

Temperature - iButtons

Motivation

Temperature is a central climate variable in several COAT modules.

State variables:

Temperature data is used to calculate the following state variables:

- Ground temperature (C12)
- Timing of snowmelt (C1)

Reference to method:

Temperature is measured using iButtons (Maxim Integrated, San Jose, California, USA) with a logging interval of 4 hours.

Spatial study design

Temperature is measured within the COAT Varanger intensive design heath, meadow and snowbed sites and within the COAT Varanger regional design in rodent snap-trapping sites.

Meadow and heath sites are nested in five river valley sections and each river valley section has 4 or 5 sites in meadow habitat, 4 or 5 sites in heath habitat near to productive areas (river valleys) and 4 or 5 sites in heath habitat far from productive areas. Komagdalen has three sections, while Vestre Jakobselv has two.

At each meadow site, there are two temperature loggers. The loggers are placed at ground level in the left corners of the 15*15 sampling quadrat when looking towards the willow thicket (i.e. corners where pellet plot 1 and 6 are, see figure 1).

At each heath site, there is one temperature logger. The logger is placed at ground level in the left corner of the 15*15 m sampling quadrat along the edge that corresponds to the thicket edge when looking towards the willow thicket (i.e. corner where pellet plot 6 is, see figure 2.1.1.1).

If you need to move the logger to other corners due to a wet spot, note this down in the metadata sheet.

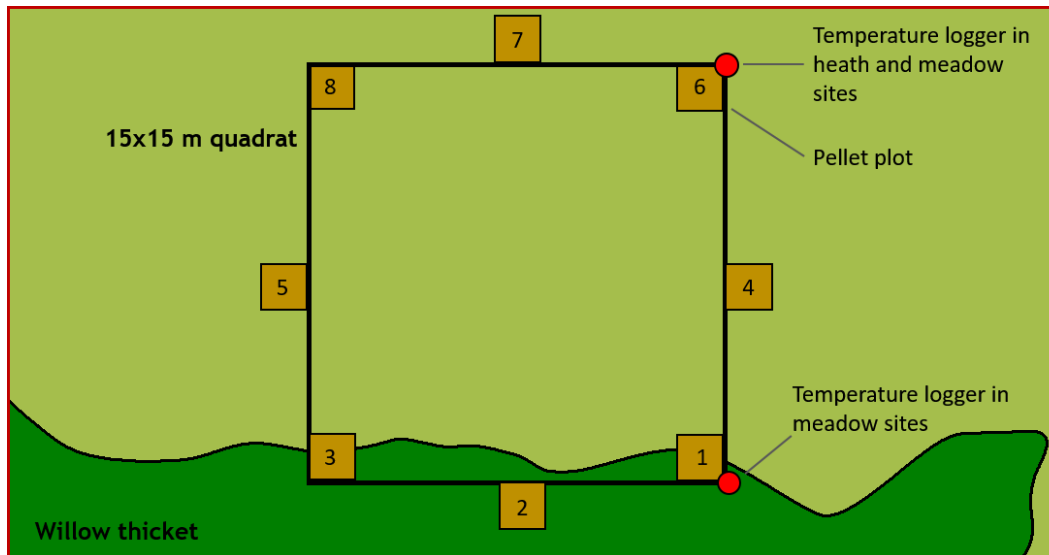


Figure 1: Location of temperature loggers in heath and meadow sites.

Snowbed sites are nested in four mountain slope sections and each section has 19 or 20 sites. Each of the intensive localities has two mountain slope sections. At each site, there is one temperature logger. The loggers are placed close to plot # 2 (figure 2), under a stone which is marked with paint. The logger should be placed so that the logger does not end up in a depression where water gathers during snowmelt.

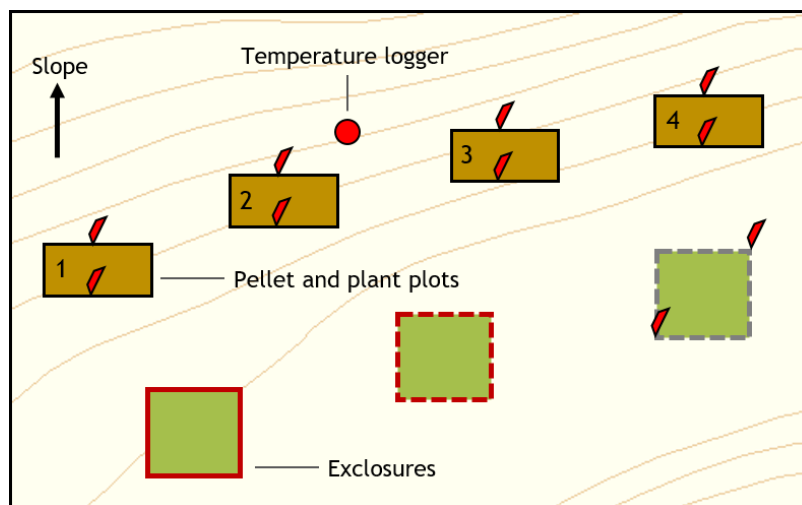


Figure 2: Location of the temperature logger in snowbed sites.

Regional snap-trapping sites are nested in four localities with 10 to 24 sites per locality. Only a subset of the regional snap-trapping sites is equipped with a temperature logger. This includes at least one site per group of sites located close to each other. At these sites, temperature loggers are placed under a flat stone in the center of the quadrat marked with marking ribbon and/or a spot of spray paint. The logger should be placed so that the logger does not end up in a depression where water gathers during snowmelt.

The complete list of siteIDs included in the current data collection is:

Heath and meadow sites:

Locality	Section	Site ID meadow (m)	Site ID heath_near (hn)	Site ID heath_far (hf)
Komagdalen (ko)	komagdalen_ovre (ko)	ko_ko_m_a ko_ko_m_b ko_ko_m_c ko_ko_m_d ko_ko_m_e	ko_ko_hf_a ko_ko_hf_b2 ko_ko_hf_c ko_ko_hf_d2 ko_ko_hf_e	ko_ko_hf_a ko_ko_hf_b ko_ko_hf_c ko_ko_hf_d ko_ko_hf_e
Komagdalen (ko)	Komagdalen_midtre (km)	ko_km_m_a ko_km_m_b ko_km_m_c ko_km_m_d ko_km_m_e	ko_km_hf_a ko_km_hf_b ko_km_hf_c ko_km_hf_d ko_km_hf_e	ko_km_hf_a ko_km_hf_b ko_km_hf_c ko_km_hf_d ko_km_hf_e
Komagdalen (km)	Sandfjorddalen (sa)	ko_sa_m_b ko_sa_m_c ko_sa_m_d ko_sa_m_e ko_sa_m_f	ko_sa_hf_b ko_sa_hf_c2 ko_sa_hf_d ko_sa_hf_e ko_sa_hf_f	ko_sa_hf_b ko_sa_hf_c ko_sa_hf_d ko_sa_hf_e ko_sa_hf_f
Vestre Jakobselv (vj)	Torvhaugdalen (to)	vj_to_m_a vj_to_m_b vj_to_m_c vj_to_m_d	vj_to_hf_a2 vj_to_hf_b2 vj_to_hf_c vj_to_hf_d	vj_to_hf_a vj_to_hf_b vj_to_hf_c vj_to_hf_d
Vestre Jakobselv (vj)	Bearaveaijohka (be)	vj_be_m_a vj_be_m_b vj_be_m_c vj_be_m_d vj_be_m_e	vj_be_hf_a vj_be_hf_b vj_be_hf_c2 vj_be_hf_d2 vj_be_hf_e2	vj_be_hf_a vj_be_hf_b vj_be_hf_c vj_be_hf_d vj_be_hf_e

These sites are in the GPS-file "intensive sites meadow heath Varanger 2020.gpx".

<https://uitno.app.box.com/file/655735580225>

Regional snap-trapping sites:

Locality	Site ID
Stjernevann	SG1, SG2, SG5, SG8, SG9, SG10, SL1, SL2, SL3, SL4, SL5, SL6, SL7, SL9, SL10, SL11, SL12, SL13
Hoppseidet	HOG2, HOG4, HOG6, HOG7, HOG9, HOL1, HOL3, HOL5, HOL7, HOL9, HOL14
Bekkarfjord	BG2, BG4, BG7, BL3, BL5, BL7, BL9
Ifjord	IFG1, IFG8, IFL2b, IFL7, st2h

These sites are in the GPS-file " regional snaptrapping sites storskala 2020.gpx":

<https://uitno.app.box.com/file/675384703933>

Snowbed sites:

Locality	Section	Site ID snowbed (sn)
Komagdalen (ko)	Kjøltindan (kj)	ko_kj_sn_1, ko_kj_sn_2... up to ko_kj_sn_19
Komagdalen (ko)	Ruossachokka (ru)	Ko_ru_sn_1, ko_ru_sn_2... up to ko_ru_sn_20
Vestre Jakobselv (vj)	Torvhaugdalen (to)	vj_to_sn_2, vj_to_sn_3, vj_to_sn_4, vj_to_sn_5, vj_to_sn_6, vj_to_sn_8, vj_to_sn_9, vj_to_sn_12, vj_to_sn_13, vj_to_sn_14, vj_to_sn_15, vj_to_sn_16, vj_to_sn_19, vj_to_sn_20, vj_to_sn_21, vj_to_sn_22, vj_to_sn_24, vj_to_sn_25, vj_to_sn_26, vj_to_sn_27
Vestre Jakobselv (vj)	Bearaveaijohka (be)	vj_be_sn_1, vj_be_sn_2, vj_be_sn_3, vj_be_sn_4, vj_be_sn_5, vj_be_sn_6, vj_be_sn_7, vj_be_sn_8, vj_be_sn_11, vj_be_sn_12, vj_be_sn_13, vj_be_sn_14, vj_be_sn_15, vj_be_sn_17, vj_be_sn_19, vj_be_sn_20, vj_be_sn_21, vj_be_sn_22, vj_be_sn_24, vj_be_sn_25

These sites are in the GPS-file "snowbeds lemming transect 2019.gpx":

<https://uitno.app.box.com/file/354916477175>

Temporal study design

Temperature loggers are logging the whole year with a logging interval of 4 hours. Loggers are changed and downloaded once a year during spring and summer fieldwork for the heath and meadow sites and for the snowbed sites, and during the fall field work for the regional snap-trapping sites.

Procedure

Before fieldwork, new iButtons need to be started as described in Appendix 1.

Loggers used at Varanger meadow, snowbed and snap-trapping sites should be placed in water proof plastic bottles that are again placed within a white in a plastic tube. Make sure to prepare all the loggers you need. The best is to do it as close before going to field as possible to reduce the time the logger is active before it is placed in the actual site we want data from. It is also possible to delay the start of the logger in the software, in that way you can program it to start ca on the day you will set it out.

Or the regional sap trapping sites, loggers are prepared with a small piece of paper with the number of the plot inside the white plastic tube. The number of the plot is also marked on the outside of the plastic tube with a permanent marker before deployment.

When you are at the site, locate the logger that is already there. Collect the logger and make sure to mark it with the location. Then deploy a new logger that was already started before you went out at the same location.

After the field: As soon as you have access to a computer with the Onewire viewer program installed and the usb-device for iButtons, the iButtons should be downloaded following descriptions given in Appendix 1. It is important that this is done as soon as possible after collection to save battery and not gather lots of data that we can't use. If you discover a logger that has not logged the full year mark this clearly and let Jan Erik know – it is important that we avoid deploying loggers that don't work.

Equipment needed

- iButtons
- Logger casings (depending on the type of the design; Varanger; white plastic bottles and tubes)
- For white logger tubes used at Varanger: screws, screwdrivers
- Computer with onewire viewer, connecting cable

Information recorded in the field

For each logger you collect, make sure to mark it with the location and write down the date you are gathering it. For each logger you deploy, write down at what date the new logger is deployed.

Data processing

Data from each downloaded logger is stored as a separate .txt file. These should be named with the site ID (for example “ko_kj_sn_1.txt” for file from komag_kjøltindan_snowbed_nr1).

For datafiles from meadow sites: add “me” for loggers at the meadow edge of the sampling quadrates and “th” at the thicket edge. For example “ko_km_m_a_me.txt”, “ko_km_m_a_me_th.txt” from site ko_km_m_a meadow edge and thicket edge.

Metadata (i.e. dates when loggers were collected and deployed, additional comments) should be entered in a metadata sheet (in the Box folder “COAT/protocol/data typing templates” link: <https://uitno.app.box.com/file/465145475195>). Save separate metadata file per dataseries/study area: eg. “temperature_loggers_metadata_meadow_KO_2017.txt”, “temperature_loggers_metadata_meadow_VJ_2017.txt”, “temperature_loggers_metadata_snowbed_KO_2017.txt”, “temperature_loggers_metadata_snowbed_VJ_2017.txt”.

Send all temperature data files and metadata files to Eeva Soininen (eeva.soininen@uit.no).

Training requirements and specialized skills

No specialized skills are needed. New field observers should be trained by experienced field observers and read the protocol carefully.

Appendices

Downloading and re-starting iButton temperature loggers using the program One Wire Viewer



Figure 1: USB connecting cable for iButtons

iButton (New DS1922L)

1. Put your iButton into the DS1402D probe
2. Connect the probe into the USB port adapters and connect the whole to your PC to your default USB port (in the small field laptops this is USB1 - the first one on right side)
3. Go to the "Mission" sheet
4. Click on the "Temperatures" sub-sheet. You will see the whole graph of the temperature along its recording time
5. Right-click and select "copy data to clipboard with labels"
6. Paste it into notepad
7. Save the notepad file as text file.
8. Go to "clock" sheet and check how large difference there is between logger and computer time. Note this down in the metadata sheet.
9. If the temperature logger is not going to be set up for a new mission, press "Disable mission" to stop the temperature logging. Otherwise the iButton will keep on logging, and this will drain the battery.
10. If the temperature logger is going to be set up for a new mission, go to the "clock" sheet of the OneWireViewer menu: Synchronize the IButton clock with the computer's clock
11. Go to the "Mission" sheet
12. Press "start new mission"
13. Set the sampling rate to 14 400 seconds (i.e. 6 samples per day)
14. Deactivate Enable rollover
15. Press "ok" and then look at the "status" sub-sheet to check if the mission is truly active or not and to have an overview of your settings.

NB: max number of temperature sampling: 8192

IButton (Old DS1921G)

1. Put your iButton into the DS1402D probe
2. Connect the probe into the USB port adapters and connect the whole to your PC to your default USB port (in the small field laptops this is USB1 - the first one on right side)
3. Go to the "Thermochron" sheet

4. Click on the "Temperatures" sub-sheet. You will see the whole graph of the temperature along its recording time
5. Right-click and select "copy data to clipboard with labels"
6. Paste it into notepad
7. Save the notepad file as text file.
8. Go to "clock" sheet and check how large difference there is between logger and computer time. Note this down in the metadata sheet.
9. If the temperature logger is not going to be set up for a new mission, press "Disable mission" to stop the temperature logging. Otherwise the iButton will keep on logging, and this will drain the battery.
10. If the temperature logger is going to be set up for a new mission, go to the "clock" sheet of the OneWireViewer menu: Synchronize the IButton clock with the computer's clock
11. Go to the "Thermochron" sheet
12. Press "start new mission"
13. Set the sampling rate to 240 minutes (i.e. 6 samples per day)
14. Press "ok" and then look at the "status" sub-sheet to check if the mission is truly active or not and to have an overview of your settings.

NB: max number of temperature sampling: 2048