



# SKNOWLEDGE collective

citizen science • meteorology • education • earth observation

## Backgrounder

In Canada, snow is a defining feature of our landscape, covering nearly the entire country at some point each winter. There are many reasons why studying snow is important, some of which are ecosystem function, water resources (e.g. drinking water availability), recreation, and even transportation. Understanding the local impacts of a changing snow cover has never been more important, as snow cover Canada-wide has seen on average declines of 5-10% over the 1980's to 2015 period.<sup>1</sup> To monitor these changes, scientists have many tools in their toolkit including: satellites, climate models, and surface observations (e.g. weather stations, and field scientists – that's you!).

In this primer, we introduce key terminology related to the *S<sup>k</sup>nowledge Collective* citizen science project. We endeavour to explain the reasons behind our choice of observations included in the survey, and how they can be used to better understand snow in our environment. On each *S<sup>k</sup>nowledge* day, together as a class, or in small groups, collect 10 sets of observations, then share them using the [Online Reporting Tool](#)<sup>2</sup>.

You may be wondering, why 10 measurements per day? We ask each class to contribute 10 because snow is highly influenced by wind and vegetation, which allows us to use a series of measurements to capture the average conditions (or local variability) in the field or schoolyard.

<sup>1</sup> Environment and Climate Change Canada: Canada's Changing Climate Report: [nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/Climate-change/pdf/CCCR-Chapter5-ChangesInSnowIcePermafrostAcrossCanada.pdf](https://nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/Climate-change/pdf/CCCR-Chapter5-ChangesInSnowIcePermafrostAcrossCanada.pdf)

<sup>2</sup> Online Reporting Tool: [sknowledge.ca/share](https://sknowledge.ca/share)

### CONNECT



EMAIL

[hi@sknowledge.ca](mailto:hi@sknowledge.ca)



TWITTER

[@sknowledgeco](https://twitter.com/sknowledgeco)



INSTAGRAM

[@sknowledgeco](https://www.instagram.com/sknowledgeco)



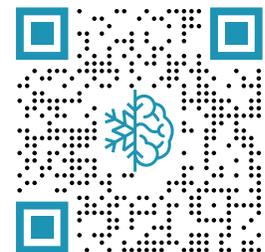
YOUTUBE

[Sknowledge Collective](https://www.youtube.com/SknowledgeCollective)



MORE INFO

[sknowledge.ca](https://sknowledge.ca)



We look forward to  
exchanging **SKNOWLEDGE!**

# Variables

The following section outlines each of the variables of interest in the *S<sup>k</sup>nowledge Collective*, and how this data can be used to enhance our understanding of snow in the local environment.

## 01. LOCATION

The word location can have many meanings. According to the *Oxford English Dictionary*, location is “a place where something happens or exists; the position of something”. Location exists at many scales spatially, from the specific degree’s latitude/longitude on a map, an address, landmark, point of interest or place name, to more expansive geographic areas of significance and connection such as a community, city, town, watersheds, province, country, Indigenous lands and territories, or planet Earth!

The *S<sup>k</sup>nowledge Collective* uses addresses, postal codes, or place names (e.g. your school name) to geo-locate data points and represent them on the interactive map. By submitting location coincident with your measurements, we can match-up your observations with satellite imagery and nearby weather stations (often found nearby airports). This allows us to see how well they compare with each other and help determine variability of snow across much larger areas than single weather station locations.

## 02. DATE / TIME

The date and time help us know when you record your observations. It also helps us know whether measurements/observations were recorded in the morning, afternoon, or evening, thus allowing us to draw comparisons more accurately between different *S<sup>k</sup>nowledge* observations, and other datasets. The *S<sup>k</sup>nowledge Collective* asks that you record time using the 12-hour clock, to help keep data consistent between observers. By recording date and time, this will also help you sort and organize data on the interactive map, allowing you to specify dates you are interested in seeing *S<sup>k</sup>nowledge* and the coincident satellite imagery.

## 03. AIR TEMPERATURE



**Figure 1:** Thermometer used to record air temperature (°C).

Measured in degrees Celsius (°C) using a thermometer (**Figure 1**), this can help us understand the weather conditions at the time of measurement. Snow forms in specific environmental conditions; when atmospheric temperature is at 0°C or below, there is a certain amount of moisture in the air, and the surface air temperature on the ground is around 0°C. Knowing the temperature at the time of measurements can also help us identify whether the snow is melting.

## 04. CLOUD COVER

Clouds help to moderate the surface air temperature and act as a significant moisture reservoir. Knowing the cloud cover at the time of your observations helps understand the role of temperature (or energy transfer to the Earth's surface) on the underlying snow cover, and whether or not we can expect coincident optical satellite imagery with your observations. Observing the clouds above, describe the cloud cover overhead as either full sun / clear sky, mix of sun and clouds, or full cloud cover (**Figures 2-4**). Within the interactive map, enable the time-slider, and zoom into some of your submitted observations to view the coincident true-colour images (Layer menu > Daily True Colour Images). Investigate the absence or presence of clouds at the time of your measurements, can you see the snow on the ground? Visit *NASA Climate Kids: Cloud Cover*<sup>3</sup> for more resources.



**Figure 2:** Full sun / Clear Sky



**Figure 3:** Mix of sun and clouds



**Figure 4:** Full cloud cover

## 05. SNOW ON THE GROUND

This is the first snow indicator that we observe as part of the *S<sup>k</sup>nowledge Collective*. If there is snow on the ground, we record 'Yes'. If there is no snow on the ground, it's reported as 'No'. Knowing if there is snow on the ground is as important as knowing if there isn't! This can help us to identify weather patterns on short time-scales, such as days, weeks, months, potentially revealing changes to our climate over larger time-scales such as years, decades, and beyond! This is an opportunity to discuss the difference between weather (e.g. what is happening outside right now), versus climate (e.g. the long-term trends in a specific area). More on weather vs. climate here from *NASA Climate Kids: Weather & Climate*<sup>4</sup>. Some patterns that you may observe are that the first snow is falling later or earlier year over year (i.e. climate) or observing the snow accumulating on the ground in a single day (i.e. weather). Explore the data on the interactive map using the time slider to see what kinds of trends in the data you observe. Toggle on the true-colour images (Layer menu > Daily True Colour Images) to see if the satellites also see the snow that you see on the ground.

Note: If there is a dusting of snow and you can see the bare ground or grass beneath it, and aren't able to measure how much snow there is, record this as a 'Yes' there is snow on the ground, and make a note in your field notes that there is trace amounts of snow. Report the snow depth for this as 0 cm.

<sup>3</sup> NASA Climate Kids: Cloud Cover: [climatekids.nasa.gov/cloud-climate](https://climatekids.nasa.gov/cloud-climate) 

<sup>4</sup> NASA Climate Kids: Weather & Climate: [climatekids.nasa.gov/weather-climate](https://climatekids.nasa.gov/weather-climate) 

## 06. SNOW DEPTH

Snow depth is used as an indicator of the amount of snow that's on the ground and allows us to estimate how much snow has fallen over the winter season. We measure this using a ruler or metre stick (**Figure 5**) by placing it on the bare ground, 0 cm side down. We then record this in centimetres (cm) while crouching down to read the ruler at eye level. Knowing how much snow there is on the ground can help us figure out exactly how much water there is stored within the snowpack, we call this Snow Water Equivalent – or SWE. The more snow there is, the more water there will be once the snow melts!

Snow is very important for water resources, it contributes to water storage (e.g. aquifers and groundwater), and is a significant source of runoff replenishing streams, rivers, and lakes as it melts in the spring. This is why we often see water flowing very quickly in rivers, and water levels rise in lakes in the springtime! Across Canada, there are several examples hydro-electric power being used to harness energy to power our homes, this relies, in part, on the snowmelt from the seasonal snowpack. Knowing how much snow is on the ground is also important for recreation activities such as downhill skiing, snow shoeing, snowmobiling, and cross-country (Nordic) skiing. Without enough snow depth, these activities wouldn't be possible! In terms of safety, knowing properties of snow, including snow depth, is important for understanding natural hazards such as spring flooding, and avalanches in mountainous terrain.



**Figure 5:** Metre stick used to record snow depth (cm).

## 07. SNOWBALL DESCRIPTIONS

We know it's fun to make snowballs! But there's some science behind them too! Here at the *S<sup>k</sup>nowledge Collective*, we are using your descriptions of the snowballs to understand how wet (or dry!) the snow is at the time of your measurement. This can change throughout the day as the temperature, and environmental conditions outside change, that's why it's so important to record the time of your measurements.



### ADDITIONAL RESOURCES

- S<sup>k</sup>nowledge Collective Activity - Snow & Temperature Data Collection: [sknowledge.ca/files/theme/Activity\\_SkNOWLEDGECO\\_DataCollection.pdf](https://sknowledge.ca/files/theme/Activity_SkNOWLEDGECO_DataCollection.pdf)
- National Snow and Ice Data Center: All about snow: [nsidc.org/cryosphere/snow/science](https://nsidc.org/cryosphere/snow/science) [↗](#)
- NASA Climate Kids: [climatekids.nasa.gov](https://climatekids.nasa.gov) [↗](#)
- Environment and Climate Change Canada: Climate Kids: [climatekids.ca](https://climatekids.ca) [↗](#)
- Environment and Climate Change Canada: Sky Watcher's Guide: [canada.ca/en/environment-climate-change/services/sky-watchers.html](https://canada.ca/en/environment-climate-change/services/sky-watchers.html) [↗](#)