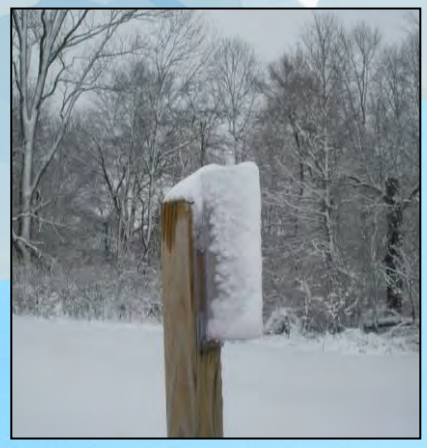
CoCoRaHS

Community Collaborative Rain, Hail & Snow Network



Ashley Novak
CoCoRaHS Coordinator
National Weather Service Wilmington, Ohio

Introduction to CoCoRaHS

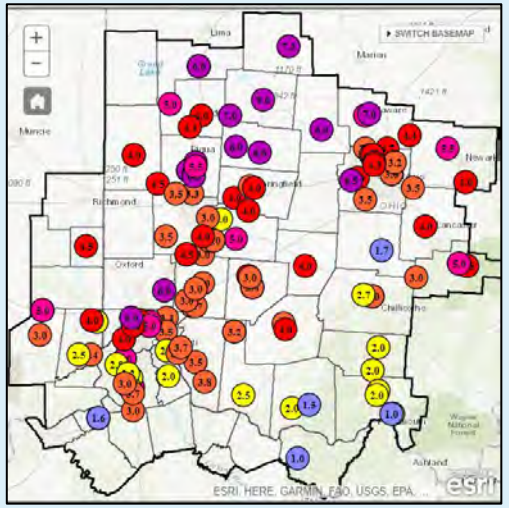
- CoCoRaHS is a non-profit precipitation network made up of volunteers who take daily measurements of precipitation right in their own backyards
- CoCoRaHS utilizes a low-cost rain gauge and an interactive website/app
- Website/app and data are all free to use

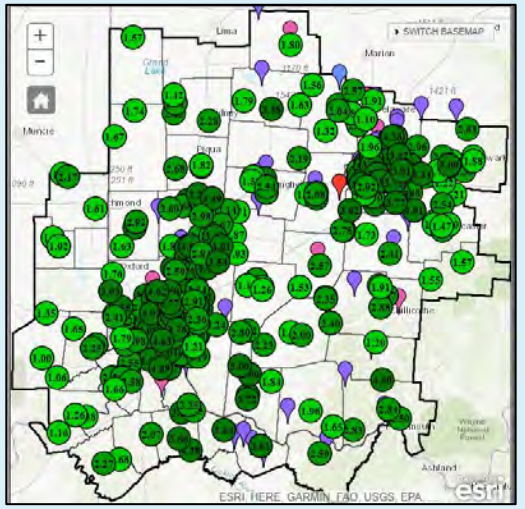
History and Purpose of CoCoRaHS

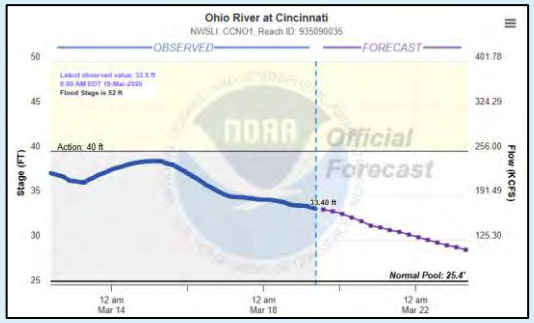
- Began in 1998 in Colorado in response to devasting flash flood in 1997 with a need for a dense precipitation network since precipitation is highly variable.
- Now observers are present across the country in every state and in other countries as well!
- You can be a part of the mission to save lives!

Uses by NWS Meteorologists and Hydrologists

- Aid in issuing and verifying life saving warnings
- Increases climatological network
- Better tracking of wet/dry areas
- River forecasting
- Research
- Improved preparedness/mitigation working with partners



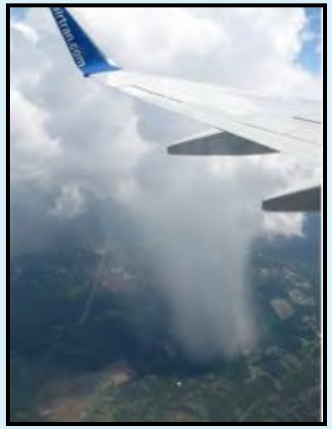




The U.S. Drought Monitor is produced through a partnership between the National Drought Mitigation Center at the University of Nebraska-Lincoln, the United States Department of Agriculture, the National Oceanic and Atmospheric Administration, and the National Aeronautics and Space Administration.

Many People and Groups Rely on CoCoRaHS

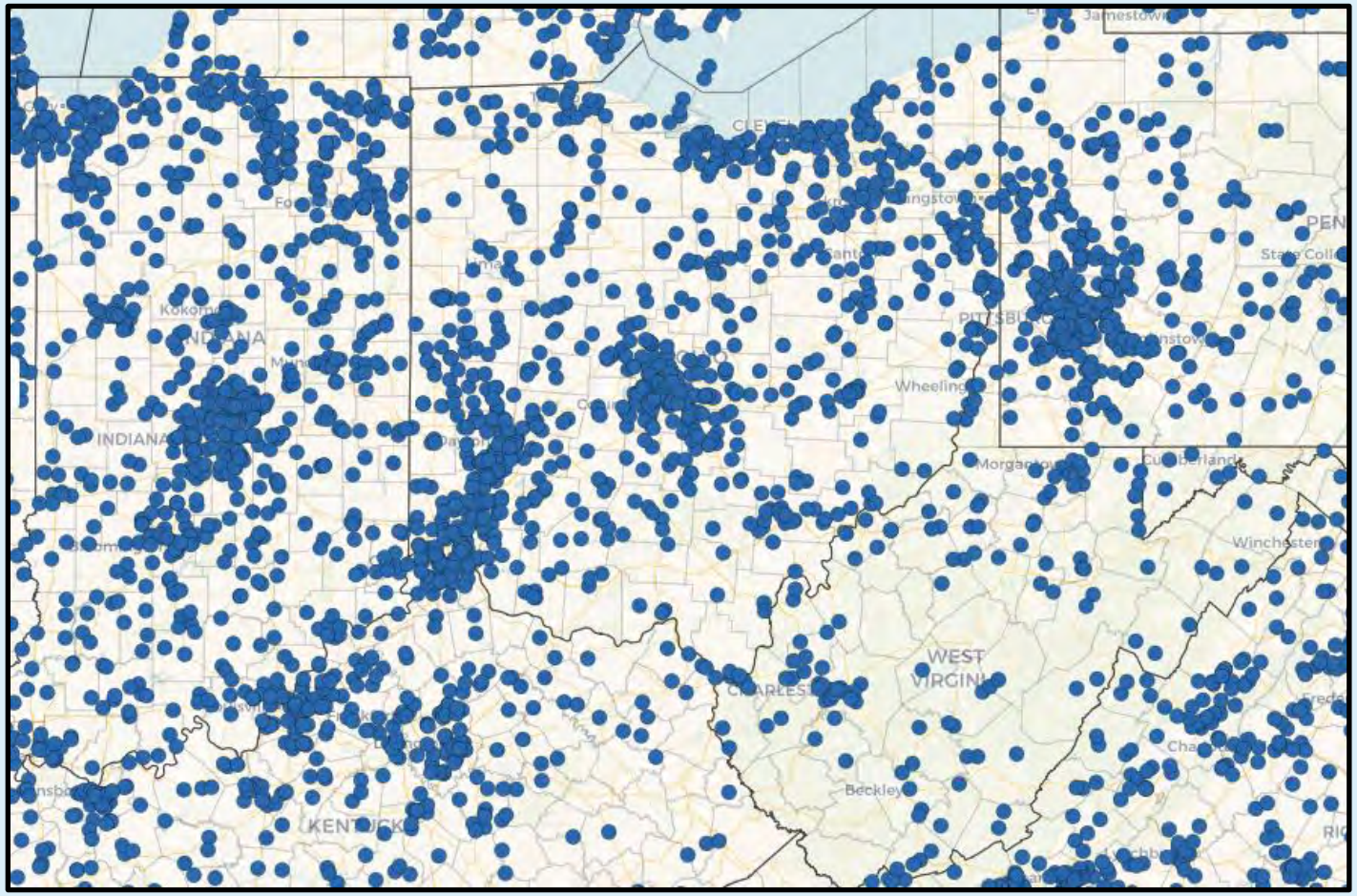
- Teachers and Students
- Media
- Farmers
- Emergency Managers
- FEMA declarations for disaster assistance
- Turf and Landscape Professionals
- Hydrologists
- City Utilities
- Insurance adjusters
- Engineers
- Mosquito control
- Outdoor & Recreation
- And many more!



CoCoRaHS Stations

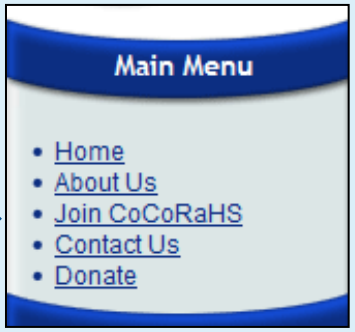
- Some counties have very few or no observers, while some have several

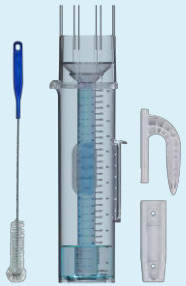
- Even in areas with several observers, precipitation is highly variable and therefore more observers are appreciated and the data heavily utilized

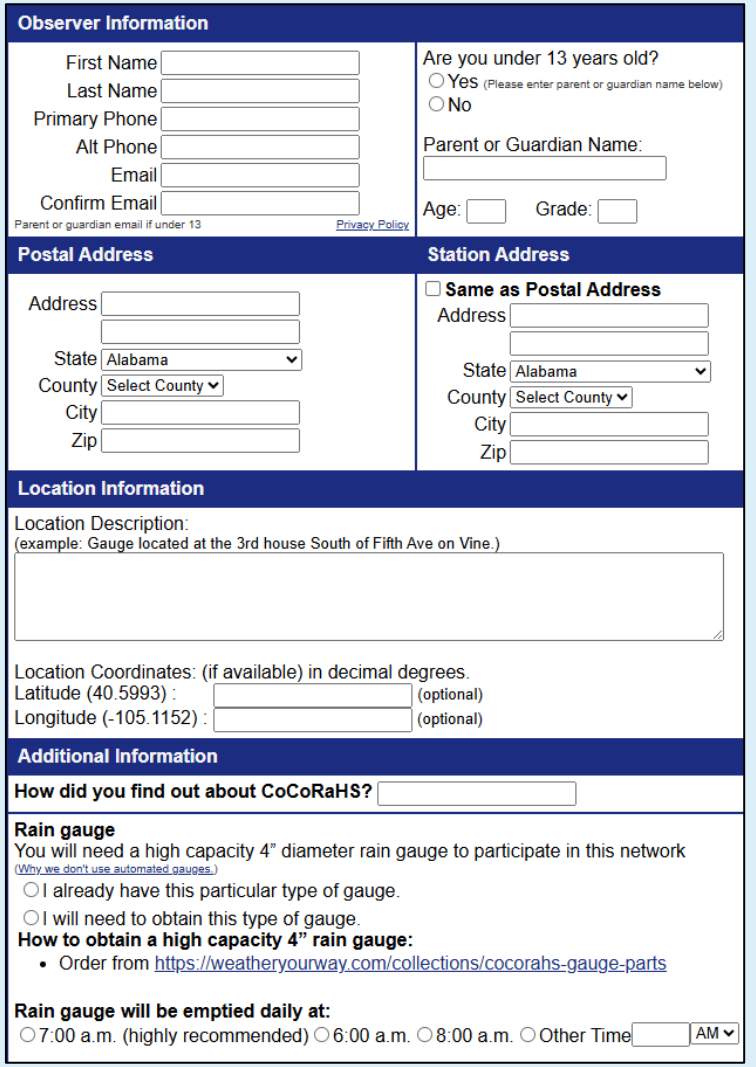


How to Join

- Computer or app access
- Fill out quick application form on CoCoRaHS website
- CoCoRaHS standard rain gauge
  - Automated gauges are not utilized b/c they can underestimate heavy rain, have a hard time with snow, and they are not used in order to make sure everyone is utilizing the same gauge
  - Can be found on the CoCoRaHS website and many other places online for around $40-45. There is another gauge the tropo gauge that is more expensive with more included. It doesn't matter which one of the two you get. This training will show the original (upper right gauge).
- Snowboard/measuring stick





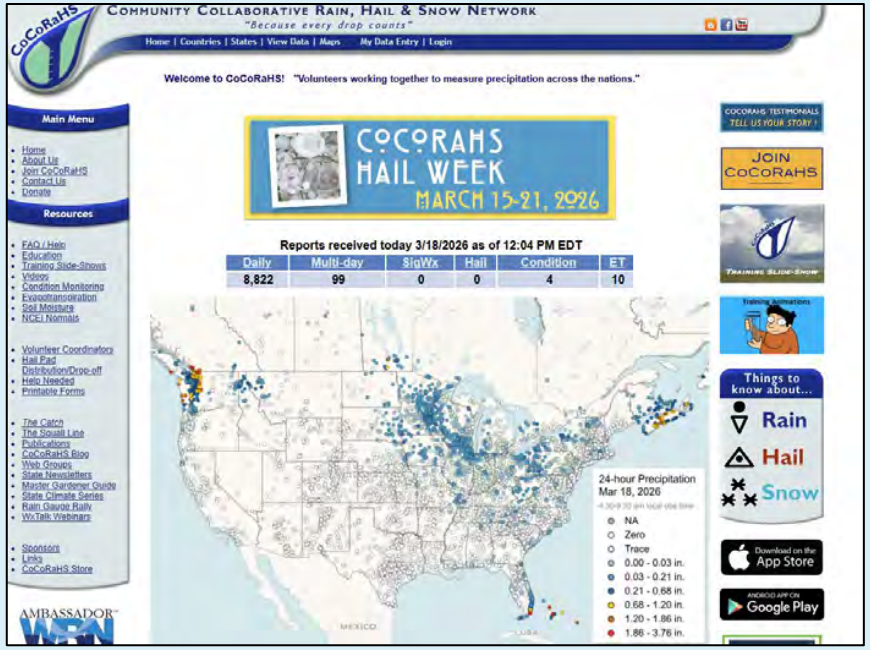


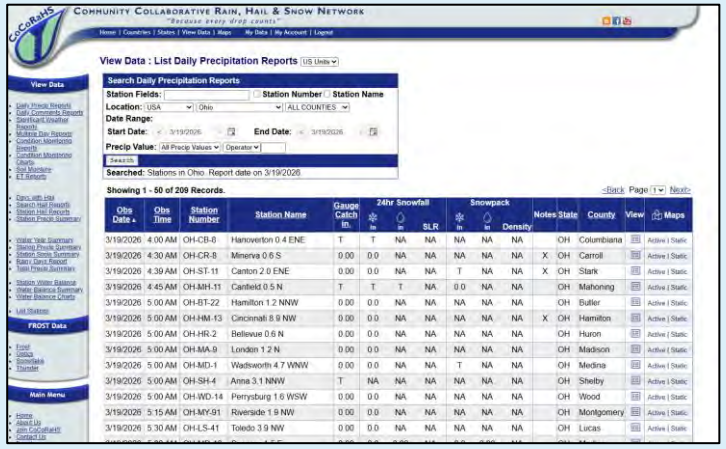
Station Number : OH-CN-16

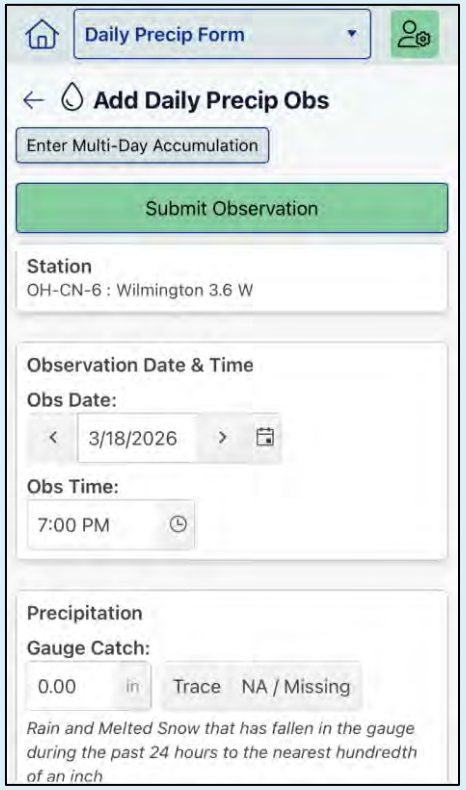
Station Name : Wilmington 1.6 SSE

CoCoRaHS Data and Viewing

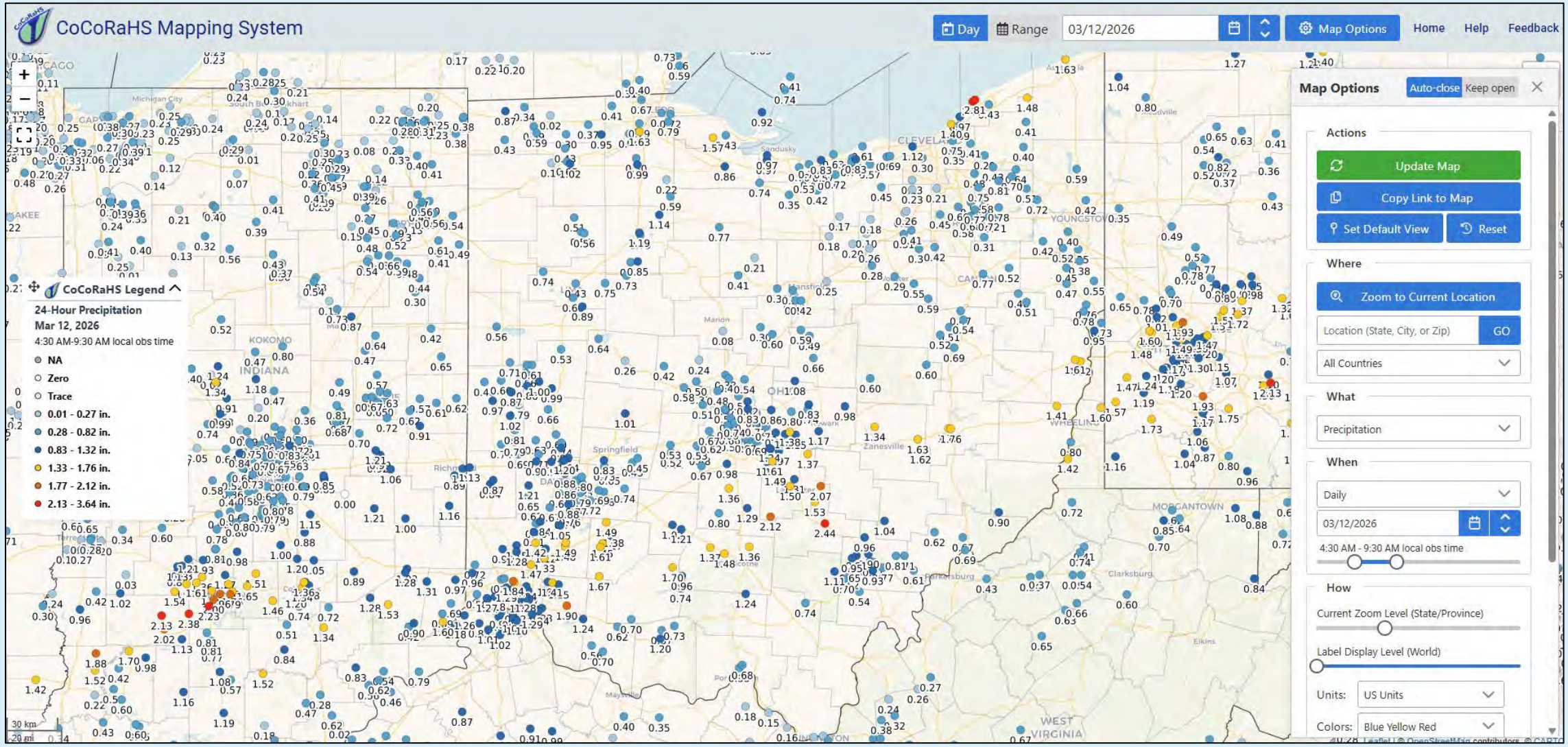
- Observations can be submitted via web (www.CoCoRaHS.org) or app and viewable within minutes
- Types of observations:
  - 24 hour daily precipitation (rain, snow, ice etc)
  - Real time occurrences (hail, significant precip)
  - Condition monitoring (drought etc)
  - Other reports (frost, thunder, etc)







CoCoRaHS Data and Viewing

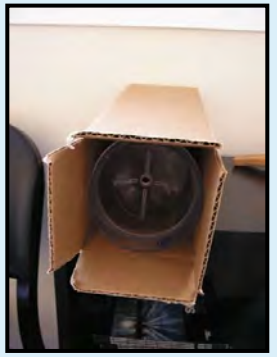


Gauge Placement and Installation

Preferred

Level and bevel if you can

Not Preferred



How to Read the Gauge and When to Report

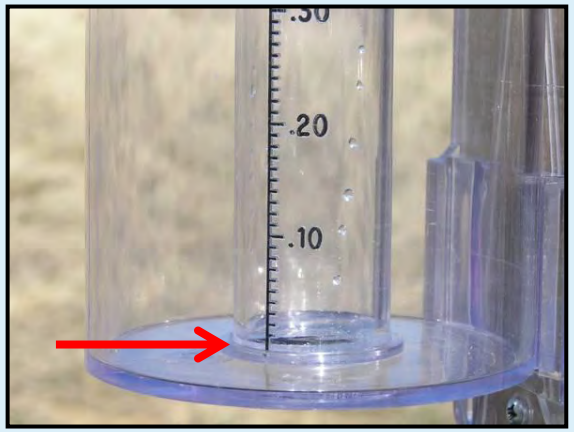
- Read at eye level
- Read the bottom of the meniscus (contact lens)-caused by surface tension
- 7:00 AM is the preferred time, however any time between 4:30am and 9:30 AM will show up on the default map. Whatever time is good for you as long as it is pretty consistent from day to day.
- It is ok if you can't report everyday, you can submit a multi-day report!

Your Most Common Observation

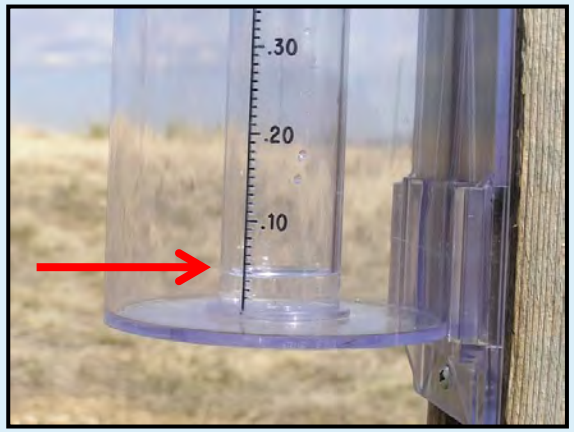
- Your most common observation will be 0.00, nothing. It is important to know where it did not rain!

- Also, dew/fog, while it may accumulate in the gauge this still counts as a 0.00. Best way to think of this is if it falls from the sky count it, if it condenses count as 0.

Trace (T)

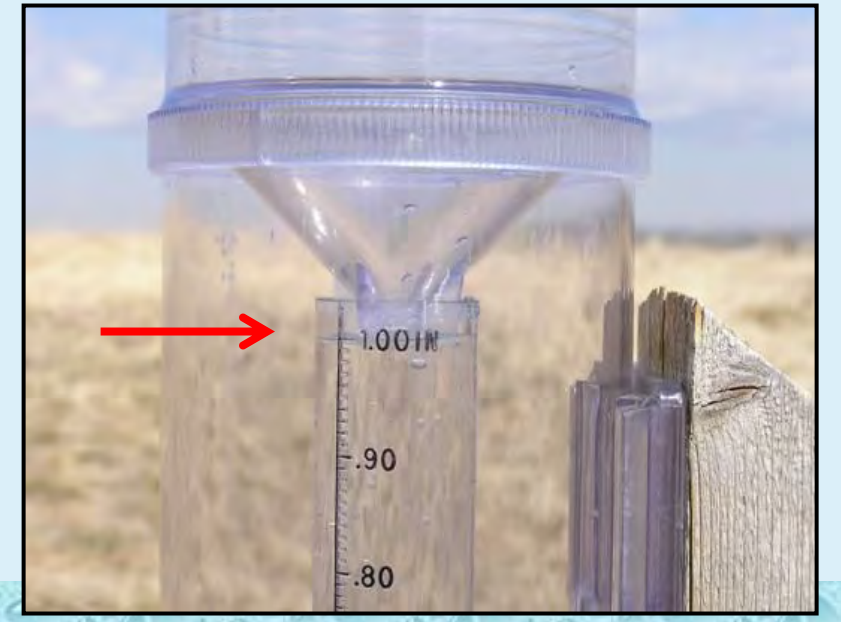


0.04 inch



0.50 inch

1.00 inch



Over an inch

Over an Inch of Precipitation

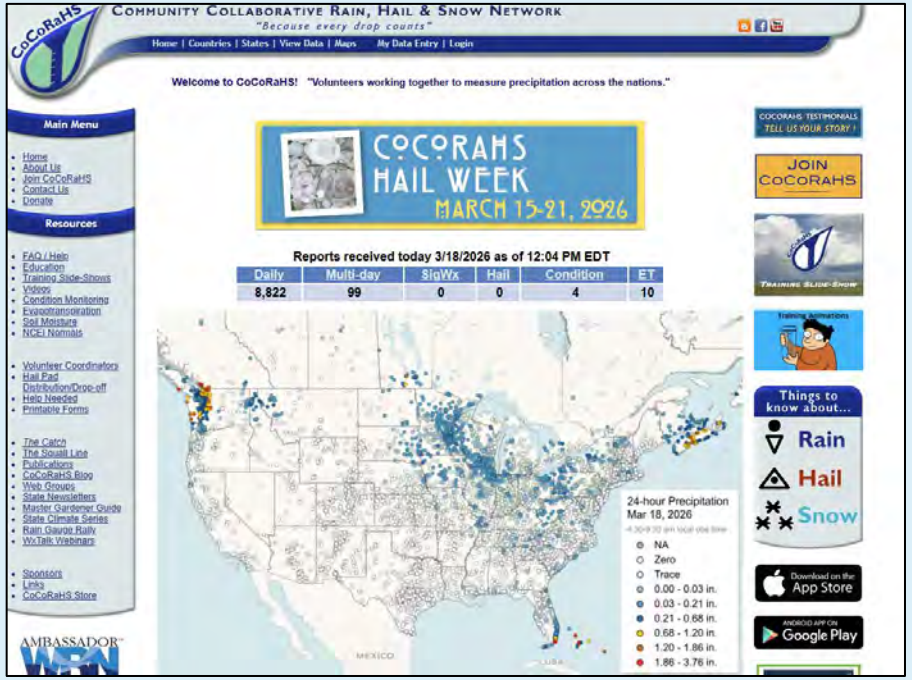
- When more than an inch of rain falls, the precipitation will overflow into the outer cylinder. The whole gauge has the capacity to hold 11 inches.
- In order to measure this amount pour out the first inch from the inner tube.
- Now pour the remaining water into the funnel & measure using the inner tube.
- Continue until all of the water has been measured. Make sure you keep track of your amounts along the way!

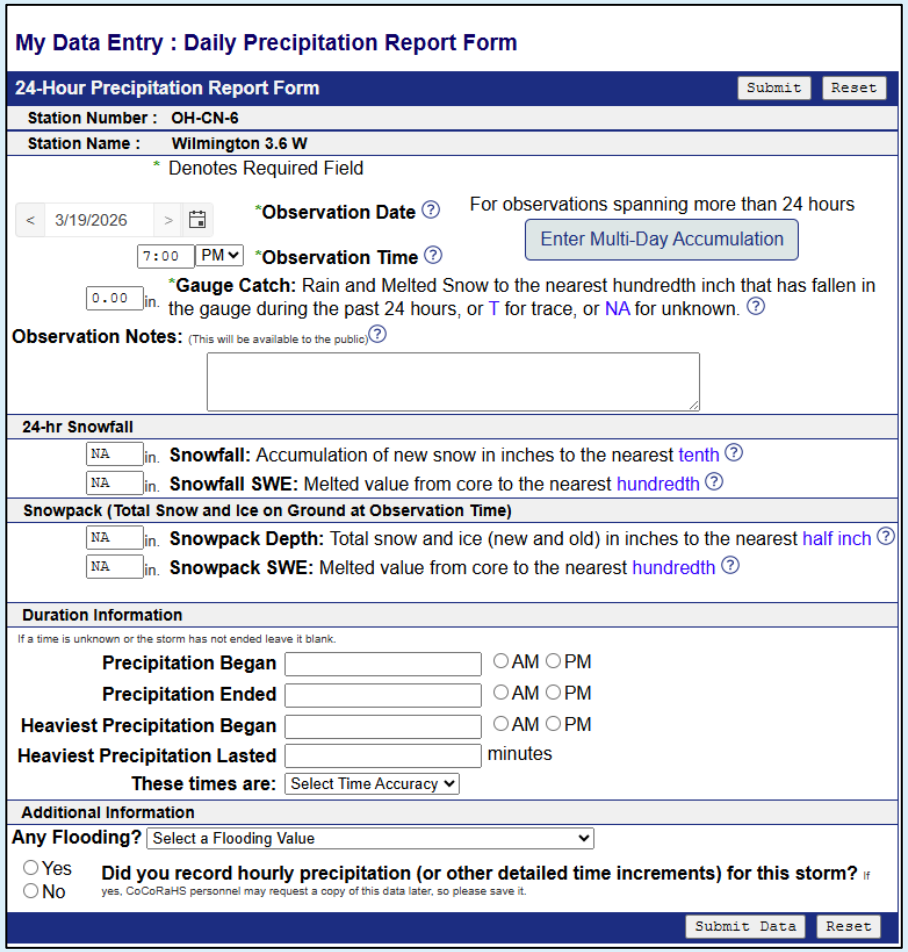
Then add up all of your measurements

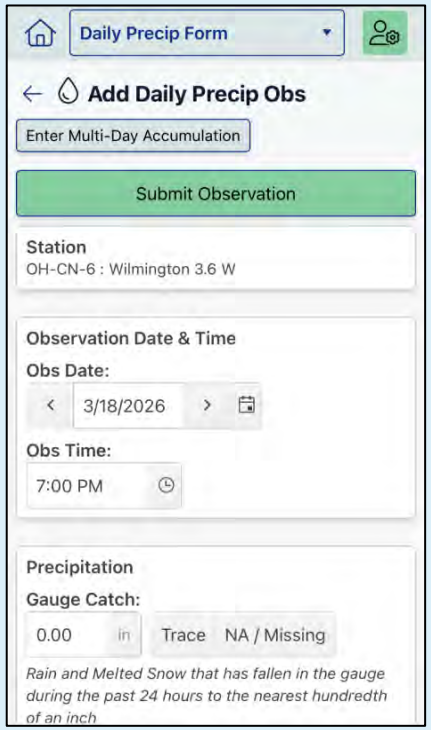
1 inch + 0.97 inches + 0.88 inches + 0.92 inches = 3.77 inches

Total = 3.77”

Submitting CoCoRaHS







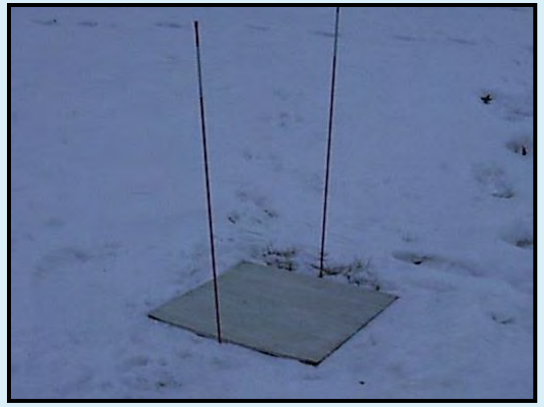
Winter Precipitation

- Take the funnel and inner tube out so the rain gauge won't freeze and crack.
- Can't accurately catch snow in the funnel and small tube.
- If it rains when you have removed the funnel and small tube, it's ok. You can just dump the rain back into the funnel and the small tube and measure just like you would with an overflow heavy rain sample.

Additional Winter Tools

- **Snow Stick**- ruler/yard stick, aluminum works best to keep from warping. If you do not have one in tenths of an inch here is a conversion.

Measurement on ruler	Measurement in tenths of an inch
3/4th	0.8
½	0.5
1/4th	0.3
1/8th	0.1
1/16th	0.1
Less than 1/16th	Trace



- **Snow Board**- board or flat surface to measure snow. 2'x2' sheet of plywood painted white works great.
- **Snow Swatter or Spatula**- helps with core samples (more info later)

Winter Precipitation

1) ***Gauge Catch***– measured to the nearest hundredth and measured with your rain gauge

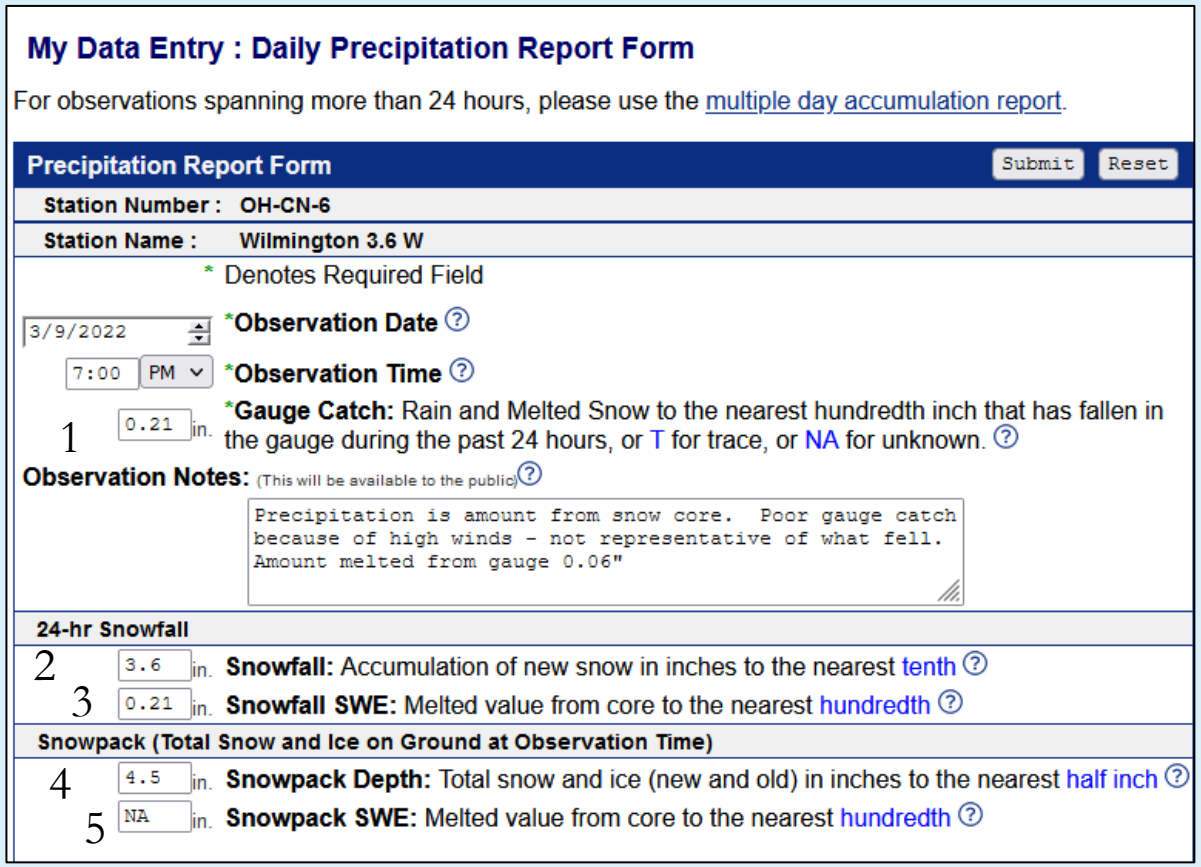
2) ***Snowfall***– measured to the nearest tenth of an inch and measured from snow board using snow stick (last 24 hrs)

3) ***Snowfall SWE***– measured to the nearest hundredth and measured with gauge (typically if windy and gauge catch is not representative). Leave N/A if separate core is not taken.

4) ***Snowpack Depth***– measured to the nearest half inch and measured from ground using snow stick

5) ***Snowpack SWE(optional, but encouraged…especially on Mondays)*** – measured to the nearest hundredth and measured with gauge.). Leave N/A if separate core is not taken.

***If you can't take all of these measurements that is perfectly alright. Do not put a value in if you did not measure. It is ok to NA!**



My Data Entry : Daily Precipitation Report Form

For observations spanning more than 24 hours, please use the multiple day accumulation report.

Precipitation Report Form Submit Reset

Station Number : OH-CN-6

Station Name : Wilmington 3.6 W

* Denotes Required Field

3/9/2022 *Observation Date

7:00 PM *Observation Time

1 0.21 in. *Gauge Catch: Rain and Melted Snow to the nearest hundredth inch that has fallen in the gauge during the past 24 hours, or T for trace, or NA for unknown.

Observation Notes: (This will be available to the public)

Precipitation is amount from snow core. Poor gauge catch because of high winds - not representative of what fell. Amount melted from gauge 0.06"

24-hr Snowfall

2 3.6 in. **Snowfall:** Accumulation of new snow in inches to the nearest tenth

3 0.21 in. **Snowfall SWE:** Melted value from core to the nearest hundredth

Snowpack (Total Snow and Ice on Ground at Observation Time)

4 4.5 in. **Snowpack Depth:** Total snow and ice (new and old) in inches to the nearest half inch

5 NA in. **Snowpack SWE:** Melted value from core to the nearest hundredth

1) ***Gauge Catch***– measured to the nearest hundredth and measured with your rain gauge with the goal of determining how much liquid is in the snow (or mix of precipitation)

- Tools: 4 inch CoCoRaHS rain gauge, possible snow swatter

- Remove your gauge from its mounting bracket and bring the gauge inside

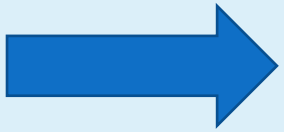
- Take your inner cylinder and add warm water to it.
- Carefully measure and record the amount of warm water you added to the inner cylinder. Now you have two cylinders, one with the snow inside it and the other with a carefully measured amount of warm water.
- Pour the carefully measured amount of warm tap water into the snowfall sample. Allow the snow sample to completely melt (swishing it around can help). Now the cylinder contains all water, some of it melted snow and the rest tap water.
- Pour the water back through the funnel into the smaller cylinder. Carefully read the amount in the cylinder. This amount represents the melted snow + the water you added.
- Subtract the amount of tap water you added earlier to get your melted snowfall to the hundredth of an inch.





Tube full 0.71- Water added 0.50 =
Final reading 0.21

Daily Precipitation Form



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24-hr Snowfall

3.6 in. **Snowfall:** Accumulation of new snow in inches to the nearest tenth

0.21 in. **Snowfall SWE:** Melted value from core to the nearest hundredth

Snowpack (Total Snow and Ice on Ground at Observation Time)

4.5 in. **Snowpack Depth:** Total snow and ice (new and old) in inches to the nearest half inch

NA in. **Snowpack SWE:** Melted value from core to the nearest hundredth

***2) Snowfall*–** measured to the nearest tenth of an inch and measured from snow board using snow stick. The goal of this is to measure snowfall from the past 24 hours.

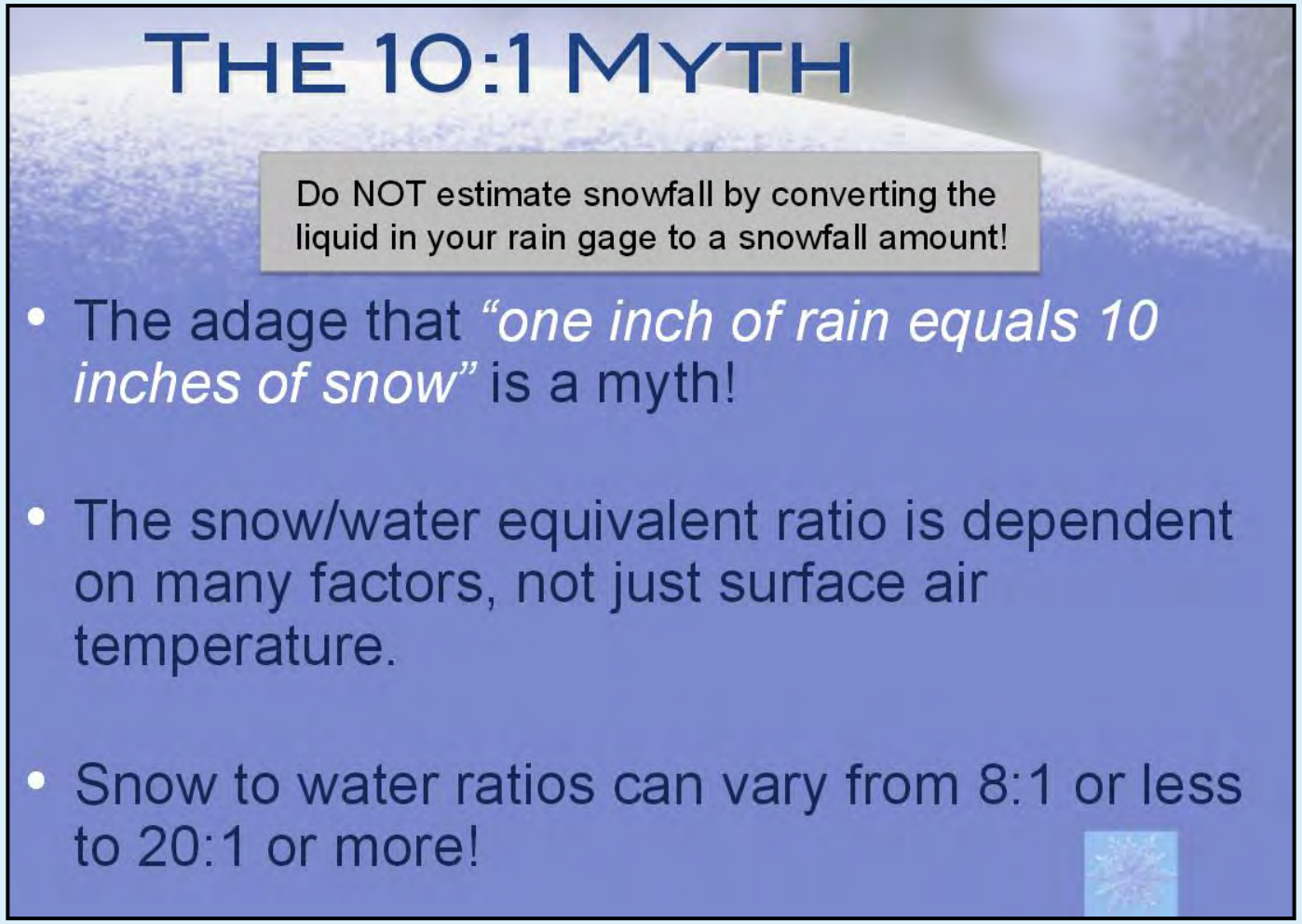
- Tools: Snow stick and snow board
- Find a nice, level place to measure where drifting or melting has not occurred (like a snowboard)
- Slide snow stick into snow until it reaches the board surface
- Read the value on the snow stick (value is always to the nearest tenth of an inch like 3.6 inches)
- Sweep the snowboard clean and place on top of snow

Note that we never measure the depth of the snow in the rain gauge itself. Any frozen precipitation in the rain gauge must first be melted, then measured.

Frequently Asked Questions on Snowfall

- **What if snow accumulates, melts, and accumulates again?**
  - The snowfall is the sum of each accumulation before melting.
  - For example: Three separate snowfalls occur during the day. You go out and measure the snow after each has ended. The first snowfall is 2.0 inches, the second is 1.5 inches, and the third is 1.0 inch. The snow melts after each snowfall and therefore there is nothing on the snowboard at observation time the next morning. The snowfall for the 24-hour period should be recorded as the sum of the individual events or 4.5 inches.
- **What if you see snow flurries, but there is nothing in the gauge?**
  - Snowfall would be reported as a trace. If this is the only precipitation, the 24hr gauge catch value would also be a trace.

Myth


THE 10:1 MYTH
Do NOT estimate snowfall by converting the liquid in your rain gage to a snowfall amount!
• The adage that "one inch of rain equals 10 inches of snow" is a myth!
• The snow/water equivalent ratio is dependent on many factors, not just surface air temperature.
• Snow to water ratios can vary from 8:1 or less to 20:1 or more!

Daily Precipitation Form

My Data Entry : Daily Precipitation Report Form

For observations spanning more than 24 hours, please use the multiple day accumulation report.

Precipitation Report Form Submit Reset

Station Number : OH-CN-6

Station Name : Wilmington 3.6 W

* Denotes Required Field

3/9/2022 *Observation Date

7:00 PM *Observation Time

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24-hr Snowfall

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Snowpack (Total Snow and Ice on Ground at Observation Time)

4.5 in. **Snowpack Depth:** Total snow and ice (new and old) in inches to the nearest half inch

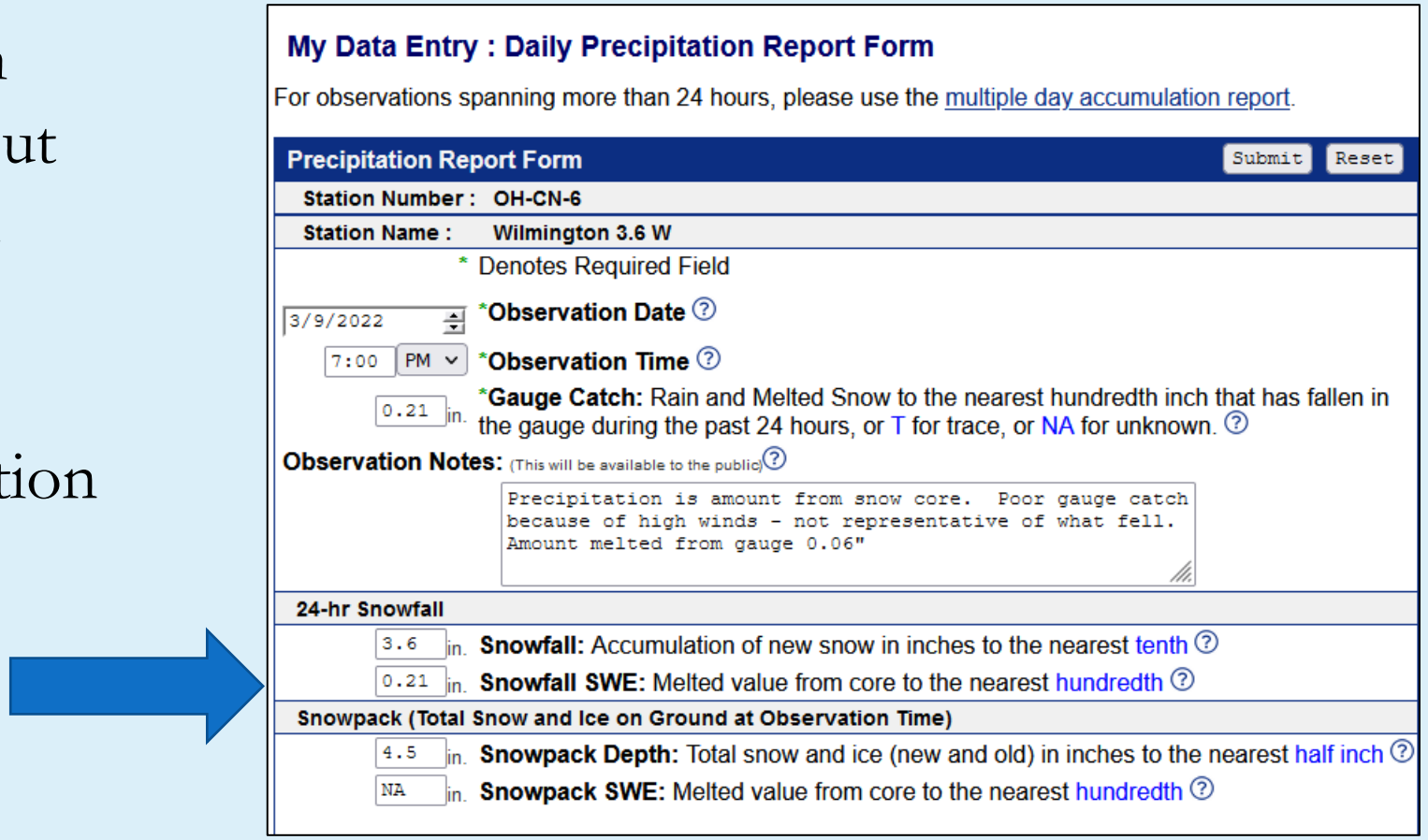
NA in. **Snowpack SWE:** Melted value from core to the nearest hundredth

3) Snowfall SWE(optional, but encouraged when needed) – measured to the nearest hundredth and measured with gauge

- Sometimes windy conditions might create a situation where an accurate amount of snow has not fallen into the gauge. If this is the case a core sample can be taken from the snow on the snow board in order to find out the liquid content of the new snow.
- Core samples of new snow are not required, however you should do this when the amount of snow in the gauge is not representative of what fell on the ground.
- In order to obtain a core sample turn the empty outer cylinder of your gauge upside down on your snowboard.
- Slide a thin, flat object under the core sample in the gauge.
- Carefully lift and flip the gauge.
- Now you can melt the snow the same as you normally would. This value will be to the nearest hundredth of an inch.
- **Only report if you actually do a separate core sample, otherwise leave NA on the form.**

Daily Precipitation Form

- If your original gauge catch was not accurate, you can put your water melted from the core as the gauge catch amount.
- Please include this information in the comments section.



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7:00 PM *Observation Time

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Snowpack (Total Snow and Ice on Ground at Observation Time)

4.5 in. **Snowpack Depth:** Total snow and ice (new and old) in inches to the nearest half inch

NA in. **Snowpack SWE:** Melted value from core to the nearest hundredth

***4) Snowpack Depth*–** measured to the nearest half inch and measured from ground using snow stick. This includes both new snow and snow that was already there.

- Tools: Snow stick
- Find a level spot, not drifted over, blown clear, or melted
- Slide snow stick through all layers of snow (new and old)
- Read value on snow stick and record the value (values are to the nearest ½" like 4.5)

REMEMBER: Report total snowpack depth every day there is any snow on the ground!

Frequently Asked Questions on Snowpack Depth

- **Snow only covers part of my yard. What do I report as my total snowpack?**
  - You will want to take the average of the bare and covered areas. If there is 1 inch in the covered area and 0 in the bare area, your average would be a snowpack depth of 0.5 inches.
  - You can also report a T for a trace of snowpack depth if it is less than half an inch.
  - You shouldn't count artificially made piles of snow as snow depth (from snowplows or shoveling, etc.)

Daily Precipitation Form

My Data Entry : Daily Precipitation Report Form

For observations spanning more than 24 hours, please use the multiple day accumulation report.

Precipitation Report Form Submit Reset

Station Number : OH-CN-6

Station Name : Wilmington 3.6 W

* Denotes Required Field

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7:00 PM *Observation Time

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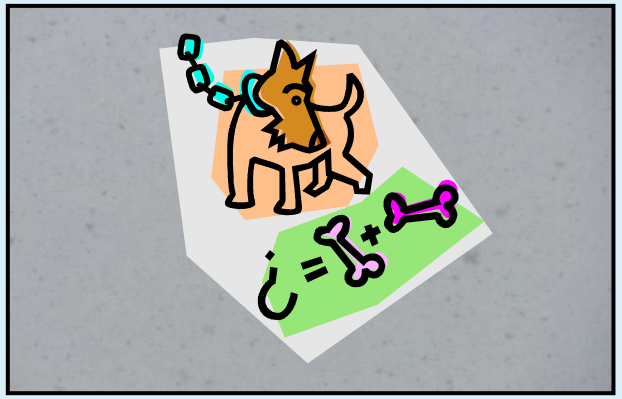
5) Snowpack SWE(optional, but encouraged…especially on Mondays) – measured to the nearest hundredth and measured with gauge. This helps determine how much liquid is in the new and old snow (Snow Water Equivalent)

- Core samples taken from the ground can provide valuable information for National Weather Service offices and River Forecast Centers! It provides information on how much water is "on the ground" that can potentially run off into rivers and streams.
- SWE Mondays! Although core samples of snow on the ground would be appreciated everyday, we realize this takes time and therefore Mondays have been designated as SWE Mondays. If possible, please report SWE values on Monday if applicable.

- In order to take a core sample of snow on the ground find a good spot free of drifting and melting. Push the gauge upside down in the snow to cut a core. Slide a thin, flat object under the core sample and the gauge. Carefully lift and flip the gauge.
- Now you can melt the snow the same as you normally would. This value will be to the nearest hundredth of an inch.
- **Only report if you actually do a separate core sample, otherwise leave NA on the form.**

Let's Review Melting Snow



- Measure and add warm water
- Measure the entire sample
- Math skills

Tube full	0.59
- Water added	0.50
Final reading	0.09

Daily Precipitation Form

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Precipitation Report Form Submit Reset

Station Number : OH-CN-6

Station Name : Wilmington 3.6 W

* Denotes Required Field

3/9/2022 *Observation Date

7:00 PM *Observation Time

0.21 in. *Gauge Catch: Rain and Melted Snow to the nearest hundredth inch that has fallen in the gauge during the past 24 hours, or T for trace, or NA for unknown.

Observation Notes: (This will be available to the public)

Precipitation is amount from snow core. Poor gauge catch because of high winds - not representative of what fell. Amount melted from gauge 0.06"

24-hr Snowfall

3.6 in. **Snowfall:** Accumulation of new snow in inches to the nearest tenth

0.21 in. **Snowfall SWE:** Melted value from core to the nearest hundredth

Snowpack (Total Snow and Ice on Ground at Observation Time)

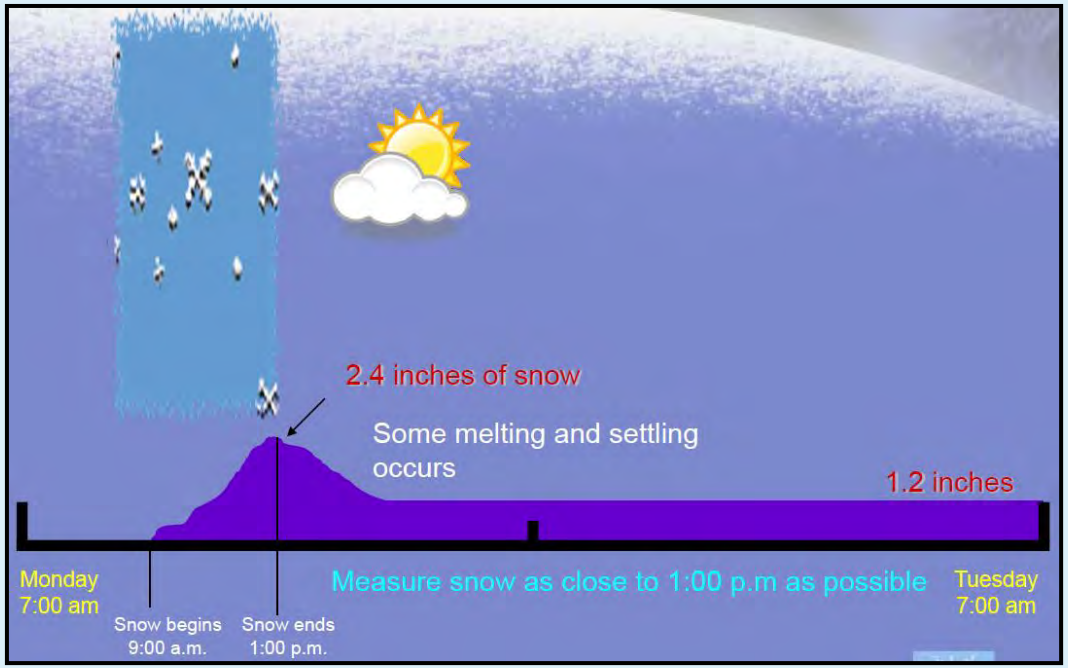
4.5 in. **Snowpack Depth:** Total snow and ice (new and old) in inches to the nearest half inch

NA in. **Snowpack SWE:** Melted value from core to the nearest hundredth

Winter Precipitation FAQ

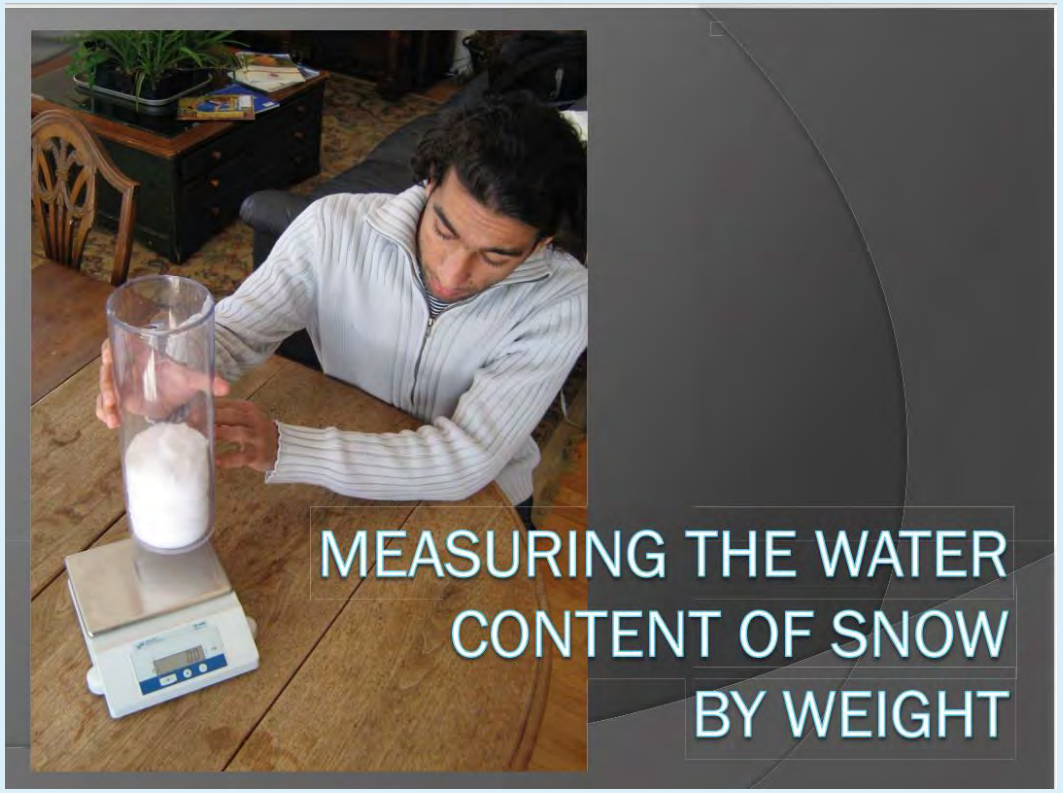
- **How do you measure sleet, freezing rain, and mixed precipitation?**
  - **Sleet** is measured just like snow. In addition to reporting it as new snow and snow on the ground if applicable, also put a note in the comments sections saying that sleet occurred.
  - **Freezing rain** is measured like rain. Melt and measure what is in the gauge and report as rain. In the comments section note that freezing rain occurred and how much ice accretion had occurred. More on this on future slides. Report the total depth of freezing rain remaining on the ground at time of observation and enter that in the 'total snow on ground' column. Make a note in your comments section so that we know it is freezing rain. Fill out an ice accretion report if you are able.
  - **Mixed Precipitation** just do the best you can! Water content in the gauge is reported as the daily precipitation. Report un-melted content on the snow board and ground the same as you would with just snow.

Winter Precipitation FAQ



- **It's done snowing, the sun is coming out, and the snow will melt. Should I measure it now instead of waiting until 7 AM?**
  - Yes! If you know the snow will melt, you should measure the amount now.
  - This is the 24 hour new snowfall on your next report (2.4 inches)
  - You will report 1.0 for the snowpack depth, since that measurement means snow on the ground at the time of observation (to the nearest half inch)!

Can I find water content by weight? Yes!



https://media.cocorahs.org/docs/Training_SnowByWeight.pdf

Freezing Rain-Pilot

Ice Accretion: Setting up the dowel

Document before an ice event

Measure the base thickness (with no accumulation)

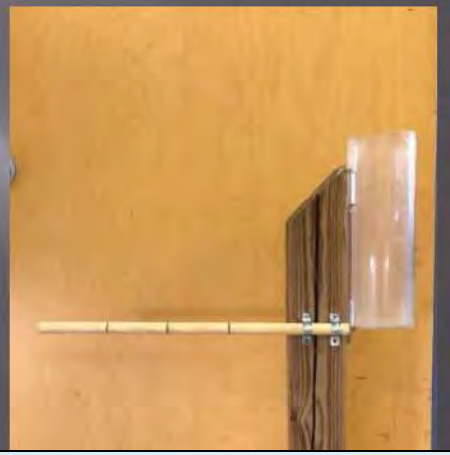
-- This is only needed once at the beginning of the season

-- Enter the value to the nearest 1/10th of an inch

Category	Descriptions of Impacts
0	No ice or a trace
1	Enough to be annoying/need scraping off your car. Looks pretty on bushes, shrubs. Dangerous to walk or drive.
2	Shrubs and other non-native shrubbery weighed down, trees manage ok
3	Small tree branches start to bend
4	Small and medium branches bend, a few small branches may fail
5	Birch trees are starting to bend, minor branch damage to weak trees
6	Birch trees sag moderately, small and large limbs start to break, ~5-10% branch loss
7	Birch trees bent nearly completely, ~10-20% branch loss on small and large limbs
8	Moderate to significant tree damage, most trees have some damage
	Credit: Jason Shafer, Northern Vermont University-Lyndon

Recommended Method for measuring ice accretion using the CoCoRaHS rain gauge post

Affixing a ¾ inch dowel to the post



Measuring Ice Accretion

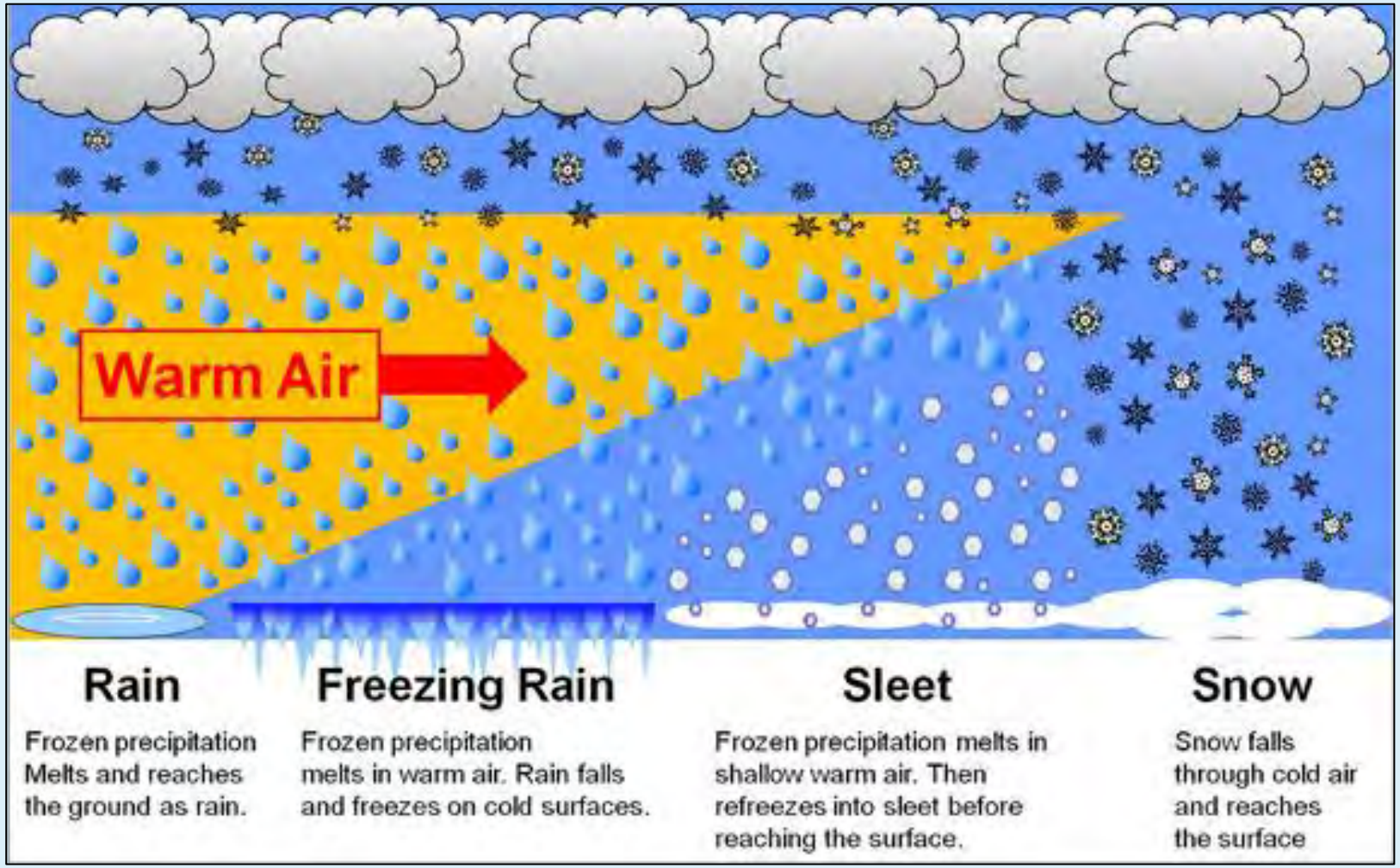
After an ice event

Measure the TOTAL thickness (Dowel + Ice)

-- Horizontal and Vertical Measurements are encouraged

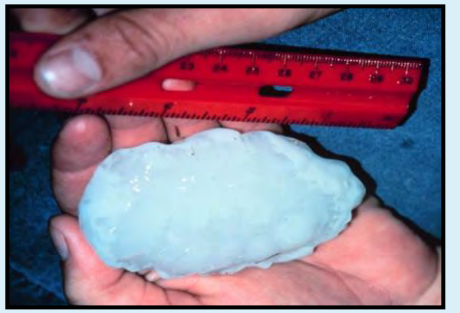
-- Enter the value to the nearest 1/10th of an inch

Why am I getting that precipitation type?



Measuring Hail

- Use a standard ruler and measure the diameter of the hail stone.
- Hail reports are extremely important to National Weather Service Meteorologists and go straight to NWS meteorologists.
- Your reports can help them issue or verify warnings, helping to protect lives and property.
- Report using the CoCoRaHS Website- this is just as useful as calling it in.
- Don't wait until your standard reporting time, report it in as soon as you can safely do so!
- Hail reports are very important, but no report is worth risking your safety.
- NEVER collect hail stones while it is still hailing.
- ALWAYS remember lightning safety!
- Use your best judgment…your health and safety are number 1 !

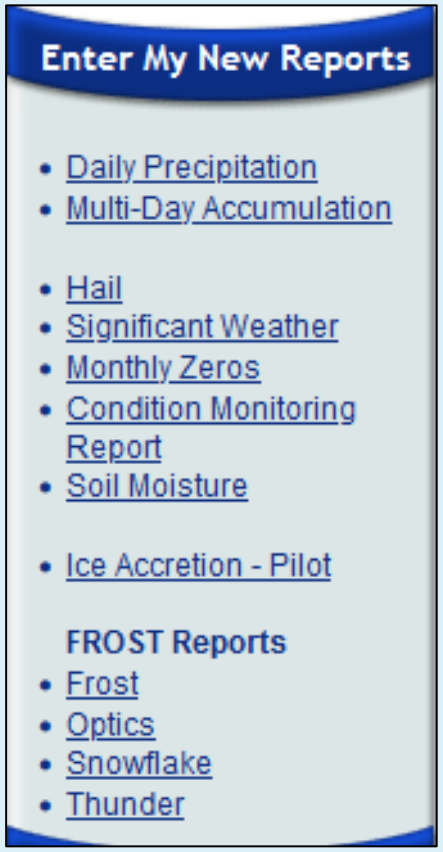


Typical Hail References

0.25 inch Pea Size
0.50 inch Mothball or Grape Size
0.75 inch Penny Size
0.88 inch Nickel Size
1.00 inch (Severe Criteria) Quarter Size
1.25 inch Half Dollar Size
1.50 inch Walnut or Ping Pong Ball Size
1.75 inch Golf Ball Size
2.00 inch Hen Egg Size
2.50 inch Tennis Ball Size
2.75 inch Baseball Size
3.00 inch Teacup Size
4.00 inch Grapefruit Size
4.50 inch Softball Size

Report Types on the CoCoRaHS Website

Daily Precipitation
Multi-Day Precipitation
Hail
Significant Weather
Monthly Zeros
Condition Monitoring
Soil Moisture
Ice Accretion - Pilot
FROST Reports



Daily Precipitation Report

If you are unable to report any aspect of the report, that is ok! Just make sure to leave the NA in place.

Rain and water content of melted snow and ice that fell in the last 24 Hours

Comments

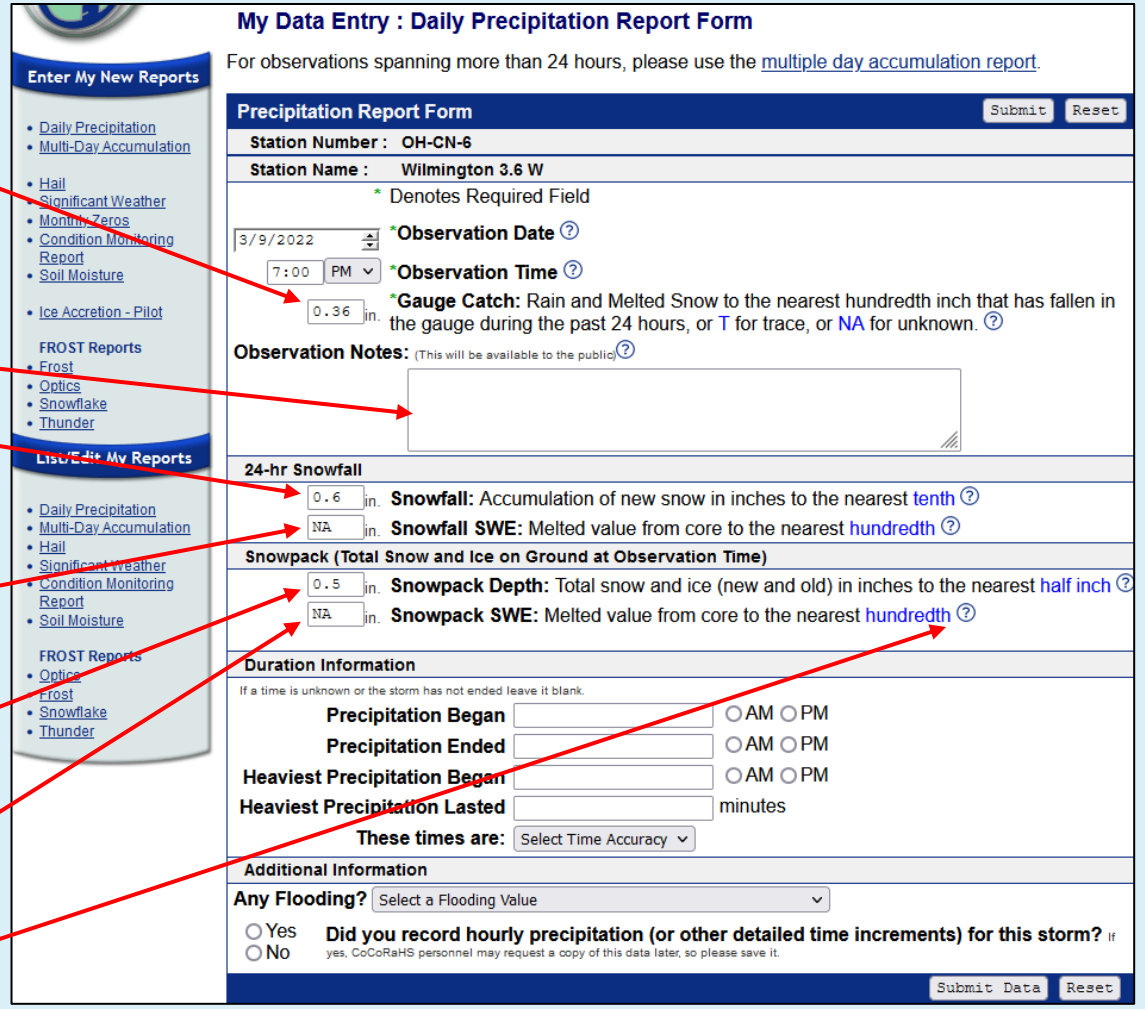
Depth of new snow in the last 24 hrs on snowboard.

Melted core from snowboard (optional)

Total depth of snow on the ground (new + old)

Melted core from ground (optional)

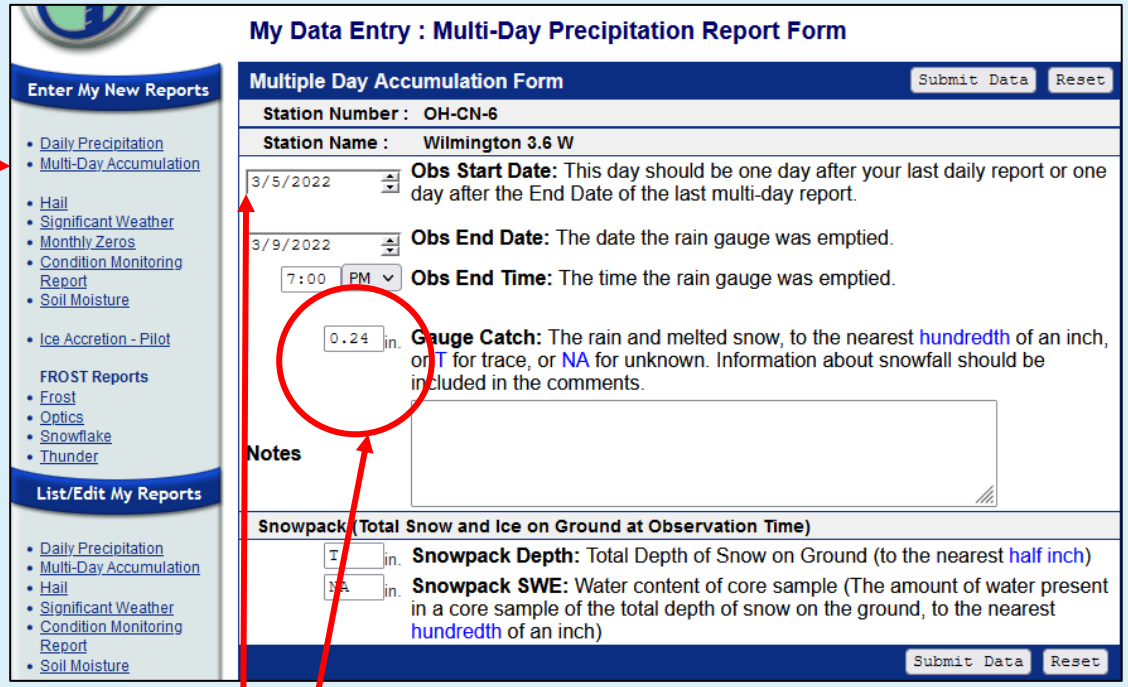
Help button



Daily precipitation report is not utilized if you are not able to read your gauge at your observation time and additional precipitation occurs. Use a multi-day report!

Multi-Day Accumulation Report

Click here to access the multi-day accumulation report



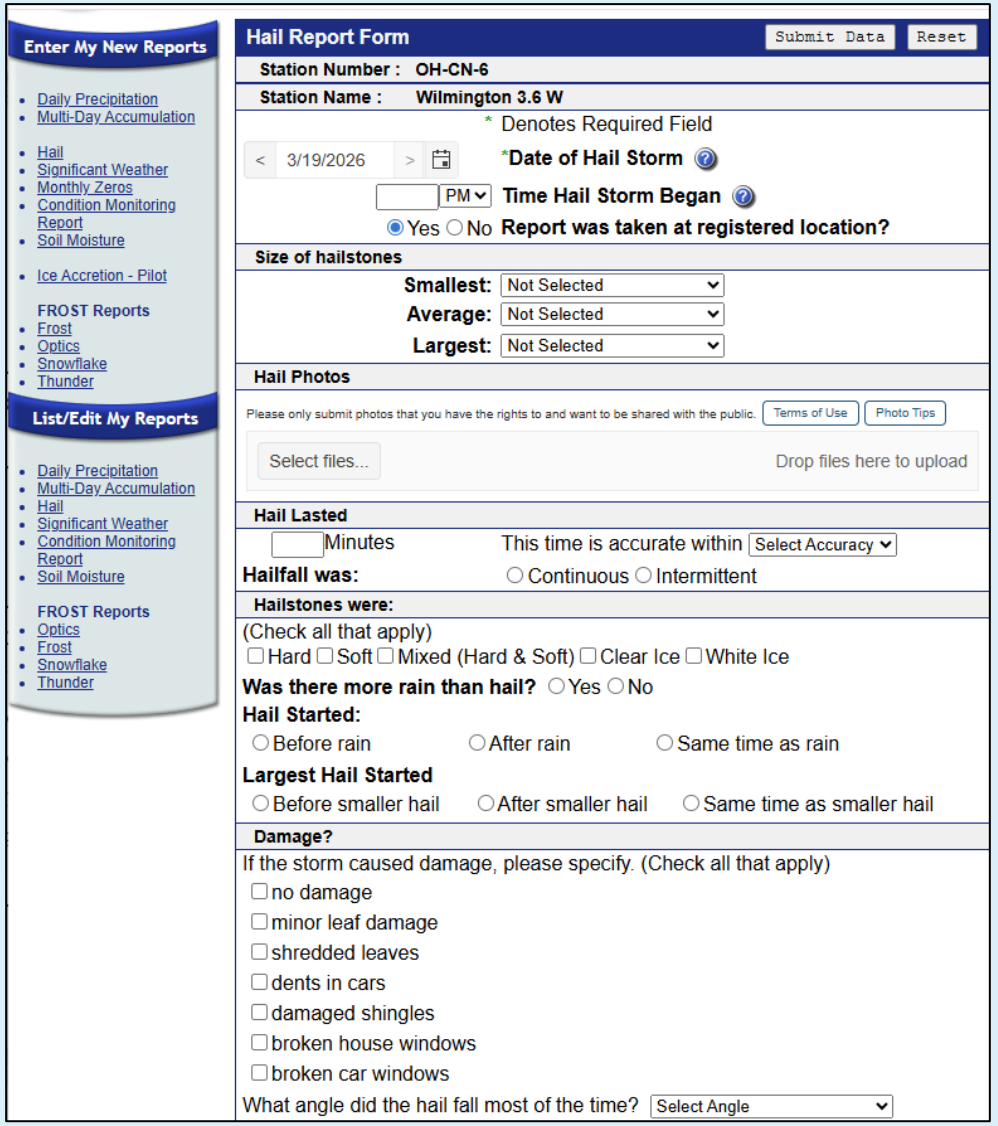
You can even enter information after you've been away for several days. Use this form for the days your have been away instead of the daily precipitation form.

I was away and looked at my gauge when I got back.

Hail Report

Click here to access hail report

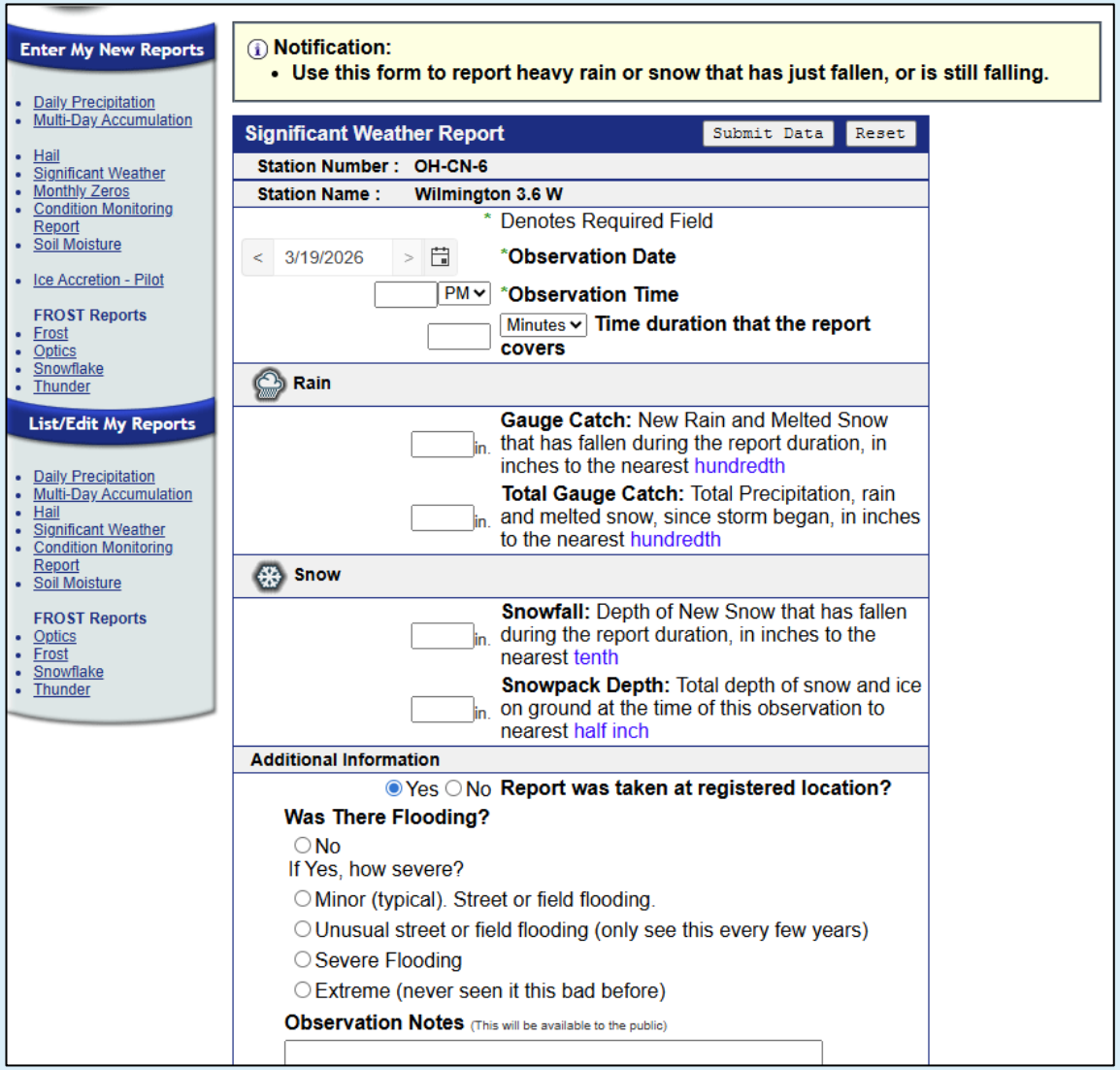
-Goes directly to NWS forecasters real time.
-Take report and submit when you can safely do so, do not wait until observation time.



Significant Weather Report

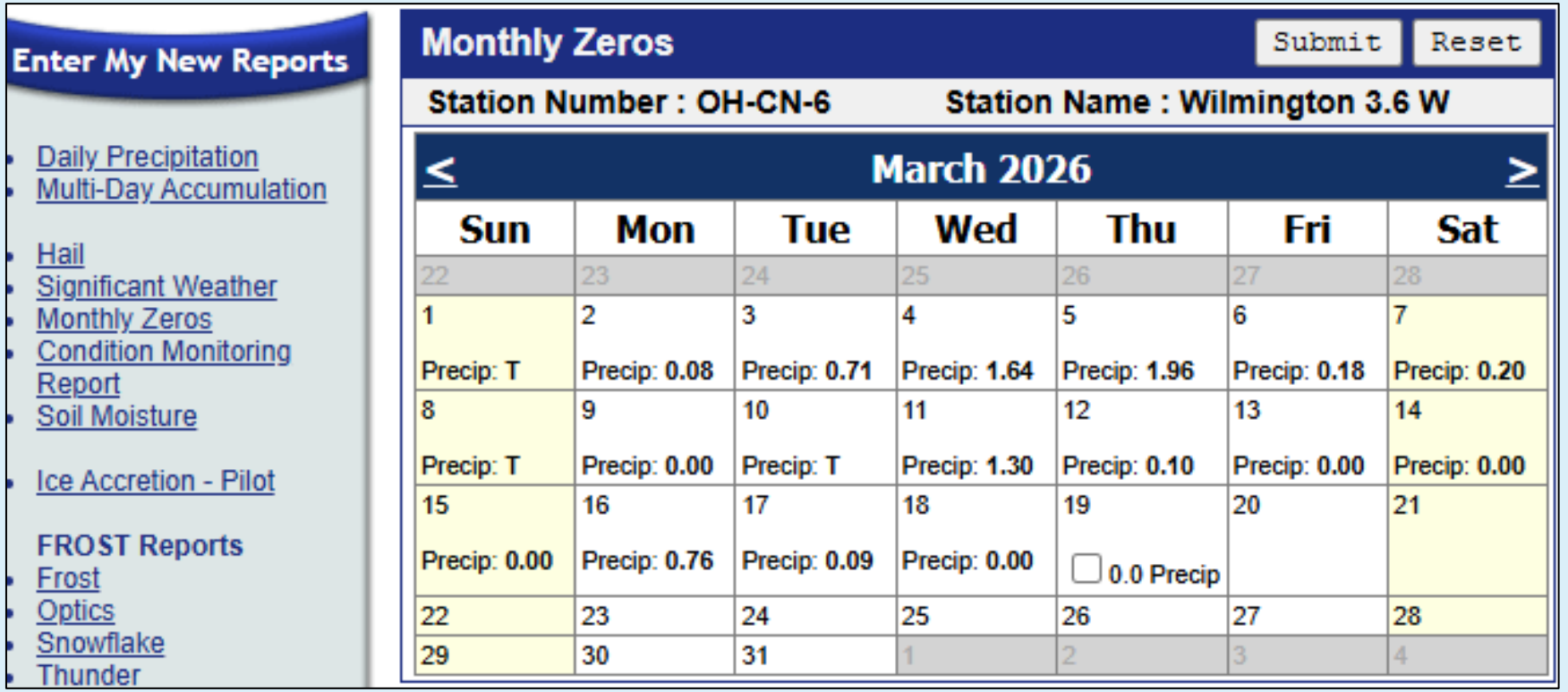
Click here to access the significant weather report

-Goes directly to NWS forecasters real time.
-Take report and submit when you can safely do so, do not wait until observation time.
-No strict definition, but good guidance is greater than an inch of rain in an hour or flooding is occurring. For snow, one inch or more falling in an hour and/or if your total snowfall at the end of the event is greater than four inches. You can put freezing rain of a tenth of an inch or greater in the comments section and also indicate if you did the new ice form as well.



Monthly Zeros

Click here to access the monthly zeros report

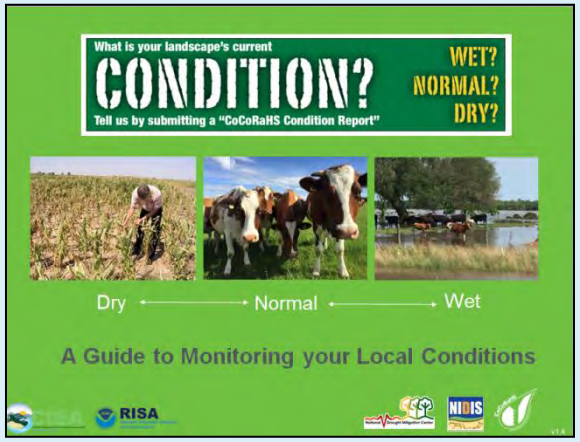


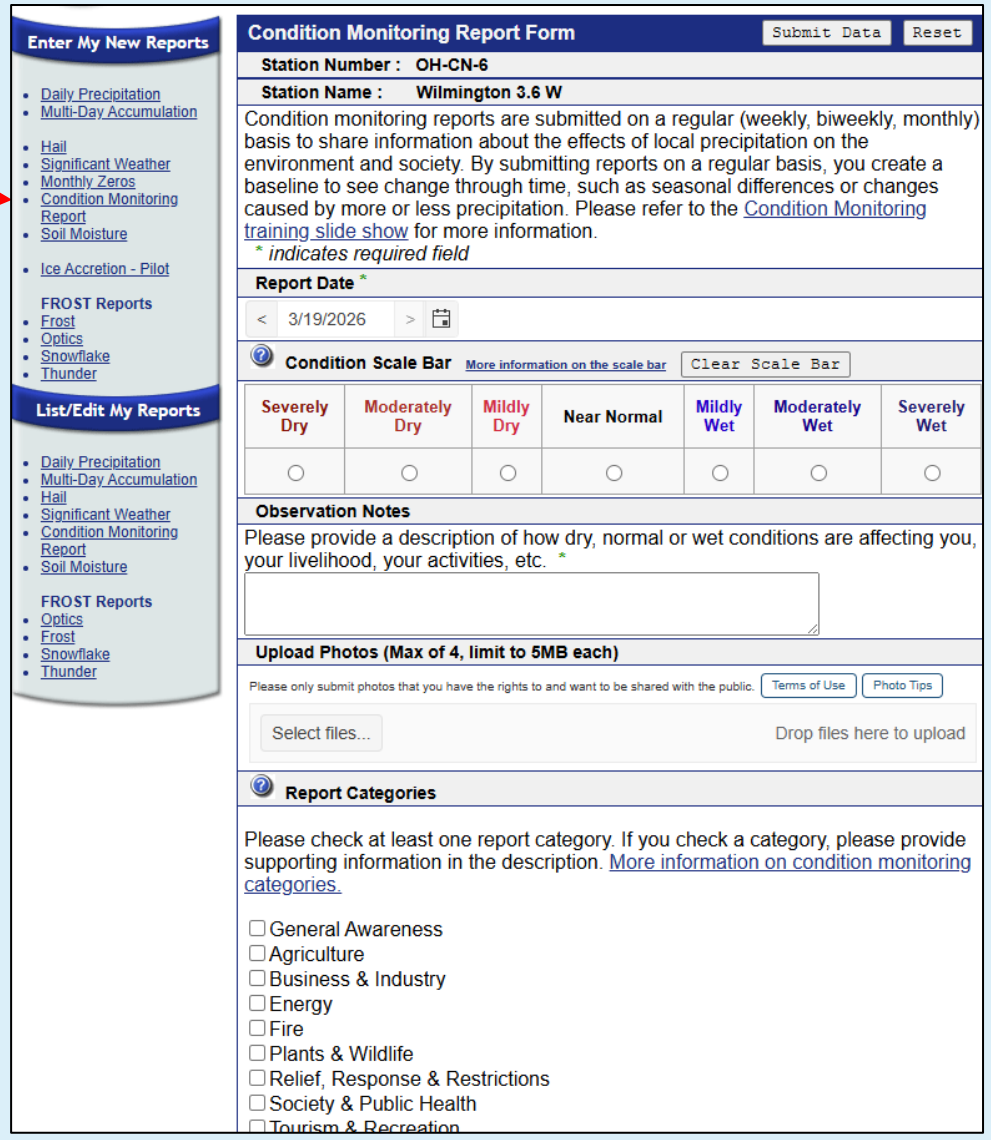
You can go back in and enter days of zero precipitation on one simple to use page

Condition Monitoring Report

Click here to access the condition monitoring report

You can enter how dry/wet conditions are impacting your activities and you. Submitted on a regular (weekly, biweekly, monthly) basis to share info about the effects of local precipitation on the environment and society.

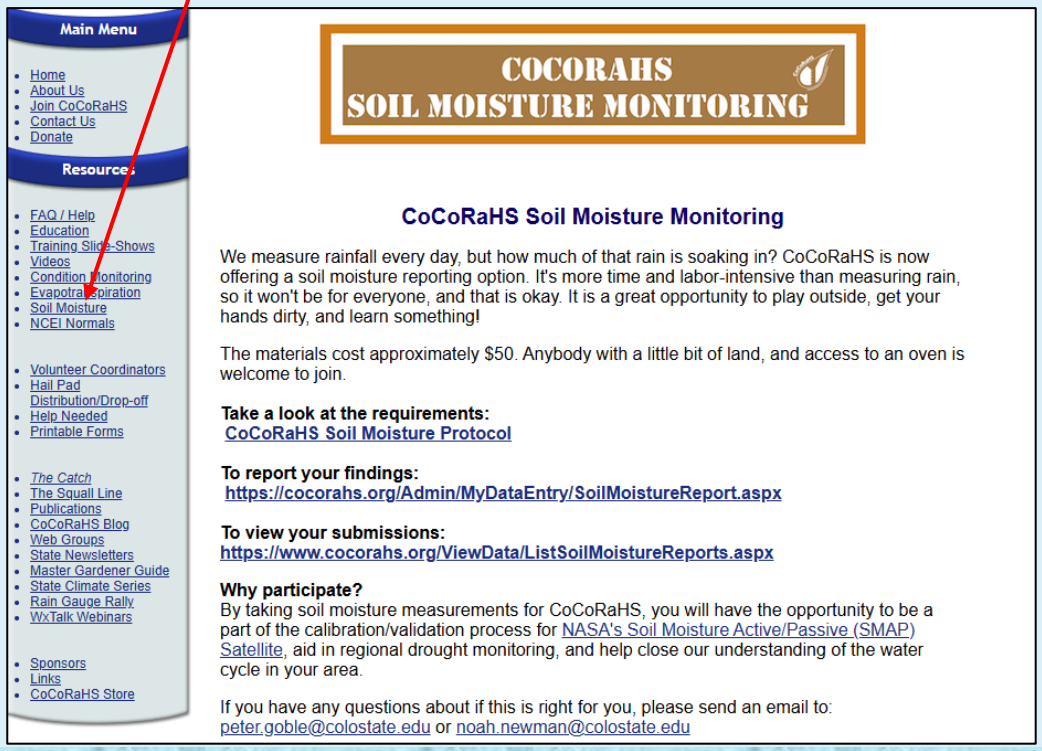


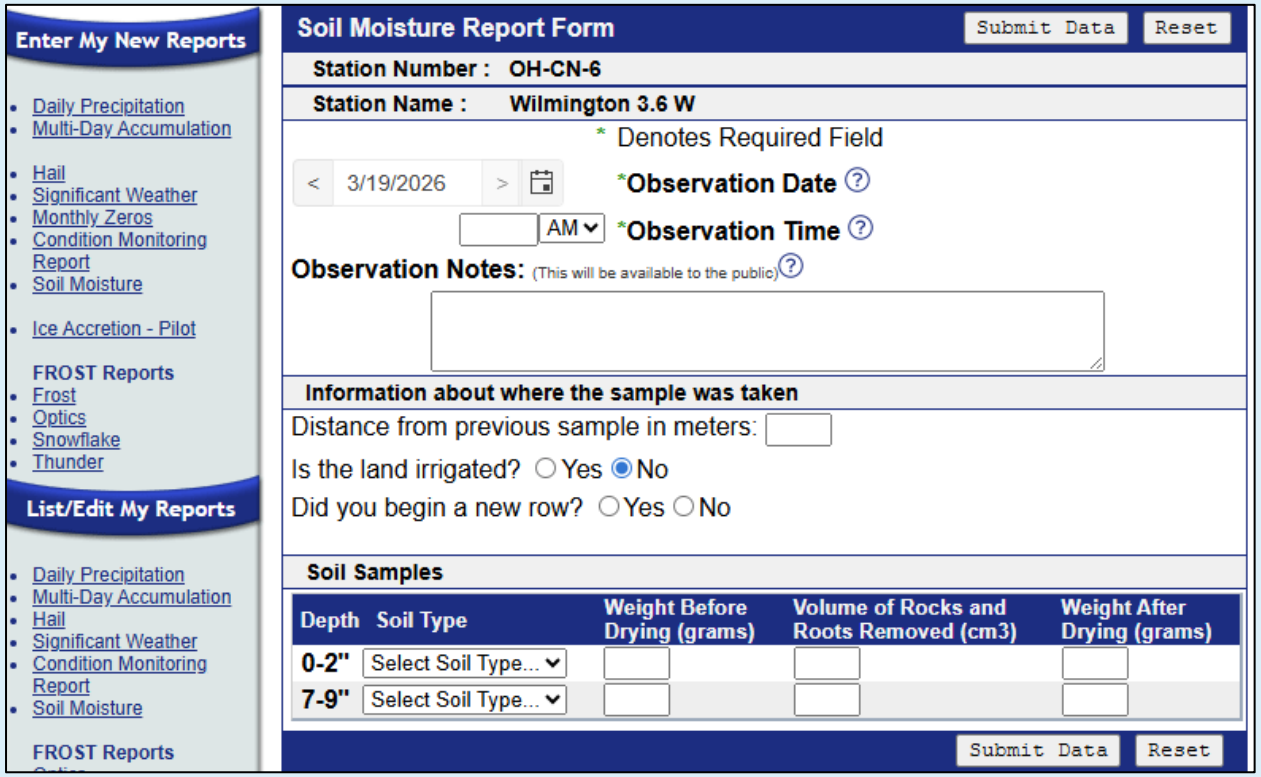


Soil Moisture

Click here to access the soil report

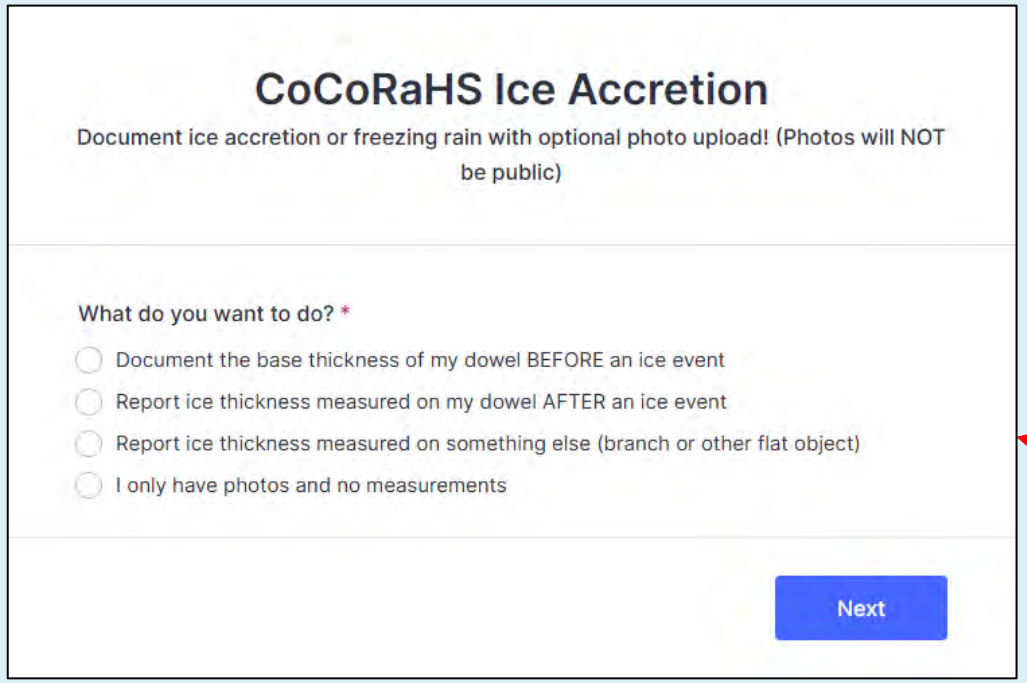
Main Page-Resources





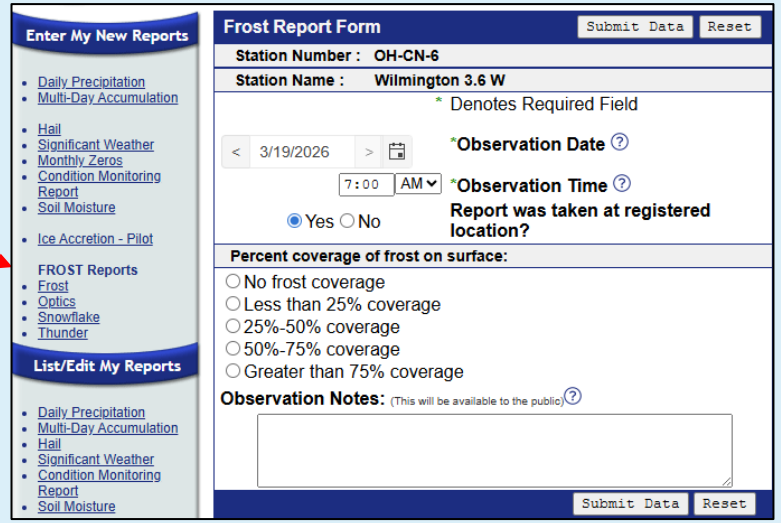
Ice Accretion - Pilot

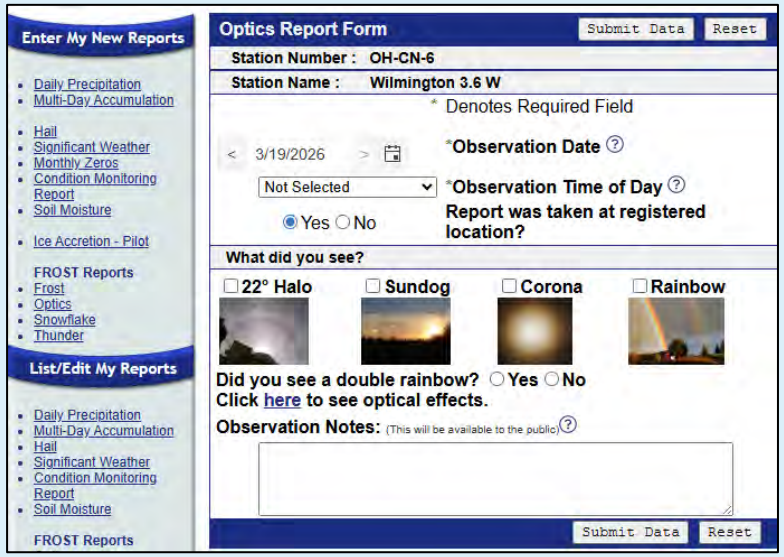
Click here to access the Ice Accretion

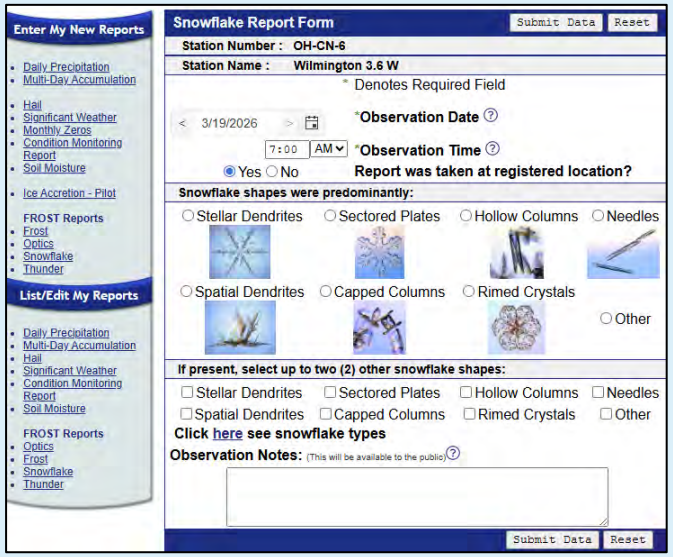


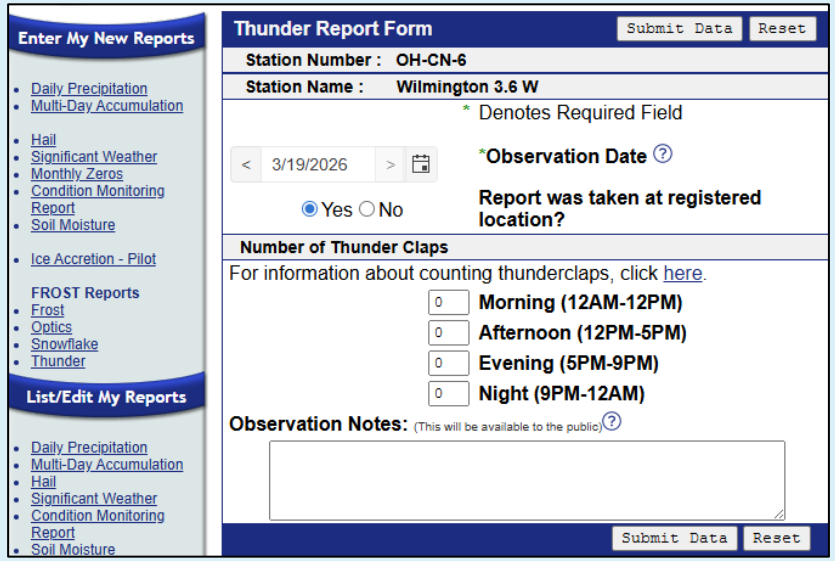
Frost Reports

Click here to access the FROST reports



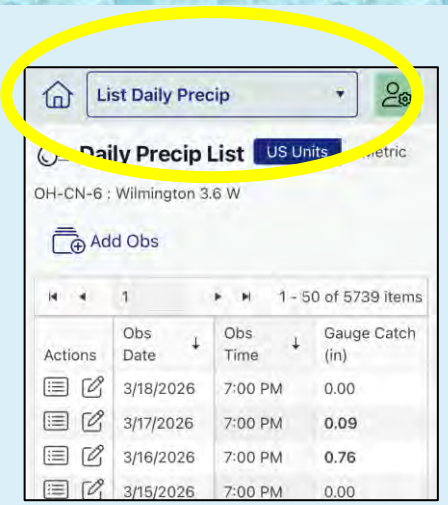


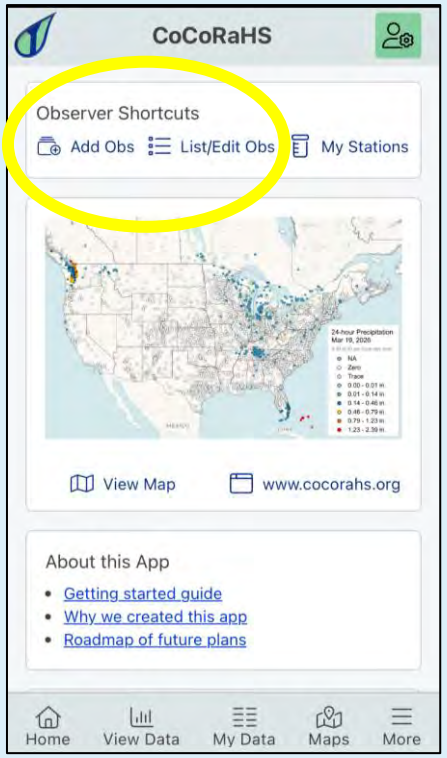


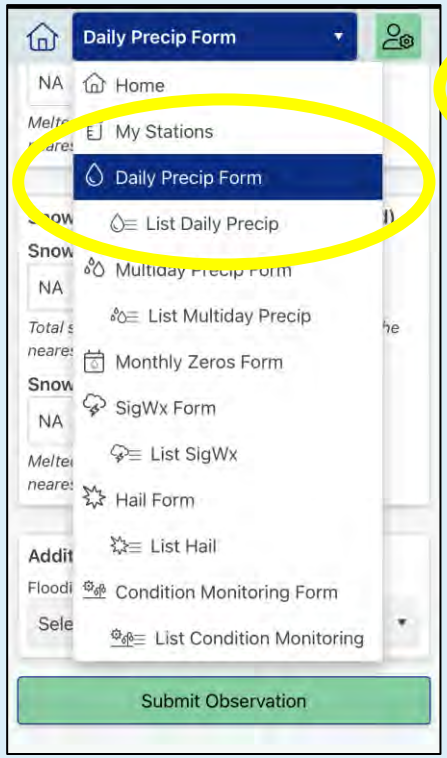


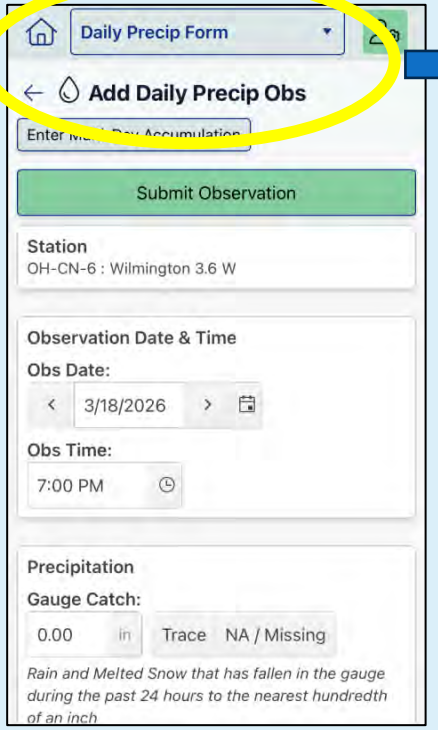
CoCoRaHS App

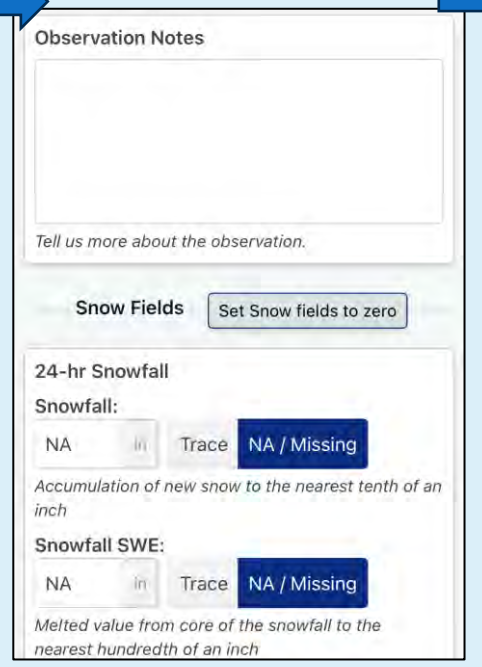
- CoCoRaHS app is available for both iPhone and Android Phone

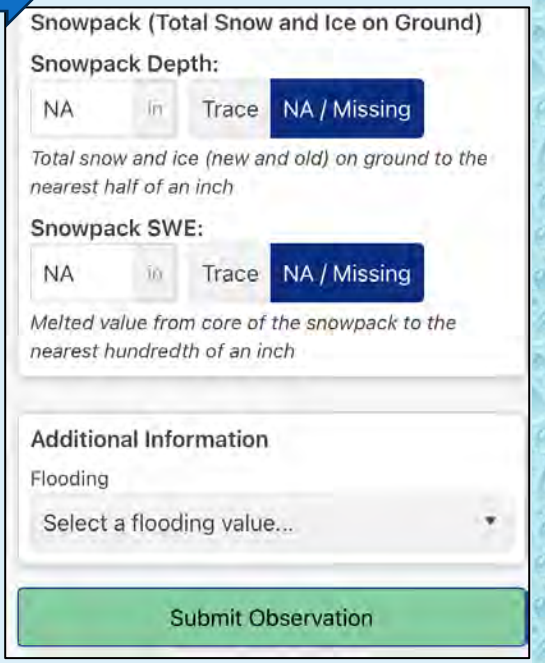






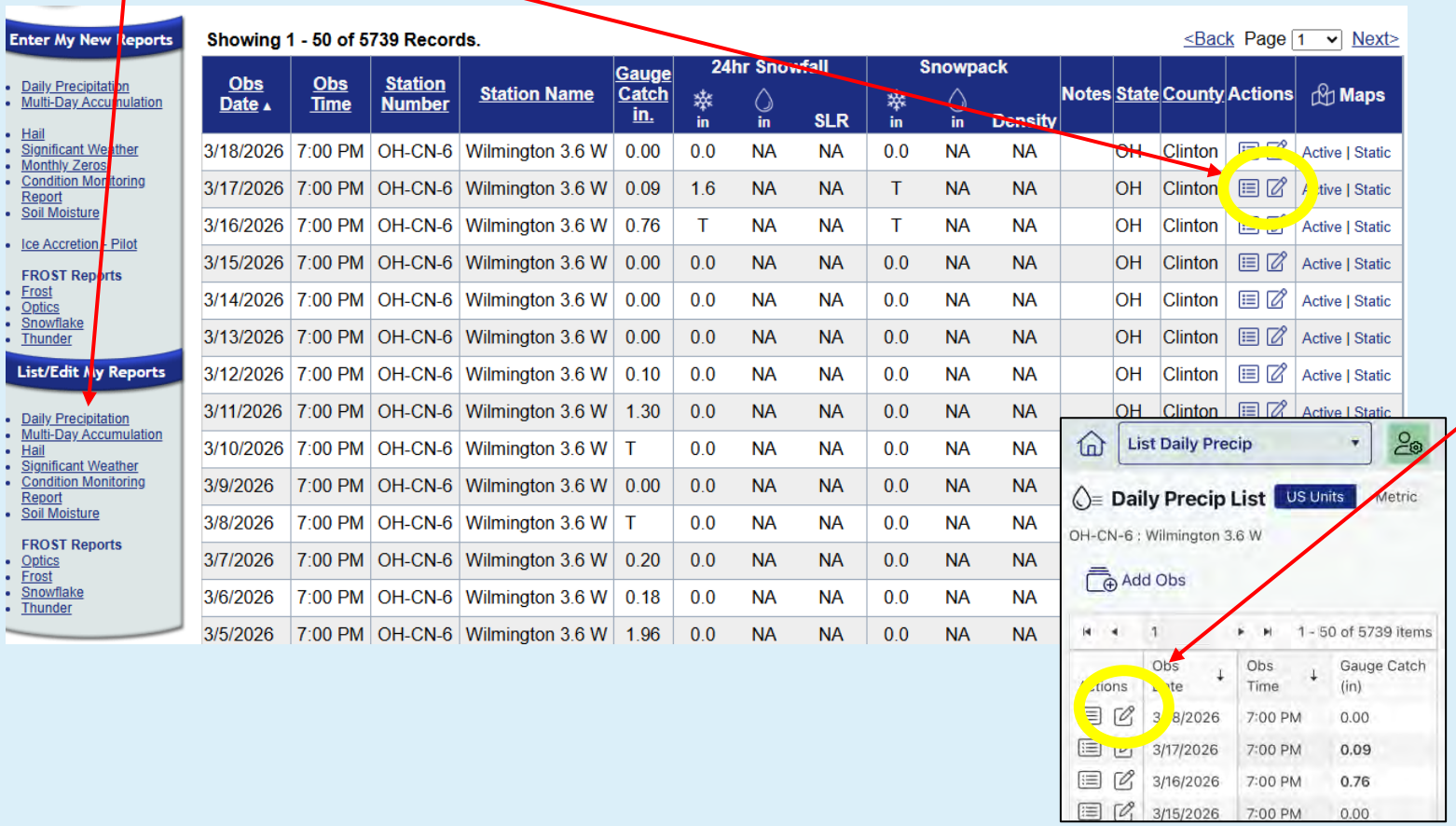






CoCoRaHS QC

Editing Your Report

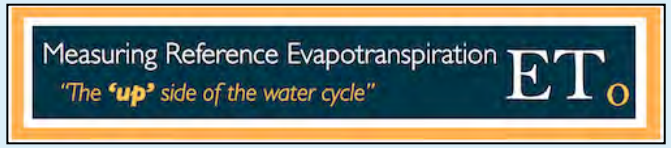


- Mistakes happen it is a part of life.
- If you think you made a mistake you can edit it on the website or via the app. On app go to list daily precip.
- Please do not discouraged if you get an email from a CoCoRaHS coordinator asking for clarification on your report

Additional Resources

- CoCoRaHS has a variety of resources to connect to from its homepage. There are educational YouTube videos, the CoCoRaHS blog, messages of the day, state newsletters, measuring evapotranspiration, and a climate guide for Master Gardeners just to name a few. You can also connect to CoCoRaHS via social media.

Resources found on left hand side of main page.



Join the CoCoRaHS Family

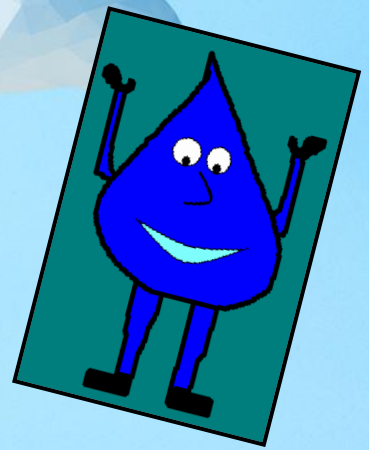
- Sign-up using the CoCoRaHS website www.cocorahs.org and obtain a CoCoRaHS rain gauge.
- Click "Join CoCoRaHS" in the left hand menu or the button on the right hand side.
- You will get an e-mail response with your info.
- Any questions please feel free to ask a CoCoRaHS Coordinator!

State Coordinator (Ohio)
Ashley.Novak@noaa.gov or
Aaron Wilson at Wilson.1010@osu.edu

Local National Weather Service Regional Coordinators are also listed along with state coordinators from other states.

You are now ready to measure precipitation with CoCoRaHS!

Thank you for being a volunteer observer!



Ashley Novak

CoCoRaHS Coordinator

National Weather Service Wilmington, Ohio

Ashley.Novak@noaa.gov