LET'S INVOLVE SCHOOLKIDS IN DATA COLLECTION EFFORTS

by

George P. Claggett 1/

INTRODUCTION

Most schoolkids get a little exposure somewhere along the line about the make-up of our weather and climate. They are lectured about phenomena such as how to measure rain, snow, temperature, wind, and streamflow, and how these parameters, along with other terms like evaporation, sublimation, transpiration, infiltration, percolation, etc., relate to the hydrologic cycle. But it's generally pretty basic, dry "quick and dirty," and on to the next subject in the fascinating world of science. But talking about our climate and hydrologic cycle isn't very fascinating for kids unless they get involved in it. Teachers say kids learn best through the "hands-on" learning experience. And many science teachers are anxious for a new idea for the hands-on approach to teaching. Here is an idea for your agency, business, or you personally to get schoolkids involved in how to collect climatological data. This way more kids will absorb a higher percent of the rest of the story: need for accurate and timely data, plus the highly important and widely varying uses of these data. Initial contacts in Alaska have generated considerable support and enthusiasm from science teachers/educators exposed so far. An enormous side benefit is the prospect of data being collected that will be accurate, long-term, and of publishable quality for the benefit of many current and future data uses and users.

HERE'S HOW

In a nutshell, you help set up school-run climate data collection learning modules (see figure 1). Grades 6-9 appear best suited: students will collect maximum and minimum temperatures, precipitation, and, where appropriate, snow depth and water-content. The centerpiece of this learning experience is measuring, recording and plotting daily temperatures. Each school day, a designated student team takes maximum and minimum temperature readings from a maximum/minimum thermometer and plots these readings on a school year-long graph (10 minute task). The key to this graph is that the school's own temperatures are plotted against the historical record of a reference station (see figure 2). An extremely high percentage of students, teachers, parents, and the public in general find this relationship fascinating. Most students will remain interested over the course of the school year, and potentially the rest of their lives. Another plus is the school-wide benefit: the daily survey team could consist of two to four students whose term lasts about 2 weeks. Each week half the team is replaced by new team members, thereby staggering the team turnover which provides training and continuity.

The job may rotate several times around a classroom, or be passed from one class to another class, so that an entire (small, rural) school could potentially be involved. (This is a very important aspect from the standpoint of the data collected -- it maintains a high level of interest in continued data collection over the course of the entire school year.) This would also add security to the data site and instrumentation as all students would have an interest in its safety and maintenance. Plotting the temperature needs to be a simple process so all students can achieve success. This is provided by a large format (60-90 cm) graph which has a scale of .25 cm with a tick for each day of the school year and a sliding temperature scale (that lines up on the current day's tick) also of .25 cm with a tick for each degree. Preferably, the graph would be frame-mounted and prominently displayed in an accessible and visible location of the school. The entire student body could watch the progress of climate changes and anticipate their turn to be the surveyors.

The second instrument of value is a precipitation gage. For northern regions where snowfall is the dominant form of precipitation in winter, a clear plastic cylinder, acting as a storage gage, that is large enough to catch snow and hold an antifreeze solution, is the perfect instrument for readings taken by schoolkids. With a tailoring tape glued to the side of the see-through cylinder, the students have only to record the fluid level, which increases with each new increment of precipitation. A cylinder dimension of 20 cm diameter by 1 m tall provides several things: the orifice is a "standard" dimension and allows an accurate catch of snowfall; the height is sufficient to provide a complete

Presented at the Western Snow Conference, April 1990, Sacramento, California.

1/ Data Collection Office Supervisor, Soil Conservation Service, Anchorage, Alaska.

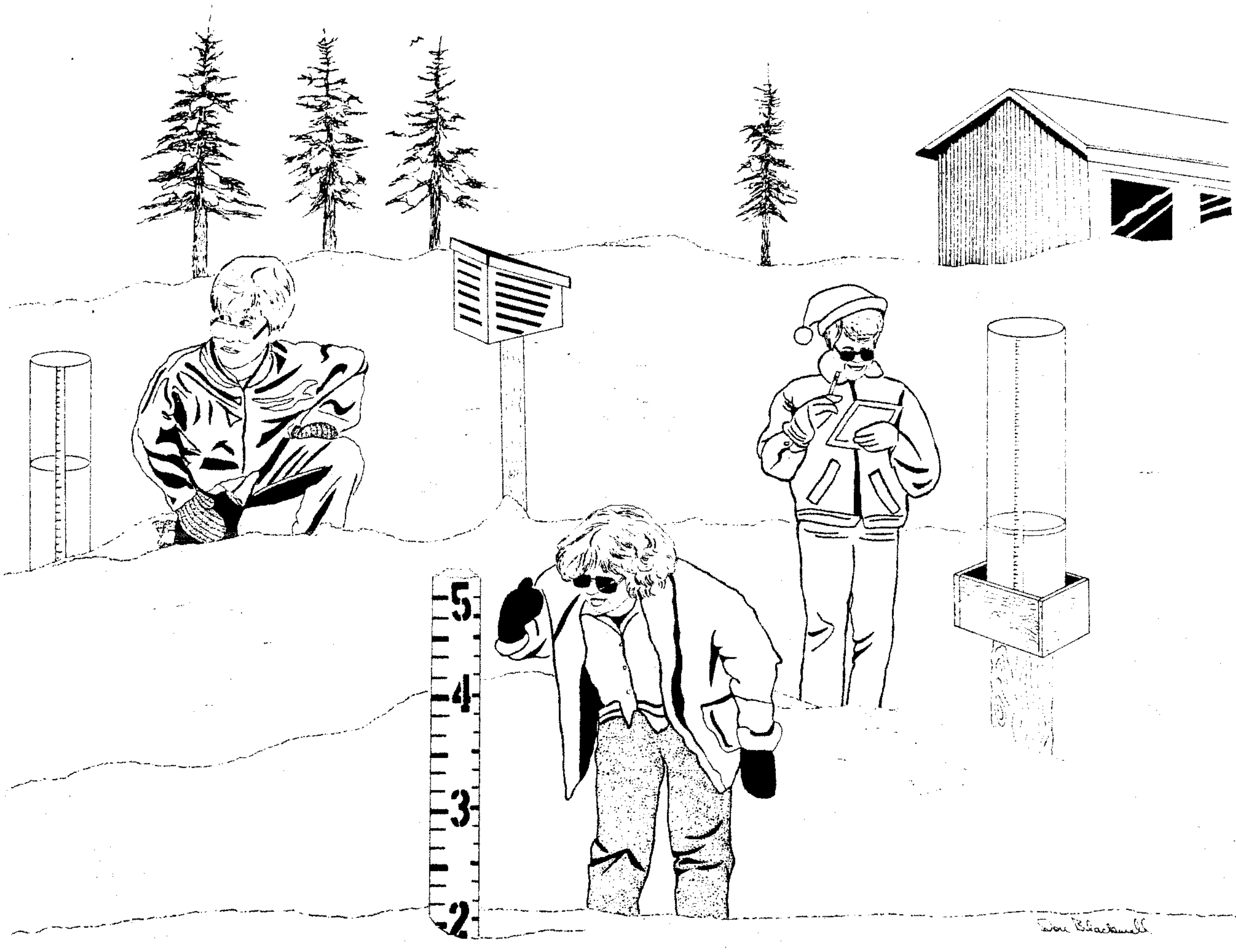

Figure 1

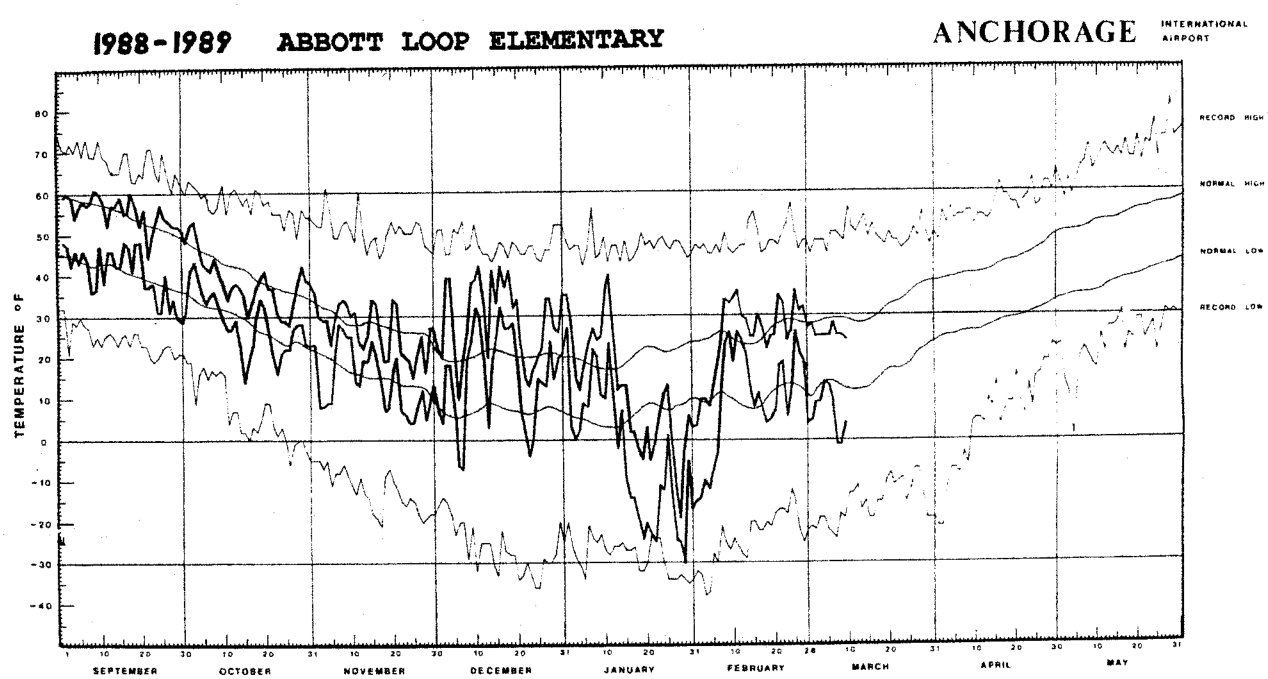

Figure 2

school year's catch of precipitation at the majority of locations, and puts the orifice at a height (approximately 2.2 m) above the reach of mischievous hands, yet the fluid level is generally about eye level. An advantage of having the precipitation gage located next to the thermometer is it ensures a daily reading. Therefore, a gage that is "tampered" with would be discovered the very next school day. A daily check reduces the chances for problems with the gage contents, and if a problem occurs, it can be rectified with little loss of record. Therefore, it is most likely that high quality data will be recorded when the gage is checked each school day. Schools will want to plot and "tract" the accumulated precipitation on a second school year-long graph. The background of the graph should be a plot of historical average precipitation of the reference station and possibly the previous year's record along with the record high and low precipitation years for additional comparisons. You should provide the graphs and historical data plots to your schools.

The third climate measure of interest and value is snow depth. Daily readings of snow depth could be observed from a snow stake (2x6 board x 1.5 m, painted and marked) located close by the thermometer mount and precipitation gage. Daily snow depth could be plotted, along with precipitation, on the same graph.

The fourth measure is snowpack water-content. This should be done at a much lower frequency -- only once a month since a small area of snow is disturbed each time. The standard federal sampler is one alternative for making the snow survey. It is currently being used by several schools in Alaska. But it has several drawbacks: high cost for a school budget -- a standard survey sample kit costs at least $575 for shallow snowpacks; teachers note that there are always a few kids who have difficulty with or never catch on how snow water-content is determined by weighing the sample. An alternate method has been devised specifically for schools (see appendix A for a description of the "Schoolyard Snow Survey Method"). This method, which melts the snow core rather than weighing it, is much easier for all students to assimilate the results, is far less expensive (1/10th) and is even more accurate. It is very important that the snowpack water-content measurement should be done as near to the 1st (within a few days) of the month as possible. Then it would correlate with snow measurements being taken by other schools nearby and by the cooperative state and federal Snow Survey Program, overseen by the Soil Conservation Service, State of California, or Canadian Province.

Each school would determine site location and need for or degree of security to provide. Most schools have an area, often right in front, that is not used, that could be set aside to be used for the climate instruments. Consideration of site location may include wind protection for the precipitation and snow measurements. If wind is a factor, you should equip the gage with an appropriate artificial windshield -- either Alter or Nipher type, depending on degree of wind exposure.

The large graphs are critical to the long-term interest of both teachers and students. Otherwise, data collection will be short-term and the equipment put away until the next school year. You must provide the needed graphs to each school for the project to be successful. Also provide data tabulation forms to make the data collection effort as easy as possible, and self-addressed envelopes to ensure their sending the data to you. Another key is helping educators teach real uses of the data that the kids can relate to, such as "how to" and "what for" do we make water supply forecasts in the arid west; or in Alaska, the build-up of stress (winterkill risk) on big game animals due to snow depth and accumulated winter-long "coldness;" the build-up of freezing potential, which is daily accumulated coldness offset by the presence of the snowpack (each day's changing snow depth), as it relates to winterkill of salmon eggs; river ice thickening; and ground frost penetration; and a relationship of river ice thickness and snowpack water-content so the class may make their own assessment of the annual breakup season ice-jam flood potential.

SUMMARY

Educators have already shown that collecting climatic data is not only interesting for students, but ties into so many other important aspects of daily life that it becomes a key "building block" in developing and holding interest in broader and more technical weather related subjects. They say it is possible that a data collection project, such as outlined here, could become institutionalized to the point there is carryover as teachers and principals inevitably come and go. This is because it will be in the school's interest to be collecting accurate, school year-long climatic data.

"SCHOOLYARDS" SNOW SURVEY METHOD

STEPS TO DETERMINE SNOW WATER-CONTENT BY MELTING A SNOW CORE

A. Preliminary Step

Prior to first snowfall, select designated snow measurement area. This must be a place where the snowpack will not be disturbed. Wind effects (snow redistribution) should be minimized. The ground surface should be smooth, level and groomed (eliminate brush, rocks, gravel, etc.). A lawn is ideal. Mark, sign or fence off, if necessary.

B. Normal Procedure

1. At survey time, dig a small pit (1/2 meter square, or so) to the ground surface. Disturb no more snow than necessary. You will want to save all the undisturbed area you can for future measurements (unless space is not a problem).
2. Shove cylinder, open end down, vertically through the snow profile just beyond the edge of the pit.
3. Read snow depth to nearest centimeter (half-inch) and record.
4. Remove snow away from wall of cylinder on pit side.
5. Carefully insert small, flat aluminum shovel, piece of tin, or the like, between bottom of cylinder and ground surface to act like a cap.
6. Tilt cylinder and cap into pit, holding cap in place and being careful not to spill any of snow core, reinvert so core slides to bottom.
7. Note length of snow core and record.
8. (Optional) If core length is less than half cylinder length, dump core into plastic garbage bag and obtain second sample. If room for three cores, get three samples. (There is enough natural variability in the snowpack that adjacent samples are rarely exactly the same. Several samples give a better average of the pack.) Dump all snow cores back into cylinder.
9. Take indoors to melt snow core.
10. Monitor time for complete melting so water depth can be recorded soon after disappearance of all ice. It takes quite a while at room temperature. If it takes overnight, don't sample on Fridays.
11. Read water level and divide by number of samples to obtain snowpack water-content and record.
12. Divide average water-content by average snow depth to obtain snowpack density and record.
13. Send copy of snow survey notes (and precipitation gage and temperature readings) to Soil Conservation Service.

C. Deep, Hard, or Icy Snow Conditions

1. If hard or crusty layers are present in pack, making insertion of cylinder difficult, or if snowpack is deeper than the length of the cylinder, remove snow core same as above, but in stages.
2. Shove cylinder down to hard layer and stop.
3. Insert shovel at top of hard layer and carefully remove cylinder as before and turn open end up.
4. Cut out a slab of the hard layer larger than the cylinder opening and place over the opening.
5. Press down with bottom of shovel causing cylinder to cut through hard layer allowing piece to fall inside.
6. Dump this much of snow profile into plastic garbage bag and save.
7. Continue down through snow profile in like manner until ground surface is reached. Record snow depth.
8. Dump all snow in plastic bag back into cylinder, thaw and record as before (for deep snow, pack snow back into cylinder or only thaw half at a time).
9. Send copy of notes and precipitation gage readings to Soil Conservation Service.

D. Shallow or Highly Variable Snow Conditions

1. Take 10 samples, dumping each snow core into the same plastic bag. Record depths of all samples.
2. Dump snow cores of all samples back into cylinder, thaw and record as before.
3. Divide final water-level and total depth by number of samples to determine average of group. Send copy of notes to Soil Conservation Service.