

The Catch

COCORAHS -- MORE INFO ON MEASURING SNOW AND ICE

FORT COLLINS, CO — Saturday, February 5, 2011

Greetings and good morning,

Perhaps this will be my last message of this winter season focused on snow and ice. That should please many of you :-). Those of you in southern climates may be able to sit back and skip over this one -- but then again, if I'm not mistaken, haven't we had snow in southern New Mexico and ice as far south as Brownsville, TX this week?

Dealing with the challenges of snow and ice

I have been bombarded this week by e-mails from volunteers in many parts of the country as they confront the difficulties of winter precipitation measurements. The storms this week have included frigid temperatures, widespread blizzard conditions of extreme severity, and large areas of freezing drizzle, freezing rain, sleet and various combinations of mixed precipitation. Snow and ice in southern New England is so deep and moisture-laden that some buildings have been collapsing under the extreme weight. These are the most difficult situations we will meet up with as CoCoRaHS volunteers. But they are likewise situations where our data are of particular value. Other than the National Weather Service's Cooperative Weather Observing Network that a few of us are already a part of

<http://www.srh.noaa.gov/ohx/?n=cooperativeobserverprogram>

and a few airports across the country staffed with weather observers, there are surprisingly few other sources of point measurements of snow and ice.

Our CoCoRaHS precipitation reports this week have appeared on TV, in many newspapers, in on-line news stories and in countless National Weather Service summary reports as our volunteer efforts supplement the

official weather observing networks of our country. Your efforts are GREATLY APPRECIATED.

I applaud all of you who braved this winter onslaught to report your precipitation. I also applaud those of us who have had the commonsense to stay indoors and wait until spring for returning to the pleasant routine of daily weather observations in warmer weather. After all, this is a volunteer effort, and many of us are not as young, agile and resilient as we once were. Traipsing out to in the ice and snow on cold winter mornings to take measurements can be hazardous especially in weather like we've had this week. There is no reason to risk getting stuck, breaking a hip or such just to measure some snow or freezing rain. Be wise.

Snow measurement questions

Rather than trying to answer each individual e-mail that I received this week, I thought I would group the questions into a few categories and try to cover this for everyone who might be interested. Read the parts that apply to you and skip over the rest or come back to it when you need to. I wish there was a way to make this brief and easy. After all, measuring rain is a piece of cake. But snow and ice require more time, thought, care, and good judgment. So here we go

Freezing rain/glaze

The challenge of glaze from freezing rain is 1) it's remarkably slippery, 2) it makes it difficult to remove your gauge from its mounting bracket, 3) it often is accompanied by other forms of precipitation, and 4) it takes a long time to melt. The glaze from freezing rain accumulates both on the outside and the inside of your gauge.

When it comes to freezing rain, the measurements that we are most interested in are 1) the total amount of water content in the gauge -- just your regular daily precipitation amount and 2) the ice accretion that has accumulated on wires, branches, etc. This is the average "radial thickness" of the accumulated ice. We don't have a special form yet to submit this extremely useful observation, but we hope you enter this in your "Comments" (see instructions for ice accretion under "Training Slide Shows"). The U.S. Forest Service, state forest services, arborists, electric utilities, airport operations and many other groups are extremely interested in getting good data on the accumulation of ice from freezing rain. We are hoping to have a better way to enter and view ice accretion

by next winter. Some professional organizations may help make this possible.

To measure the water content, just melt and measure what's in the gauge making sure to include any ice frozen to the inside sides of the gauge (and making sure that any ice on the outside of the gauge is not included. Many have told me they have avoided the problem of the gauge freezing and sticking in the mounting bracket by applying a layer of non-stick vegetable oil. Others have had good luck by taking out a pitcher of warm water to thaw out the bracket. My approach, but we get very little freezing rain here, is to remove the gauge from the bracket prior to an icing event so it is easier to retrieve. If there is a very thick layer of ice, do the best you can. We've had a few people break their gauge trying to pry it free from thick layers of glaze -- so don't get too carried away.

Blizzard conditions and uneven snow conditions

Yes, we always try to measure as accurately as we can -- precipitation amounts to the nearest 0.01", snowfall to the nearest 0.1" and total depth (old plus new snow) to the nearest half or whole inch. But when the blizzard comes, as it did this week from OK to MO, IA, IL, IN, WI and MI, then throw that out the window and just do the best you can.

The simple fact is that wind-driven snow is not inclined to land in our gauges or accumulate politely on our favorite snow measurement areas. The gauge may be nearly empty and there may be areas of bare ground showing while nearby are drifts 3-6 feet tall. In fact, in blizzard conditions we may have to disregard what lands in our gauge and revert, instead, to finding -- to the best of our reasoning abilities -- a "representative location" where the accumulation of new snow seems to be about the average. There you can report the average depth and take a core sample of the snow, measure the water content and then ponder, before you send in your report, if that reading seems reasonable.

You may think that us "professionals" know how to handle all situations with grace and precision, but the fact is that coming up with measurements from true blizzard storms -- such as the 20.2" total reported at Chicago O'Hare earlier this week (3rd largest single storm in recorded history), is often a combination of measurement (usually an average from several locations), experience (comparing to past storms you have measured) and judgment. In other words, there are situations where a good guess is probably closer to the truth than any one particular measurement you can make.

There is no magic formula for how you determine how much snow fell and what its water content was. You just assess as best you can. I assure you, you can tell the difference between a 1" snow, a 6" snow and a 12" snow, even in blizzard conditions. So start crudely and then narrow it down to a better estimate. If you're in an open wind-swept area, chances are you will report less than if you are in a very protected area where the snow builds up. In fact, in both the recent Chicago storm and the one that hit New York City the day after Christmas, the deepest snows were measured in very densely populated neighborhoods. Because of the very strong winds with these storms, snow was blown from the many roofs and streets and deposited in the small yards. The backyard measurements may have been somewhat enhanced by the roof-blown snow.

So don't give up on these storms. No, your "measurement" may not be perfect, but no one's will be. Just do your best, be reasonable, and be consistent. Then check with what you see from neighboring stations. Chances are you will be in the right ballpark. And the more measurements there are in any given area, the more confident we become. People think we're crazy when we say we are hoping to achieve at least one volunteer per square mile in populated areas -- but when we have that concentration of observations we learn a whole lot.

Dealing with deep snow and ice taller than my gauge or too dense to penetrate

My hat is off to all of you who have been and continue to measure and report the water content of the total accumulation of snow on the ground. We certainly don't expect everyone to take the SWE measurement but this is information that is hard to come by and of much utility. The water content from deep snow may fuel the next big flood or it may weigh down roofs and buildings to the point of damage or collapse.

There is a lot of snow now in many parts of the country including widespread areas of New England right to the coast with close to 2 feet of dense snow. This snow may have several inches of water content. Just to give you an idea, if you happen to have three inches of water content in the snow that is perched on the roof of your house, that works out to over 15 pounds per square foot. Add up the square feet of your roof and all of a sudden you're talking about a lot of weight.

Our equipment is not well suited to getting quick measurements of the water content of deep or icy snow. The outer cylinder of our gauge is only

12" tall, which makes it hard to get a core sample from deep snow. Furthermore, some of your snow has ice layers and is so dense that you nearly crack the gauge trying to get a core sample. Thanks for trying, that's for sure.

Here are a couple of suggestions we've received to try to make this important measurement feasible. If you have others, please let me know. There are a lot of practical and ingenious folks out there.

"Hi Nolan,

You mentioned that our observers are having a problem measuring snow depth to get the water content. I believe the problem is that the outer tube is too small to measure the deep snow that some people have. Trying to push the plastic tube thru deep encrusted snow may damage the tube.

This what I did to solve this problem. I took #2 cans, the kind you get fruit cocktail or tomatoes in, and cut the tops and bottoms off. Then I taped them all together with metal tape that you can find in most hardware stores. Leave bottom on the last can. you can add as many cans as you think you need.

My can measuring tube is 22" long, and it cuts thru snow and crust easy. IT IS THE SAME SIZE DIAMETER AS OUR PLASTIC GAUGES (so I can then melt the snow and pour it into the calibrated inner cylinder to get the final measurement)

Hope this suggestion may help.

*Bob
Tilton, N.H."*

Nolan -

OK, we found the report for the muffler snow tube - looks like a great idea for getting through ice, but the equipment includes the 2.5"-diameter plastic tube that NWS co-ops have, and a little help from the muffler shop and their equipment.

The basic idea is that a length of muffler tube, 2.5" in OUTSIDE diameter, is flared at the bottom to make the INSIDE diameter 2.5" (this is the muffler shop equipment). Then teeth are notched with a jigsaw and metal-cutting blade. The NWS plastic gauge is stuck on the other end

(non-flared) and the sample is dumped into the rain gauge and measured.

So, for folks to do this without the plastic rain gauge is definitely possible, but we'd have to supply them with "easy math" (i.e. a simple conversion factor) to calculate the water by volume or weight.

If you're interested in more information about this, here's the link:

http://www.crh.noaa.gov/mqt/?n=swe_muffler_pipe.php

Again, let me know if I can help!

Moisture stuck on the side of the gauge

Our motto is "every drop counts" but many of you have noticed that quite a few drops stick to the side of the large outer cylinder when the funnel and inner tube are removed for winter weather operations. When you do your observation, make sure that all snow and ice stuck on the sides of the gauge are dealt with. any snow and ice on the outside of the cylinder should be wiped off and anything inside should be included in your measurement. As much as about 0.01" can stick to the inside of the cylinder even after you pour the contents into the inner cylinder for measurement. When the gauges are very new, very little moisture sticks to the side, but older or dirtier gauges retain more. If you note a lot of water left on the inside of the gauge, consider rounding your measurement up by 0.01". But considering the other uncertainties of the measurement, you probably don't need to worry about it

Are there affordable scales for measuring precipitation by weight?

Many of us have learned that it is much quicker and easier to measure precipitation by weight rather than the cumbersome process of melting snow and pouring it into the inner cylinder for measurement. This is especially helpful when measuring the snow water equivalent (SWE) of a deep or icy snowpack. To measure to the nearest 0.01", you need a scale that can measure to the nearest gram. For our 4-inch diameter gauges, each 0.01" of precipitation weighs very close to 2 grams. Scales this accurate tend to be somewhat expensive. The one I used in the training slide show came from university laboratory and costs several hundred dollars. But some of you have found good scales in the range of \$25-100 that appear to do the job. I wish I could help more with this, but if we get better suggestions I will try to pass on the information.

Rapidly accumulating but rapidly settling low-density snowfalls

While some of us have had ice and dense wet snows, others have had generous amounts of fluffy, low-density snow. This type of snow provides its own challenges. Some of the "lake effect" snow that is common around the Great Lakes and in some other areas can be amazingly fluffy with water content of 5% or less (i.e. 1 inch of snow may contain 0.05" of water or less). We've had quite a few reports this winter of snow with only 1-2% water content -- now that's fluff! Without even measuring, it's easy to tell low-density snow from denser snow just by walking through it, sweeping or shoveling. The main thing to think about when measuring is to remember the definition of "snowfall". Snowfall refers to the accumulation of new snow since the previous observation. Ideally, it is the maximum accumulation of new snow -- prior to melting or settling -- that occurs within your 24-hour observing period. You can stick your ruler in the snow as often as you wish during the day to see how much has accumulated. It is OK to measure and then clear your snow board (if you have one) up to four times a day at 6-hour intervals -- which is what our long-term airport weather stations did for many years. But to be considered a valid measurement please don't clear your measurement surface and sum the increments for periods of less than 6 hours. It is best, for measurement consistency, to only clear the measurement surface once a day at your regular morning observing time.

Questions about the "Time of observation" and time of submitting your report

There have been many questions about observation time. Do you wait until the snow is over or do you try to report at 7 AM (or your normal scheduled time of your daily observation)?

Our preference is that you go ahead and do your regular daily measurement even if it is still snowing or raining at the time. That way it is possible for us and the myriad of users of your data to have daily reports to compare from as many locations as possible. If you usually measure at 7 AM but don't get to it until 8:15 due to the cold and snow, then just make sure you type in "8:15" as your time of observation so we know when you really took the measurements. In order for your daily measurements to show up on our precipitation, snowfall and snow depth maps, your observation time that you enter needs to be between 4:30 AM and 9:30 AM. It is OK to measure earlier or later if that fits your

schedule, but we don't map the data if it's more than about 2 hours off from 7 AM just for issues of consistency.

If it is raining or snowing very hard at 7 AM (or your normal daily observation time) there is some risk that you may miss some precipitation while you're taking the measurement. For this reason, it is really helpful and convenient to have a second outer cylinder so you can set one out while you bring in the other. This allows a more relaxed and less hurried observation.

We also encourage reports of significant weather any time of the day using the "Significant Weather Report" entry form. We may have set a CoCoRaHS record on Feb 1 with 225 Significant Weather reports. These reports are a huge help to NWS forecasters, emergency managers, etc.

Many of us are rushed in the morning as we try to get to work or to school on time. We realize it is not always possible to get on the computer and send in your report as soon as you finish the observation. We get many questions about this. It turns out that it is fine and acceptable to send in your report later in the day if that works best for you. Many of the groups using CoCoRaHS data are grabbing and exporting the data reports in the window of 7 – 10 AM. The sooner you report, the more your data will be used. But for our climatological uses (weekly totals, monthly, seasonal and annual totals, etc) it doesn't matter nearly as much. Quite frankly, report when you have time and we will appreciate your data a lot.

Why do so many false "Zero" reports show up on the CoCoRaHS maps after snowstorms?

I'm not sure how to answer this. For some reason some of us -- probably by accident -- send in reports of 0.00" precipitation, snowfall and/or total depth of snow on the ground even when there is snow. All I can say is please check your reports and make sure you didn't accidentally type in 0.00 when you shouldn't have. We have a great team helping keep an eye on our data reports each day to spot and then help correct errors. But the best check is your own check. Before you push that "Submit" button, always review your entry. Also, remember that there is a View/Edit option after you submit your report so you can always go back and easily fix a mistake.

What training resources does CoCoRaHS have?

Again, as stated several times this winter, we encourage you to view our training materials. We have several forms of training materials on our website -- some training slide shows, some traditional narrative instructions and even some videos. Most of these can be found under "Training Slide Shows" and "Things to know about rain, hail and snow" <http://www.cocorahs.org/Content.aspx?page=snow> There are also quite a few U-tube videos now. Some are excellent. Over the course of the next year, we'll hopefully have additional choices to make snow measurement training easier.

While I was gone

While I was at the National meeting of Conservation Districts in Tennessee last week (hopefully introducing many people from all parts of the country to CoCoRaHS), I managed to miss out on our coldest weather here in Fort Collins in several years. We got down to -20F at our house Tuesday AM. By the time I got home Wednesday night it had warmed to -5F and it's been warmer since then. Kathy (my wife) has not been amused by the timing of my travels. As those of you who have farms and animals know, life gets harder when temperatures get colder. Somewhere around -10 things start getting really challenging as all of you ranchers who are already in your calving season know.. I came home to discover that Kathy had dealt with the challenge by moving our chickens from their uninsulated unheated chicken coop into our unfinished basement. They were caged -- but still it's a bit odd to find chickens in the house. Fortunately, the horses were still in the barn. And the Great Pyrenees seemed largely unimpressed.

Thanks for sticking with CoCoRaHS. Winter will be losing its grip soon enough. So hang in there.

Best regards,

Nolan Doesken
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