

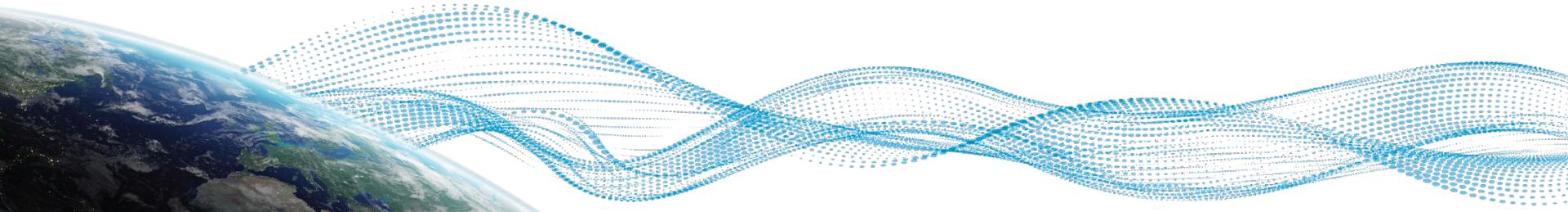
Synoptic.

Sharing Earth's Data

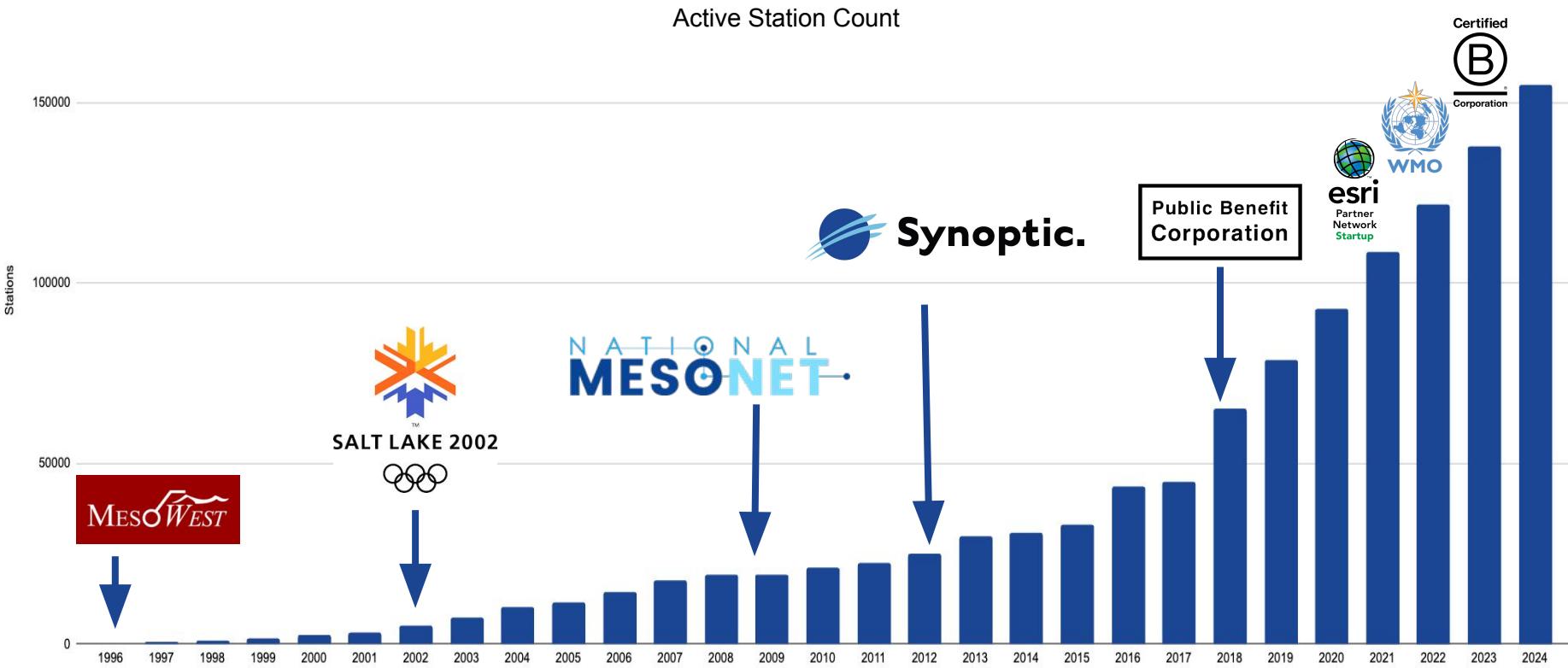
USFS Webinar

Feb 4, 2025

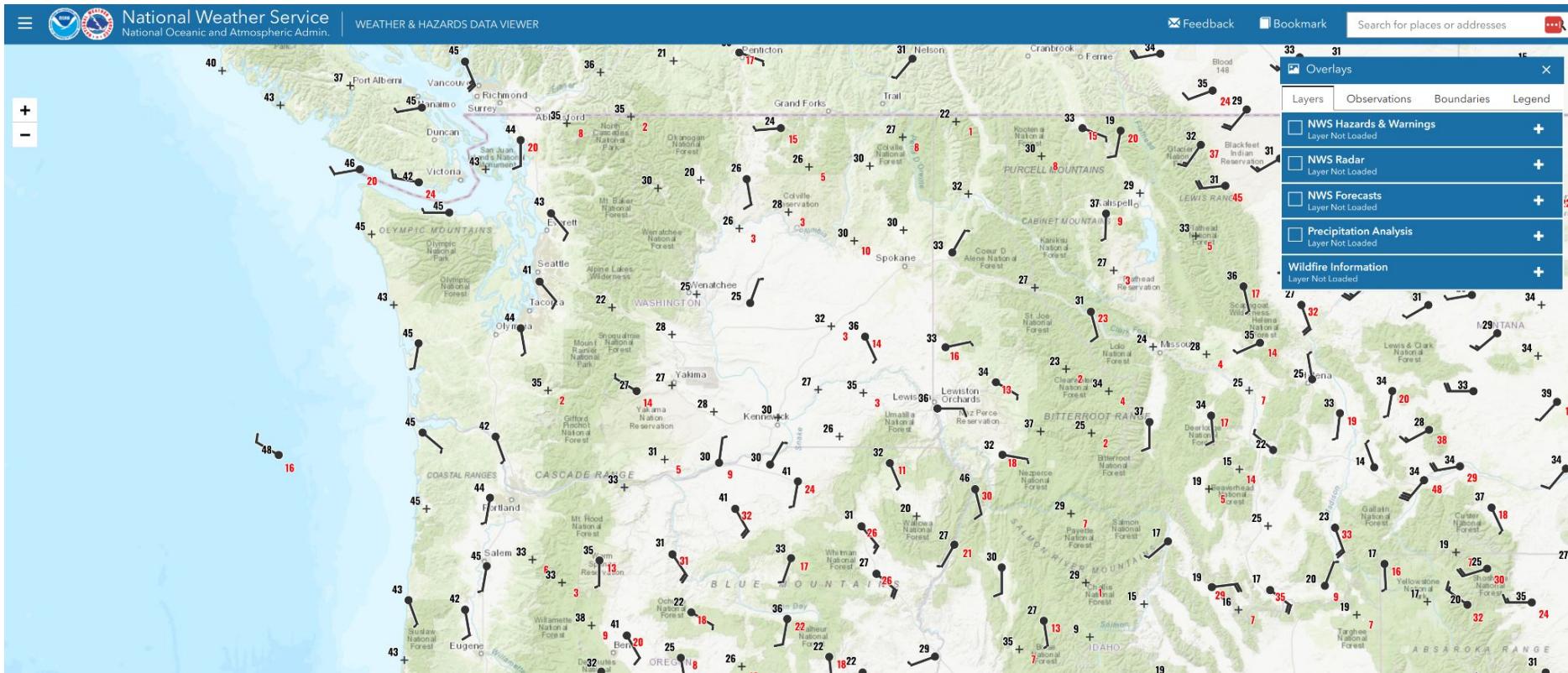
Toby Meierbachtol, Brock Burghardt, Patrick Wright



Company Overview - USFS Partnership



Company Overview - USFS Partnership



Measurement to Dissemination - The Stations, Instruments



- Instantaneous wind speed, direction (anemometer)
- Instantaneous wind speed, direction (sonic)
- Relative humidity
- Temperature, pressure

- Each produces an electric signal that is collected, and processed by a data logger.
- The logger will average, remember what maximum values are within a set interval.
- All or some rolling window of data is stored on the data logger.
- Data is retrieved or more commonly transmitted to some source (home computer, central network server)

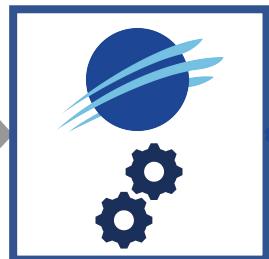
Company Overview - USFS Partnership



Measurement to Dissemination - Synoptic dissemination scaled



Synoptic Data
Mesonet API



US Forest Service



Enterprise,
university
customers, etc

Through robust and scalable back-end processes, Synoptic Data can ingest, process, and disseminate obs from over 100,000 stations

Company Overview - USFS Partnership



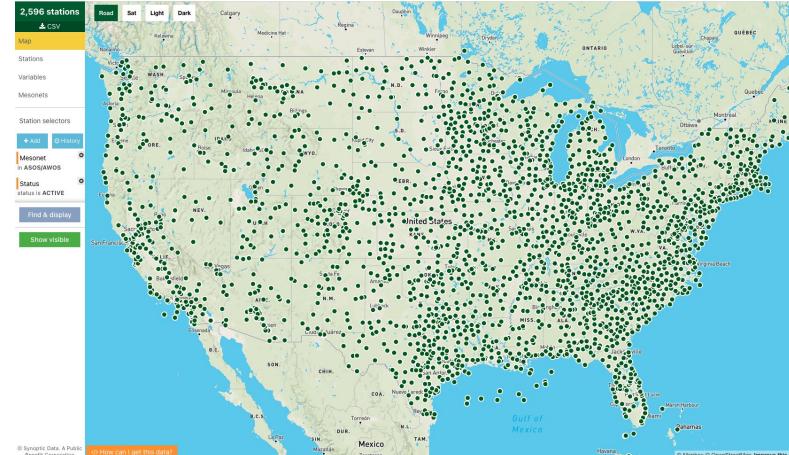
Data Providers - Who are they?

Federal, state, and local governments

Monitoring conditions for transportation safety, emergency response, etc.

Data used internally and often shared publicly

Stations located at airports (ASOS/AWOS), along highways (DOTs), or across cities (e.g. Hennepin county)



Company Overview - USFS Partnership



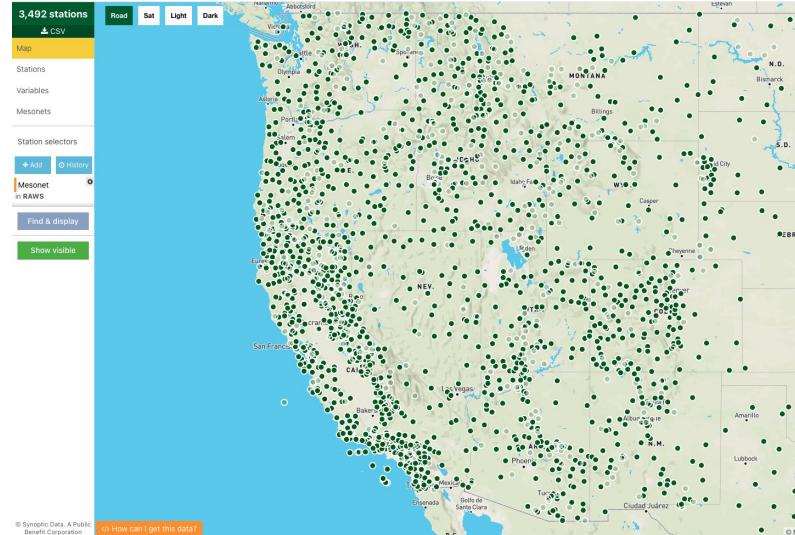
Data Providers - Who are they?

Fire Weather (RAWS, IRAWS)

Monitoring weather conditions related to fire danger, air quality, research

Data used internally and often shared publicly

Stations located most densely across the western US in rugged terrain and fire prone areas



Company Overview - USFS Partnership



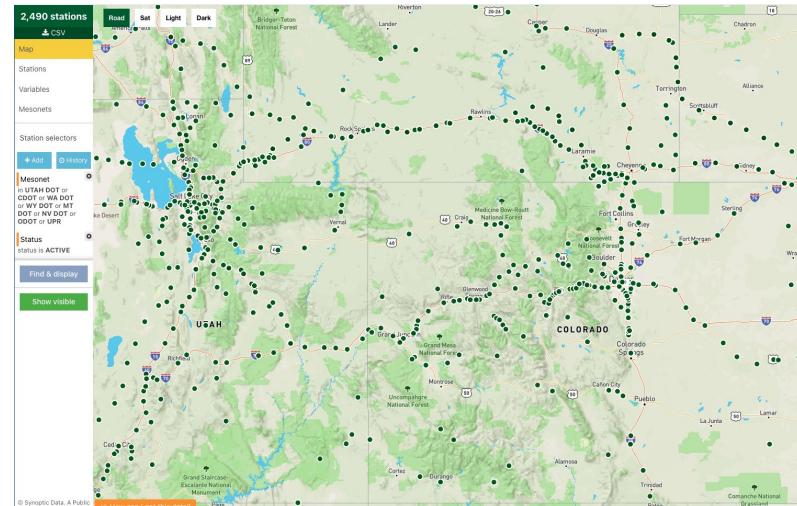
Data Providers - Who are they?

Road and Railway Weather Networks

Monitoring weather conditions near and along railways and roadways

Data used internally and often shared publicly (not always easily accessible)

Stations located along highways and railways



Company Overview - USFS Partnership



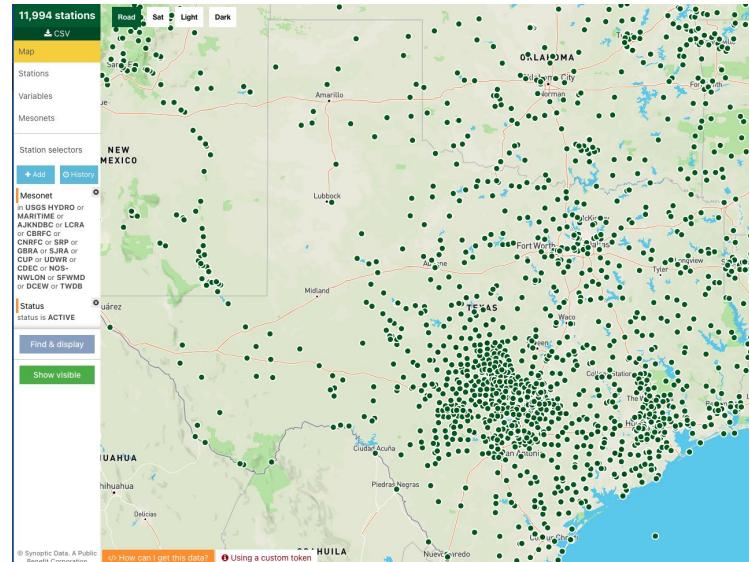
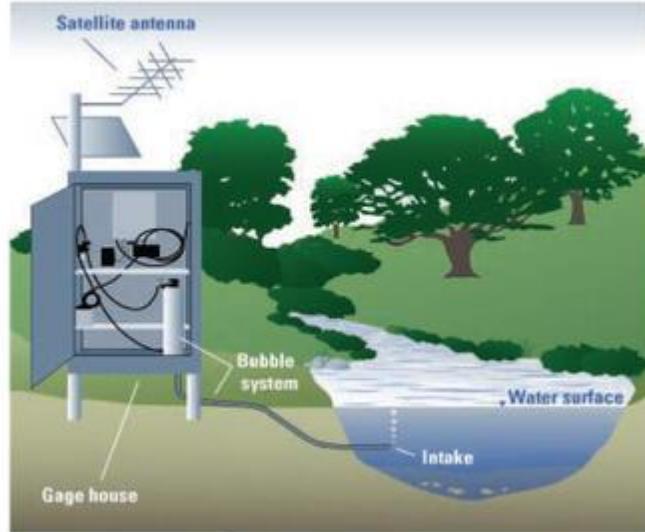
Data Providers - Who are they?

Hydrological Networks

Measuring various water-related variables such as streamflow, water level, water height

Data used internally and often shared publicly

Stations located along streams, rivers, lakes, reservoirs and coastal locations for monitoring water levels, flow, and coastal tsunami hazards



Company Overview - USFS Partnership



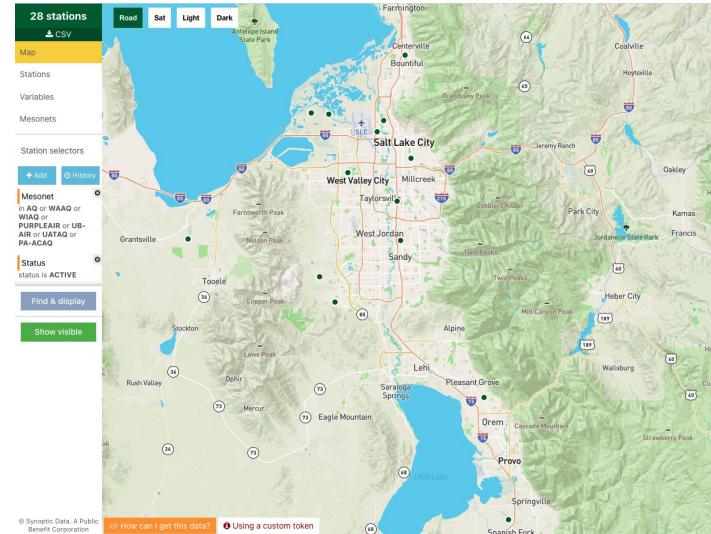
Data Providers - Who are they?

Air Quality Networks

Measuring weather and particulate matter for air quality monitoring

Data used internally and often shared publicly

Stations typically located across certain urban corridors (more personal, home stations coming online)



Company Overview - USFS Partnership



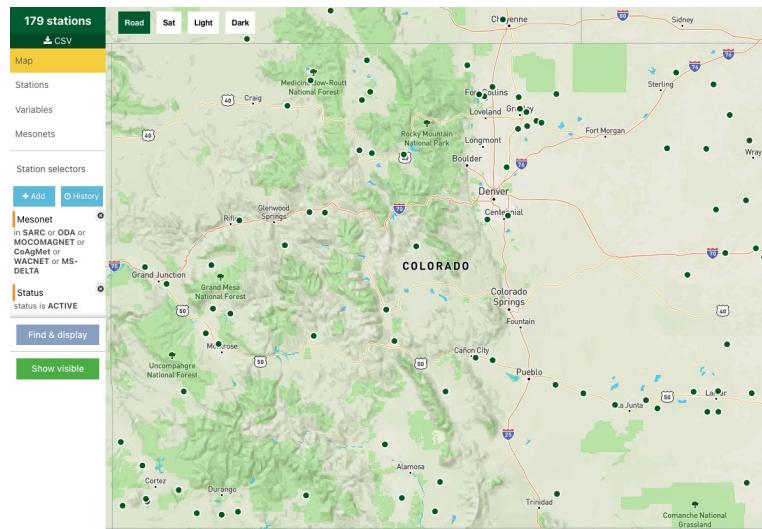
Data Providers - Who are they?

Agricultural Networks

Monitoring weather conditions most impactful to agriculture (e.g. evapotranspiration)

Data used internally and often shared publicly

Stations typically located in more rural and farming communities



Company Overview - USFS Partnership



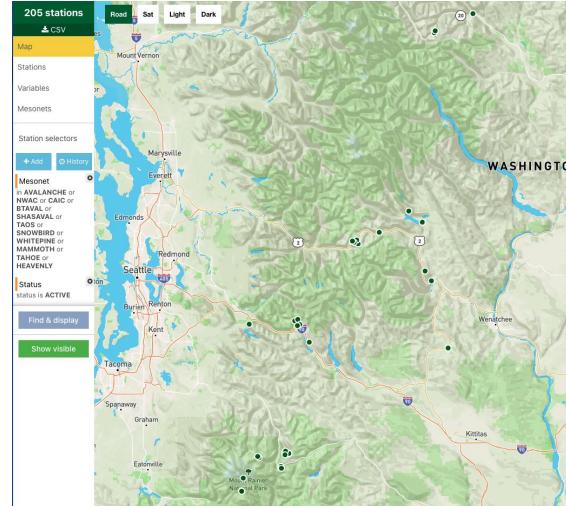
Data Providers - Who are they?

Ski and Avalanche Networks

Monitoring weather conditions impacting on-mountain safety and avalanche conditions

Data used internally and often shared publicly

Stations located in and around ski resorts and avalanche-prone terrain



Company Overview - USFS Partnership



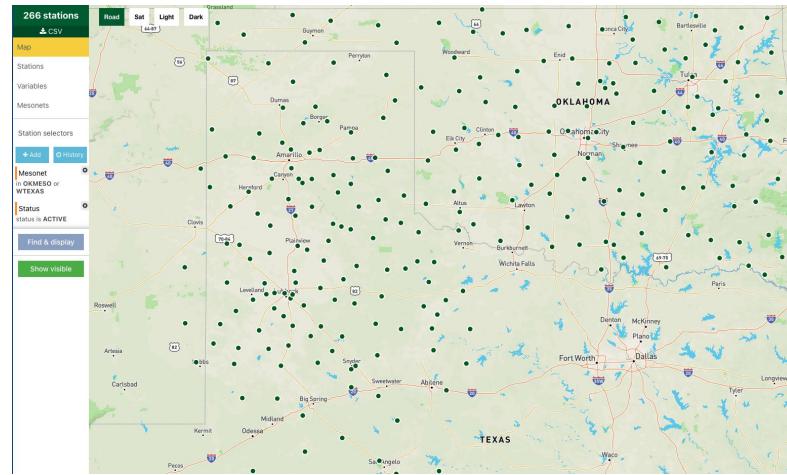
Data Providers - Who are they?

University Mesonets

Monitoring various weather conditions for situational awareness and research

Some data shared publicly, other data is restricted and requires purchase to access

Stations across states where universities have set up (Texas, Oklahoma, Kansas, Illinois, Indiana, New York, and growing!)



Company Overview - USFS Partnership



API Settings	USFS Settings
Spatial	Global Access
Historical	Real-time + full historical
QC	Basic + Advanced QC
Precip	Basic + Advanced QC
API Seats	Unlimited

The screenshot shows a web browser displaying the Synoptic Weather API documentation at docs.synoptictdata.com/services/weather-data-api. The page is titled "Weather API". On the left, there is a sidebar with a tree view under "Web Services" showing categories like "Time Series", "Latest", "Nearest Time", "Precipitation", "Quality Control Segments", "Metadata", "Quality Control Types", "Variables", "Networks", "Network Types", "Latency", and "Weather API Query Builder". The "Weather API" category is expanded. To the right, the main content area has two columns. The left column is titled "Data" and lists services: "Time Series", "Latest", "Nearest Time", "Precipitation", "Quality Control Segments", "Metadata", "Quality Control Types", "Variables", "Networks", "Network Types", and "Latency". The right column is titled "Metadata" and lists services: "Time Series", "Latest", "Nearest Time", "Precipitation", "Quality Control Segments", "Metadata", "Quality Control Types", "Variables", "Networks", and "Network Types". At the top right of the page, there are links for "Synoptic Data", "Pricing", and "My Account", with "My Account" being highlighted with a red box.

For new signups please use usda.gov email and put “USFS” under ‘company’

Company Overview - USFS Partnership



customer.synopticdata.com/credentials/

Synoptic. brock.burghardt@synopticdata.com sign_out BR

[My Profile](#) [Data credentials](#)

Synoptic's main data products deliver data and information authenticated with public API tokens. There's no cost to having keys and tokens, and you can have as many tokens or keys as you need. Remember that keys are to be kept secret, and can be used by your applications to create more tokens.

- [Build with Synoptic](#)
- [Learn more about data access credentials](#)
- [Elevate your token security by rotating](#)

Private keys

Keys are used to manage tokens. You cannot make requests with our data products using keys.

Key	Created
Kuz89if3FGdEa1YI62U3efSDS6N1ZNqbtvYGpXI3p	13 Dec 2024

[Create a key](#)

Public tokens

We are currently limited to showing you up to the first 100 tokens on your account.

Token value
3269e07b602745e392644e8d58629e50

[Create token](#)

Edit Token CLOSE

Protected
Protect token from being deleted.

Http Origins

https://synopticdata.com,
https://staging.synopticdata.com,

Limit your token usage to specific domains. Add multiple URLs by supplying a comma separated list. [Read more about this setting](#)

Save

Product Overview



Our products are generally grouped into two main categories:

Value-add derivatives on top the raw data

- QC
- Precip
- Stats & percentiles (*planned release Feb, 2025*)

Ways you can access the data

- Viewer
- Push Service
- Weather API

Accessing data and services <mostly> through token-based permissions. Tokens can be created from a Synoptic account

Product Overview



Quality Control

- ‘Erroneous’ data: sensor failure, calibration, transmission, siting
 - Large outliers easier, localized/seasonal outliers harder
 - All QC performed in “real time” and delivered alongside data
 - R&D for QC procedures over last ~decade. Recently re-processed historical QC using current test suite (from 1997 forward, all stations)
 - Available via API, Push, Viewer/dashboards
-
- **Basic QC:** Range, Rate-of-change, Persistence checks
 - **Advanced QC:** Spatial and Percentile checks
 - More to come...

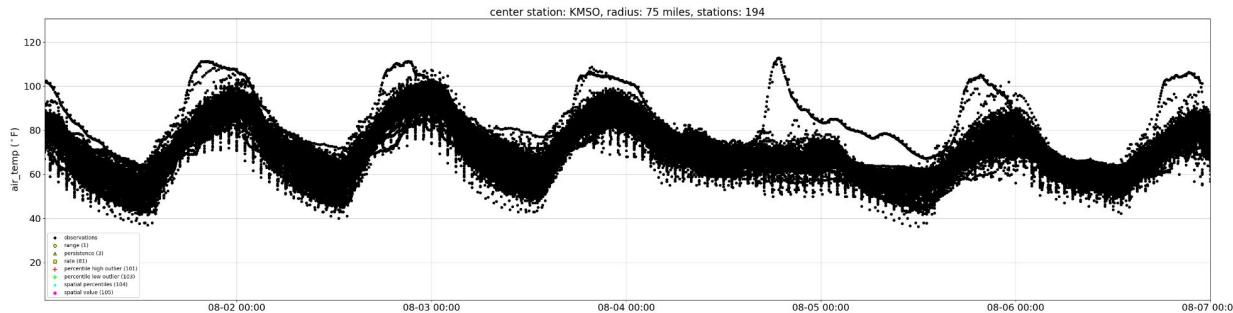
<https://docs.synopticdata.com/services/mesonet-data-qc>

Product Overview

Quality Control

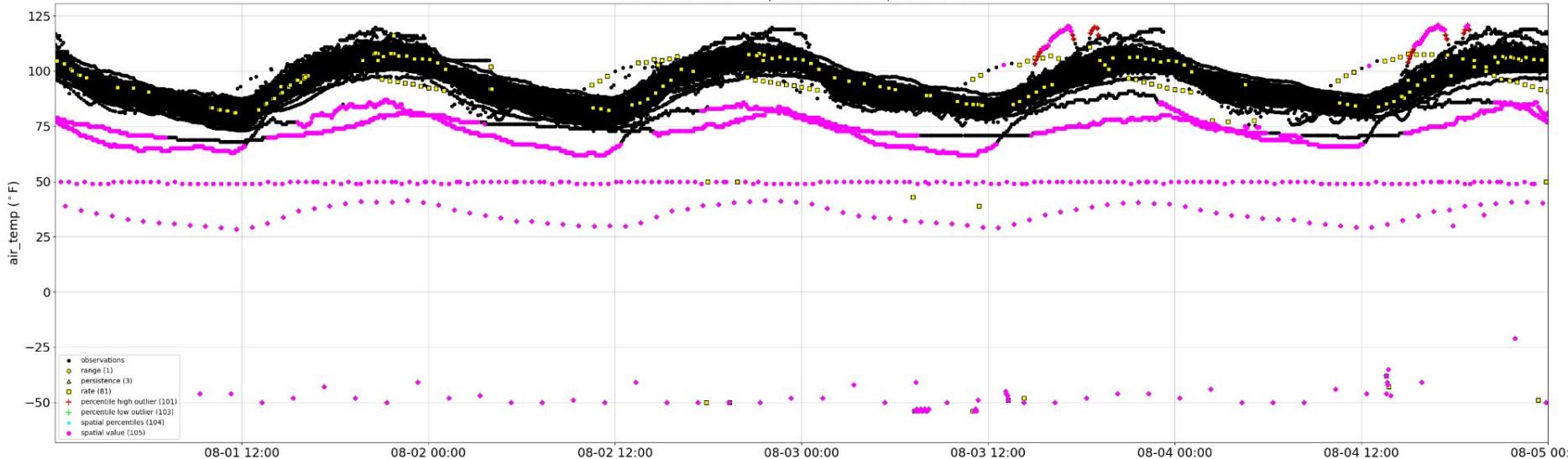
August 2024

KMSO, radius 75 miles, 194 stations



Dallas, radius 25 miles, 581 stations

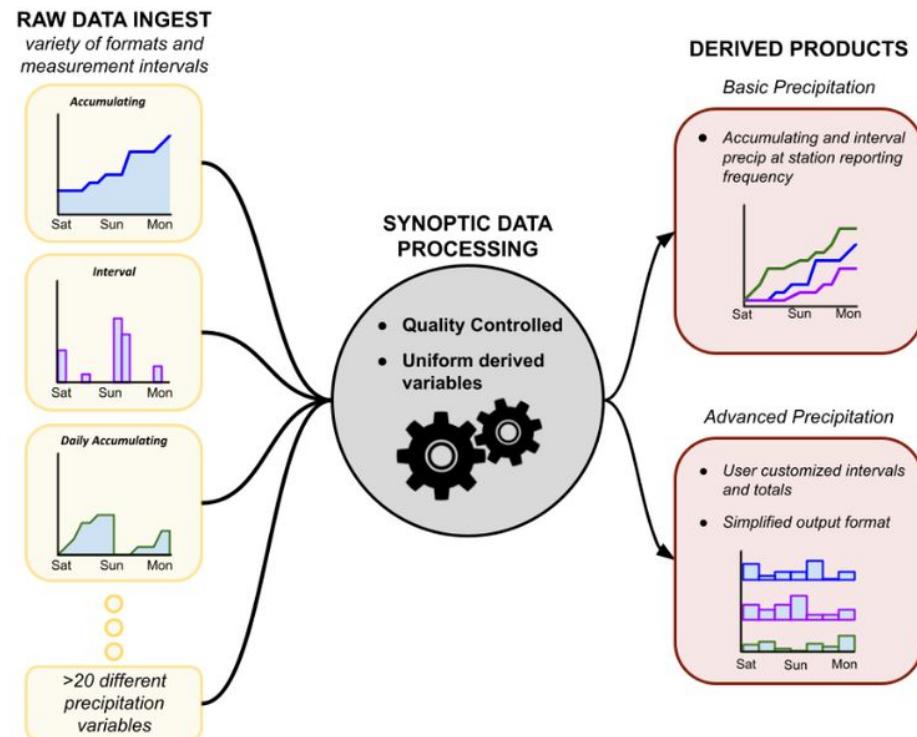
center station: GPT10, radius: 25 miles, stations: 581



Product Overview

Precipitation Service

- The large variety of precipitation variables makes it challenging for users to compare precipitation across different weather stations
- Precipitation service: uniform format for precipitation data through our API.
- Request intervals & totals across various networks or geographic regions

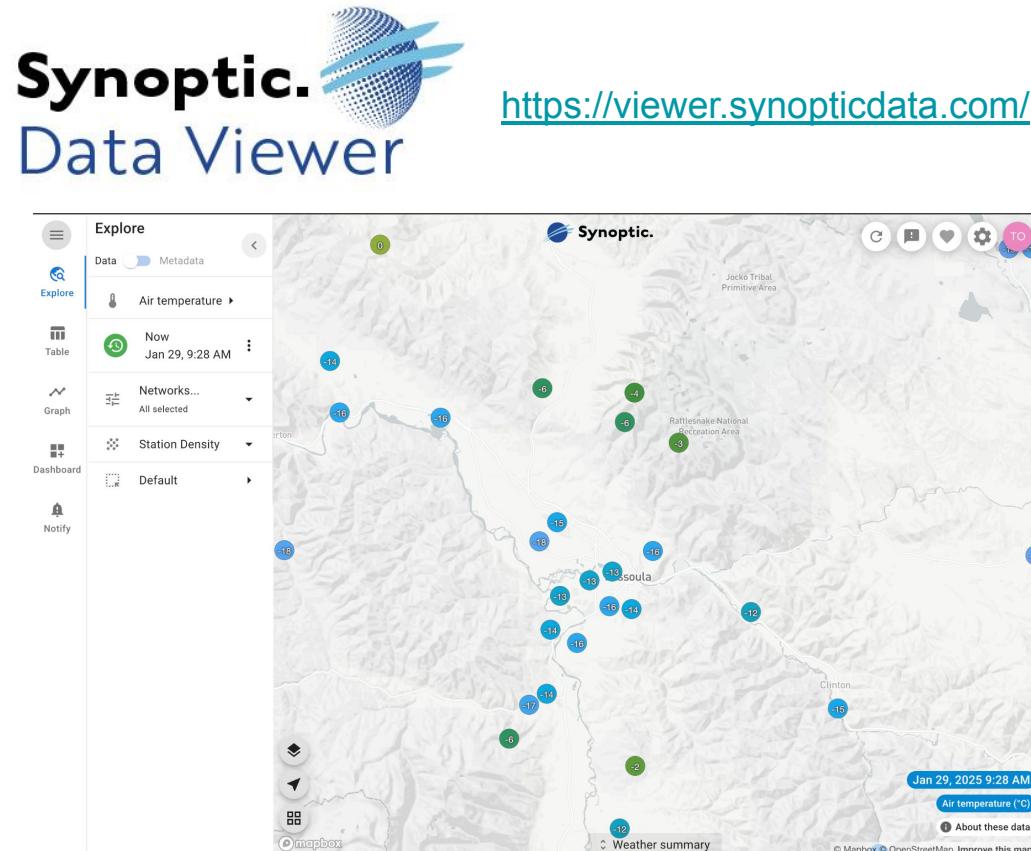


Product Overview - Data Access



Data Viewer

- Pages & settings
- Favorites and share-able url
- Station discovery – metadata explorer
- Feedback is encouraged!



Product Overview - Data Access



Data Download tool

- csv download
- No time volume restrictions
- Single station
- Must be signed in

```
# The provisional data available here are intended for diverse user applications.  
# For data required for a court of law or regulatory purposes, review the information  
# available from the NCEI (https://www.ncdc.noaa.gov/customer-support/certification-data)  
# or consult a CCM (http://www.nicm.org).  
# STATION: KMSO  
# STATION NAME: Missoula, Missoula International Airport  
# LATITUDE: 46.92083  
# LONGITUDE: -114.09250  
# ELEVATION [ft]: 3199.0  
# STATE: MT  
Station_ID,Date_Time,air_temp_set_1,relative_humidity_set_1,wind_speed_set_1,wind_gust_set_1  
,,Celsius,%,,m/s,m/s  
KMSO,2025-02-02T12:00:00Z,-4.0,100.0,2.06,  
KMSO,2025-02-02T12:05:00Z,-4.0,92.73,2.57,  
KMSO,2025-02-02T12:10:00Z,-4.0,92.73,2.57,  
KMSO,2025-02-02T12:15:00Z,-4.0,100.0,2.57,  
KMSO,2025-02-02T12:20:00Z,-4.0,92.73,2.57,  
KMSO,2025-02-02T12:25:00Z,-4.0,92.73,2.57,  
KMSO,2025-02-02T12:30:00Z,-4.0,92.73,2.06,  
KMSO,2025-02-02T12:35:00Z,-4.0,92.73,2.06,  
KMSO,2025-02-02T12:40:00Z,-4.0,100.0,2.57,  
KMSO,2025-02-02T12:45:00Z,-3.0,86.04,2.57,
```

<https://download.synopticdata.com/>

The screenshot shows the Synoptic Data Download tool interface. At the top, there is a navigation bar with the Synoptic logo, a star icon, 'New Download', 'Downloads (0)', '7 remaining', 'Docs', and a sign-out button. Below the navigation bar is a message box containing text about provisional data usage and links to NCEI and CCM information, along with a 'Review our data disclaimer for details' link. The main area has a heading 'Make a new download request. Learn more!' and a 'Choose Station' section.

Choose Station

You can download data from one station at a time. Search for a station ID and pick the one you want from the list that appears below.

You can also hit [enter] to force-select a given STID (if it is not valid we'll let you know)

Search station names and IDs

Dates

UTC

Start Earliest: End Latest:

Variables

The following variables can be downloaded from this station. Not every observation will contain all variables.

Units: Metric English

Select a station to see variables.

Product Overview - Data Access

Push Service

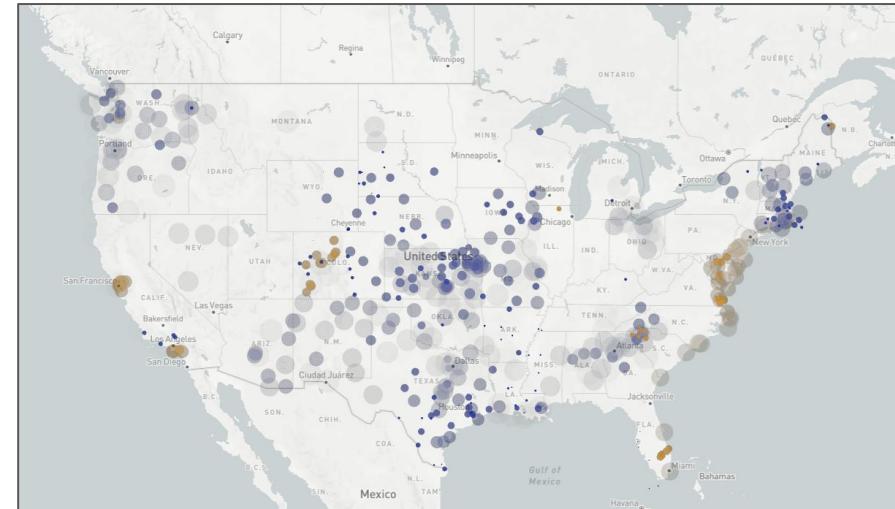
- Data is “pushed” via streaming websocket connection
- Useful for monitoring/alerting with minimized latency
- Standard API arguments to isolate data of interest, as well as `filter_on` which allows filtering on conditional statements (<, >, etc)

Map demo:

<https://demos.synopticdata.com/push-map/>

Viewer streaming:

<https://viewer.synopticdata.com/stream>



<< BREAK >>

Product Overview - API tutorial



Overview of Mesonet API services

Timeseries: Return station data (& metadata) for defined time range. Synoptic archive to 1997.

Latest: Return the single most recent observation

Nearest: Return single nearest-in-time observation

Precipitation: Access to derived precip product (totals, intervals, etc)

Metadata: Retrieve comprehensive station metadata

<https://docs.synopticdata.com/services/>

Station selection parameters:
stid, network, country, state,
county, nwszone, nwsfirezone,
gacc, subgacc, radius, bbox

260k stations
360 networks
238 variables

Statistics and Percentiles: Planned release in Feb 2025!

Product Overview - API tutorial



Basic request & JSON structure

JSON viewer browser extension recommended

Latest request, 100 mile radius from KMSO (limit 50), within last 2 hrs (air temp, wind speed, wind gust)

[https://api.synopticdata.com/v2/stations/latest?radius=kmso,100&limit=50&within=120&vars=air_temp,wind_speed,wind_gust&complete&sensorvars&qc_checks=synopticlabs&qc_flags=on&token=\[mytoken\]](https://api.synopticdata.com/v2/stations/latest?radius=kmso,100&limit=50&within=120&vars=air_temp,wind_speed,wind_gust&complete&sensorvars&qc_checks=synopticlabs&qc_flags=on&token=[mytoken])

Timeseries request, recent 24 hrs, RAWS, state of MT (air temp, wind speed, wind gust)

[https://api.synopticdata.com/v2/stations/timeseries?recent=1440&state=mt&network=2&vars=air_temp,wind_speed,wind_gust&complete&sensorvars&qc_checks=synopticlabs&qc_flags=on&token=\[mytoken\]](https://api.synopticdata.com/v2/stations/timeseries?recent=1440&state=mt&network=2&vars=air_temp,wind_speed,wind_gust&complete&sensorvars&qc_checks=synopticlabs&qc_flags=on&token=[mytoken])

Free trial token for webinar: **07a920b581a1444a97ab4b722d6c9ed9**

Use cases

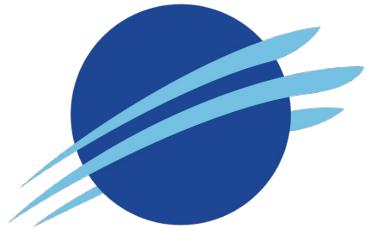


Public repository with use cases (and slide deck for reference).

<https://github.com/synoptic/USFS-webinar-2025>

Can load the .ipynb files directly into Google colab for following along & updating:

<https://colab.research.google.com/>



Synoptic.

Sharing Earth's Data

Thank You

