



Measuring Snow and Ice

The best thing to do before you start taking measurements is to get familiar with the daily precipitation entry form and make sure you know what each item means. Once you have that figured out, then it will be easier to confidently measure and report winter precipitation.

The following instructions go line by line through the main part of the data entry form.

My Data Entry : Daily Precipitation Report Form

Precipitation Report Form		Submit Data	Reset
Station Number : CO-LR-610			
Station Name : Fort Collins 3.5 SW			
* Denotes Required Field			
<input type="text" value="12/8/2011"/>	*Observation Date ?		
<input type="text" value="7:00"/> AM	*Observation Time ?		
<input type="text" value="0.75"/>	*Rain and Melted Snow to the nearest hundredth inch that has fallen in the gauge during the past 24 hours ?		
<input checked="" type="radio"/> Yes <input type="radio"/> No Report was taken at registered location?			
Observation Notes: (This will be available to the public) ?			
Snowstorm over night. Calm with cold temperatures this AM			
New Snowfall			
<input type="text" value="9.5"/>	Accumulation of new snow in inches to the nearest tenth ?		
<input type="text" value="0.75"/>	Melted value from core to the nearest hundredth ?		
Total Snow and Ice on Ground at Observation Time			
<input type="text" value="9.5"/>	Depth of total snow and ice (new and old) in inches to the nearest half inch ?		
<input type="text" value="0.75"/>	Melted value from core to the nearest hundredth ?		

1) **Station:**

That's easy. The computer fills in your station name and number automatically. The station number in this example is CO-LR-610.

2) **Observation Date:**

Again, this is easy. The computer fills in this date for you. But if you are reporting for a different date, make sure you use the arrow keys to change the date or type in the correct date using the mm/dd/yyyy format.

3) **Observation Time:**

The computer automatically fills in the time that you originally signed up for to take your daily observation (most often 7:00 AM). If the time shown is not the time you actually did your daily measurements, then type in the correct time and correctly select AM or PM. The time of observation is a very important piece of information for interpreting the reported precipitation amounts.

OK, now comes the most important parts – the precipitation measurement section.

4) **“Rain and Melted Snow” to the nearest hundredth inch that has fallen in the gauge during the past 24 hours:**

That is the water content of the precipitation that has fallen in your gauge -- rain, snow, freezing rain, sleet or any combination. You'll need to remove the funnel and inner cylinder if frozen precipitation is expected. Otherwise, the funnel clogs up and the snow spills out (bummer)! Or worse yet, water will collect in the inner tube, freeze and then crack the tube and you're out of the CoCoRaHS business. Not good.

Rain, snow and ice (any and all combinations) will then be able to accumulate in your outer cylinder. To measure the “precipitation” you will need to MELT the contents so you can pour that water and measure the content in the calibrated inner cylinder of the gauge (just like measuring rain).

A quick way to melt snow and ice in the gauge is to add a measured amount of warm water. You will then need to REMEMBER to subtract that amount from the total to get the correct reading. Some people use their microwave, and that can work if you do it very carefully -- but I've seen a few distorted melted gauges. They're ugly. Do what works best for you and make sure you don't spill.

Another way to measure is to WEIGH your rain gauge outer cylinder. Weighing is much quicker and easier -- if you happen to have a good kitchen or laboratory scales that reads to the nearest whole or half gram. We describe that method in a message sent in late 2008: http://www.cocorahs.org/Media/docs/TheCatch_2008-12-30.pdf

There are situations where your gauge will not catch and accurately measure the moisture from snow. Wind driven snow (traveling nearly horizontally) may deflect around and over your gauge and not land inside. If you feel that your gauge measurement is not accurate or representative, mention this in your observation notes. Then take a core sample. I describe this in section (7) below.

Enter the correct precipitation amount on the form and proceed. Make sure your decimal point is in the correct location. If no precipitation has fallen in the past day, then be sure to enter 0.00" and submit your report.

A common error for beginners is to enthusiastically report the new snow amount in the "Rain and Melted Snow" data field. For example, if you measured 5.0" of snow it is tempting to report 5.00" of precipitation. Oops, but that would be a mistake since you need to melt that snow to report its water content.

5. "Observation Notes":

This is your chance to add more substance to your observation. Measuring snow can be tough, but if you can describe briefly the weather conditions you've observed it will help us interpret your data. If your snow observation is problematic, just describe it in your notes. Here is an example from an observer in South Dakota last year: *"Bad blizzard in progress. Emptied gauge at noon on Wednesday before precipitation turned to snow, had 0.27" then. Got all our pickups stuck. Power out and on generators. Snow depth an estimate only. Drifts are so variable it's hard to know what is average."* So while this observer may not have made a precise measurement, we had a good idea of what was going on. Here's another from eastern Colorado. "This is one of the only times we have had no wind so could get a really good measurement." Your remarks are worth a lot. Don't hold back. You can mention when the snow started and stopped or when it changed from rain to snow, etc. Tell the story.

The next two entries are measurements of new snow (or sleet) that has fallen in the past 24 hours since your previous daily report.

6) **"Accumulation of new snow in inches to the nearest tenth":**

If possible, have a snow measurement surface planned ahead of time in an area of your yard where the snow typically lands and stays reasonably level. Having a white board or white plastic surface (called a snow measurement board) in a representative area makes it easier to measure the accumulation of new snow to the nearest 0.1". Do not measure the depth of snow that has accumulated inside your gauge since snow collects unevenly in the gauge and often sticks to the side making it look like there is more snow than actually collected on the ground. If you only have a ruler that shows fractions (1/8, 1/4, etc.) then convert the readings to decimals. 1/4" for example should be reported as 0.3" (or 0.2" if it's just slightly less than 1/4). We have a fraction conversion table under "Things to know about Rain, Hail and Snow": <http://www.cocorahs.org/Content.aspx?page=snow>

Mark the spot where you placed your snow measurement board with a flag or pole so you don't lose it when it snows. The "Accumulation of new snow" is the depth of snow and/or ice pellets (sleet) that fell and accumulated during the past 24 hours. Remember to report the maximum accumulation of new snow that was observed prior to melting, settling or redistribution by the wind. There is a great example of this in our online snow measurement training slide show. Getting a good measure of the maximum accumulation may require doing a quick measurement during or immediately after the snow ends and not waiting until the next morning. The snow might melt or settle overnight. If all the snow melts as it hits the ground and never accumulates, then report T (for "trace"). If it snowed but you did not have the chance to measure it, then please type in NA (for "not available") and add appropriate explanation in the "Observation notes" section.

7) **"Melted value from core to the nearest hundredth"**

This is a helpful but optional field. If you are concerned that the amount of moisture in the gauge was not accurate or representative due to wind or other factors reducing your gauge catch, or even if you're just very interested and curious, then collect a core sample of the new snow from a representative location where the snow accumulated uniformly. Taking a core sample from your snowboard is ideal – assuming your snow board collected a representative amount. Melt (or weigh) the sample to measure the water content. It is fascinating to see if the moisture collected from the core measurement differs

from what was in your gauge. Sometimes they are very similar but sometimes the gauge catch and the core are quite different.

If water content of the core sample of fresh snowfall is significantly different from what was in your gauge AND you feel it is a more accurate and representative measurement, then enter go back to the "Rain and melted snow" and enter the amount from your core sample. Mention this in your "observation notes" and record the amount that you measured in your regular gauge so we can go back and see how they differed.

The next measurements are measurement of the snow and ice that remains on the ground at the time of observation – even if no new snow has fallen in the past day.

8) "Depth of total snow in inches to the nearest half inch"

The total depth of snow is how much is still on the ground at your scheduled daily observation time. This can be new snow, old snow, or a combination of both. For example, if there was an inch of old snow on the ground yesterday, then it snowed 3" new, but that snow settled to just 2" by your regular observation, then your total depth would be 3".

Keep in mind that your total depth will likely be different than your "New Snow" unless new snow has just fallen on previously bare ground and has not had time to melt or settle. If the snow depth is uneven (and it often is) then take an average of several measurements, or find a measurement location that is representative of the average snow depth in your area. For example, if your front yard and back yard are the same size, and the average depth in your front yard is 2" but in the back yard is 6", then report 4" for your total depth.

REMEMBER, our computer automatically enters NA for your total snow depth. So if there is any snow on the ground be sure to type in the amount to the nearest half-inch (or whole inch if that's easier). If there is some snow remaining on the ground, but more than half the ground is bare, then type in T. During the winter months it is greatly appreciated if you replace the default "NA" with 0.0" when there is no snow on the ground so we know that for sure.

9) "Melted value from core to the nearest hundredth":

This last data entry field is optional but very useful, especially to hydrologists and structural engineers. It is the water content of the total snow on the ground at your scheduled time of observation. This measurement is called SWE which

stands for "Snow Water Equivalent". This is the amount of water that would soak into the ground or run off into streams and rivers if that snow and ice were to melt quickly. Take a core sample of the "total snow" in a representative location, and either melt it or weigh it to obtain the water content.

For areas where deep snow accumulates, the measurement of SWE is cumbersome at best but very important. Also, taking core samples of the snow day after day may eventually leave your yard or measurement area pitted with holes and disturbance. Starting a couple years ago we began "SWE Monday" where we encouraged observers to take this important measurement just once a week on Monday morning. That's easier and provides a better data set. If, however, you live in areas where snow accumulation is less frequent and reliable, or if the snowpack is changing quickly, then take this measurement and report any day of the week.

More information about measuring snow?

Again, we have various other online training sources that you can view at your convenience. For more thorough instructions and explanations go the CoCoRaHS website: www.cocorahs.org where you will find training videos, slide shows and written instructions to help you. If you need additional help, then please contact your CoCoRaHS local coordinator or write to: info@cocorahs.org

Please make use of the CoCoRaHS website to view maps and reports of recent and past snow events so that you can see all the great data that you and our other volunteers are helping to collect. We can all learn a lot by examining our data and comparing to others in our areas.

Special situations

When it comes to snow you will often have to deal with special situations. Snow melts, snow settles and snow flows around. Snow doesn't always land in the rain gauge, either. Don't be frustrated. Perfect measurements may be impossible. Use good judgment, check and cross check your data, and you'll do very well.

Some frequently asked questions about measuring snow and some common problems

Many observers try to enter their measurement of the accumulation of new snow into the "Rain and Melted snow" column. For example, if they measured 2" of

new snow they try to type in 2.00" for the daily "rain and melted snow" amount. Don't do that.

What do I report for my new snow amount when the snow has been melting or settling?

If there is only 2" of new snow left when you do your 7 AM measurement, but you know there was closer to 4" there yesterday before the melting and settling began, then report 4.0" for your new snow amount. For the total depth of snow on ground, report what you measure at 7 AM -- in this case, 2.0" (assuming the ground had previously been bare)

What if I get freezing rain? How do we measure and report that?

Freezing rain is precipitation that falls as rain but then immediately freezes on contact with the ground and/or elevated surfaces. The frozen moisture is called "glaze". Report freezing rain just like rain -- it is NOT SNOW. But you'll need to melt the ice to get an accurate reading. Be very careful on the ice. But if ice does accumulate on the ground or on the old snow, that depth should be included in your measurement of total depth of snow on ground (8 and 9).

It is very, very useful to report the thickness of the ice that accumulates on branches or wires. For purposes of measurement, glaze is called "ice accretion" or "coating". An elevated aluminum strip or wooden dowel can be used for measuring the thickness of accumulating freezing rain on elevated surfaces. . If a metal strip is not available, other common surfaces can be used such as metal mailboxes, metal fences, and metal railings. Measure the vertical depth of accretion atop whichever horizontal surface(s) you use. Exposed tree branches will suffice, but remember to measure the ice accretion, or "Radial thickness" of the ice from the edge of the branch outward. If one side of the branch has a greater thickness of ice than another side, simply take an average. Once you have taken measurements from five or so different surfaces, take an average of all of your measurements, and report it in tenths of an inch. Enter that amount in the "Observation Notes" section of your report. This type of quantitative information about ice buildup has not been routinely measured at most weather stations. It is extremely useful data for a wide variety of applications. We have a quick training slide show on how to measure ice accretion at:

http://www.cocorahs.org/Content.aspx?page=training_slideshows

What if we receive rain and snow on the same day? Then what?

Mixed or changing precipitation types are common in some parts of the country. Report both the rain and the water content of snow that landed in your gauge as your daily precipitation amount. Then measure the amount of new snow and ice pellets (sleet) that accumulated, prior to melting, and report that as your daily snowfall amount. If you can, take a core sample of the snow to get the water content of the accumulated new snow. Then we can infer how much moisture fell as rain and how much fell as snow.

Wouldn't it be helpful to have more than one gauge for winter measurements?

Yes indeed. I actually have four outer cylinders to make snow measurement quicker and easier. I keep extra ones indoors. At 7 AM I go out to retrieve my gauge and replace it with a clean, empty cylinder so I don't have to go out again. I also have two extra cylinders for taking the core sample of fresh snow and the core sample of total snow on the ground all in the same trip. Then I bring them all in together and do all the measurements at the same time. Extra outer cylinders can be ordered online from: WeatherYourWay.com for a reasonable price. Having extras saves a lot of time. There are other ways to speed things up, too, without needing extra equipment.

I've heard that 10 inches of snow equals 1 inch of water. Is that always true?

A typical wet snow or snow with dense, small crystals will often have between 0.80 and 1.00" of water for every 10 inches of new snow. But the "density" (water content) of snow can vary greatly. It is possible in very dry, fluffy snows to get as little as 0.10 to 0.30" of water from 10" of new snow. Also, in extremely wet snows, values as high as 2.00" of water from 10" of new snow is possible. All you have to do is walk or drive in the snow -- or shovel it -- and you'll immediately have a good idea if the density is high, low or medium. That's why we take separate measurements of the snowfall accumulation and the water content. Do not assume the "10:1" ratio.

Can I just measure the snowfall and not worry about the water content?

Some CoCoRaHS volunteers only measure the accumulation of new snow and the total depth of snow on the ground. We really appreciate also knowing the

water content, since it can be so variable. If you do report only the snow depth, then remember to type in "NA" ("for not available") for the daily precipitation amount. If you report snow but you just leave the "Daily Precipitation" box blank (0.00") the computer will give you an error and you won't be allowed to report. So just type in NA for the "rain and melted snow" and then type in the new snow amount and the computer will be happy.

Do I have to report if it didn't snow today?

Knowing that it didn't snow is important. Please report your zeros if you can.

If no new snow fell but there is old snow still on the ground, should I report that?

Yes. Snow cover, even old snow, has a huge effect on the climate. Whenever you have old snow on the ground, try to report the average depth and the water content of that snow each day. While it is fascinating watching snow fall and accumulate, it is also very interesting watching it settle, melt and disappear.

What if the wind is so strong that the snow is badly drifted?

Wind-drifted snow is very difficult to measure accurately. Do your best to come up with an average accumulation of new snow -- and then take a core sample at a point with average accumulation to get the water content. Check the numbers to see if they appear reasonable -- and also mention your challenging plight in your "comments"

What if it's too cold, slippery and I just don't feel like going outside?

Well, that happens to the best of us, especially in these dark days of midwinter. The good news is that you're a volunteer. If you don't feel like it or if it's unsafe, don't do it. But if you can take winter measurements, I assure you they are appreciated. Very few weather stations are able to measure snow and ice so your CoCoRaHS reports are extremely useful.

Finally, don't forget to use the "Significant Weather Report" to send in reports of snow, sleet or freezing rain that you think might be significant to travelers, forecasters and anyone out and about in the winter.