Weather Keeper User Guide

Manitoba Métis Federation and the Centre for Earth Observation Science

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Document Control

Version History

Version	Author(s)	Type	Date Modified	Comments
1.0	Friesen, K. L.	Working Copy	2022/01/26	Working copy

Document Location

A digital copy of the document can be found in the MMF repository on Gitlab. This repository is accessible by the Manitoba Métis Federation (MMF) and its designees

Link: https://cwincloud.cc.umanitoba.ca/manitoba-metis-federation/weather-keeper-program/-/tree/main/Guides (English only)

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Weather Station Setup

The Weather Keeper Program is a collaboration between the Manitoba Métis Federation and the Centre for Earth Observation Science at the University of Manitoba, to support the collection of atmospheric data in the Manitoba Great Lakes region. This program is a co-developed, and jointly managed, monitoring network that will provide information on how the Manitoba Great Lakes respond to land-use changes and variability in weather. The program will also give insight into the local and regional effects of climate change.

Stations

The following are pictures of weathers stations operating in the program.

Figure 1. St Laurent Li Taan Aen Staansyoon.

Figure 2 Dawon Bay Li Taan Aen Staansyoon.

Sensors

Each weather station consists of 7 different sensors. The following is a diagramed image of a typical weather station.

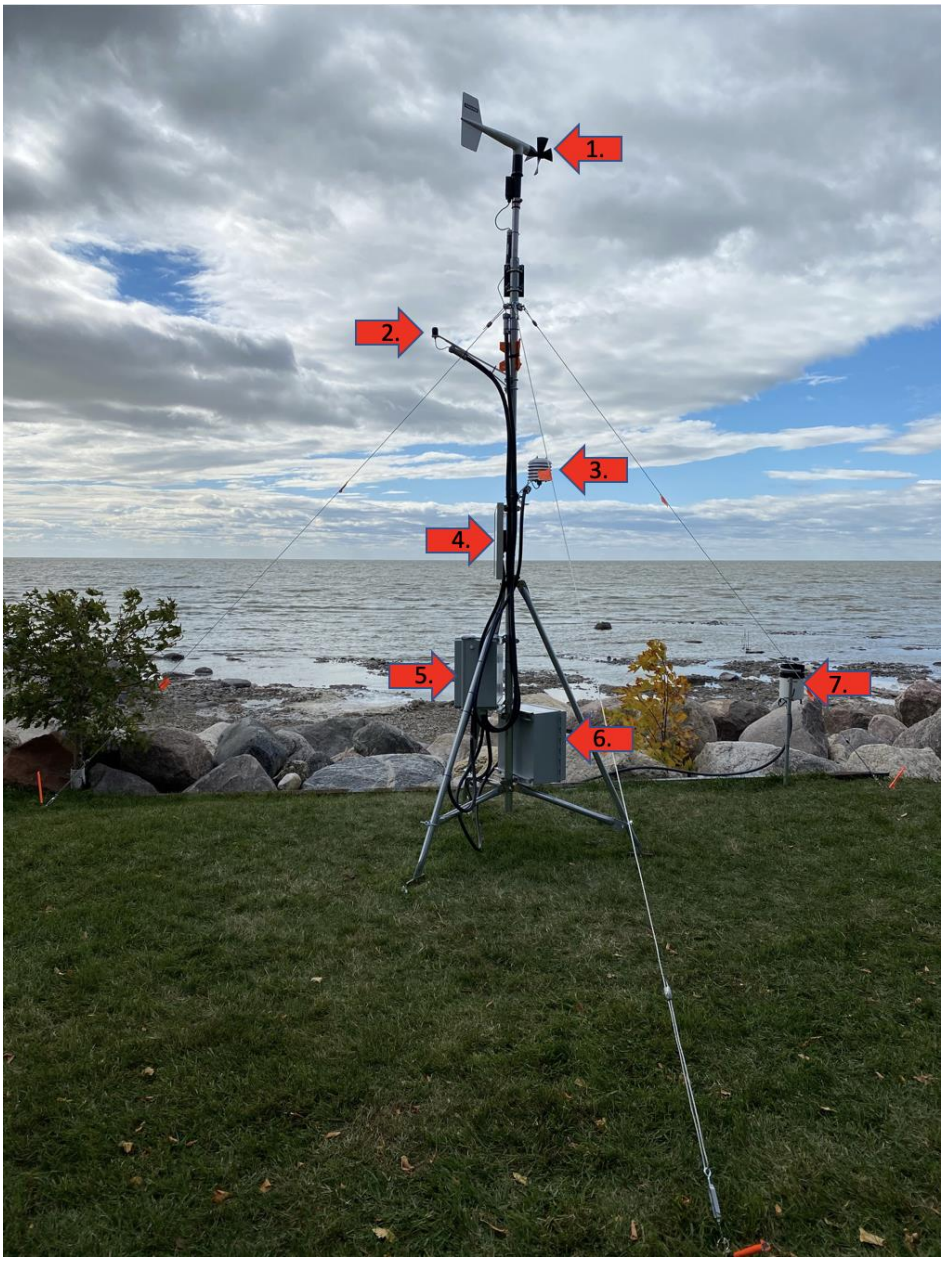


Figure 3. Complete weather station with (1) Anemometer, (2) PAR sensor, (3) Temperature and relative humidity, (4) solar panel, (5) logger housing box, (6) battery housing box, (7) Rain gauge or bucket, and guy wires identified with orange flagging tape.

The following are pictures of each sensor to help you identify them during regular checks and maintenance.

Figure 4. Anemometer fitting attached to top of separate pipe which is mounted to the tower pipe. Connector must be mounted horizontally (arrow). This sensor measures wind direction, gust speed, and wind speed.

Figure 5. Anemometer with broad side of box facing due North to fix the wind value to report true directions (arrow). This sensor measures wind direction, gust speed, and wind speed.

Figure 6. Photosynthetically active radiation (PAR) sensor (yellow arrow) attached above solar panel.

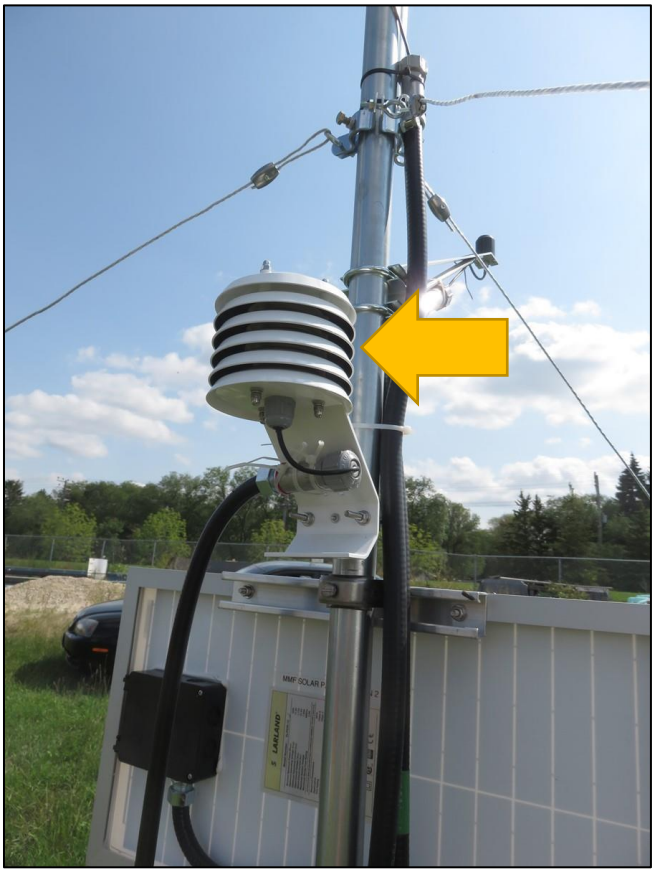


Figure 7. Temperature and relative humidity sensor housing (yellow arrow) is placed on the north side of the pole, opposite to the PAR sensor and above the solar panel.

Figure 8. Rain gauge, or tipping bucket, mounted to pole (left) placed 3 meters from tripod (right).

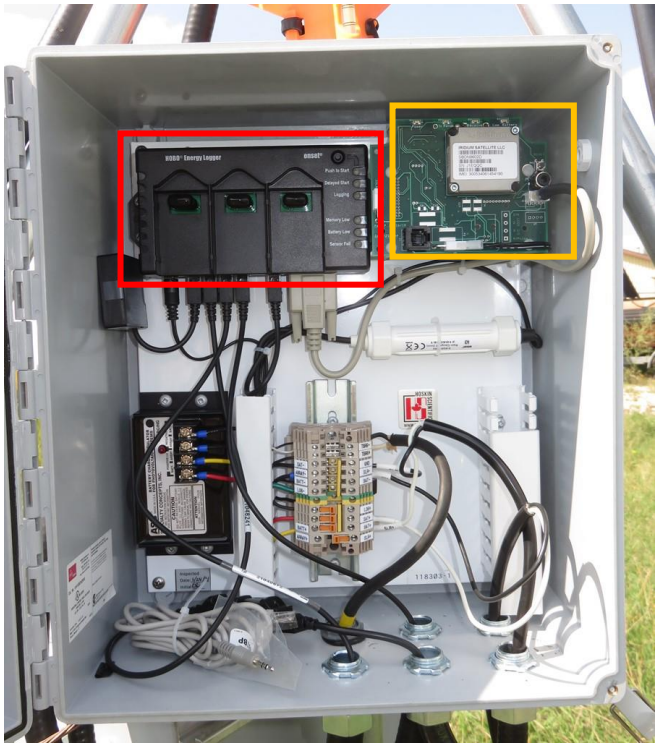


Figure 9. Logger housing box with sensor and battery connected to black box (red box on left) and the Iridium chip to the right (yellow box on right).

Figure 10. Tripod mount with logger box above battery box at base of mount.

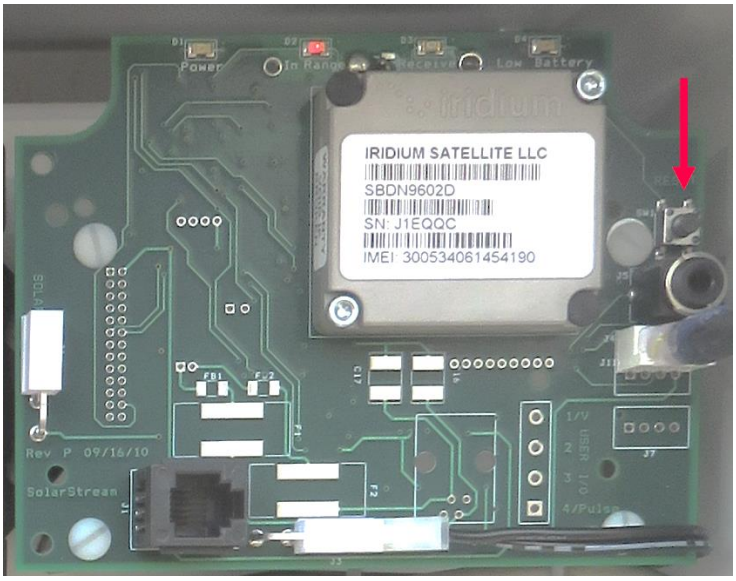


Figure 11. Iridium chip with reset button indicated by red arrow.

Figure 12. Battery housing box with 12-volt battery.

Figure 13. Measuring open circuit voltage between SLR+ and SLR- with a multimeter, voltage should read just below or greater than 20V if solar panel is getting full sunlight.

Maintenance

Maintaining the weather station is important to ensure we are providing accurate weather information. There are two parts to weather keeping maintenance. The following tasks (Table 1) are to be completed during your visit. The frequency (how often you should perform these tasks) is noted in the Frequency column beside each task.

Table 1. Weather Keeper Maintenance Activities.

Activity	Task	Frequency
PART 1		
Regular check	Physically looking at weather station for damage or dirt/snow collection.	Bi-weekly/twice a month
Emergency check	If weather station data is 'bad' (described below) or there is a physical issue with the weather station.	As needed
PART 2		
Written logbook	Filling out paper copy of logbook with paper provided in weather keeper kit.	Bi-weekly/twice a month
Online logbook	Transferring written observations from paper logbook to online logbook.	Bi-weekly/twice a month

MMF has provided you with a Weather Keeper Kit that includes the following:

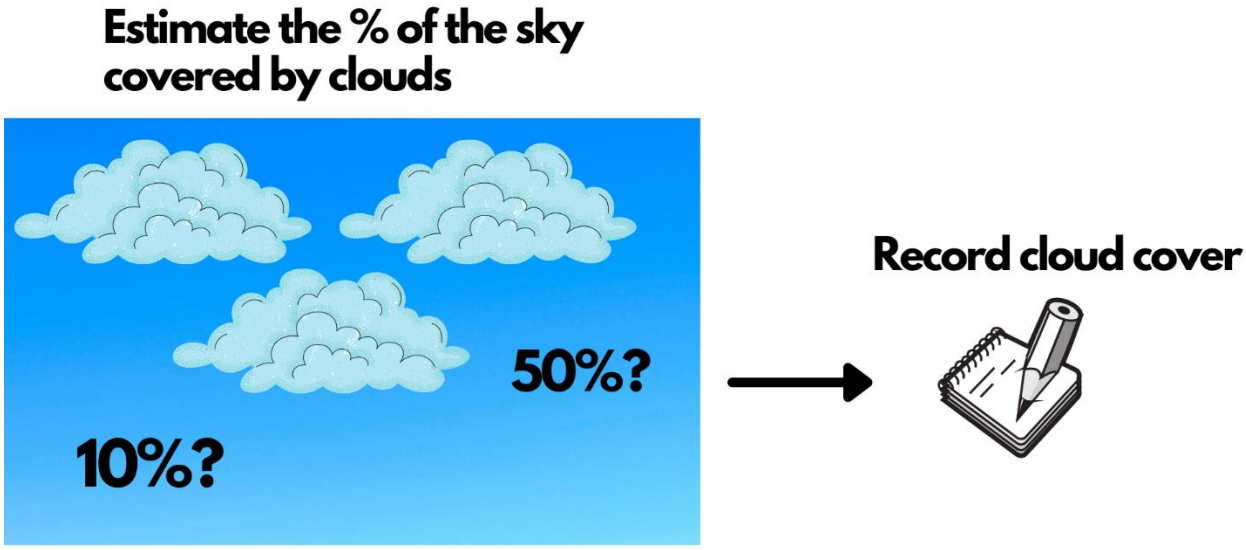
- 2 pencils;
- 1 pencil sharpener;
- Rite-in-Rain paper copies of logbook;
- Metre stick;
- Cleaning cloths;
- Multimeter, or voltmeter for battery testing;
- Flathead screwdriver

Paper Logbook

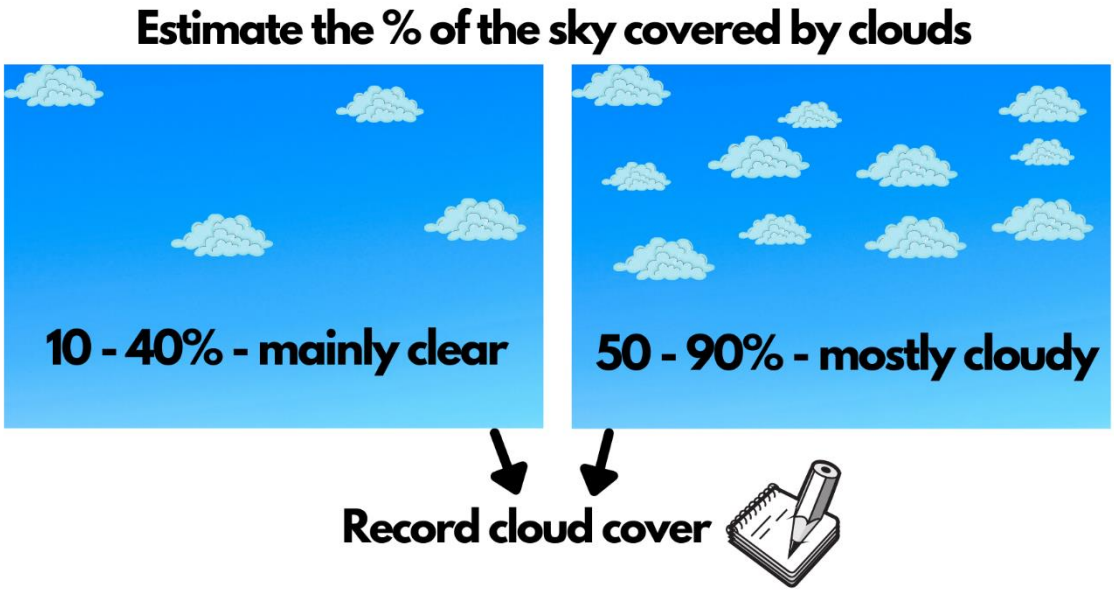
The paper copy of the logbook contains the following categories:

1. **Station Name:** Name of your weather station
2. **Weather Keeper Name:** First and last name.
3. **Observation Time Start:** Time at which you started making your observations.
4. **Cloud cover:** Select the percent cloud coverage (from 0 – 100%) you see above you.
5. **Snow Depth:** Measure the snow depth with the meter stick provided in the kit.
6. **Rain Gauge:** Check if the rain gauge, or bucket, is vertical (standing upright) or if it has tipped (not vertical). If the bucket is tipped estimate the angle in relation to the ground.
7. **Notes/Observations:** Here you can place any additional comments. For Example - additional descriptions about the weather, the weather station, or any changes you see around the station setup.

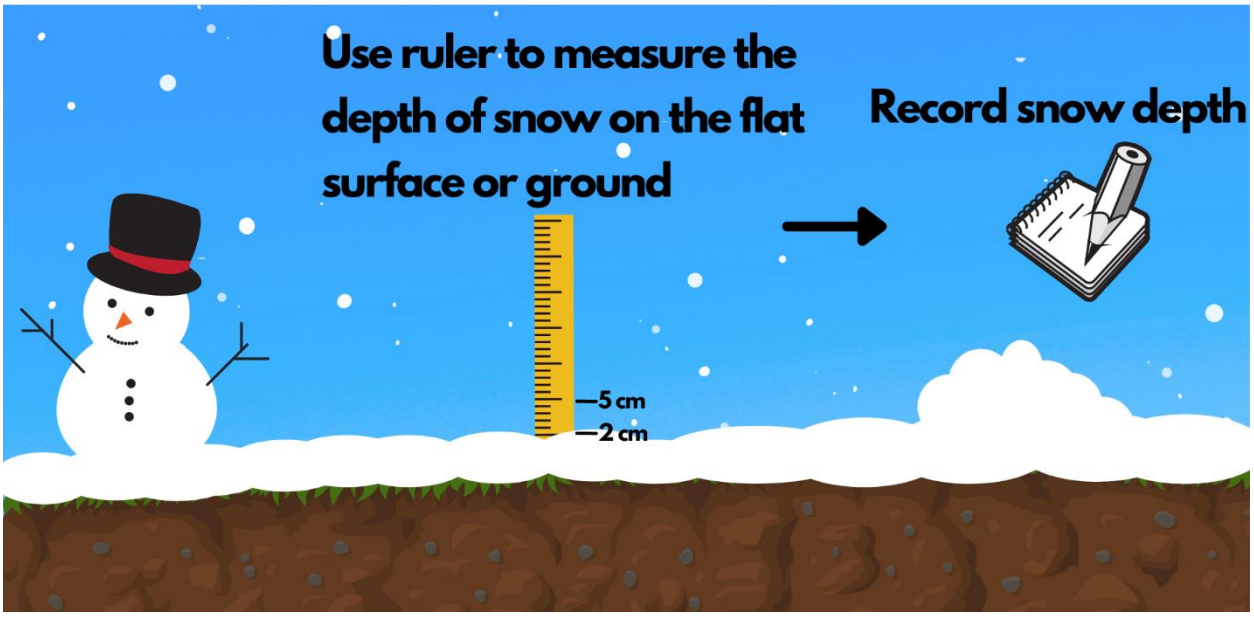
Estimating cloud cover



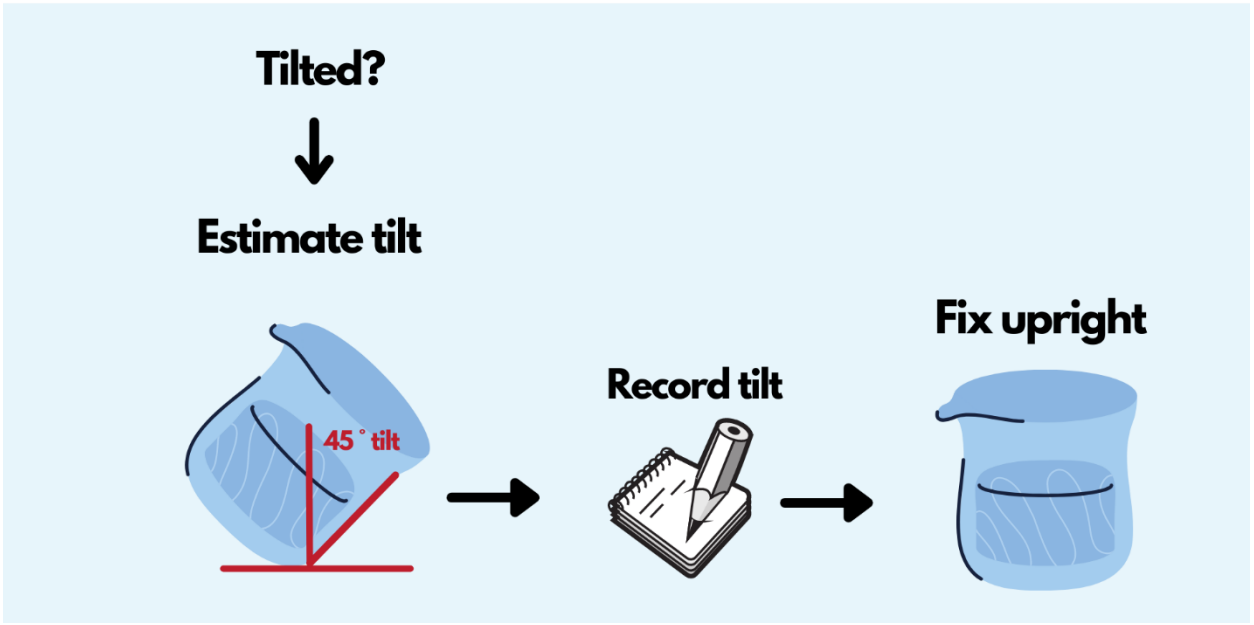
Estimating cloud cover



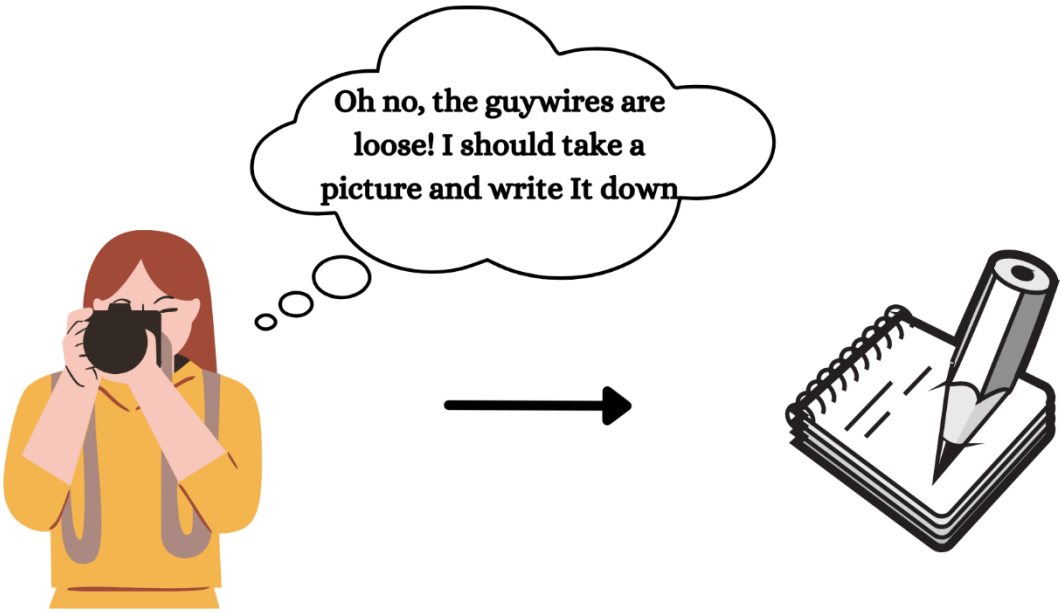
Measuring Snow depth



Checking rain gauge

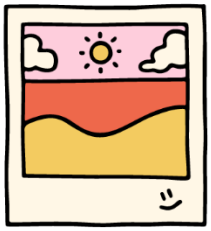


Take pics and additional notes!



Complete the online form

Transfer observations from the logbook to the online form



Transfer pictures from phone or camera to the online form

Online Logbook

There are two ways you can submit your field logbook data.

1. Online form
2. Mobile application (mobile logbook)

When submitting data online, weather keepers are also able to upload images. Uploading images is not necessary; however, images are always helpful – for example:

- If you have an issue and need help from MMF, an image can help show the issue;
- Images showing the weather station location from all four directions (N, E, S, W) help record any changes in the site over time

To submit your logbook online you can use 1 of 2 methods.

Method 1: From your computer or tablet, Weather Keepers can log into the online logbook form using the following link.

- Computer: https://form.jotform.com/212906402189051

Method 2: Weather Keepers can download the form as a mobile app to use on their smartphone or tablet. You can click the **link** or scan the **QR code** below, where you will be taken to the online logbook. A pop-up button should appear with instructions on how to save the logbook as an application to your mobile device. An icon will be installed on your home screen so you can easily access the form in the future.

- Link: https://www.jotform.com/app/220244990942256
- QR:

Below is an example of a completed online logbook.

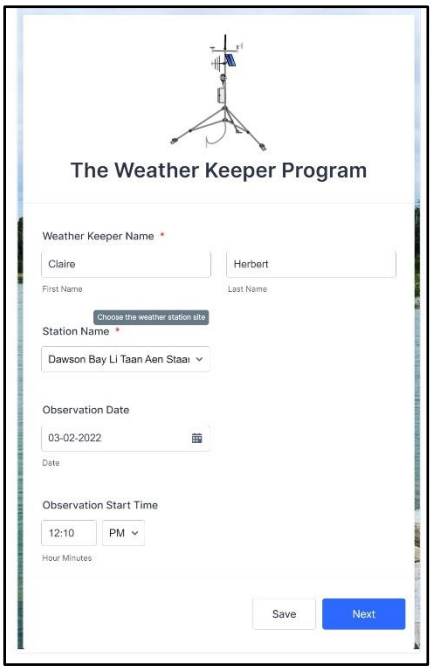


Figure 14. First page - name, location, date, and time entries.

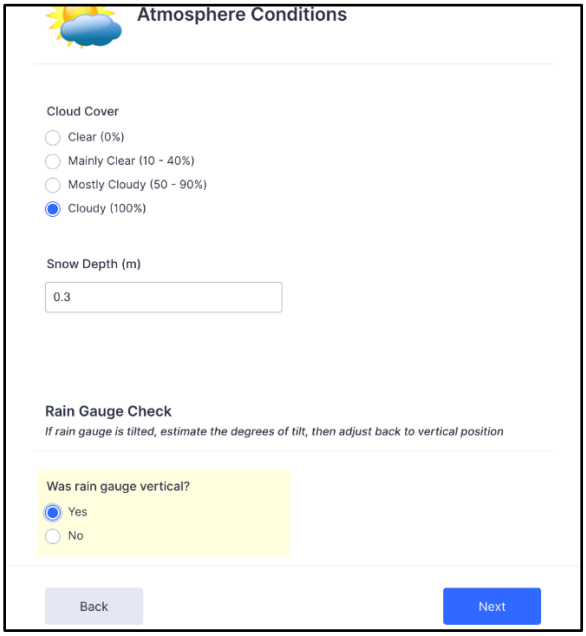


Figure 15. Second logbook page - cloud cover and rain gauge entries.

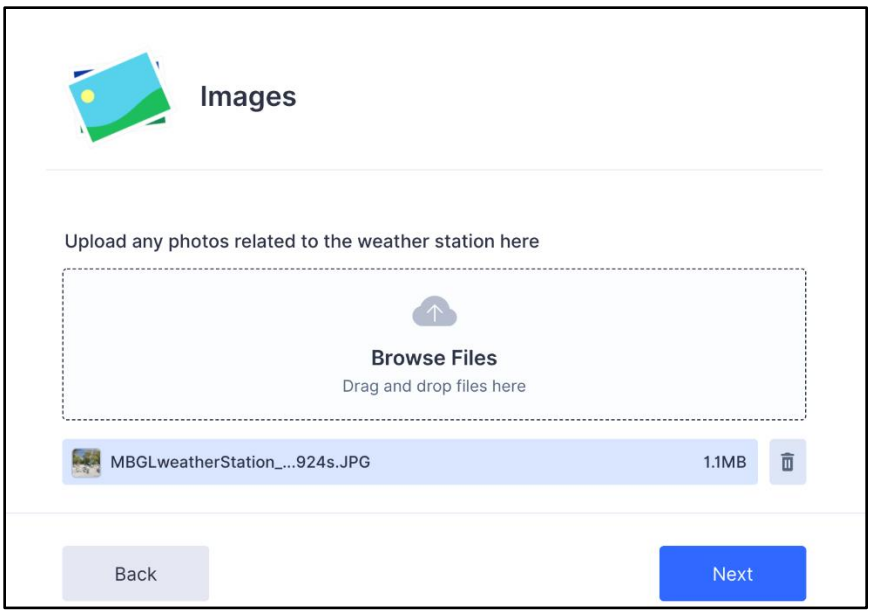


Figure 16. Third logbook page - uploading images

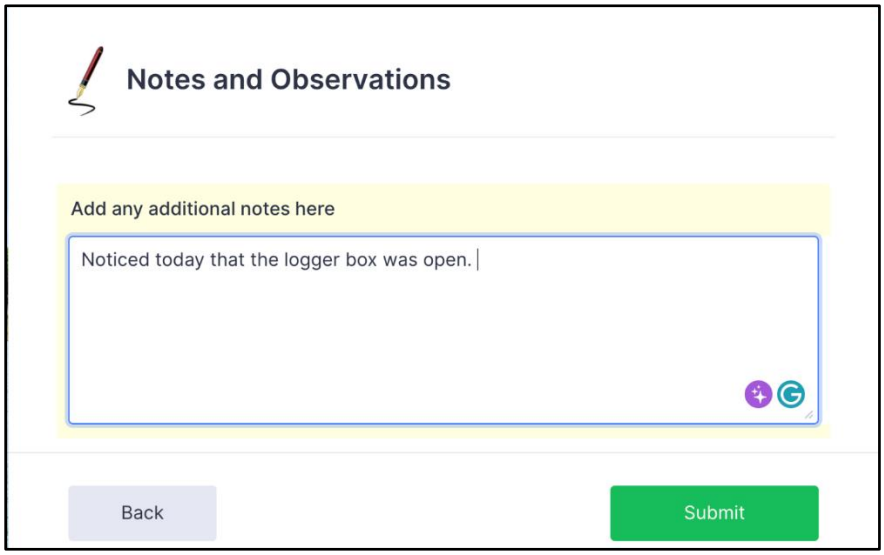


Figure 17. Fourth logbook page - notes and observations.

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Data Dashboards

As Weather Keepers, you can view near real-time data from your weather station by using a computer or mobile device to view a Dashboard (Figure 18). The link will be given to you by your MMF technician.

Figure 18. Example of data dashboard on a computer screen.

The instructions below will help you decide whether the data coming from your weather station is "good" or indicates there may be a problem with a sensor or the station itself "bad".

Good Data

The following table lists each sensor and provides examples on the values you should see when the data is "good".

Definitions:

- **Lowest number** means the smallest number that the sensor can measure accurately.
- **Highest number** means the largest number that the sensor can measure accurately.

Table 2. Good Data from each sensor.

Sensor	Meaning	Lowest number	Highest number	Units
Wind Speed Figure 4 and 5	Speed of wind	0.0	212.4	Kilometers per hour (km/hr)
Gust Speed Figure 4 and 5	Speed of a brief strong rush of wind	0.0	212.4	Kilometers per hour (km/hr)
Photosynthetically Active Radiation (PAR) Figure 6	Amount of light at the surface	0	2,500	Mircomol per meters squared per second (μmol/m^2/s)
Temperature Figure 7	How hot the air is	-40.0	75.0	Degrees celsius (˚C)
Relative humidity Figure 7	Amount of moisture in the air	0.0	100.0	Percent (%)
Barometric pressure Figure 7	Pressure of air in atmosphere	660	1,070	Millibar (mbar)
Rain gauge Figure 8	Amount of water during a rain event	0	127	Millimetres (mm)

When values are lower or higher than the numbers in Table 2, we say the data is inaccurate, or 'bad'. The following tables (Table 3, 4, and 5) are examples of 'bad' and 'good' data. Table 3 shows examples of bad data where each sensor is measuring numbers below or above the numbers in Table 2.

Table 3. Example of bad data from each sensor.

SENSOR	BAD DATA	REASON
Wind Speed Figure 4 and 5	212.8 km/hr	Above highest number in Table 2.
Gust Speed Figure 4 and 5	212.8 km/hr	Above highest number in Table 2.
PAR Figure 6	2501 μmol/m^2/s	Above highest number in Table 2.
Temperature Figure 7	-40.1 ˚C	Below lowest number in Table 2.
Relative Humidity Figure 7	101.0 %	Above highest number in Table 2.
Barometric pressure Figure 7	1071 mbar	Above highest number in Table 2.
Rain gauge Figure 8	128 mm	Above highest number in Table 2.

We also need to consider the differences in seasons along with day and night conditions, as well as possible sensor failure. Table 4 shows examples of bad data when you are looking at the dashboard at night during winter.

Table 4. Example of bad data from each sensor at night during winter.

SENSOR	BAD DATA	REASON
Wind Speed Figure 4 and 5	178.2 km/hr	Between low and high numbers in Table 2 but same as gust speed. Sensor may have failed.
Gust Speed Figure 4 and 5	178.2 km/hr	Between low and high numbers in Table 2, but same as wind speed. Sensor may have failed.
PAR Figure 6	440 μmol/m^2/s	Between low and high numbers in Table 2, but number too high for night with no sun. Sensor may have failed.
Temperature Figure 7	-50.1 ˚C	Below lowest number in Table 2.
Relative Humidity Figure 7	200.0 %	Above highest number in Table 2.
Barometric pressure Figure 7	1,000 mbar	Between low and high numbers in Table 2, but number too high for night with no sun. Sensor may have failed.
Rain gauge Figure 8	10 mm	Between low and high numbers in Table 2, but number is an error since it is a winter month and below zero (freezing).

Errors with the data shown in Table 4 are:

- **Wind** and **Gust speed** at 178.2 m/s, is likely a sensor failure. Contact your MMF technician.
- **PAR** is measuring 440 units of light during the night. You would only see this amount during daylight hours, even when it is 100% cloudy.
- **Temperature** is below the lowest number the sensor can read in Table 2.
- **Relative Humidity** is above the highest number the sensor can read in Table 2.
- **Barometric pressure** is measured at 1,000 mbar, which also only happens during daylight hours when the sun is in the sky heating the air and increasing pressure in the atmosphere.
- **Rain gauge** is measuring 10 mm of water in winter. In the winter rain measurements should be ignored and are likely due to the collection of snow in the bucket that is melting. If the snow is melting you can take a picture and/or make a note of this in your observations during your next *Regular Check.*

Table 5 shows good data during an early spring late morning/early afternoon.

Table 5. Example of good data from each sensor.

SENSOR	GOOD DATA	REASON
Wind Speed Figure 4 and 5	14.8 km/hr	Between low and high numbers (Table 2).
Gust Speed Figure 4 and 5	0.7 km/hr	Between low and high numbers (Table 2) and not higher or the same speed as wind.
PAR Figure 6	440 μmol/m^2/s	Between low and high numbers (Table 2) Number may increase to 700 or 800 when sun is at its highest point in sky.
Temperature Figure 7	-1.0 ˚C	Between low and high numbers (Table 2).
Relative Humidity Figure 7	32.5 %	Between low and high numbers (Table 2).
Barometric pressure Figure 7	995 mbar	Between low and high numbers (Table 2). Number can increase to 1,000 mbar when sun is at its highest point in sky.
Rain gauge Figure 8	5 mm	Between low and high numbers (Table 2) and temperature above +1.

Regular Checks

Regularly checking the weather station is important to the lifespan of the station itself. The better the care, the longer the weather station will be able to collect valuable information for you to share with your community. Below is a checklist you can refer to when checking your weather station.

Table 6. Regular checks.

Weather Station Part	Inspection Check	Maintenance Action
Logger housing box Figure 10	Is the box open or damaged?	Note any issues in your logbook under *Notes/Observations.* **Contact your MMF tech if the item needs immediate attention.**
Logger housing box Figure 10	Is the box dirty?	Wipe the housing box with a damp cloth. **Do not use any chemical cleaners or soap.**
Cables Figure 4-9, and 12	Are any cables from the sensors to the logger box damaged?	Note any issues in your logbook under *Notes/Observations.* **Contact your MMF tech if the item needs immediate attention.**
Solar Panel Figure 6 and 10	Is the solar panel dirty?	Wipe the panel down with a damp cloth. **Do not use any chemical cleaners or soap.** Note any issues in your logbook under *Notes/Observations.*
Temperature and relative humidity sensor Figure 7	Is there snow/dust collecting in the vents (pictured)?	Wipe with damp cloth or gently brush snow off with snow brush (e.g. vehicle snow brush). **Do not use any chemical cleaners or soap.**
PAR sensor **F**igure 6	Is there snow/dust on sensor lens?	Wipe with damp cloth or gentry brush snow off with soft material (towel or gloves). **Do not use any chemical cleaners or soap.**
Battery Figure 9, 12, and 13	Is the battery low light flashing red? (Figure 9 red box**)**	Turn multimeter on, connect the red end of the meter to the positive lead of battery and the black end of the meter to the negative lead. Readout should be around 12 volts (V) when operating correctly (Figure 12). Check solar panel with multimeter (Figure 13).
Iridium chip Figure 9 and 11	Is the light flashing red (Figure 9 yellow box)?	Reset chip by pressing and holding the reset button (picture provided) for 5 seconds, you can use the end of a pencil for this. The power light will flash back on (Figure 11).