



# **NW-AIRQUEST**

## **Air Sensor Working Group**

Von P. Walden

Lab for Atmospheric Research, WSU

6 February 2020



# Timeline of Air Sensor Working Group

## 2019

- February – Discussing of possible formation of Air Sensor Working Group
- April – Organizational telecon meeting with 15-20 people
  - Lots of interest
  - But not sure what our “mission” should be
- ??...

## 2020

- Institute either quarterly or bi-annual telecons, before NW-AIRQUEST “general meetings”



# Personal Research Activities

## 2017

- Avista Streetlight project through Urbanova
  - Low-cost AQ sensors
  - Established a reference site in Spokane
  - Monitored urban air through 2017 and 2018 wildfire seasons
    - High PM<sub>2.5</sub> values (peak of 250  $\mu\text{g m}^{-3}$  in Spokane)
  - Used social media (Twitter) to correlate AQ with public reactions

## 2018

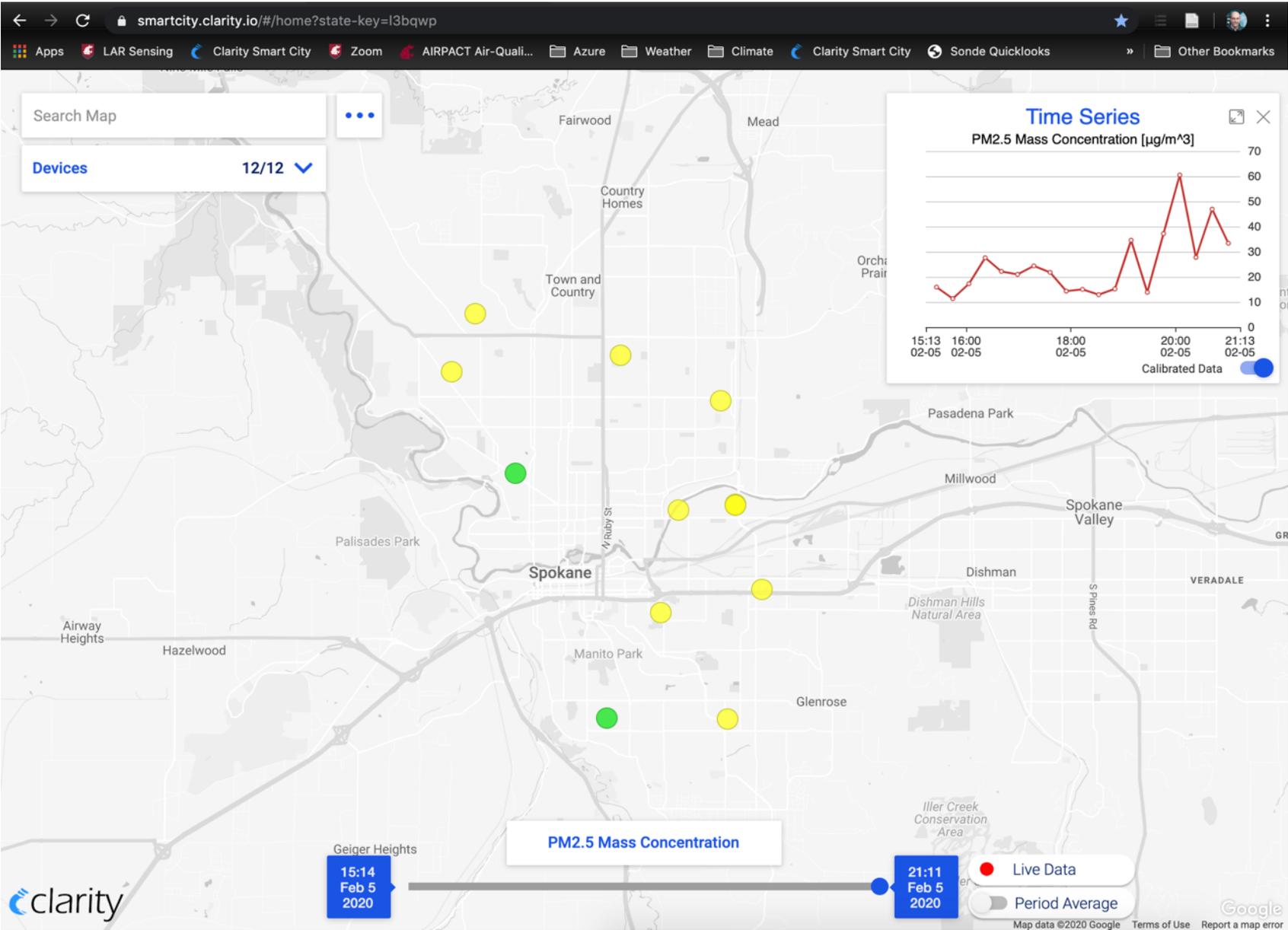
- Formation of Wildfire and Health group for proposals

## 2019

- Creation of the Urbanova Cloud
- Spokane School Project funded by Ramboll
  - June 2019-May 2020
  - Installation of 10 outdoor (Clarity) and 10 indoor (WSU) PM<sub>2.5</sub> sensors
- Submission of NIH R21 proposal
  - Use Spokane AQ network
  - Outfit university students with GPS trackers and spirometers



# Spokane AQ Network



# Purple Air Sensors

- Julie Fox (DOH)
  - Has a set of Purple Air sensors that she is using to engage users at schools and in the general public
  - Protocols for usage
- Air Sensor WG
  - Should share code (like that shown at the right) for general use
  - Establish a GitHub code repository

## Obtain and Plot Global PurpleAir Sensor Data

Von P. Walden, Washington State University  
5 February 2020

```
In [1]: import urllib
import json
from datetime import datetime
import pandas as pd
import geoviews as gv
import geoviews.feature as gf
gv.extension('bokeh')
```

Download data from global Purple Air sites

[Purple REST API](#)

```
In [2]: url = 'https://www.purpleair.com/data.json'
response = urllib.request.urlopen(url)
purpleAirSites = json.loads(response.read())
now = datetime.now()
```

Prepare data for plotting with Geoviews

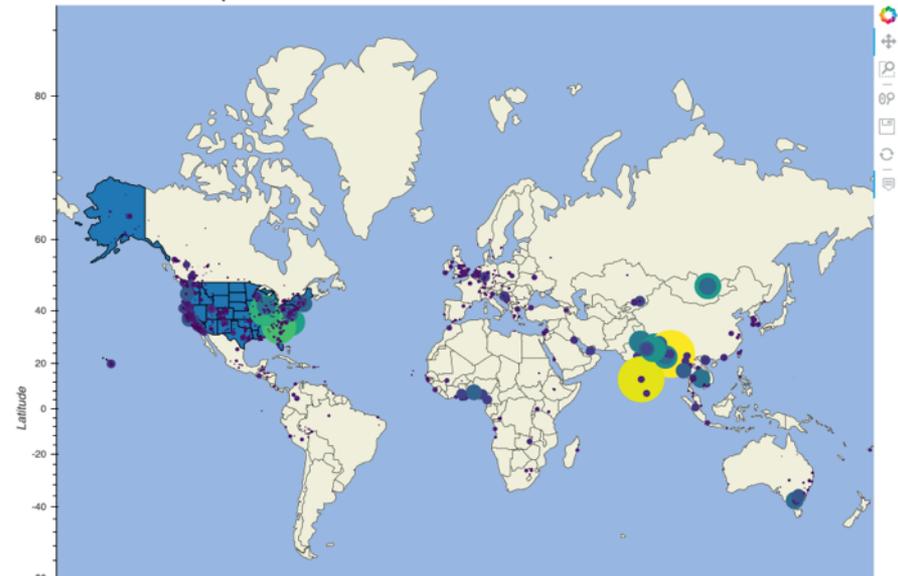
```
In [3]: pAir = pd.DataFrame(purpleAirSites['data'], columns=purpleAirSites['fields'])
pAir.dropna(subset=['pm_2', 'Lon', 'Lat'], inplace=True)
pm2_5 = gv.Dataset(pAir, kdims=['pm_2'])
points = pm2_5.to(gv.Points, ['Lon', 'Lat'], ['pm_2'])
```

Plot the data on a global map

```
In [4]: features = gv.Overlay([gf.ocean, gf.land, gf.borders, gf.coastline, gf.states])
features * points.opts(
    color='pm_2', cmap='viridis', size=gv.dim('pm_2')*0.1,
    tools=['hover'], width=950, height=950, global_extent=True,
    title='PM 2.5 from Global Purple Air Sites at ' + now.strftime('%Y-%m-%d %H:%M')
)
```

Out[4]:

PM 2.5 from Global Purple Air Sites at 2020-02-05 20:08





# Future Activities that are related to NW-AIRQUEST

## 2020 - ...

- Quarterly meetings of the Air Sensor WG
- Establish a code repository for a wide variety of users
- Use existing networks as testbeds
  - How well do low-cost sensors work?
  - Establish methods for streaming data to users (AWS, Urbanova Cloud)
  - How often do the sensors need to be calibrated?
  - Can machine learning (ML) techniques be used to improve the quality of low-cost sensors?
- Discuss the establishment of sensor networks in mountainous regions with wood burning issues
  - Pinehurst, Idaho (?)
  - Bend, Oregon (?)
  - Wenatchee, WA (?)

# Looking forward

- Deploy low-cost mobile sensors
- Continue to operate Reference site
  - Fitted with research grade instruments
  - Co-locate with sensor packages for calibration and validation
- Mobile sampling using new LAR instrumented van for regional field campaigns
  - Meteorology
  - Surface flux measurements
  - PTR-MS
  - Mobile reference site for field projects



**Questions?**



# Urbanova Cloud

- <https://alpha.urbanova.cloud/>

The screenshot shows a web browser at the URL `alpha.urbanova.cloud/dashboard`. The browser's address bar and tabs are visible at the top. The dashboard itself has a dark blue header with the 'urbanova' logo on the left and a 'Dashboard' title in the center. Below the header, there is a user profile for 'Von Walden' with a circular profile picture. To the left of the main content area is a dark sidebar menu with icons and labels for 'Dashboard', 'Catalog', 'Collections', 'Projects', 'Account', and 'Chat'. At the bottom of the sidebar are links for 'Documentation', 'Support', and 'Sign Out'. The main content area features a purple 'Create Project' button at the top left. Below it is the section 'Your Projects', which contains four project cards. Each card has a blue line-art icon of a city skyline with a circular sensor. The projects are: 'Pulse Spokane' (version 0.0.1, no description), 'Ramboll School AQ' (version 0.0.1, no description), 'Urbanova Streetlight Project' (version 0.0.1, no description), and 'CENSE Spokane' (version 0.0.1, no description). Each card also has a download icon and an eye icon at the bottom.