

Alternative Methods For Making CoCoRaHS Snow Water Content Measurements

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Introduction

This document will cover off two alternate methods for measuring the water content of the daily snowfall and the snow pack. Part one covers how to determine the water content of the snowfall by measuring the weight of the snow. Part two covers how to make a simple, low cost tool to make the measurement of the water content in the snow pack (each Monday) much easier.

Part 1 : Weighing Snow

The standard CoCoRaHS procedure for measuring the water content of any snow in your precipitation gauge or taking snow core measurements is to melt the snow then measure the liquid amount by pouring it into the inner graduated cylinder. This works fairly well but can be time consuming and is somewhat prone to error. A quicker and easier way to make this measurement is by weighing the snow with a simple low cost digital nutrition scale. The weight of snow is directly proportional to the amount of water content. This is covered in the CoCoRaHS Training Slide Show here:

http://www.cocorahs.org/Media/Training/Training_SnowByWeight.html

Weighing Snow



If you are weighing daily snowfall in your **4 inch** precipitation gauge or from a snow core simply place the gauge with contents on your scale and measure the weight in grams:

1. Determine the weight of the empty dry gauge first. In this case 458 g (grams) (note that your gauge will likely be a different weight).
2. Determine the weight of the gauge and snow. Be sure that the outside of the gauge is dry and has no snow stuck to it. In this case the gauge plus contents weighs 879 g
3. Subtract the weight of the empty and dry gauge. Weight of the snow = $879 \text{ g} - 458 \text{ g} = 421 \text{ g}$
4. Now simply multiply the weight of the snow by the standard **4 inch gauge conversion factor** to determine the water content:
 - * For Metric: $421 \text{ g} \times 0.126 \text{ mm/g} = 53.0 \text{ mm}$
 - * For Imperial: $421 \text{ g} \times 0.00498 \text{ inches/g} = 2.10 \text{ in}$

Similar digital nutrition scales as the one shown here can be purchased at most house wear retailers for about \$20.00.

Part 2 : A Better Snow Core Tool

The standard CoCoRaHS procedure for measuring the water content of the snow pack (total snow depth) is to take a snow core using the outer portion of your CoCoRaHS precipitation gauge. This measurement is taken once per week on Mondays and is a very valuable measurement to understand the changes in the water content of the snow pack which is required by flood forecast agencies. The CoCoRaHS 4 inch gauge works OK early in the winter before the snow pack is deep and or becomes icy but later in the season this can be a difficult task. A good solution that we have developed is to use a section of 2 inch ABS (black plastic) drain pipe to take the core. This is a new approach which is not yet covered in the CoCoRaHS training material and these are not yet available for purchase...but you can, however, make your own gauge with some basic low cost materials and about 20 minutes work. Here's how....

Making The Snow Core Tube



We recommend purchasing a length of **2 inch (diameter)** ABS black plastic pipe to make this tool. The 2 inch pipe is easier to handle and somewhat more effective than 4 inch pipe.

Be sure that the pipe has a 2 inch inner diameter (not outer). ABS pipe can be purchased at most hardware or plumbing supply stores and in many cases the pipe is available in pre-cut shorter lengths like 3, 4 or 5 feet or the store may cut it for you. Don't substitute with 2 inch PVC white plastic pipe

Making The Snow Core Tube



You will also need to purchase a blue plastic 2 inch Test Cap for the ABS pipe normally available in the same plumbing section of the store. A black ABS cap can also be used but is a bit more expensive and not required. The cap is required to keep your snow sample from falling out of the tube.



Finally you will require a small triangular shaped file (for metal) commonly available at most hardware stores. This will be used to create the cutting teeth on one end of the pipe.

Making The Snow Core Tube



1. Cut your pipe to the required length (be sure the end is cut-off square and not at an angle). The length is up to you but should be long enough to do a full core of the normal maximum winter snow depth in your area. For most parts of Canada a length of 3 to 5 feet should be sufficient.

2. Use your triangle file to cut teeth into one end of the pipe with the flat side of the file facing up toward you. Hold the file at a compound angle as shown in the photos. You will need to support one side of the pipe against a bench or some other rigid object so the pipe will not move too much when filing.

Making The Snow Core Tube



3. Continuing filing until the file reaches it's full depth (top side of the file even with the top of the pipe).



4. Begin the next cut for the 2nd tooth by using the full width of the file to measure the distance to the next cut in point.

5. Continue this process working your way around the pipe until you have filed all the teeth. It doesn't need to be perfect!

Making The Snow Core Tube



When you have finished it should look something like the photo at left. The process will take you 15 to 20 minutes.

6. Place the blue test cap on the other end of the pipe (not too tightly) and you're done with construction! Do not glue the test cap on the pipe as you need to be able to remove it when coring.

7. Wipe the tube down to ensure it is clean and dry. Weigh the empty tube on your digital nutrition scale to determine the dry weight in grams...you'll need that later.

Using Your Snow Core Tube

1. When taking the once per week snow cores hold the 2 inch snow core tube vertically and press it into the snow pack with a twisting motion. Harder layers of snow and ice will require more twisting motion to cut through the snow pack. **It is important not to push down too forcefully as harder layers of ice can block the tube and prevent you from getting a full core. Also be sure to remove the end cap before you begin coring otherwise you may not get a full core.**
2. Be sure you take your measurement in a spot where the snow depth is representative of your average total snow depth.
3. Keep going until you are fairly sure you have reached the ground level. If the snow is dry you may be able to lift the tube straight out and retain the core.
4. In most cases you will have to remove some snow from one side of the tube so it can be tilted over on an angle and you can get your snow paddle or hand over the bottom end. If the snow is deep and or hard packed you may need to use a shovel.
5. Place the blue end cap back on the pipe snugly then lift up the tube and flip it over so the open end is facing up.

Using Your Snow Core Tube



Bring your **2 inch** snow tube inside and place it on the scale. Be sure to first remove any snow or moisture on the outside of the tube:

1. Determine the weight of the tube and snow. In this case 1050 g (grams).

2. Subtract the weight of the empty and dry tube. In this case the dry tube weighs 610 g (note that your gauge will be a different weight). Weight of the snow = 1050 g – 610 g = 440 g

3. Now simply multiply the weight of the snow by the standard **2 inch pipe conversion factor** to determine the water content:

- * For Metric: $440 \text{ g} \times 0.500 \text{ mm/g} = 220.0 \text{ mm}$
- * For Imperial: $440 \text{ g} \times 0.0197 \text{ inches/g} = 8.67 \text{ in}$

Note that if you choose to melt the core and measure with the graduated cylinder you must multiply the measured amount by 3.97 as the graduated cylinder is calibrated for the CoCoRaHS 4 inch gauge

We'd Like Your Comments

We'd like to hear from you if you have any comments, questions or suggestions regarding this information. As volunteers ourselves we are very aware that the winter measurements are more challenging and so we have provided this information to make that as easy and efficient as possible for our volunteers. We hope that you will take advantage of these new techniques for taking your snow measurements and if you do please let us know!

Feel free to drop us a line or call:

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