



United States Department of Agriculture



# Air and Water Database (AWDB) Tools

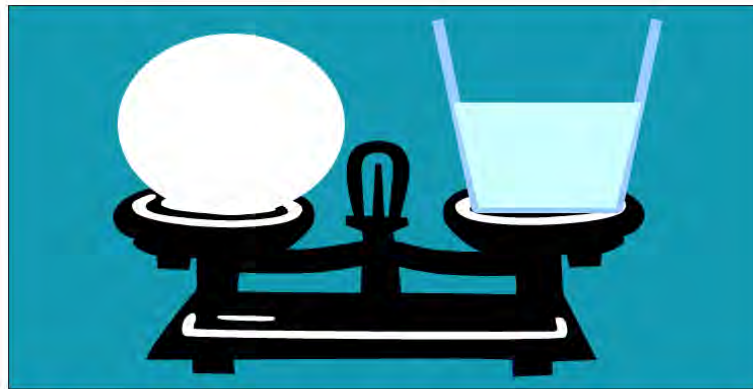
June 6<sup>th</sup>, 2024 | Beau Uriona

Natural  
Resources  
Conservation  
Service

[nrcs.usda.gov/](https://nrcs.usda.gov/)

# Snow Water Equivalent

**Snow Water Equivalent (SWE) is a commonly used measurement used by hydrologists and water managers to gage amount of liquid water contained within snowpack. It is amount of water that will be released from snowpack when it melts.**



Weight of Frozen water (SWE) = Weight of liquid water

## **SWE varies with density**

**In general, 1" SWE = 10" of new snow (10% density)**

**Light powder 1" SWE = 25" new snow (4% density)**

**Heavy "Sierra cement" 1" SWE = 5" new snow (20% density)**



# The visionary



Photo Credit: UNR Archive UNRS-P2004-18-331

Scientist:  
Father of Snow Surveying



## Dr. James E. Church 1869-1959



Photo Credit: UNR Archive UNRS-P1988-63-096

World Traveler:  
Established snow surveys in  
Himalaya and Andes at age 78.  
His goal was to solve water disputes  
and create world peace.



Photo Credit: UNR Archive  
UNRA-P1747-1

Classics Professor  
University of Nevada, Reno  
Taught: German, Latin,  
Literature, Art History  
Helped establish Nevada Art  
Museum



**1906** Established the Mt Rose Observatory



**1910** First Western Water Supply Forecasts for Lake Tahoe Rise with assistance of HP Boardman, Dept of Engineering University of Nevada Reno



Dr. Church and his wife, Florence

**1908–1909**

Invented the Mt. Rose Sampler and scale to measure water content



# Snow Courses



- Snow courses are permanent snow measuring locations marked at endpoints by signs on poles or trees
- Typical snow courses have 5 – 10 measurement points spaced at 50 feet
- Middle points sometimes marked by poles too



## Snow Course Measurement

Snow tube inserted into snow and weighed to measure water content.  
+300,000 snow course measurements to date

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Until the 1970's almost all snow measurements were done by hand.

There are records for > 2,400 U.S snow courses in the NRCS Air & Water Database

Today about 1,040 are still active



# Snow Surveys Spread



- **Good results around Tahoe = spread**
  - 1917 California – Sacramento and San Joaquin Basins
  - 1919 Nevada – Truckee, Carson and Walker  
Wyoming – USBOR – Jackson Lake
  - 1920 Idaho – Coeur d’Alene Basin  
Washington – Lake Chelan Basin
  - 1922 Montana – Glacier NP
  - 1923 Utah Cooperative Snow Surveys
  - 1925 California – LA Dept. of Water and Power in Owens River
  - 1928 Oregon Cooperative Snow Surveys
- **These programs were administered separately**



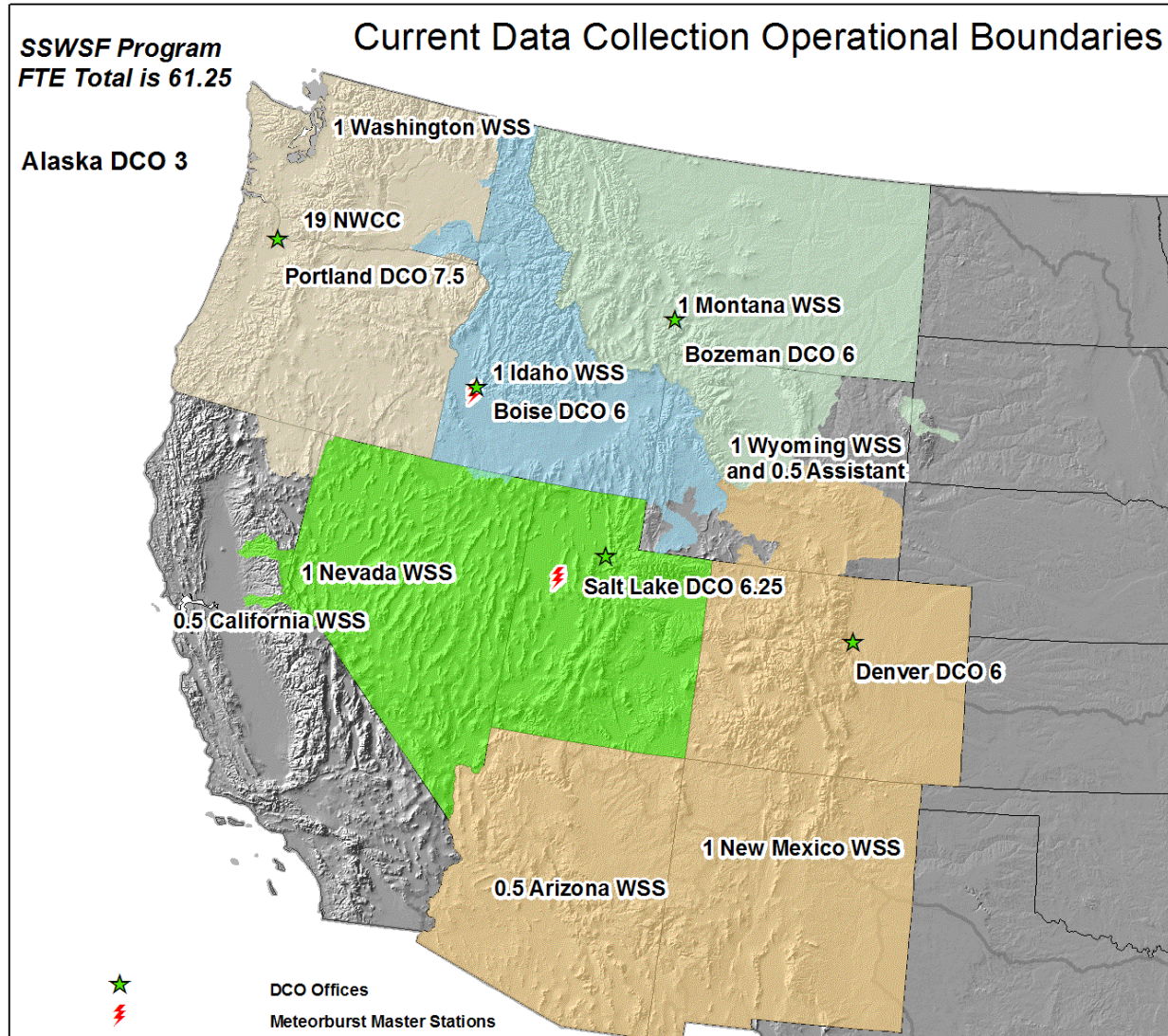


# Overview of Today's NRCS hydroclimatic data collection network

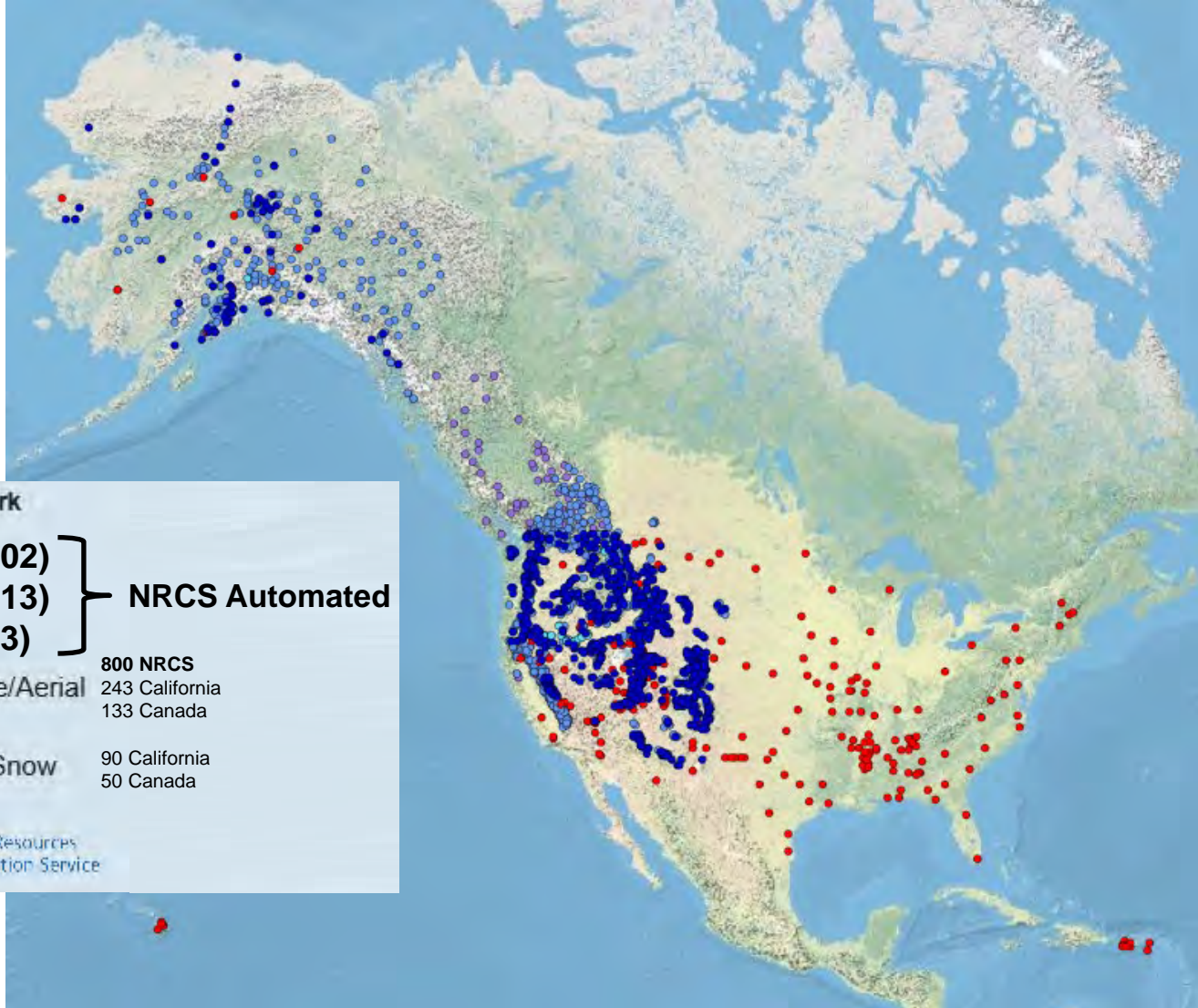


# Organizational Structure

- CO, ID, MT, OR, UT and AK are Data Collection Offices (DCOs)
- Forecasting mostly consolidated in Portland at National Water and Climate Center (NWCC)
- AZ, CA, NM, NV, WA are Water Supply States (WSS's)



# Types of Sites



**Stations by Network**

	SNOTEL (902)	} <b>NRCS Automated</b>
	SCAN (213)	
	SNOLITE (43)	
	Snow Course/Aerial Marker	800 NRCS 243 California 133 Canada
	Cooperator Snow Sensors	90 California 50 Canada

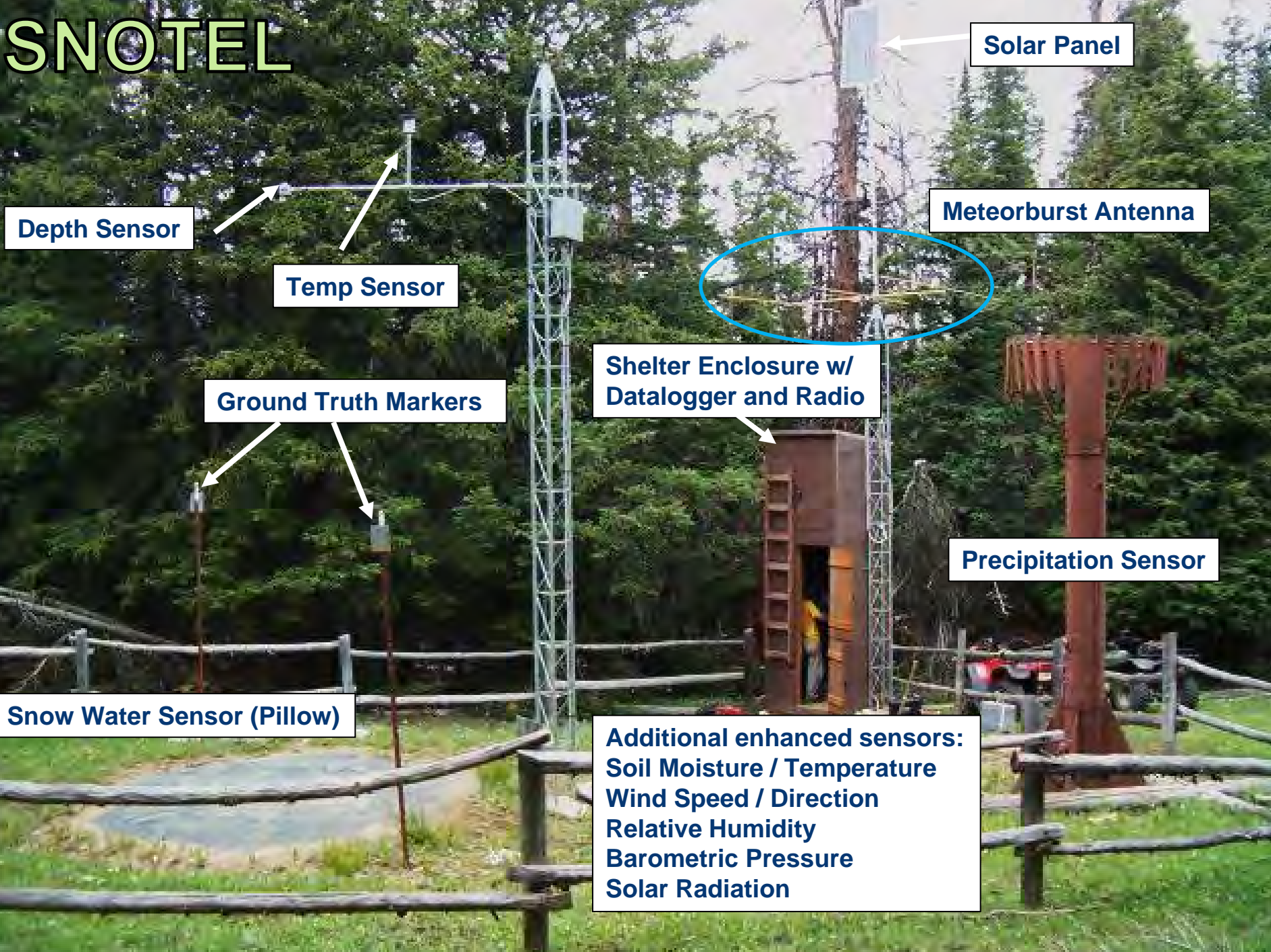
**NRCS** Natural Resources Conservation Service

Natural Resources Conservation Service

[nrcs.usda.gov/](http://nrcs.usda.gov/)



# SNOTEL



Solar Panel

Meteorburst Antenna

Depth Sensor

Temp Sensor

Ground Truth Markers

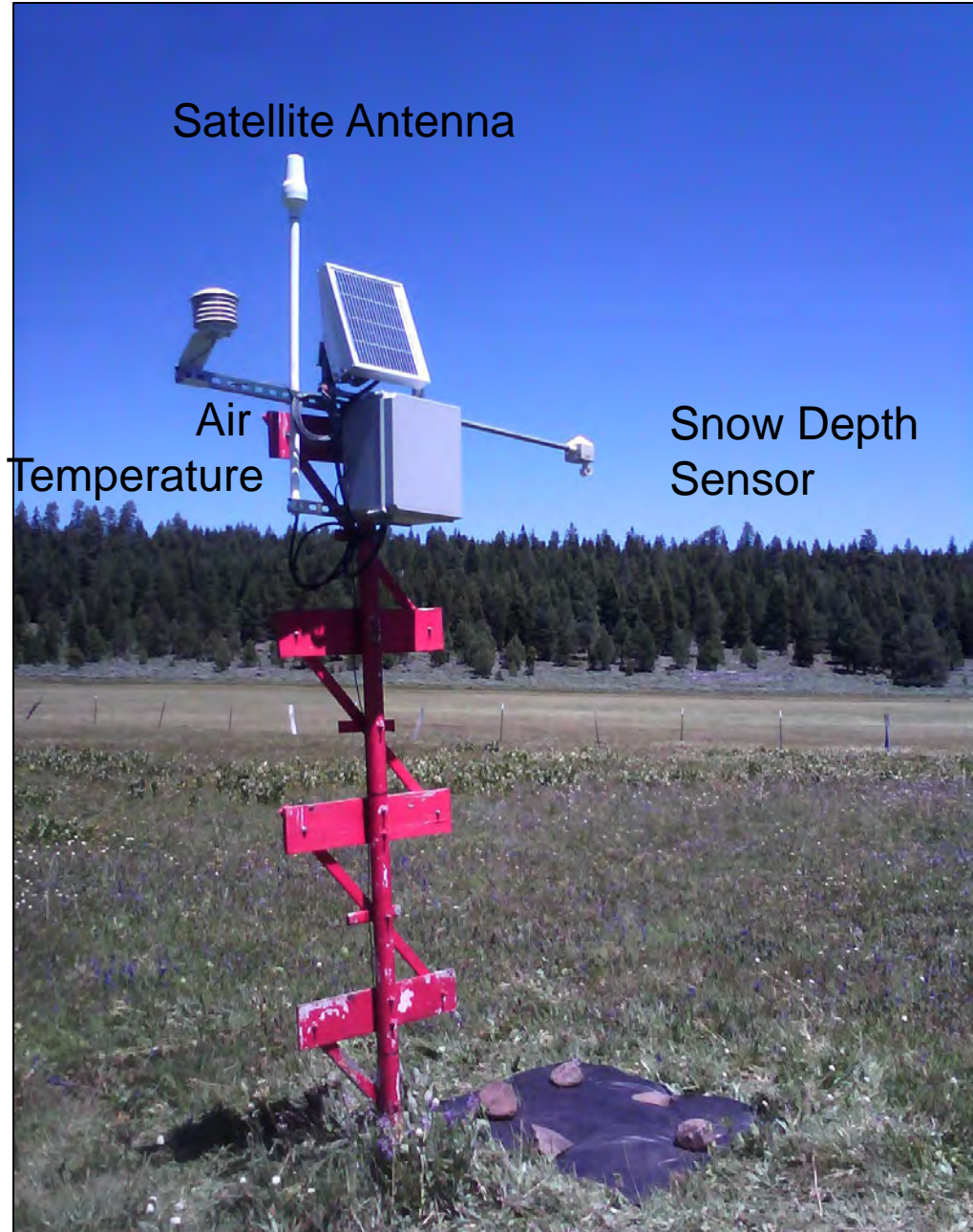
Shelter Enclosure w/  
Datalogger and Radio

Precipitation Sensor

Snow Water Sensor (Pillow)

Additional enhanced sensors:  
Soil Moisture / Temperature  
Wind Speed / Direction  
Relative Humidity  
Barometric Pressure  
Solar Radiation

# Snolite



Satellite Antenna

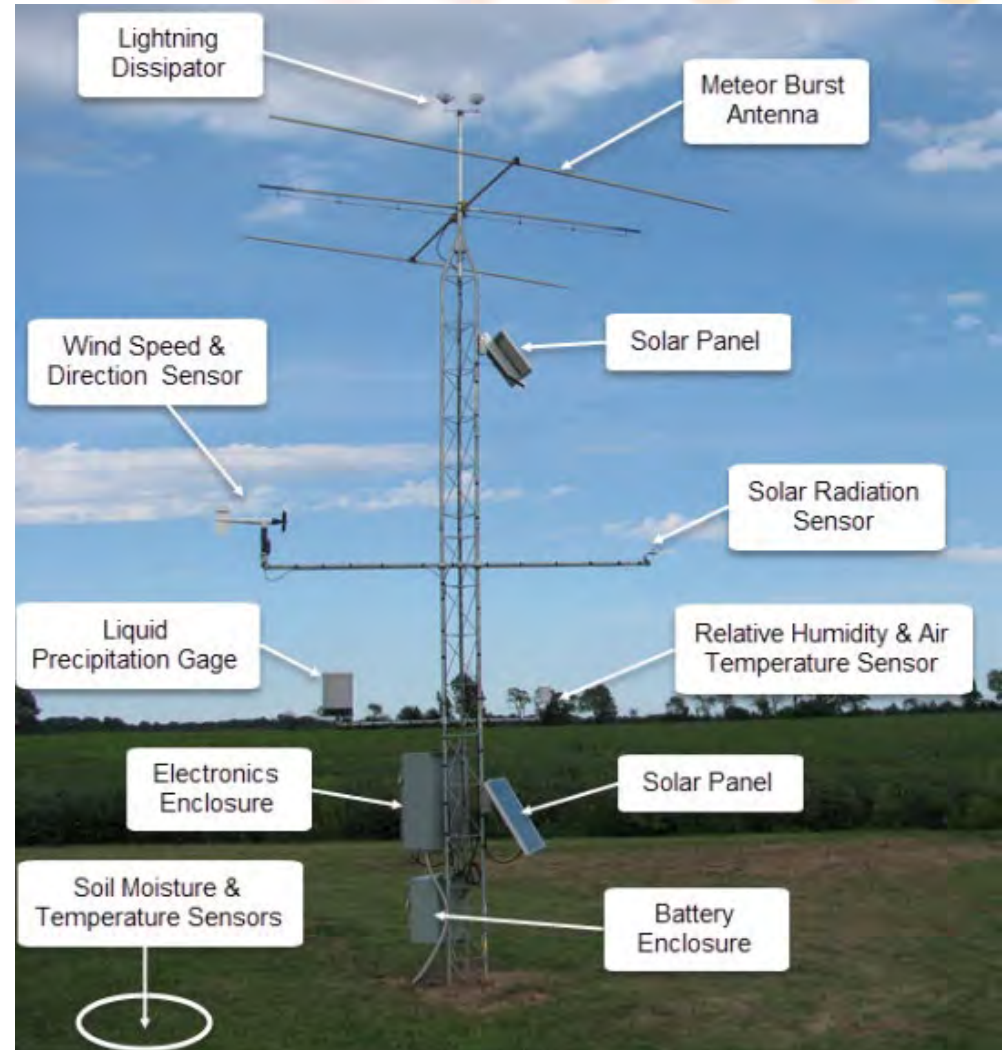
Air  
Temperature

Snow Depth  
Sensor

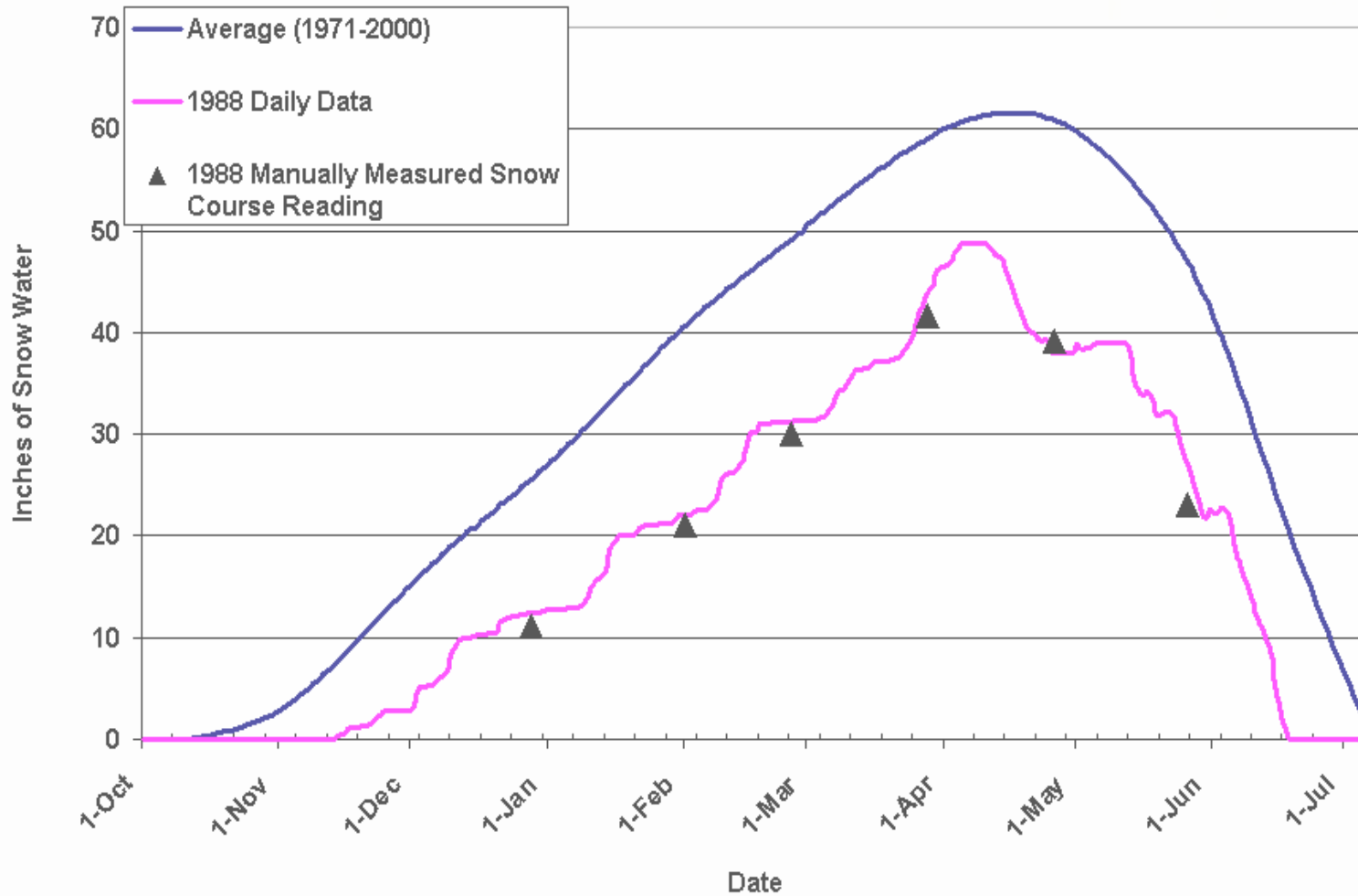


# Soil Climate Analysis Network (SCAN)

- Wind Speed
- Wind Direction
- Air Temperature
- Relative Humidity
- Solar Radiation
- Precipitation
- Soil Water Content & Temp  
at 2", 4", 8", 20", 40"



## Lost Lake Daily Data vs. Monthly Data



# Non-NRCS Datasets used in Seasonal Streamflow Forecasting

- **Streamflow Gage Data**
  - **USGS, Various State/Federal Water Agencies, Water Conservancy Districts, Canadian Water Agencies**
    - **Mostly automatically ingestion (daily data), some manual (monthly to semi-monthly)**
    - **Unregulated flows (monthly to semi-monthly SRVO) calculated based on mass balance adjustments**
- **Reservoir Storage**
  - **Mostly USBR & USACE, some local and regional agencies**
    - **Mostly automatic ingestion (daily data), some manual (monthly to semi-monthly)**
    - **Used in Streamflow Adjustment Calculator (SAC) for unregulated flow calculations (SRVO)**
- **Non-NRCS Meteorological Stations**
  - **Mostly ACIS & CADWR, some cooperators in Canada as well**
- **Non-NRCS Snow Surveys**
  - **Mostly CADWR and Canadian Partners (AB and BC)**



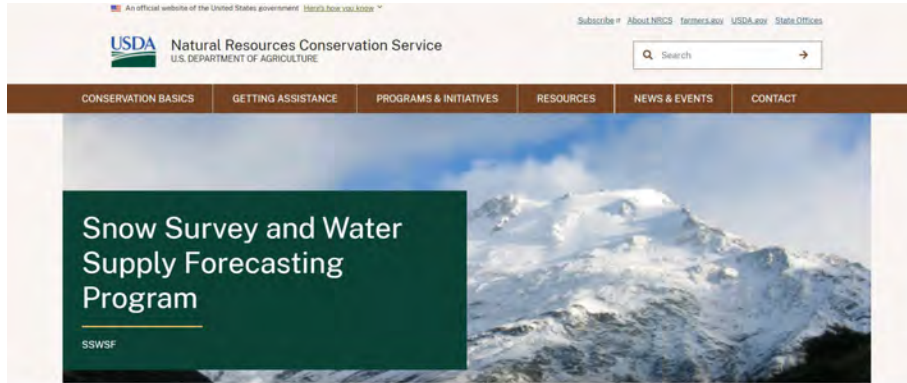




# Get the Data

## National Water and Climate Center Homepage

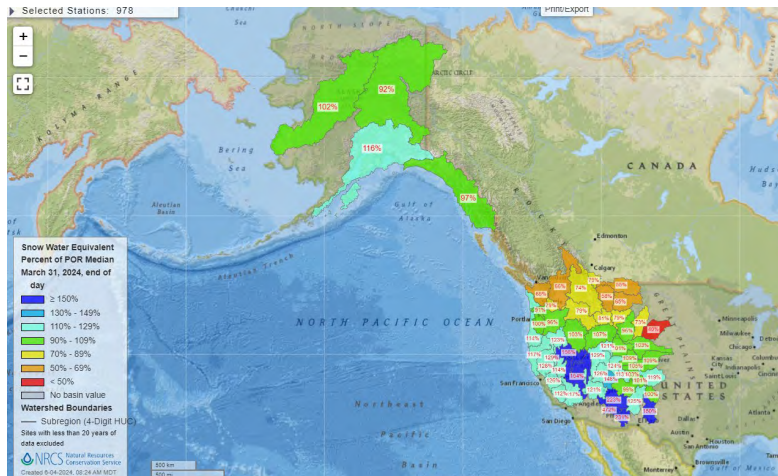
<https://www.nrcs.usda.gov/programs-initiatives/sswsf-snow-survey-and-water-supply-forecasting-program>



Informational/Context

## National Water and Climate Center Applications (nwcc-apps)

<https://nwcc-apps.sc.egov.usda.gov/imap/>



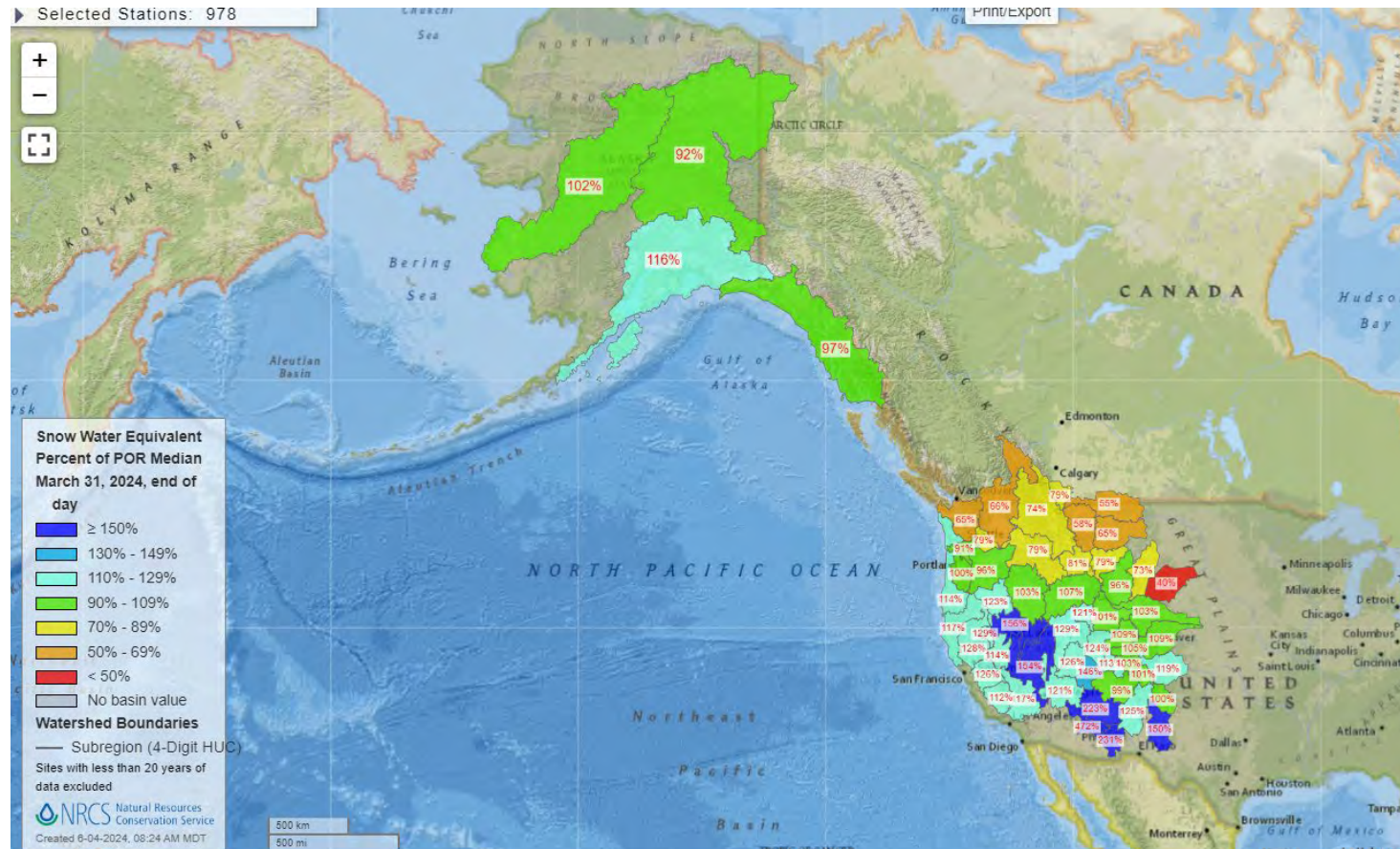
Operational/Data Driven Tools and Products



# Get the Data

## Interactive Map (imap)

<https://nwcc-apps.sc.egov.usda.gov/imap/>



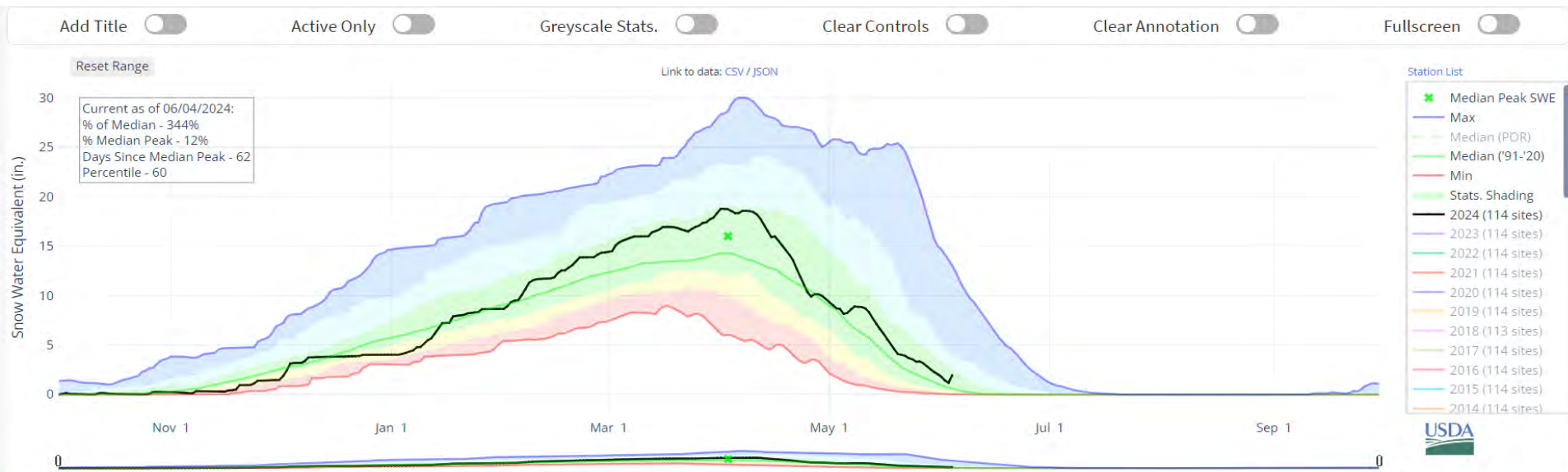
# Get the Data

## Air, Water, and Soil Plots (aws plots)

<https://nwcc-apps.sc.egov.usda.gov/site-plots/> - site/station basis

<https://nwcc-apps.sc.egov.usda.gov/huc-plots/> - Hydrologic Unit Code (HUC) basis

<https://nwcc-apps.sc.egov.usda.gov/basin-plots/#UT> - state "custom" basin basis



Statistical shading percentiles are calculated from period of record (POR) data, excluding the current water year. Percentile categories range from: minimum to 10th percentile, 10th - 30th, 30th - 70th, 70th - 90th, and 90th - maximum.

For more information visit: [30-Year Hydroclimatic Normals](#)

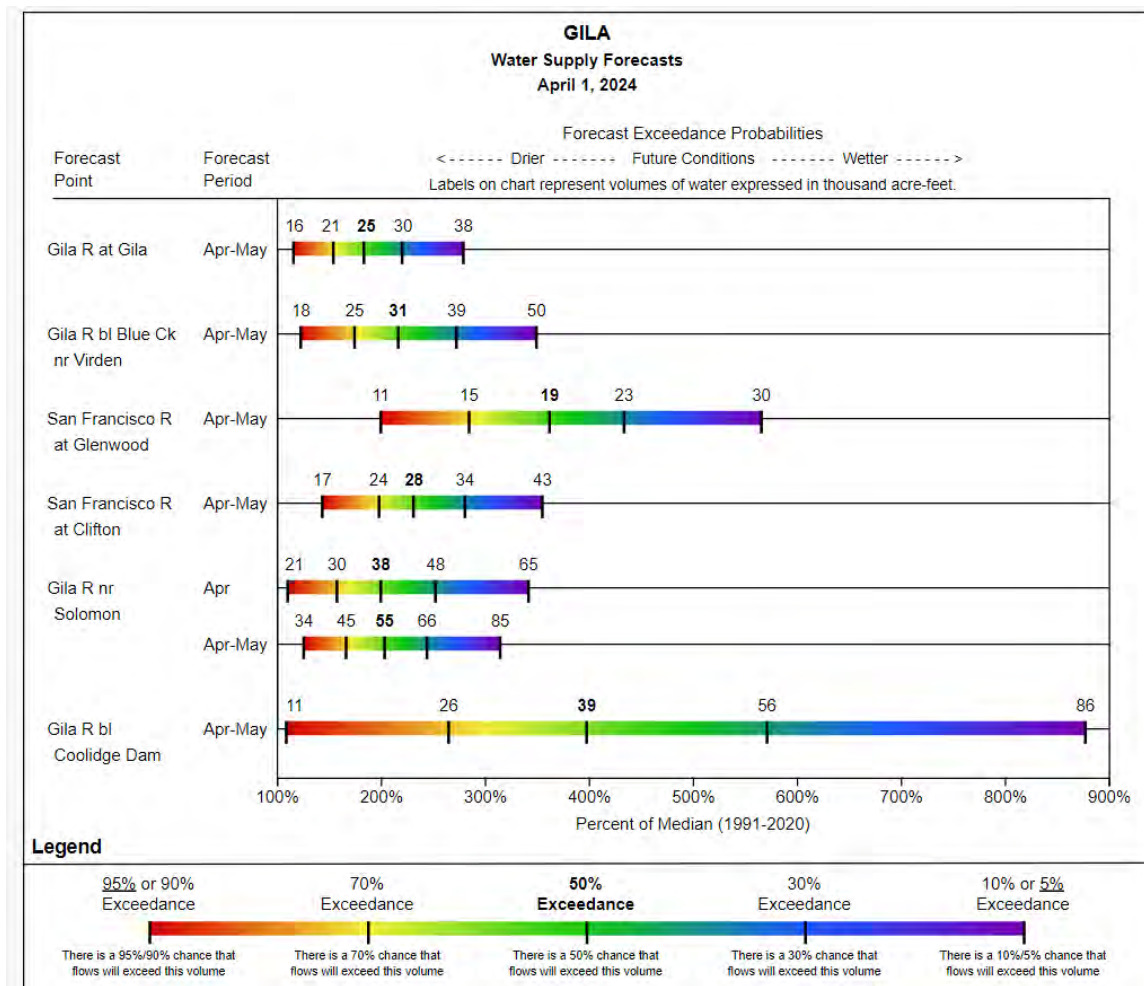
Updated: Tuesday, Jun 04, 2024 09 AM CST



# Get the Data

## Seasonal Volume Forecast Plots (forecast plots)

<https://nwcc-apps.sc.egov.usda.gov/forecast-plots/> - state "custom" basin basis





# Get the Data

## AWDB Report Generator (report gen)

<https://wcc.sc.egov.usda.gov/reportGenerator/>- site basis only

### Report Generator 2.0

View Station Information

Output Format 
 Layout 
 Time Period 
 Fit Table To Screen

**Jones Corral (1099)**  
**Utah SNOTEL Site - 9749 ft**  
**Reporting Frequency: Daily; Date Range: 2024-05-29 to 2024-06-04**

(As of: Tue Jun 04 06:52:54 GMT-08:00 2024)  
 \*\*Provisional data, subject to revision\*\*

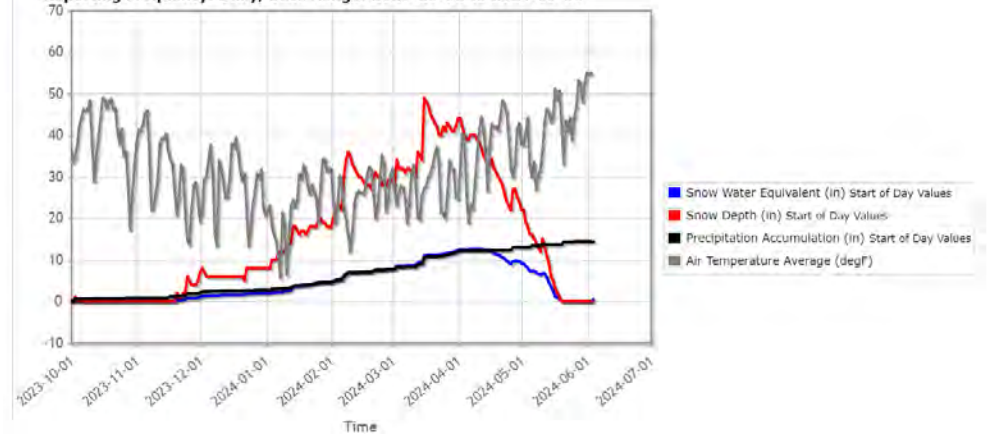
Date	Jones Corral (1099) Snow Water Equivalent (in) Start of Day Values	Jones Corral (1099) Snow Depth (in) Start of Day Values	Jones Corral (1099) Precipitation Accumulation (in) Start of Day Values	Jones Corral (1099) Air Temperature Average (degF)
2024-05-29	0.0	0	14.4	52.5
2024-05-30	0.0	0	14.4	48.0
2024-05-31	0.0	0	14.4	52.7
2024-06-01	0.0	0	14.4	54.9
2024-06-02	0.0	0	14.4	54.5
2024-06-03	0.0	0	14.4	54.9
2024-06-04	0.4		14.3	

### Report Generator 2.0

View Station Information

Output Format 
 Layout 
 Time Period 
 Fit Chart To Screen 
 Use Log Scale

**Jones Corral (1099) Utah SNOTEL Site - 9749 ft**  
**Reporting Frequency: Daily; Date Range: 2023-10-01 to 2024-09-30**



Can deliver html table/plot/csv data formats  
 Powerful albeit complex UI for preparing  
 very specialized data reports





# Get the Data



## Air and Water Database Update Report (update reports)

<https://wcc.sc.egov.usda.gov/reports/SelectUpdateReport.html> - state "custom" basin basis (also special reports)

California SNOTEL Snow/Precipitation Update Report							
Based on Mountain Data from NRCS SNOTEL Sites							
***Provisional data, subject to revision***							
Data based on the first reading of the day (typically 00:00) for Monday, April 01, 2024							
Basin Site Name	Elev (ft)	Snow Water Equivalent			Water Year-to-Date Precipitation		
		Current (in)	Median (in)	Pct of Median	Current (in)	Median (in)	Pct of Median
<b>TRUCKEE RIVER</b>							
<b>Basin Index (%)</b>				115			99
<b>LAKE TAHOE</b>							
<b>Basin Index (%)</b>				115			99
<b>CARSON RIVER</b>							
<b>Basin Index (%)</b>				118			103
<b>WALKER RIVER</b>							
<b>Basin Index (%)</b>				110			103
<b>KLAMATH RIVER</b>							
<b>Basin Index (%)</b>				107			103

-M = Missing data.  
 \* = Analysis may not provide a valid measure of conditions.  
 N/A = Not available.

Footnotes for median and average:  
 (#) = If less than 30 years are available, this value specifies the number of years used for the median and average calculations. Sites with less than 10 years available do not have medians or averages.

If the Basin Index (%) percent value is flagged as potentially invalid, care should be taken to evaluate if the value is representative of conditions in the basin.





# Get the Data

## Air and Water Database SOAP Webservice (SOAP webservice)

<https://wcc.sc.egov.usda.gov/awdbWebService/webService/testwebservice.jsf?webserviceName=/awdbWebService- site basis>



**Methods**

Operations

- [areYouThere](#)
- [getAllForecastsForStation](#)
- [getAveragesData](#)
- [getAveragesPeak](#)
- [getCentralTendencyData](#)
- [getCentralTendencyPeakData](#)
- [getCentralTendencySWETiming](#)
- [getData](#)
- [getDataInsertedOrUpdatedSince](#)
- [getElement](#)
- [getElements](#)
- [getForecast](#)
- [getForecastConfigurations](#)
- [getForecastEquations](#)
- [getForecastEquationsMultiple](#)
- [getForecastPeriodAverages](#)
- [getForecastPeriodCentralTendency](#)
- [getForecastPeriods](#)
- [getForecastPoint](#)
- [getForecastPoints](#)
- [getForecastValue](#)
- [getForecasts](#)
- [getForecastsByPubDate](#)
- [getHeightDepths](#)
- [getHourlyData](#)
- [getInstantaneousData](#)
- [getInstantaneousDataInsertedOrUpdatedSince](#)
- [getPeakData](#)
- [getReservoirMetadata](#)
- [getReservoirMetadataMultiple](#)
- [getStationDataAssuredFlags](#)
- [getStationElements](#)
- [getStationMetadata](#)
- [getStationMetadataMultiple](#)
- [getStations](#)
- [getUnitName](#)
- [getUnits](#)
- [runDiagnostics](#)

**Input and Output Parameters**

Input Parameters for getStations method

Name	Value
heightDepths: unitCd	
heightDepths: value	
stationIds	
stateCds	UT
networkCds	
hucs	14
countyNames	Garfield
minLatitude	
maxLatitude	
minLongitude	
maxLongitude	
minElevation	9000
maxElevation	
elementCds	WTEQ
ordinals	
logicalAnd*	true

Test Operation   Clear Output   Clear All

Test result of the getStations method

**Soap Elements**

Soap Request

```
<?xml version="1.0" encoding="UTF-8"?>
<SOAP-ENV:Envelope xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/" xmlns:q0="http://www.wcc.nrcs.usda.gov/ns/awdbWebSer" >
  <SOAP-ENV:Body>
    <q0:getStations>
      <stateCds>UT</stateCds>
      <hucs>14</hucs>
      <countyNames>Garfield</countyNames>
      <minElevation>9000</minElevation>
      <elementCds>WTEQ</elementCds>
      <logicalAnd>true</logicalAnd>
    </q0:getStations>
  </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

Soap Response

```
<?xml version="1.0" encoding="UTF-8"?>
<soap:Envelope xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/" >
  <soap:Body>
    <ns2:getStationsResponse xmlns:ns2="http://www.wcc.nrcs.usda.gov/ns/awdbWebSer" >
      <return>1261:UT:SNL</return>
      <return>1269:UT:SNL</return>
      <return>1249:UT:SNL</return>
    </ns2:getStationsResponse>
  </soap:Body>
</soap:Envelope>
```



# Get the Data



## Air and Water Database REST API (REST API)

<https://wcc.sc.egov.usda.gov/awdbRestApi/swagger-ui/index.html> - site basis

### AWDB REST API 1.0 OAS 3.0

/awdbRestApi/v3/api-docs

AWDB REST API

Servers

#### Data Method to get data for one or more stations



**GET** /services/v1/data Gets data for one or more stations



#### Forecast Method to get forecast data for one or more stations



**GET** /services/v1/forecasts Gets forecast data for one or more stations



#### Reference Data Gets reference data



**GET** /services/v1/reference-data Gets reference data



#### Station Metadata Method to retrieve the station metadata for one or more stations



**GET** /services/v1/stations Gets the metadata for one or more stations





# Get the Data

Misc. Products – Tools – Code Repos – Links

[Streamflow Adjustment Equations](#)- provides streamflow gage data mass balance equations used to create unregulated flow datasets for use in forecasting models

[Unregulated Streamflow Normals Comparisons](#) – provides a comparison of avg/medians for unregulated Streamflow datasets (SRVO) between the previous [hydrologic/climatic reference period](#) ('81-'10 vs '91-'20)

[Air Temp. Bias Reduction Map/Tables/Info](#)– information and background on the NRCS efforts to [reduce the air Temperature bias](#) found in historic datasets; this link will update with the site's which have been bias reduced

[M4 Modeling Engine - GitHub Repo](#)– code used as the model/engine of the current National Water & Climate Center's seasonal streamflow modelling system.

[AWDB JSON Materialized View](#)– a suite of JSON files updated regularly for a select set of parameters, many products utilize these files for client-side rendering of data, often useful for quick period of record data access.

[Basin Definitions as JSON/GeoJSON](#)– a suite of JSON and GeoJSON files that communicate the association sites within HUCs and state “custom” basins. Also includes geometry of basins and HUCs

[Contact Us](#) – can be used to submit questions, comments, and directly connect with NWCC staff (including myself)

[REST API Demo Repo](#) – includes this ppt as pdf





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- (1) mail: U.S. Department of Agriculture Office of the Assistant Secretary for Civil Rights 1400 Independence Avenue, SW Washington, D.C. 20250-9410;
- (2) fax: (202) 690-7442; or
- (3) email: [program.intake@usda.gov](mailto:program.intake@usda.gov).

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