“In Depth” Snow Measuring
Measuring Snow

- Snowfall measurement is typically more difficult than rainfall.
- Snowfall measurement takes a little more time.

Accurate and timely snowfall measurements can be extremely important to your local National Weather Service office, public works departments, media outlets, climatologists, and other scientists.
Tools of the Trade

- 4” Diameter CoCoRaHS Rain Gauge
  - Outer Cylinder for winter weather
Tools of the Trade

- Snow measuring board
  - 16”x16” piece of ½ or ¾” plywood painted white
Tools of the Trade

- Snow ruler or Yardstick
  - Measure in 10\textsuperscript{th}'s of an inch
• CoCoRaHS “Snow-Swatter” and spatula
  ▪ Helps with taking core samples
Where to Measure

- Before it snows, put your snow measuring board outside.
- Your snow measuring board should be on the ground in an area not subject to drifting.
Where to Measure

- It's a good idea to mark the location of your snow board with a flag or reflector
IF SNOW IS ANTIČIPATED . . .

Remove the **funnel** AND **inner tube**, otherwise snow will clog the funnel.
Taking measurements of snow
The Four CoCoRaHS Snow Measurements are:

1. The depth of new snow (new snowfall)
2. Liquid water equivalent of new snow (either in the gauge or on the snowboard)
3. The total depth of new snow and old snow and ice at observation time
4. Snow Water Equivalent (SWE) of total snow on the ground (optional)
DEPTH OF NEW SNOW

1. The **depth** of new snow (new snowfall)

2. Liquid water equivalent of new snow (either in the gauge or on the snowboard)

3. The total depth of new snow **and** old snow and ice at observation time

4. Snow Water Equivalent (SWE) of total snow on the ground (optional)
Measuring the depth of new snowfall
What is Snowfall?

Snowfall is the accumulation of new snow and ice in the past 24 hours prior to melting or settling.
The 10:1 Myth

- 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!
When to Measure New Snow

- Measure new snowfall as soon as possible after it ends, before settling and melting occur.
- This often will not be at your regular observation time.

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.
A Snow Event

Monday 7:00 am
Snow begins 9:00 a.m.
Snow ends 1:00 p.m.

Tuesday 7:00 am

2.4 inches of snow

Some melting and settling occurs

Measure snow as close to 1:00 p.m as possible

1.2 inches
WHERE TO MEASURE NEW SNOWFALL

1. Find a nice, level place to measure where drifting or melting has not occurred (like a snow board).

2. Slide your snow ruler into snow until it reaches the ground/board surface.

3. Read value on snow ruler (value is always to nearest tenth of an inch, like 3.4 inches).

4. If using snowboard, sweep it clean after taking a snow core. Place the board on top of the new snow.
Snow measured under a tree!

Notice that only 3.0 inches of snow has accumulated here
Snow measured in the open!

Whereas 6.5 inches has fallen in the open
Measure at eye level, as an angle will give you an inaccurate measurement.
After you have measured the snow on your board and taken a core sample, clean it off and replace it on top of the newly fallen snow. Be sure to mark its location. Now you are ready for the next snowstorm.
Report your measurement of new snowfall to the nearest tenth of an inch.
IMPORTANT!
Please do not put your snowfall amount in the ‘Rain and melted snow’ box!!!!

Don’t be tempted to put your snowfall amount here! It’s a common mistake.

It should go here instead.

![Precipitation Report Form](image-url)
1. The depth of new snow (new snowfall)

2. **Liquid water equivalent** of new snow (either in the gauge or on the snowboard)

3. The total depth of new snow and old snow and ice at observation time

4. Snow Water Equivalent (SWE) of total snow on the ground (optional)
Measuring the Water Equivalent of New Snow
1. Measuring Snow Water Content of What Fell in the Gauge
YOU MAY HAVE AN ACCUMULATION OF SNOW ON THE RIM OF YOUR GAUGE!
How do I know what to measure and what not to??

Take your snow-swatter and tap gently on the rim of the gauge.
What falls in the gauge we measure!

Go ahead and clear away the snow from the gauge.

We will disregard the snow that lands outside the gauge.
Melting snowfall

Notice that you have two cylinders

Add some warm water to the inner cylinder
Carefully measure your tap water before adding to outer cylinder

Be sure to measure to nearest hundredth of an inch
Add the warm water to the snow sample!

Pour water directly into sample

Allow sample to completely melt
Measure the liquefied snowfall sample!

Pour snow sample into smaller tube. Remember “Every drop counts!”
Carefully read to the nearest one hundredth of an inch
Remember to subtract the amount of warm water that you’ve added to the tube!

Reading of 0.79 inches of water minus 0.50 inches of water added gives a final reading of 0.29 inches

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<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Tube full</td>
<td>0.79</td>
</tr>
<tr>
<td>- Water added</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>-------</td>
</tr>
<tr>
<td>Final reading</td>
<td>0.29</td>
</tr>
</tbody>
</table>
The gauge may not always give an accurate measure of snow water content in new snow. It may be necessary to take a snow core sample off your snowboard!
2. Water Content from a Snow Core of New Snow

- Use your snow board or other hard surface.

- Take core after you have measured snow depth, but before you have cleared the board or surface of snow.

- For example, if you determined the total depth of the new snow is 4 inches, then take your core sample from an area where the depth of new snow is 4 inches.
Taking a Snow Core of New Snow

Capture a core by inverting the outer cylinder and pushing straight down into the snow.

Use something thin and sturdy to slide under the cylinder (spatula, snow swatter).
TAKING A SNOW CORE OF NEW SNOW

Like in the previous example, melt and measure the snow.
Water melted from core is reported as the daily precipitation.

Include amount melted from gauge in comments.

Reporting Liquid Water Equivalent of new Snow

Precipitation Report Form

- Station Number: CO-LR-610
- Station Name: Fort Collins 3.5 SW

* Denotes Required Field

- Observation Date: 11/9/2011
- Observation Time: 7:00 AM

* Rain and Melted Snow to the nearest hundredth inch that has fallen in the gauge during the past 24 hours?

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

Precipitation is amount from snow core. Poor gauge catch - not representative of what fell. Amount melted from gauge 0.29".

New Snowfall
- Accumulation of new snow in inches to the nearest tenth
- Melted value from core to the nearest hundredth

Total Snow and Ice on Ground at Observation Time
- Depth of total snow and ice (new and old) in inches to the nearest half inch
- Melted value from core to the nearest hundredth
Total Depth of New and Old Snow

1. The depth of new snow (new snowfall)
2. Liquid water equivalent of new snow (either in the gauge or on the snowboard)
3. The **total depth** of new snow and old snow and ice at observation time
4. Snow Water Equivalent (SWE) of total snow on the ground (optional)
Measuring the Total Depth of Snow on the Ground
Snow depth is the average depth of snow (including old snow and ice as well as new) that remains on the ground at observation time.
Measuring Total Snow on the Ground

- Snow is rarely uniform in coverage, so take several measurements and average them to obtain your total depth of snow.
- Slide snow ruler through all layers of snow (new and old).
- Read value on snow ruler and record (values are to the nearest ½” like 4.5” or 5.0”).
- Don’t measure “artificial accumulations”, such as plowed piles, large drifts, or shoveled snow.
Snow on the ground!

On some days snow will only partially cover the ground. To record this take an average of both covered and bare areas.
If half the ground has 2.0” and half the ground is bare, report 1.0” as your total depth.

If more than half the ground is bare report “T” (trace) and mention the range of depths in your comments.
IF POSSIBLE

Please report “Total Snow Depth” EVERY day that there is any snow on the ground!
Report the total depth to the nearest half inch.
SWE
Snow Water Equivalent

1. The depth of new snow (new snowfall)
2. Liquid water equivalent of new snow (either in the gauge or on the snowboard)
3. The total depth of new snow and old snow and ice at observation time
4. Snow Water Equivalent (SWE) of total snow on the ground (optional)
Measuring Snow Water Equivalent (SWE)

In parts of the nation where snow stays on the ground for a long period of time we ask our volunteers to take a SWE measurement only once a week. Monday seems to be a good day to do so!

- This is a measurement that is useful to hydrologists and river forecasters.
- It provides an estimate of how much water is “on the ground” that can potentially run off into rivers and streams.
Sometimes snow on the ground can be very deep!

"Measure what you feel comfortable with"
How to Measure “SWE”

- Take a “core sample” from the snow on the ground (not on your snowboard).
- Melt the core sample
- Measure the amount of water in the core
First find a representative location

- The location should have not drifted, melted, or blown clear

- For example, if you determined the total depth of the snow is 7 inches, then take your core sample from an area where the depth of snow is seven inches

“This looks like the best place!”
Steps to cutting a core sample

Place gauge upside down and push down into the snow

Clear snow from around the gauge
**Capturing the core**

1. **Slide**
   - Slide snow-swatter (spatula works, too) under gauge

2. **Lift**
   - Carefully lift and get ready to flip the gauge

3. **Flip**
   - Bring the sample inside to melt
Snow Cores in Deeper Snow

Push down

Turn

Pull
In wetter snow, the core will come out in one piece!
Snow Water Equivalent (SWE)

• Melt and measure

• Report this on your Daily Report form
Report the melted value to the nearest hundredth.
Special Situations
Windy conditions may create a situation where the amount of snow in the gauge is not representative of what fell on the ground.

- In this case, we need to take a “core sample” from the snowboard or an area representative of the average new snow depth.
- Melt and measure the core sample.
- If you feel this is more representative of the actual precipitation, then report this amount as your Daily Precipitation and make a note in the comments. Include the melted amount from the snow that actually fell in the gauge in your comments.
What if’s:
Some additional situations
you may encounter
What if’s:
There’s very heavy snow falling. Can I let someone know?

Indeed! File a “Significant Weather Report” at any time. This report goes directly to the National Weather Service in ‘real-time’ and helps out greatly.

- Report the time duration that the report covers
- Indicate the depth of the new snow that has fallen during this time
- List the depth of the total snow on the ground
- Add notes to paint a fuller picture.
What if: Snow melts as it lands and never accumulates

• Report the precipitation in your gauge (melted) as the Daily Precipitation

• Report a Trace of new snow

• In your comments write: "Snow melted as it landed"
WHAT IF: I TAKE MY SNOW MEASUREMENT, BUT DON’T HAVE TIME TO MELT THE CORE ON MY WAY OUT THE DOOR?

Put NA in the ‘Rain and Melted Snow’ box, as well as the melted core boxes and add an observation note.

When you come back later, go to edit and put the liquid amount in the ‘Rain and Melted Snow’ box, as well as the ‘Melted Core’ box.
How do I measure freezing rain?

“Freezing rain” is rain that falls in liquid form but freezes on contact with a surface.

Do **NOT** report freezing rain as "Snow". Melt and measure the moisture that has accumulated **inside** your gauge and report that as your daily precipitation amount.

Report ZERO for your new snow amount (assuming that it all fell as rain, and no sleet or snow fell or accumulated).

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's freezing rain.
Melt any snow/ice in your rain gauge, and report this as your daily precipitation.

Measure the accumulation of new snow on your snowboard.

Take a core from your snowboard, melt and report in the "New Snowfall" section. (optional)

Measure the total snow on the ground (new snow plus old snow and ice).

Report the water equivalent of total snow on the ground (SWE). (once a week if possible)
Snow Zeros

There’s no zero’s like ‘snow zeros’!

If you are in the winter season and you have not had new snow in the past 24 hours, please fill in those ‘snow zeros’!

Here are three cases

Case number one:
- No new snowfall
- No snow currently on the ground

0.0
0.0
There’s no zero’s like ‘snow zeros’!

Case number two:
- No new snowfall
- Snow already on ground
- You have taken a snow core of the snow on the ground

<table>
<thead>
<tr>
<th>New Snowfall</th>
<th>Accumulation of new snow in inches to the nearest tenth</th>
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</table>

<table>
<thead>
<tr>
<th>Melted value from core to the nearest hundredth</th>
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</thead>
<tbody>
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<td>0.0</td>
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<td>0.0</td>
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<table>
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<tr>
<th>Depth of total snow and ice (new and old) in inches to the nearest half inch</th>
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<tr>
<td>17.5</td>
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<tr>
<td>1.3</td>
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<table>
<thead>
<tr>
<th>Melted value from core to the nearest hundredth</th>
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</thead>
<tbody>
<tr>
<td>1.3</td>
</tr>
</tbody>
</table>
Snow Zeros

There’s no zero’s like ‘snow zeros’!

Case number three:
- No new snowfall
- Snow already on ground
- You have not taken a snow core of the snow on the ground

![Image of data entry form]

- No new snowfall
- Snow already on ground
- You have not taken a snow core of the snow on the ground
Additional Winter Training

Click here

HTML  PDF  

ICE ACCRETION

MEASURING THE WATER CONTENT OF SNOW BY WEIGHT

HTML  PDF  

Click here
THE END

For more information
contact: info@cocorahs.org