



Air Resource Specialists, Inc.

# National Park Service Visibility Monitoring Network

## IMPROVE Steering Committee Meeting

Presented By  
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Presented On  
October 12, 2021



# Nephelometer & Web Camera Locations





# Nephelometer Network Changes 2020 – 2021

- The every two -year nephelometer full -service site visit scheduling has become more challenging due to GPMP contract cuts from twice -annual visits to one annual visit.
- The Teton National Park nephelometer was decommissioned and removed on October 4, 2021.
- Generally, NPS operator support has improved since last year during and after the pandemic lockdown.
- Testing for the Optec NGN2 nephelometer replacement continues.

# Reasons to Replace the Optec NGN2 Ambient Air Nephelometer

The Optec 2, and associated support infrastructure, has been in service for over 25 years!

- Many parts are no longer available
- The manufacturer no longer supports the instrument
- The supply of instruments to cannibalize for parts is dwindling
- Data storage capability is low (2.5 days) compared to modern electronic instrumentation (months to years).
- The open-air inlet concept has chamber high RH limitations. Wall scattering climb is also rapid and episodic. Spiderwebs cause frequent noise and require cleaning. Precipitation can enter the chamber in the right conditions.
- The Optec power supply, data logging and user interface are not integrated.
- New technology and capabilities beckon.





# Optec Nephelometer Replacement Candidate: Airphoton IN102

## PROS

- 450 nm, 532 nm and 632 nm
- 7 to 170 degree integration angle
- Multiple particle size cuts achieved with variable flow rate and size selective inlet
- Chamber near ambient temperatures
- Used in Surface PARTiculate mAtter Network (SPARTAN)

## CONS

- Environmental robustness
- Documentation and support
- No data collection software, data storage card
- Support has diminished in since the purchase of the test instrument.

# Optec Nephelometer Replacement Candidate: Ambilabs 2 -WIN



## PROS

- 525 nm and 635 nm
- PM<sub>2.5</sub> size selective inlet.
- 10 to 170 degree integration angle.
- Manufacturer has been anxious to help NPS test and reach operational goals

## CONS

- Chamber temperature heated actively and passively
- Remote control changes are in manufacturer development.

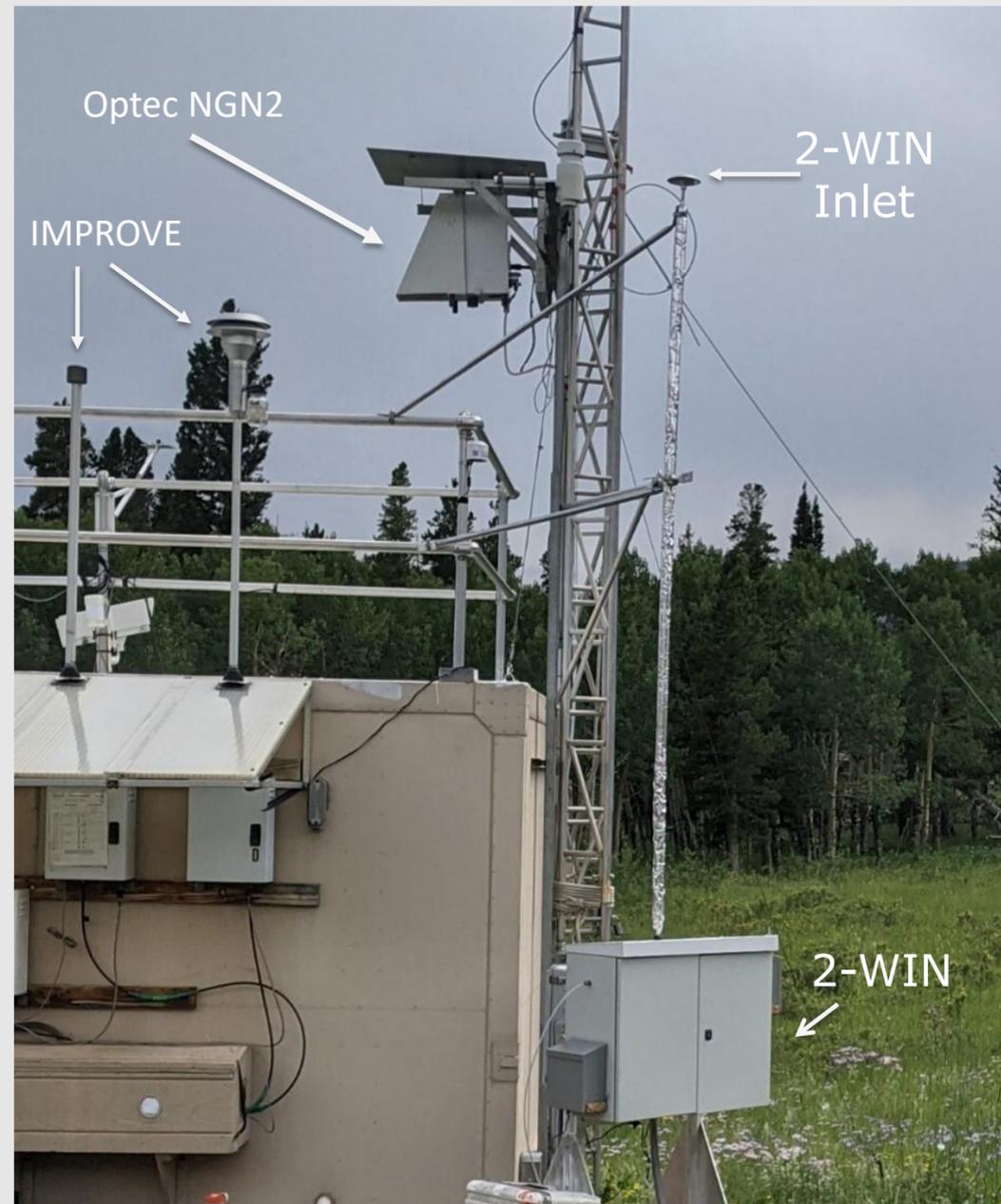


# Ambilabs 2 -WIN Testing

Summer 2021 testing found the primary chamber heat source to be the electronics.



# Rocky Mountain NP Nephelometer Comparison

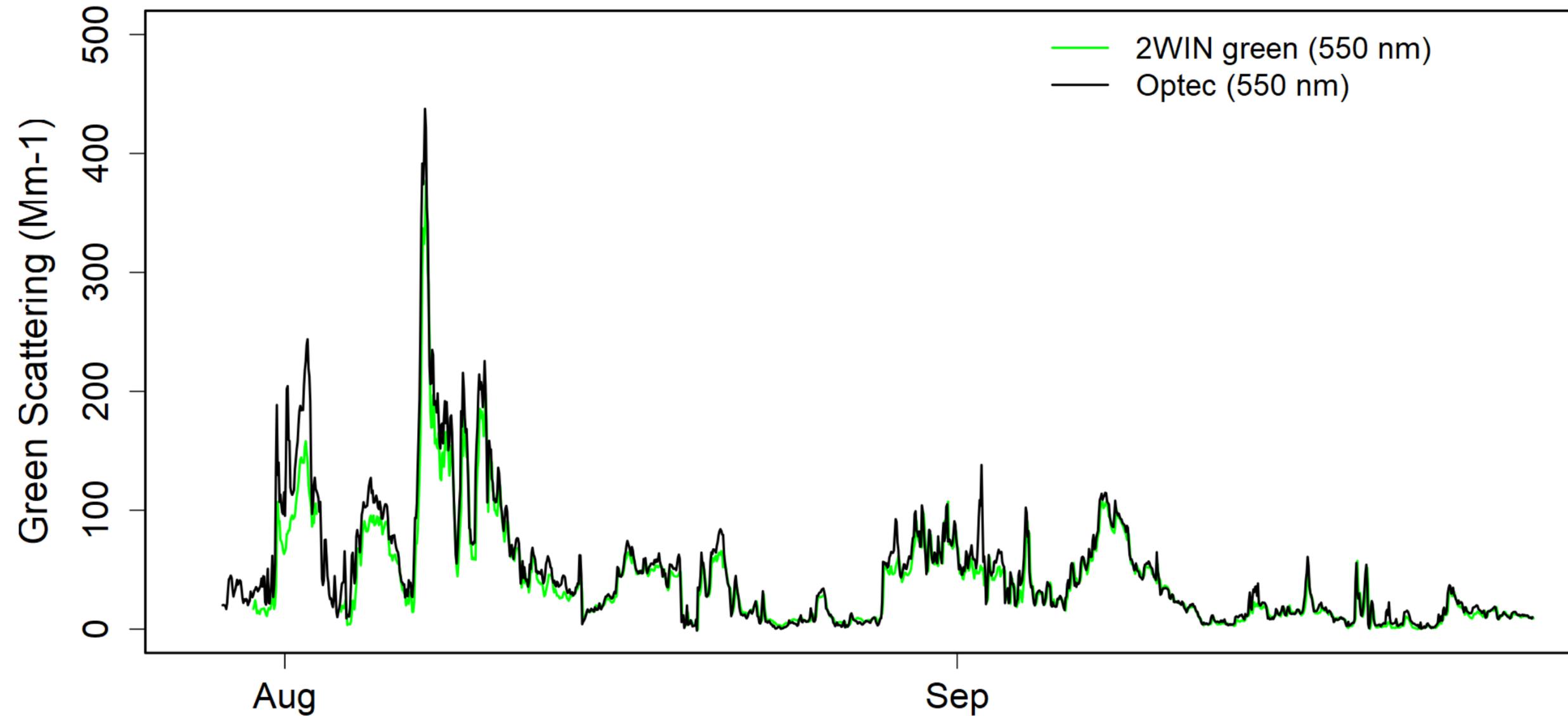


## AMBILABS 2 -WIN

- 2-WIN was installed in July 2021
- Environmental enclosure and inlet installed near Optec and IMPROVE Sampler inlet height
- 2-WIN inlet insulated and reflective tape covered to mitigate temperature change
- Both 25 CFM enclosure fans replaced with 115 CFM fans
- 2-WIN inlet heater off for  $RH < 90$
- 2-WIN instrument case opened to assist in removing waste heat

# 2-WIN Data Plot

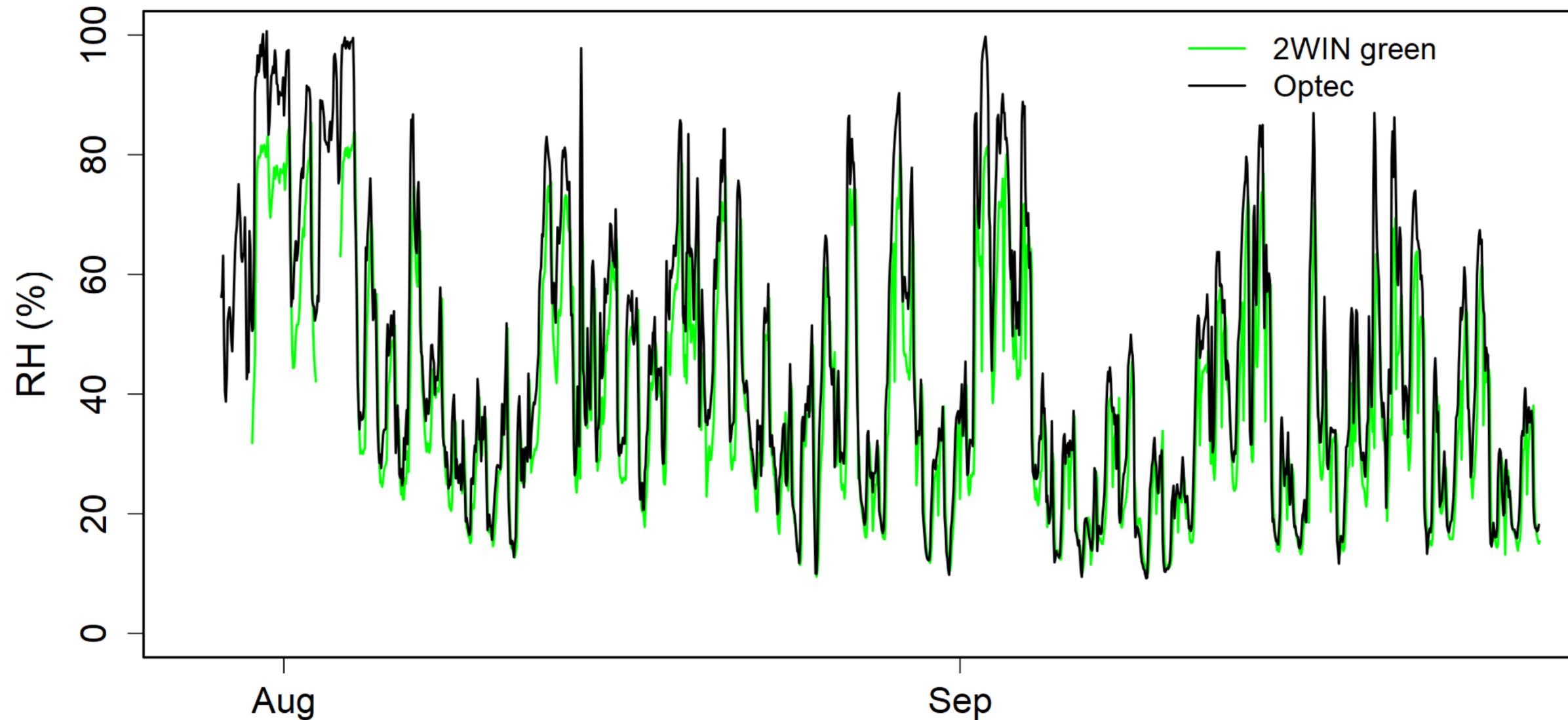
## ROMO 2WIN vs Optec Scattering



2-WIN compares well with Optec. Both are corrected to 550 nm. Optec is slightly higher, particularly in earlier time period.

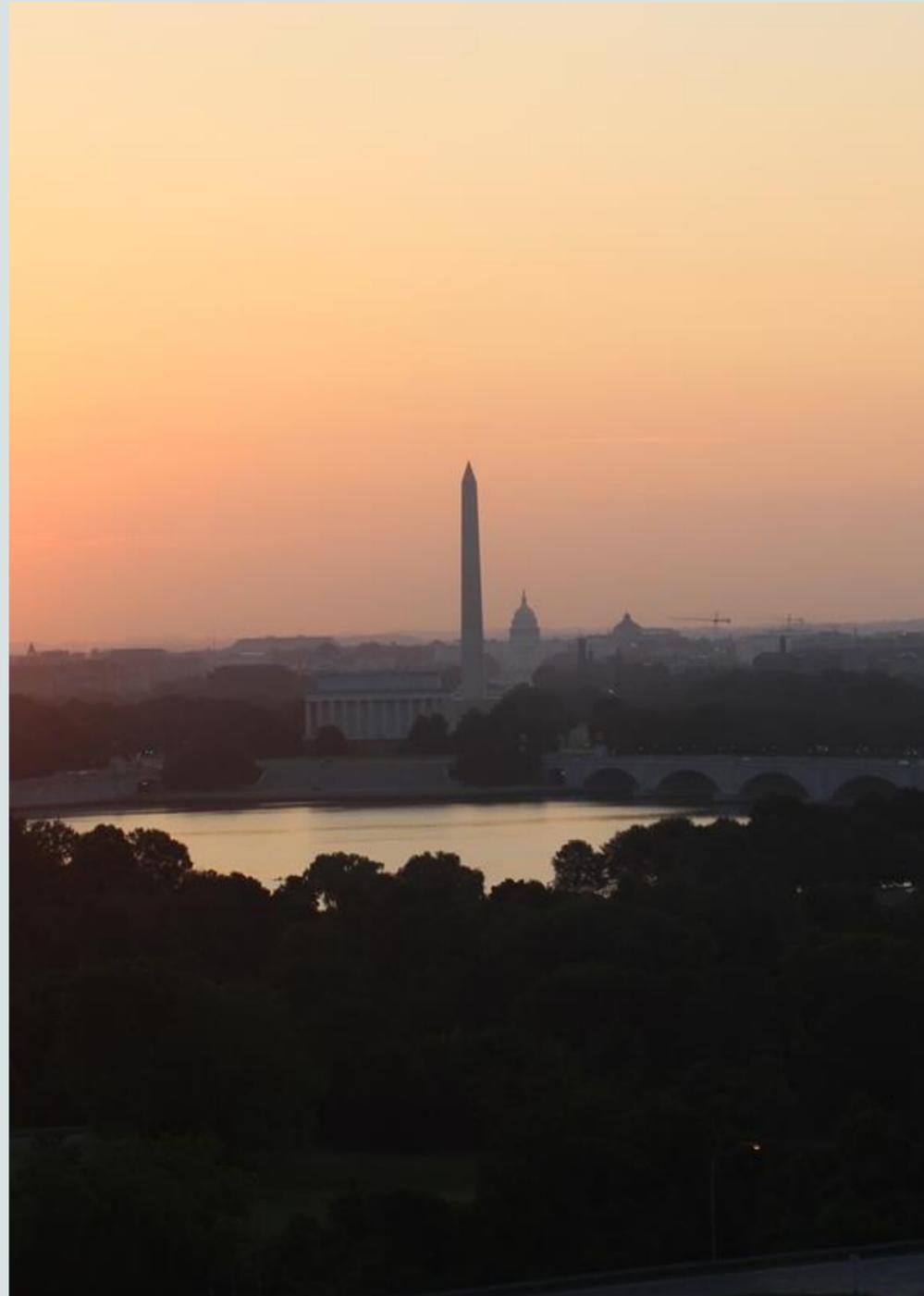
# 2-WIN Data Plot

## ROMO 2WIN vs Optec RH



2-WIN is near ambient, but below Optec RH, likely accounting for small offset, but 2-WIN RH is wellknown, and an upper threshold can be set (<90% RH) so we don't lose data.

# Webcam Network Operations



- The National Capital webcam system was rebuilt and re -installed in the newly reconstructed Netherlands Carillon at Arlington in August 2021.
- NPS Operator site visits remained curtailed in 2021 due to the pandemic and widespread wildfires.
- The Sequoia/Kings Canyon Lower Kaweah webcam system is back in operation wildfire in September 2021.
- NPS data and webcam sites moved from DOI servers in Denver to Amazon Web Services platform in September 2021.
- New image and data elements are now available for embedding in individual park pages at:

<https://www.nps.gov/grca/learn/nature/airquality.htm>

# Low-Cost PM Sensor Data Integrated into Webcam and Live Data Websites

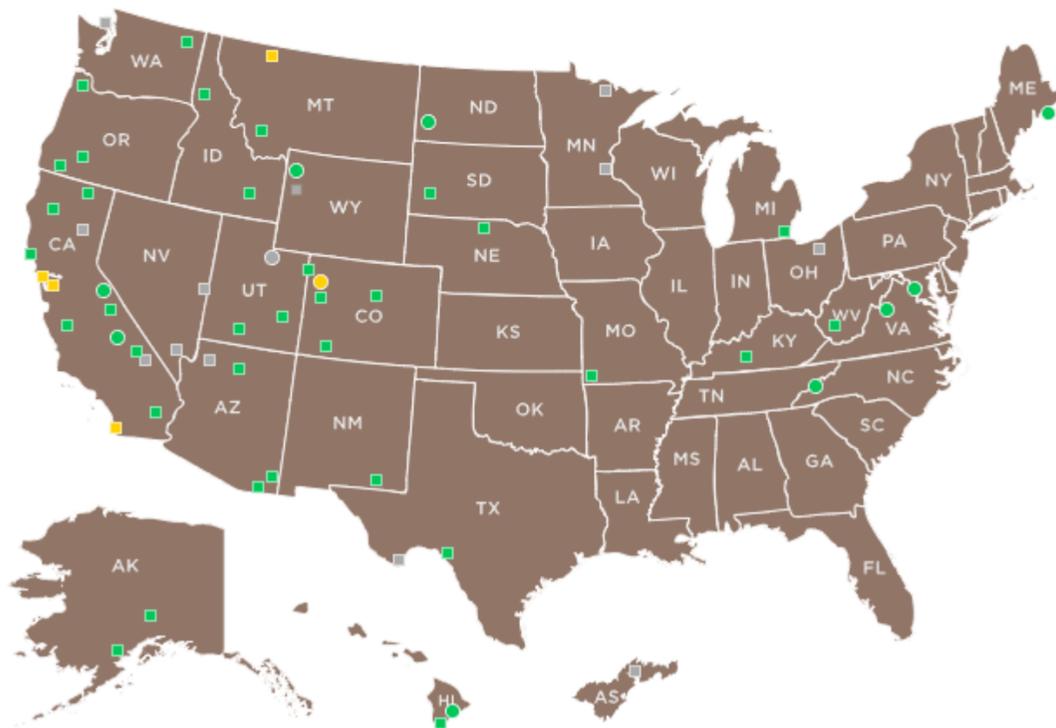
## Live Weather & Air Quality Data

Select a national park

Explore park and park sponsored monitoring locations from the map or list view below.

- Explore by Ozone Map
- Explore by Particulate Map
- Explore by Location

Site colors reflect the current Nowcast Particulate Matter (PM<sub>2.5</sub>) Air Quality Index.  
Click a dot to see more information for that location.



## Mammoth Cave National Park

[More Webcams](#)

**Webcam** | **Air Data & Weather**

### Ozone (O<sub>3</sub>)

CURRENT 1-Hour Average **33 ppb**

CURRENT 8-Hour Average **26 ppb**

Good Moderate Unhealthy for Sensitive Groups Unhealthy Very Unhealthy

Today's Maximum O <sub>3</sub>		Yesterday's Maximum O <sub>3</sub>	
1-Hour Average	33 ppb	1-Hour Average	33 ppb
8-Hour Average	26 ppb	8-Hour Average	31 ppb

Ozone is measured in parts per billion (ppb).  
Updated 11/03/2021 04:00 PM CDT  
Data collected at Houchin Meadow

[Charts](#) | [Ozone Health Effects](#) | [Data Disclaimer](#)

### Particulate Matter (PM<sub>2.5</sub>) - Low Cost Sensor

CURRENT Nowcast Air Quality Index **17**

Good Moderate Unhealthy for Sensitive Groups Unhealthy Very Unhealthy Hazardous

Today's Maximum PM <sub>2.5</sub>		Yesterday's Maximum PM <sub>2.5</sub>	
Nowcast Air Quality Index	17	Nowcast Air Quality Index	18

Particulate Matter is measured in micrograms per cubic meter of air (µg/m<sup>3</sup>) and reported using the Nowcast Air Quality Index.  
Updated 11/03/2021 02:00 PM CDT  
Data collected at Houchin Meadow

[Charts](#) | [Particulate Matter Health Effects](#) | [Data Disclaimer](#)

### Current Air Quality

Ozone (O<sub>3</sub>) **Good** 26 ppb  
Updated 11/03/2021 04:00 PM CDT  
Data collected at Houchin Meadow

Particulate Matter (PM<sub>2.5</sub>) **Good**  
Updated 11/03/2021 02:00 PM CDT  
Data collected at Houchin Meadow

Sulfur Dioxide (SO<sub>2</sub>) **Good** 0 ppb  
Updated 11/03/2021 04:00 PM CDT  
Data collected at Houchin Meadow

Visibility **Distance** 152 Miles  
Updated 11/03/2021 04:00 PM CDT  
Data collected at Houchin Meadow

Standard  Metric  
[See more air data](#)

### Current Weather

Temperature **46 °F**  
Humidity **48 %**  
Precipitation, 1-Hr **0.00 in.**  
Wind **N 4 mph**  
Updated 11/03/2021 03:00 PM CDT  
Data collected at Houchin Meadow

Standard  Metric  
[See more air data](#)

Questions?

