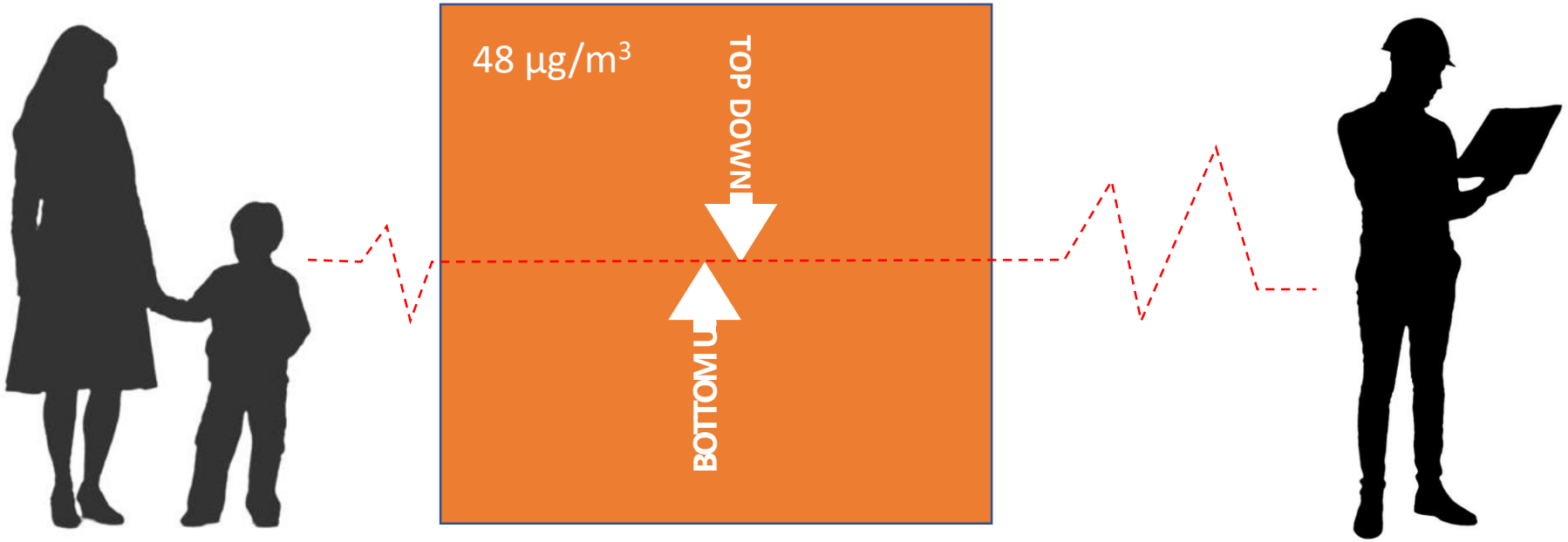
Metric	Reference	Sensors
Parameters(s)	Few	Multiple; not uniform
Coordinates Date Time Location Conventions	Some problems	Not always clear Not always labeled
Metadata	Available - updated?	Often lacking
Number (worldwide)	10,000 (slowly growing)	100,000 (rapidly growing)

“Too”s and “Not”s

- Too many sites
- Too few sites
- Too uncertain
- Too stationary

- Not representative
- Not long-term
- Not useful
- Not profitable
- Not wanted

Perspective



"My sensor instantly tells me what's happening outside my house."

"Are these sensors accurate to monitor smoke from fires?"

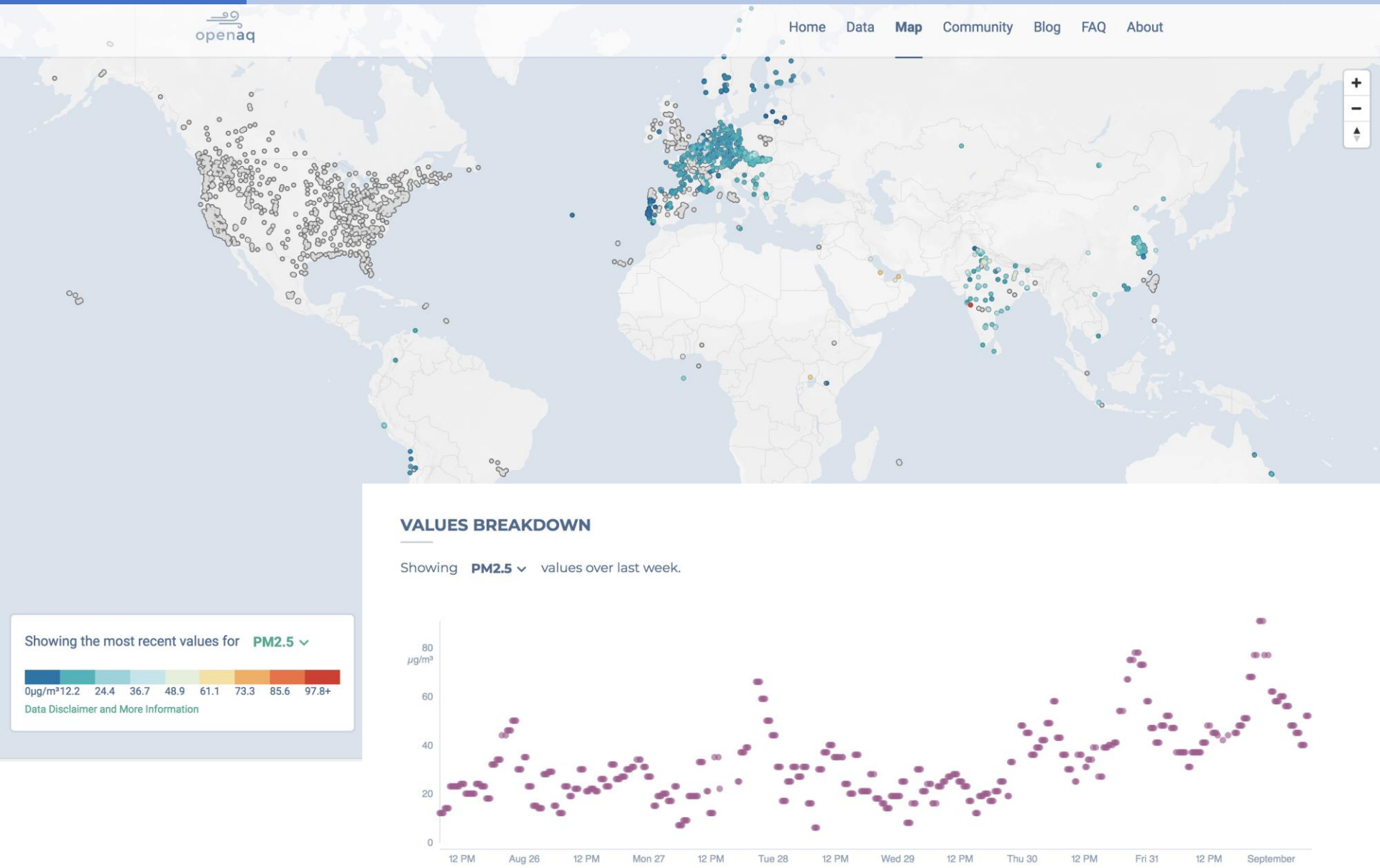
Air Sensing Tools

Open goodness

Data crunching

Hybrid data systems

Open OpenAQ



www.OpenAQ.org

Open AirNow API

AirNow Developer Tools

Home | Web Services | Data Feeds | File Products | FAQ | Air Quality 101 | Analytics

Web Services > Historical Observation By Latitude and Longitude

Documentation

Query Tool

1

Latitude: 37.8028 °

Longitude: -122.2732 °

Date: 2018-09-02

Distance: 25 miles

Format: application/json

Build

2 Generated URL

http://www.airnowapi.org/aq/observation/latLong/historical/?format=application/json&latitude=37.8028&longitude=-122.2732&date=2018-09-02T00-0000&distance=25&API_KEY=28545717-1CE2-4F70-B810-55B602C36960

Run

3 Output

LOADING...

https://docs.airnowapi.org/webservices

42.1617	-123.64835	2018-09-05T	PM2.5	11.5	UG/M3	Cave Junctio	Oregon Dept	410330036	8.4041E+11
43.2266	-123.36479	2018-09-05T	PM2.5	9.2	UG/M3	Roseburg - G	Oregon Dept	410190002	8.4041E+11
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42.623225	-122.81016	2018-09-05T	PM2.5	54.1	UG/M3	Shady Cove -	Oregon Dept	410290019	8.4041E+11
45.014998	-122.79038	2018-09-05T	PM2.5	10.2	UG/M3	Silverton	Oregon Dept	410470007	8.4041E+11
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44.778743	-122.61705	2018-09-05T	PM2.5	11.5	UG/M3	Lyons	Oregon Dept	410432003	8.4041E+11
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44.063916	-121.31255	2018-09-05T	PM2.5	17.9	UG/M3	Bend - Pump	Oregon Dept	410170120	8.4041E+11
44.6306	-121.1316	2018-09-05T	PM2.5	20.3	UG/M3	Madras - We	Oregon Dept	410310007	8.4041E+11
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35.04676	-120.58777	2018-09-05T	PM2.5	10.6	UG/M3	Nipomo Mes	San Luis Obis	60792007	8.4006E+11
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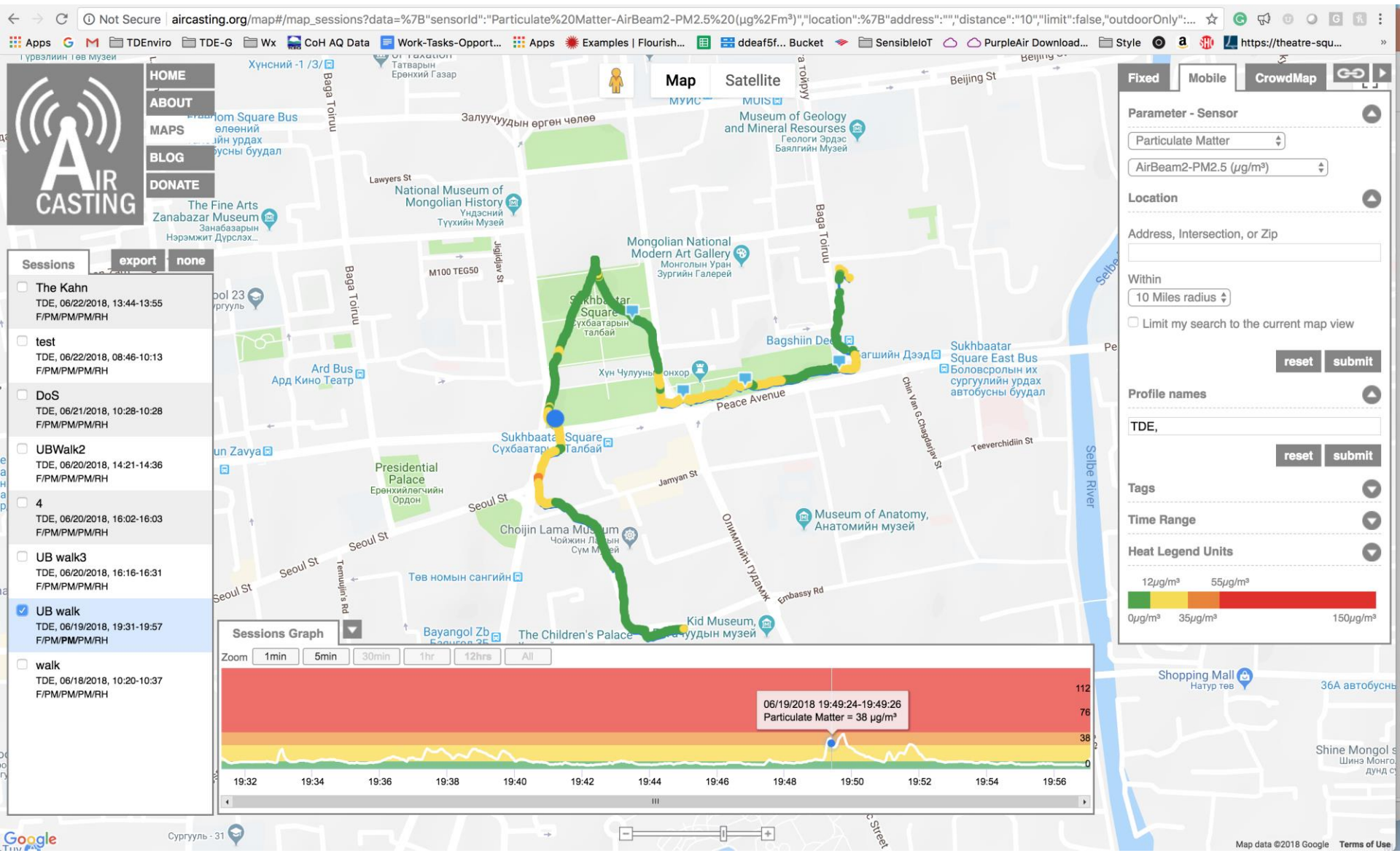
Open AirCasting



Crunch Python

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sns.pairplot(df)
```

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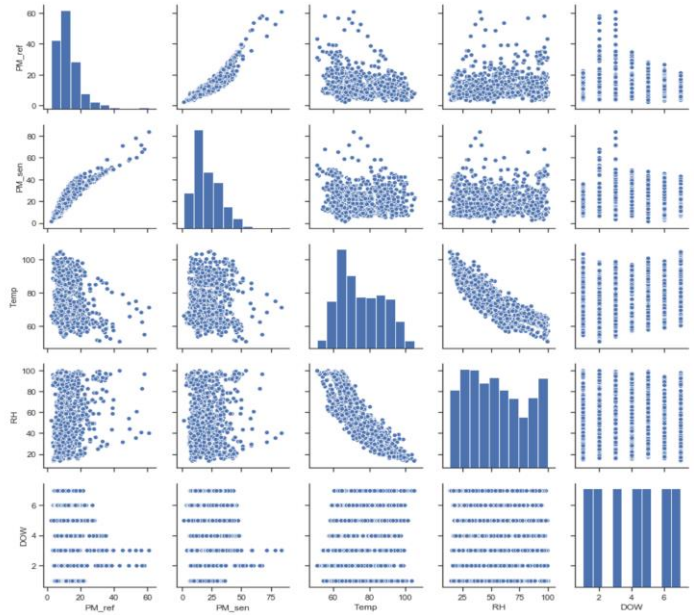
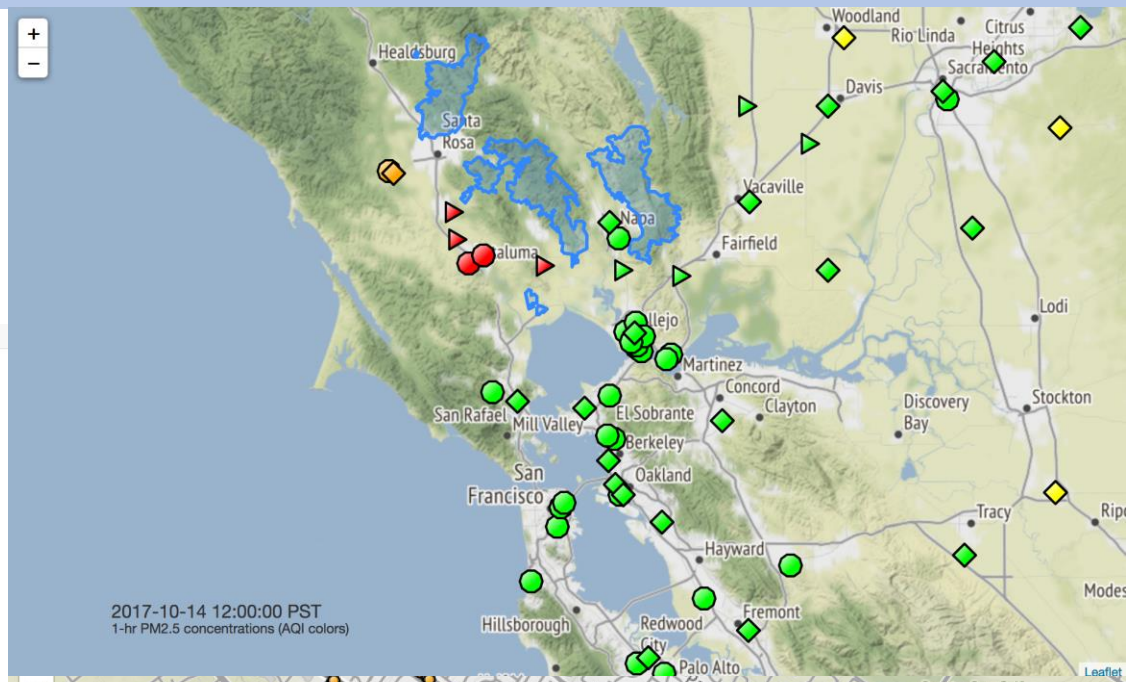
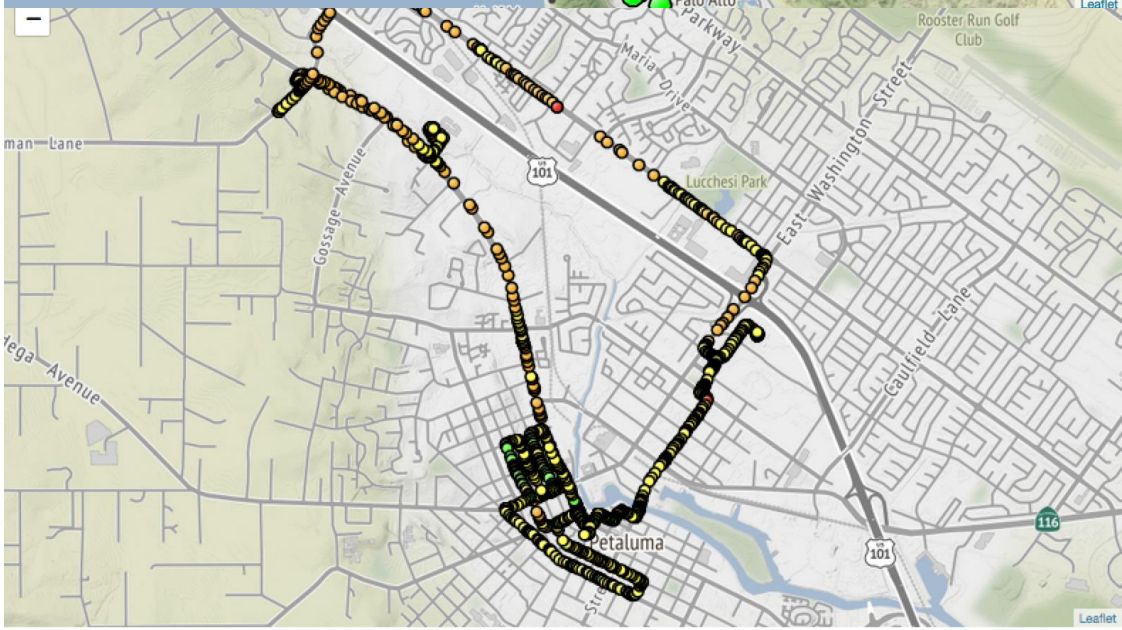






Crunch OpenAir

HOME

THE OPENAIR PROJECT » HOME

openair - open-source tools for air pollution data analysis

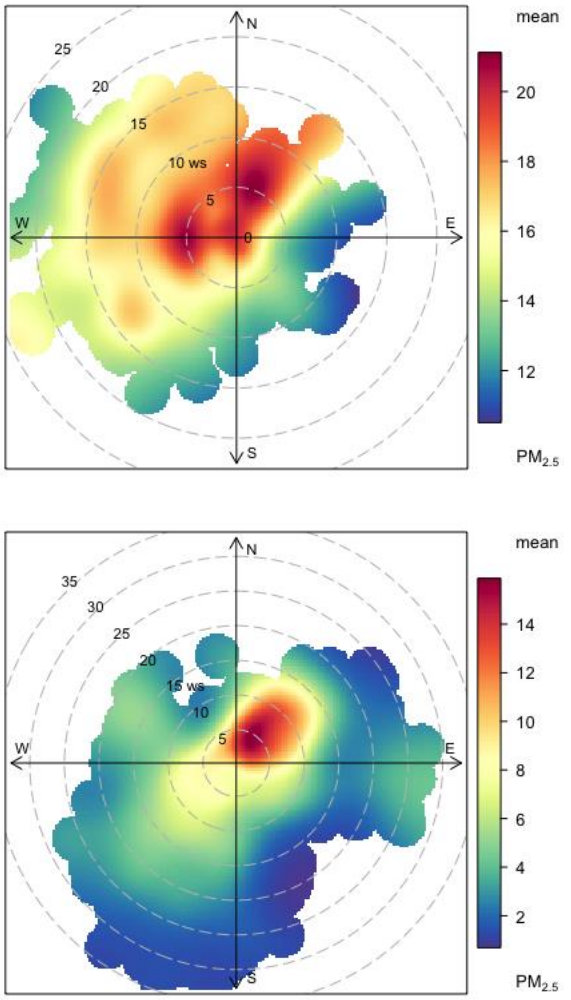
The **openair project** was a Natural Environment Re
to provide a collection of open-source tools for the a
background information to the project. The project w

The project was led by the Environmental F
the University of Leeds and is now hosted a

http://davidcarslaw.github.io/openair/

hat aimed
e

pported by



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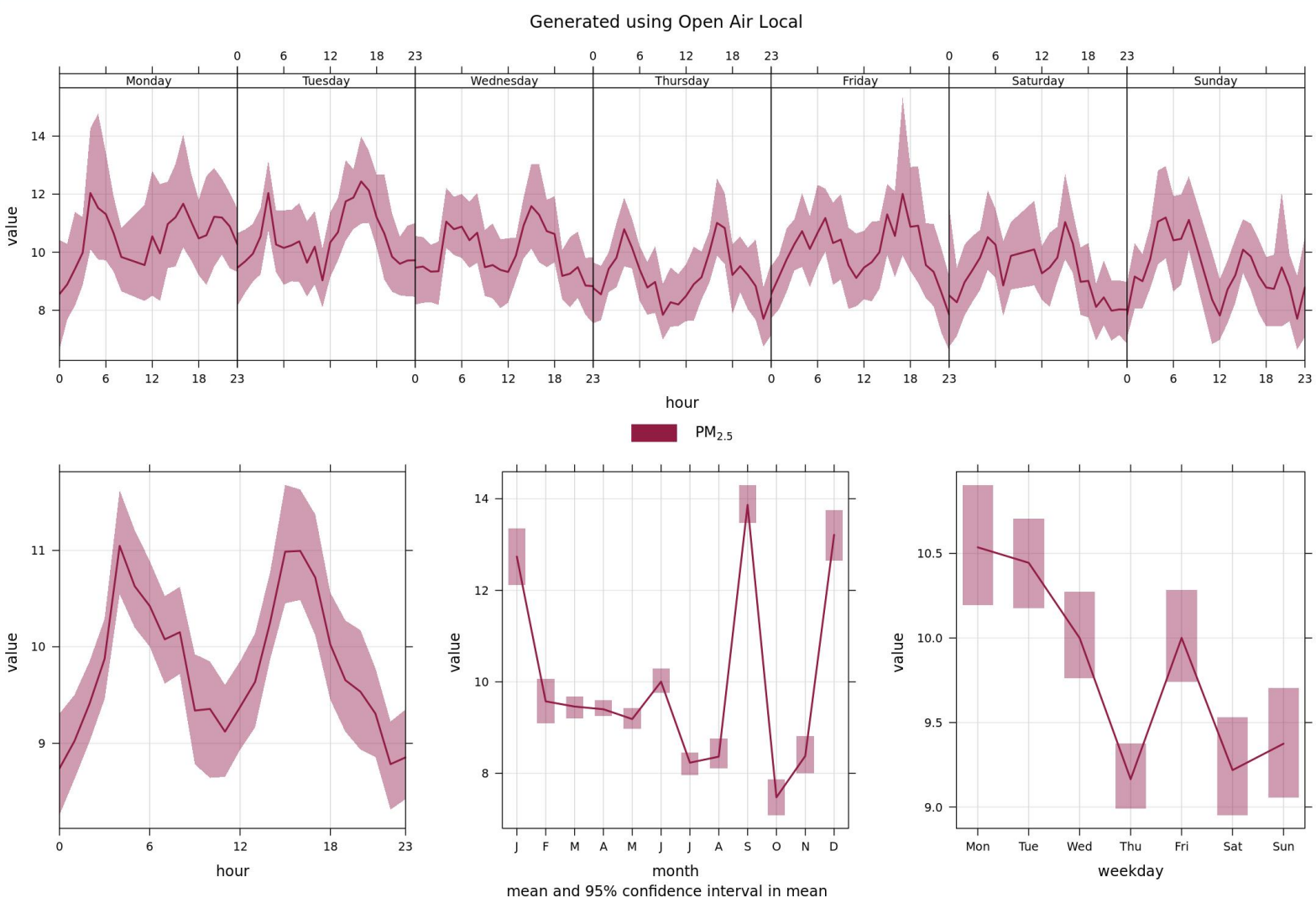
http://www.openair-project.org/

Crunch OpenAirLocal



http://www.openairlocal.org

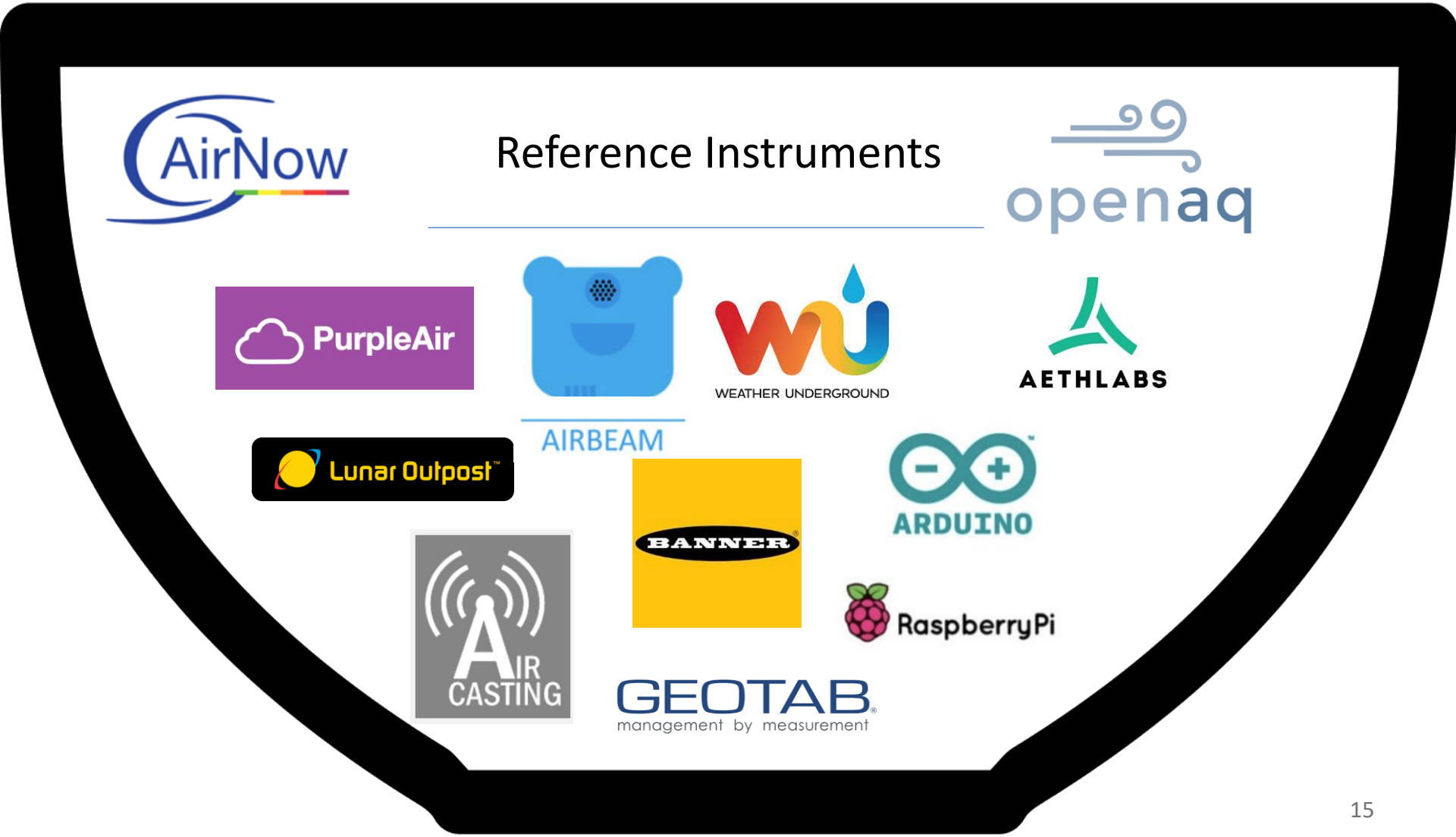
Hybrid Many Systems

Hybrid data systems:

- Collect, store, distribute
- Purpose-driven
- Multiple data types
- Normalization
- QC
- Easy-to-use

and many more…

Hybrid AirSense – Data Ingest



Hybrid AirSense - Alerts

AirSense

8/15/2018 12:16:22 AM

Site Name	Instrument Name	Last Updated	Percent Complete	Parameter Name	Max Value	Min Value	Average Value
Site 1	Met (Airmar)	8/14/2018 10:05:10 AM	100	Temperature	34.3	28.4	31.8
				Relative humidity	53.5	39.3	45.4
				Wind speed	8.8	0.0	1.9
				Wind direction	358.6	0.0	181.6
	Data logger (CR6)	8/14/2018 10:05:10 AM	100	Battery voltage	12.3	11.7	12.0
				Panel temp	41.0	28.4	37.1
	Aetholomerter (MA-200)	8/14/2018 10:05:10 AM	99.6	UV BC1	21.5	-2.9	1.5
				UV BC2	20.9	-5.4	1.5
				IR BC1	27.0	-12.0	1.3
				IR BC2	22.6	-13.5	0.9
	PM2.5 (PDR-1500)	8/14/2018 10:05:10 AM	98.4	Particulate Matter (2.5 um)	20.0	-1.7	2.4
Site 2	Met (Airmar)	8/14/2018 2:25:02 PM	100	Temperature	37.3	27.5	33.3
				Relative humidity	67.6	32.7	44.4
				Wind speed	10.4	0.0	1.9
				Wind direction	359.9	0.0	184.0
	Data logger (CR6)	8/14/2018 2:25:02 PM	100	Battery voltage	12.4	11.1	11.6
				Panel temp	44.5	29.9	40.8
	Aetholomerter (MA-200)	8/14/2018 2:25:02 PM	99.4	UV BC1	109.8	-7.6	1.8
				UV BC2	116.8	-9.6	1.9
				IR BC1	103.7	-17.1	1.3
				IR BC2	113.6	-18.6	1.1
	PM2.5 (PDR-1500)	8/14/2018 2:25:02 PM	55.7	Particulate Matter (2.5 um)	231.2	8.0	22.9

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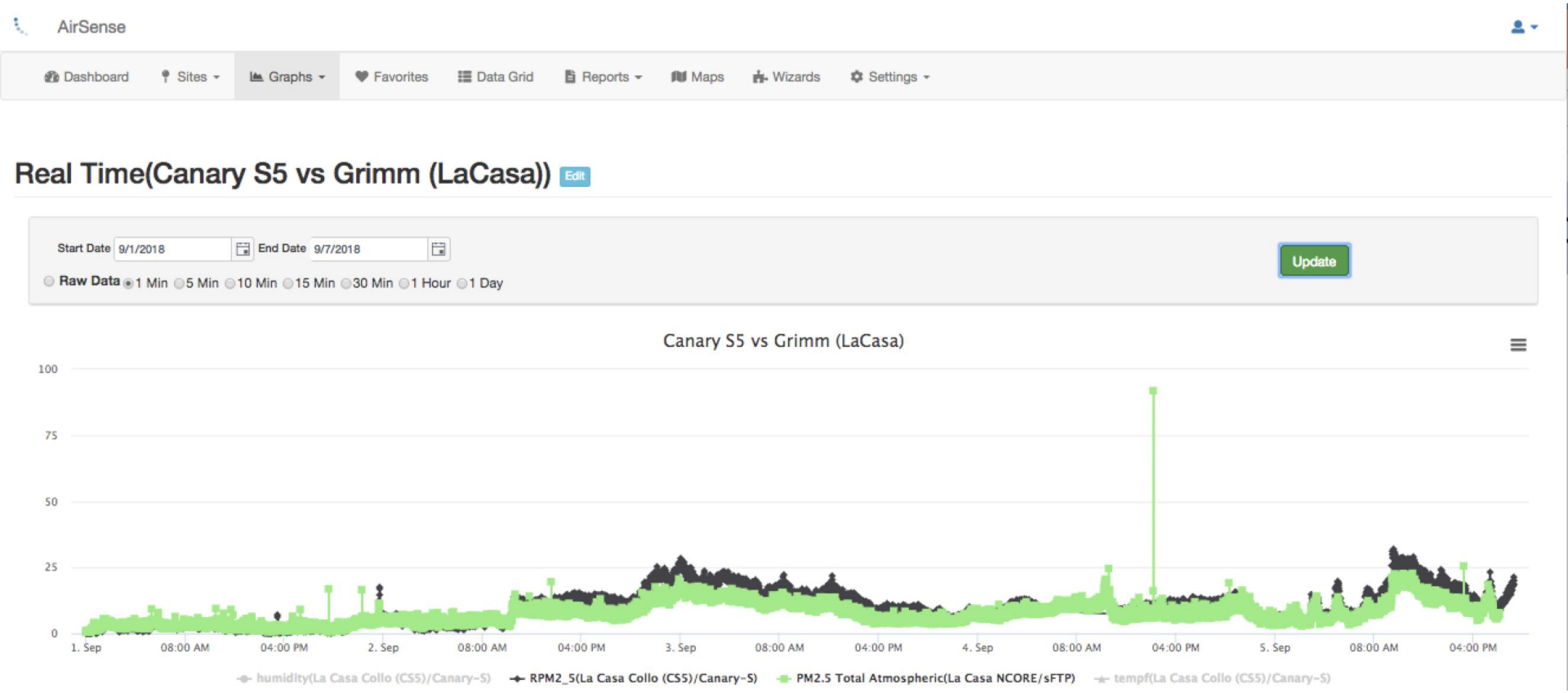
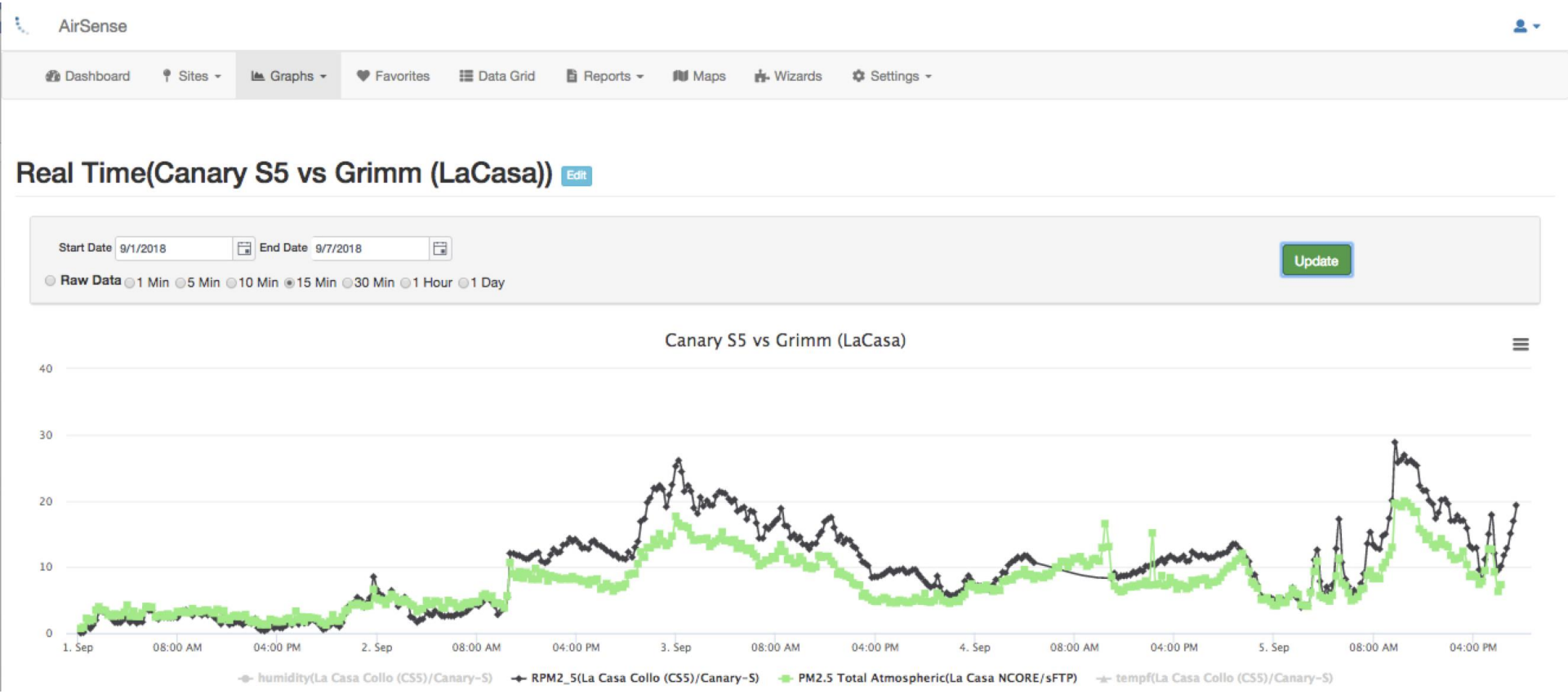
Hybrid AirSense – On the Fly Aggregations



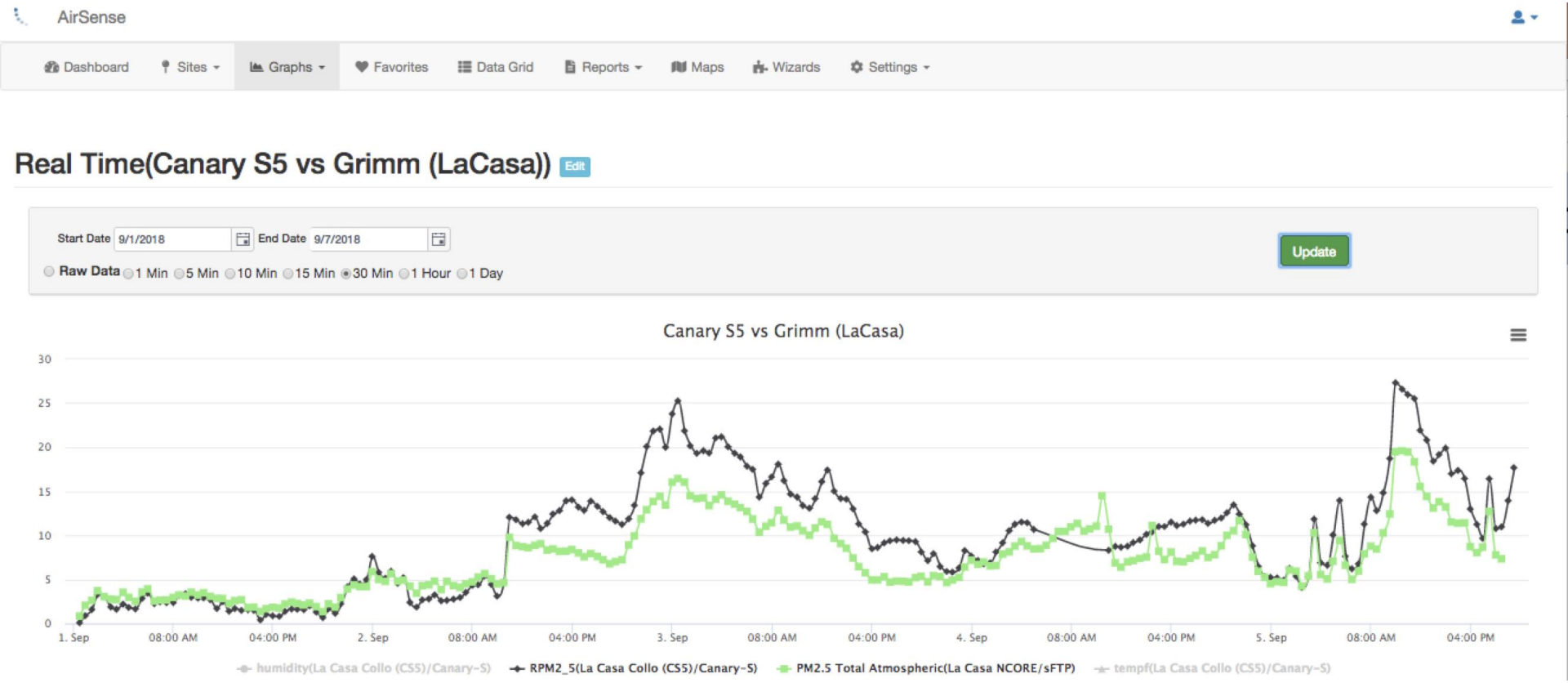
Hybrid AirSense – On the Fly Aggregations

Hybrid AirSense – On the Fly Aggregations

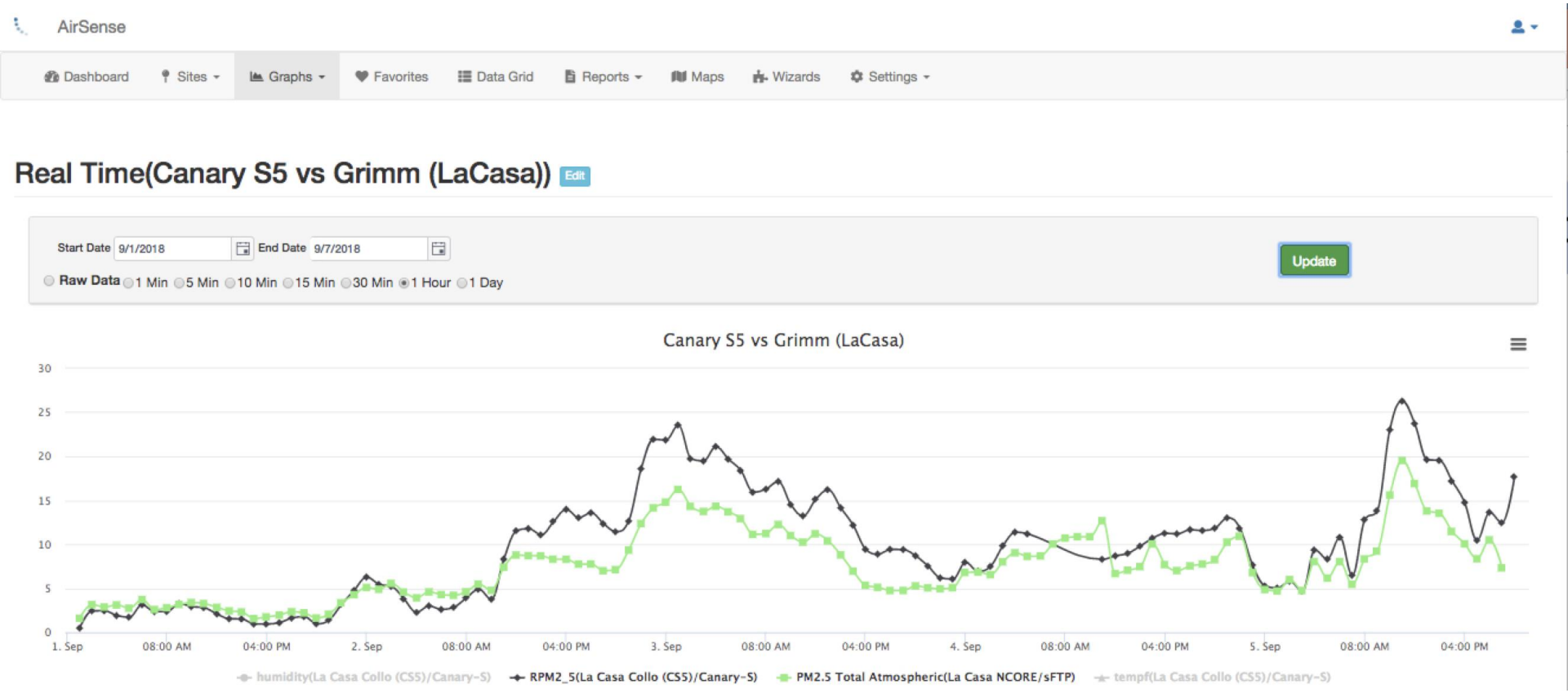
Hybrid AirSense – On the Fly Aggregations



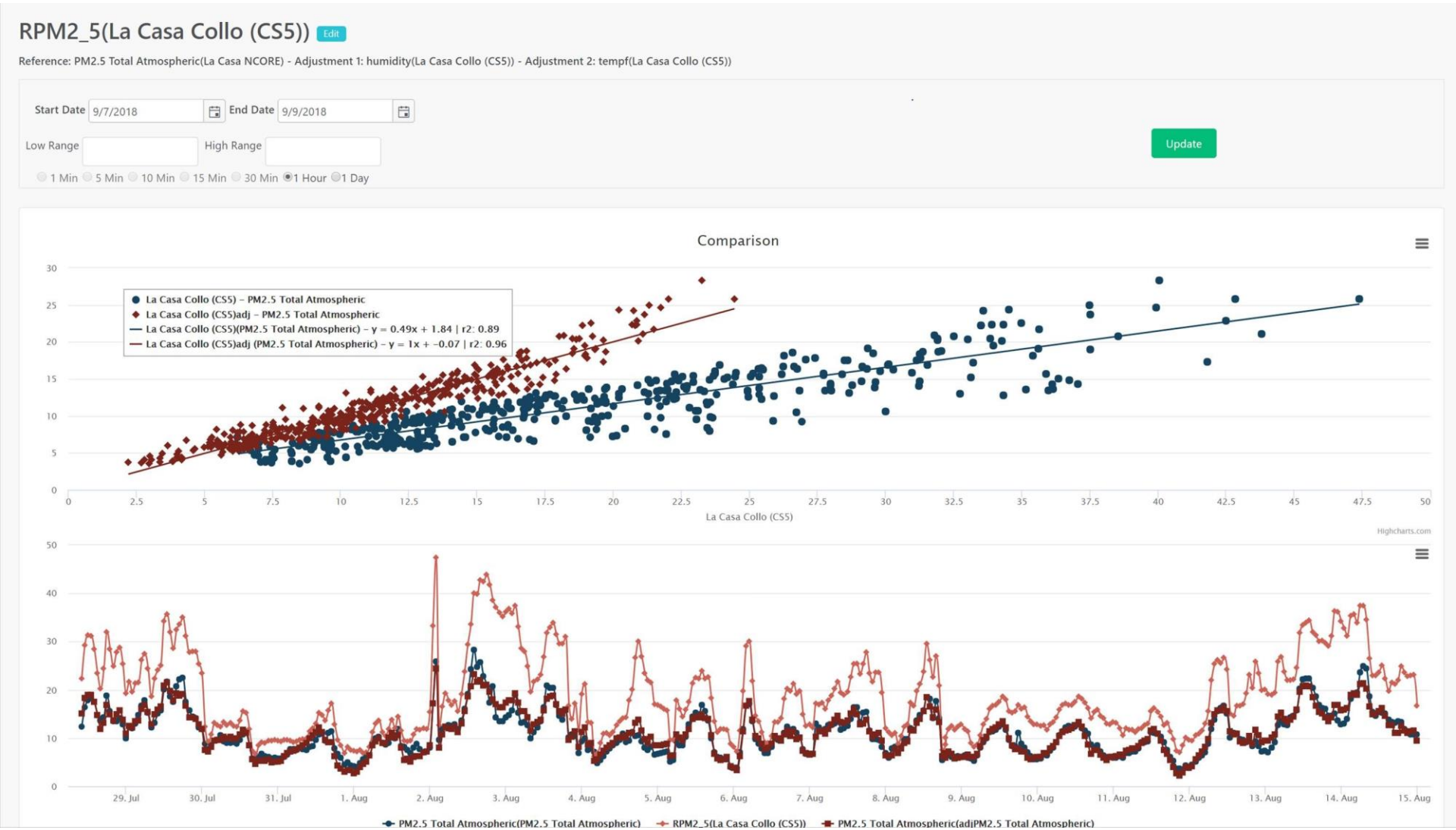
Hybrid AirSense – On the Fly Aggregations



Hybrid AirSense – On the Fly Aggregations



Hybrid AirSense - Normalization



Hybrid AirSense – Custom Dashboards

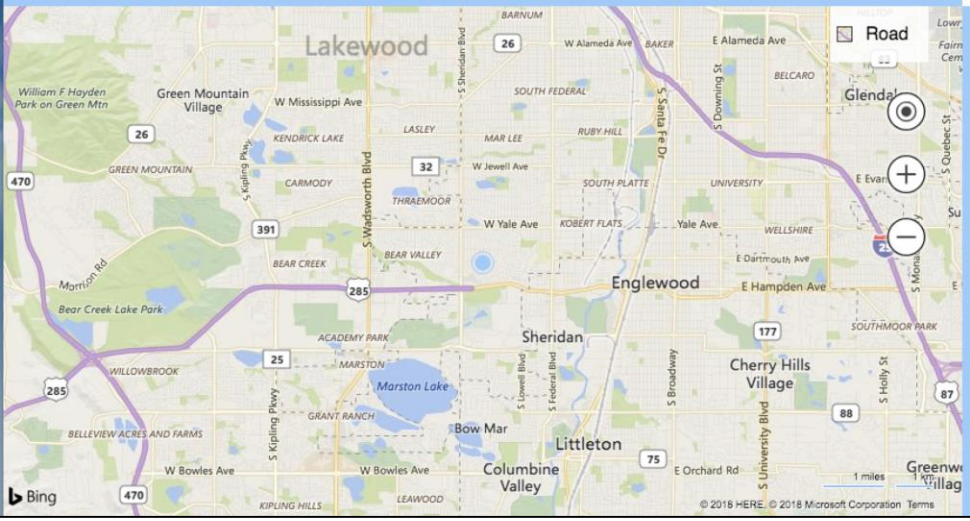
Sabin World School

68 °F
Temp

6

↗
Trend

($PM_{2.5}$ 30 min avg)



Alert Levels (µg/m3)		
0 - 30	Low	22 Days (30 Day History)
30 - 70	Medium	0 Days (30 Day History)
70 - 500	High	0 Days (30 Day History)
500 - 3000	Very High	0 Days (30 Day History)

ACTION

Enjoy your outdoor activities!

Going Forward…

- Harmonization
- Standards
- Open systems & data exchange protocols
- Much more analysis
  - What does this mean?
  - Where did it come from?
- Making it easy

Contact Information

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TD ENVIRONMENTAL SERVICES
Air quality sensing, analytics, and insights