GeoBasis Manual

Guidelines and sampling procedures for the geographical monitoring program of Nuuk Basic in Kobbefjord

Version 14 – June 2025

GEM Greenland Ecosystem Monitoring

ASIAQ

Institut for Geovidenskab og Naturforvaltning

This edition of the GeoBasis Manual

Please note that this manual is continuously updated. The GeoBasis program is subject to changes and improvements and therefore, the manual is continuously under construction. New updates will be implemented in the next edition.

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Appendix 5 River water guide

Appendix 6 Eddy Fen & Eddy Heath guide

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1 Introduction

1.1. The GeoBasis program

GeoBasis in Kobbefjord-Nuuk was initiated in 2007. It is a subprogram of the environmental monitoring program Greenland Ecosystem Monitoring (GEM) and is one out of three GeoBasis programs in Greenland with sister programs in Zackenberg (NE Greenland) and Disko (West Greenland) representing the Low Arctic, the High Arctic and border between the Low- and High Arctic, respectively. The program is funded by the Danish Energy Agency, Environmental Protection Agency and the Government of Greenland. The primary objective of the GeoBasis monitoring program in Kobbefjord is to establish baseline knowledge on the dynamics of fundamental physical parameters within a low Arctic environment. Low Arctic landscapes are extremely vulnerable to even small changes in their physical condition. It therefore they serve as sensitive indicators for environmental and climate changes. The GeoBasis program in Kobbefjord collects data of hydrological and terrestrial variables and parameters including:

- Flux monitoring; plot and landscape scale flux monitoring of CO_2, CH_4, H_2O and energy in wet and dry ecosystems.
- Meteorology and energy balance; essential meteorological variables across various surface types and elevations.
- Soil properties; monitoring of key soil variables, including temperature, moisture, heat fluxes, electrical conductivities and soil water chemistry at different depths and surfaces.
- Snow, greenness, and lake/fiord ice; monitored from automatic cameras.
- River water electro chemistry.
- Snow properties; including spatial and temporal variation in distribution, depth, temperature and density.

Collected data will be used to improve current model predictions for future changes in the ecosystem and to quantify the feedback mechanisms from the ecosystem to the climate change. Based on the experiences obtained over the past years additional activities have been and will be incorporated in the program.

1.2. GeoBasis database

Data from the GeoBasis Nuuk monitoring program is freely available through the GEM database www.g-e-m.dk. Any questions regarding the GeoBasis Nuuk data can be addressed to Andreas Westergaard-Nielsen (awn@ign.ku.dk) or Karoline Nordberg Nilsson (knn@asiaq.gl).

All GeoBasis data are public domain. However, when using GeoBasis data the following acknowledgement must be included: Data from the Greenland Monitoring Program were provided by the department of Bioscience, Aarhus University, Denmark in collaboration with Department of Geosciences and Natural Resource Management, Copenhagen University, Denmark.

All timestamps referred to in the database and in the field journal fare in West Greenlandic Winter Time (WGWT) UTC-3. Selected data from each field season is published in the 'GEM Annual Report Cards,
published by Aarhus University. Until 2016 data were published in the 'GEM Annual Report'.

1.3. Links

- Nuuk Basic: www.nuuk-basic.dk

- Annual Report Cards http://g-e-m.dk/gem-publications-and-reports/gem-annual-report-cards/
- Greenland Ecosystem Monitoring: www.g-e-m.dk
- Zackenberg Research Station (ZERO): www.zackenberg.dk
- INTERACT: www.eu-interact.org/

1.4. Field season/period

The length of the field season of Nuuk Basic is not pre-defined, but is determined by the accessibility to the station. Prior to the breakup of the fiord ice the station is only accessible by ski or snowmobile. The frequency of visits decreases with the arrival of the first snow in October, but the fiord does normally not close up before December. In the following table, the field season length of each year is shown:

Year	Start	DOY	End	DOY	Length (days)
2007	11-Jun	162	30-Oct	303	141
2008	24-Jun	176	17-Nov	322	146
2009	14-May	134	03-Nov	307	173
2010	03-May	123	13-Oct	286	163
2011	11-May	131	20-Oct	293	162
2012	15-May	136	08-Nov	313	177
2013	22-May	142	31-Oct	304	162
2014	27-May	147	14-Nov	318	171
2015	15-Jun	166	21-Oct	294	128
2016	27-Apr	118	21-Oct	295	177
2017	02-Jun	153	13-Oct	286	133
2018	04-Jun	155	21-Oct	294	139
2019	14-May	134	25-Oct	298	164
2020	22-May	143	23-Oct	397	154
2021	03-Jun	154	21-Oct	294	140
2022	10-Jun	161	31-Oct	304	143
2023	22-May	142	17-OCt	290	148
2024	3-Jun	155	11-Oct	285	130

1.5. Getting there

The field site in Kobbefjord is accessed by boat. Greenland Institute of Natural Resources (GINR) has two boats (Aage V. Jensen II and Avataq) that are used for regular transportation to and from the area. Information on how to book the boats can be found on GINRs homepage http://www.natur.gl/en/the-institute/booking-of-facilities/. During the field season, Aage is booked for the NuukBasic team Monday/Wednesday/Friday during odd weeks and Tuesday/Thursday in even weeks as default.

The boat will normally sail from Bro H in Iggia at 8.30 and from Kobbefjord around 15.00. However, the days and times are depending on weather, workload and other NuukBasic staff, so remember to keep in touch with GINR:
Katrine Raundrup: kara@natur.gl
Booking: booking@natur.gl

1.6. Getting around in the area

In order to protect the area in Kobbefjord and to minimize the impact on vegetation near the research sites and plots, some rules must be respected. Please, study the site manual (**Appendix 11 Site Manual**) carefully for a description of the regulations in different zones of the valley. Staff from the monitoring program must be prepared to give an introduction to the nearest surroundings and a guided tour, when new people arrive at the station.

- Follow trails and paths if possible
- Use the boardwalks, when working in the fen
- Do not throw garbage of any kind, not even apple core
- Use the toilet in the hut
- Do not make changes to the vegetation and the soil

1.7. Safety

Always follow the safety instructions from the Nuuk Basic Research Station, when you work in the area. GeoBasis has one VHF radio (Channel 72) and share an Iridium satellite telephone with BioBasis (+881641482375). Riffles and first aid kit can be borrowed from the Research Station.

Other occupational risks are:

- *Weather and ice*
  Many of the field activities are weather dependent and a part of planning the field work is to follow weather development: www.dmi.dk/dmi/byvejr_gl.htm?by=4250. Though the weather can change very rapidly, and it can therefore be necessary to adapt the field activities to the current weather.
  To check the ice situation in the fiord use this website: https://browser.dataspace.copernicus.eu/
- *Falling down*
  Probably the greatest risk, when working in Kobbefjord, is tripping or falling down when walking around in the area. Always take care and reevaluate a chosen route. Bring a VHF radio and a first aid kit with you.
- *Rock slides/loose rocks /rock avalanches*
  Look out for loose rocks. If you are two persons walking in steep terrain, then spread out so that you don't push rocks down into each other. Some landscape elements are more prone to rock avalanches. Look out for terrain of fresh boulders. Never walk on the southern side of Badesø lake, as rockslides frequently occur from the mountain side.
- *Electric shock*
  The solar panels, battery bank and the 220V charge regulator can give electrical shock if short circuited. Be careful to turn off the current and check that all switches are off when working with cables and the power supply. The battery bank is always dangerous if tools short circuit. Double check (+) and (-) and color codes when working on the 12V supply. When working with solar panels cover them with a jacket or similar, so they do not receive any or only limited power during work.
- *Sailing with boat*
  The boatman is responsible for person safety when onboard the boat. Always wear a safety west when standing outside.
- *Bear*
  Polar bears are extremely rare in the monitoring area. During the past years, a few bears have been spotted and some have been shot close to Nuuk. It is therefore recommended that you bring a flare gun with flares. Further, you should consider learning to use a rifle. There are two bolt rifles, calibre 30-06. One riffle is

stored behind the door from the laboratory room to the entrance room in the kitchen building. The other is stored in the entrance room in the accommodation building. There are two flare guns, caliber 4, in the kitchen (in box on shelf) and one flare gun, caliber 4 in the accommodation building.

- *Foxes and rabies*
  Several arctic foxes live in the monitoring area. They are generally not very keen on getting close to people. If a fox shows unusual behavior (i.e., approaches or is aggressive towards people), it should be treated as being infected with rabies. In that case, keep away from the fox and try to scare it away (e.g., using a signal pen with small flares or a flare gun). If the fox bites you, it is essential that you go to the hospital and start a treatment against rabies. It is important that you do not tempt the foxes by leaving food and waste in the monitoring area. If you leave instruments outside make sure that foxes are unable to bite in wires, plastic etc.

1.8. GeoBasis Nuuk Staff

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1.10. Technical Consultants

New technician?
(power, WiFi, Campbell loggers)
For now, use Asiaqs technicians for technical guidance.

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1.12. Daily Journal

The field journal is updated daily to document the observations and work performed in Kobbefjord. The field journal is a very important tool when the data is quality controlled. If there are some gaps or errors in data, it is important to see exactly what and when we have done some work at a station. The journal is also used when problems occur, and we want to draw on previous experiences and solutions. So, write a good and precise journal and remember to look for answers in the journals of the previous years, when you have problems.

During the field season the following must be recorded in a GeoBasis daily journal:

- Personal in the fiord
- Weather report (temperature, clouds, precipitation, wind, fog)
- Snow cover and ice condition and distribution
- Condition of the Kobbefjord river (water level, snow/ice, algae)
- Details about work carried out and the time (WGWT)
- Voltage on power stations
- Special events

It is always a good idea to record relevant pictures in the journal!

Follow format of previous year's field journal:
P:\B53_Nuuk_Basic\b53-06 GeoBasis\Field Work\Field Journals_Status E-mails

1.13. Equipment

1.13.1. Storage in Kobbefjord

Inside the Kitchen building GeoBasis and BioBasis share most of the space and shelves. GeoBasis have:

- The shelves on the left side of the door
- Half of the shelves above the table
- 3 boxes under the table
- 2 drawers under the table under the window
- The inner right corner of the storage room under the hut

Larger equipment can be placed in the storage building (spare wind mills, sleeping bags and mats) and in the inner right corner of the storage room under the kitchen building.

Always remember to mark equipment and drawers with "GeoBasis" to make it easy to identify for other users of the research station.

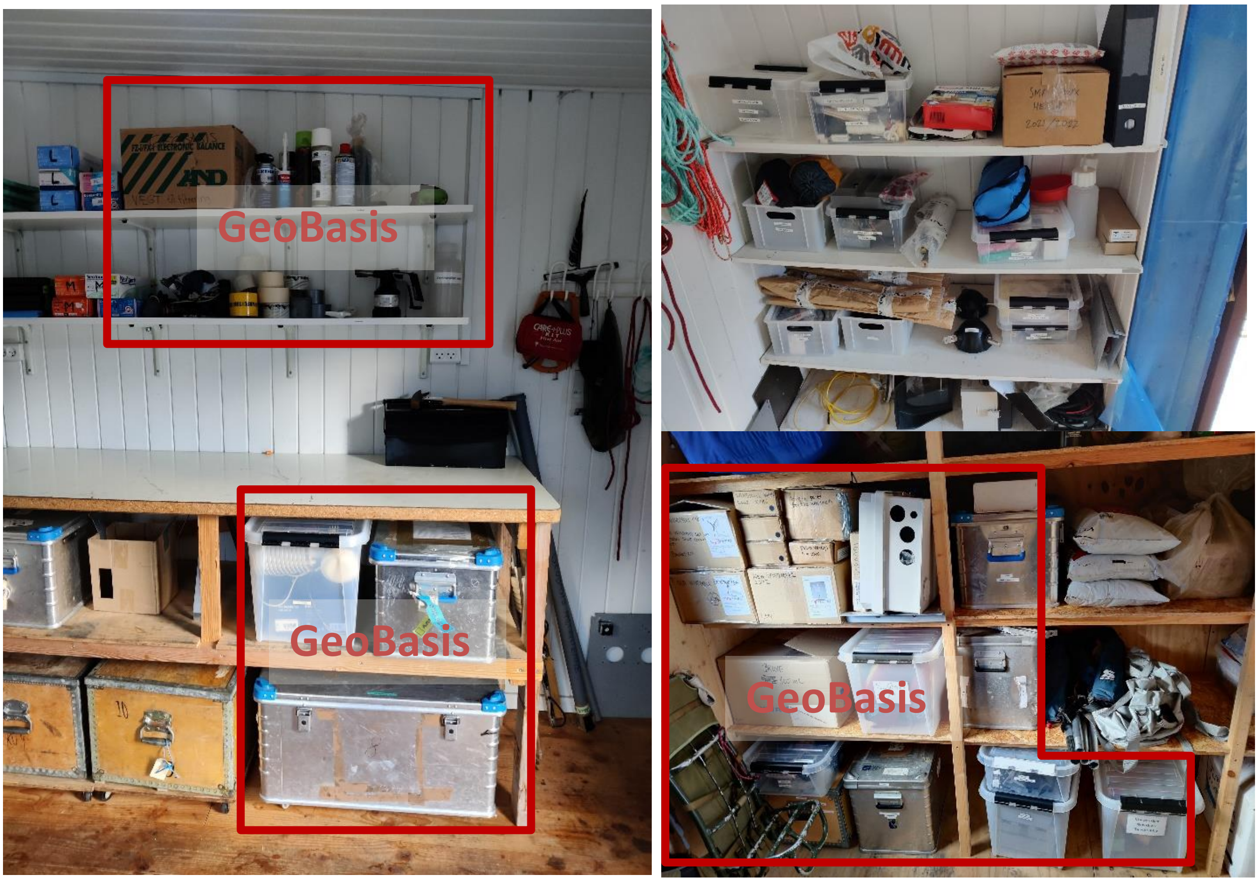


Figure 1 Location of the equipment stored in the main building and the storage building in Kobbefjord.

It is important that the GeoBasis equipment is always available and functioning; therefore under normal circumstances do not lend the equipment out to others, especially not the radios and safety equipment.

If you lend someone some GeoBasis equipment make sure to make agreement on:

- What it is used for
- When it will be back
- That they should replace it with new if something break

1.13.2. Asiaq

At Asiaq GeoBasis has equipment at two places:

- Office: Two bookcases
- New storage building: 6 shelfes in room "HKM 2"

Figure 2 GeoBasis equipment has been moved to the new storage building in spring 2024. The building is located on the opposite site of Kamik.

Figure 3 Few pieces of equipment are still stored in Kold lager in the old storage building. Don't enter by yourself, and wear a helmet.

A storage overview can be found in P:\B53_Nuuk_Basic\b53-06 GeoBasis\Field Work\End of Field Season.

1.13.3. The GeoBasis Field tablet

The field tablet has all necessary programs installed. Field assistants can log on to the computer using their personal user account and 2-point authentication (Duo). The tablet connects with the WIFI at Asiaq (Asiaq-ADM), and data can be transferred to the P-drive directly on the computer.

The field assistants will only be granted access to the GeoBasis folder on the P-drive: “P:\B53_Nuuk_Basic\b53-06 GeoBasis”.

2. The Monitoring Area and the GeoBasis Stations

The Nuuk Basic catchment area is approximately 32 km^2 and located at the bottom of Kobbefjord/Kangerluarssunguaq (64°07’ N, 51°21’ W) approx. 20 km south-east of Nuuk. The area is characterised by three major valleys surrounded by steep hills reaching approx. 1300 m a.s.l.

The mean annual air temperature in the monitoring area is -0.0 °C (2008-2024). The warmest month is July (average temperature 10.4 °C) while the coldest month is February (average temperature -9.0 °C). The mean precipitation in Kobbefjord is around 890 mm and maximum snow depths vary strongly (between 0.3 and 1.3m at the ClimateBasis station). The average mean, minimum and maximum air temperatures from the period 2008-2024 are seen in Figure 4.

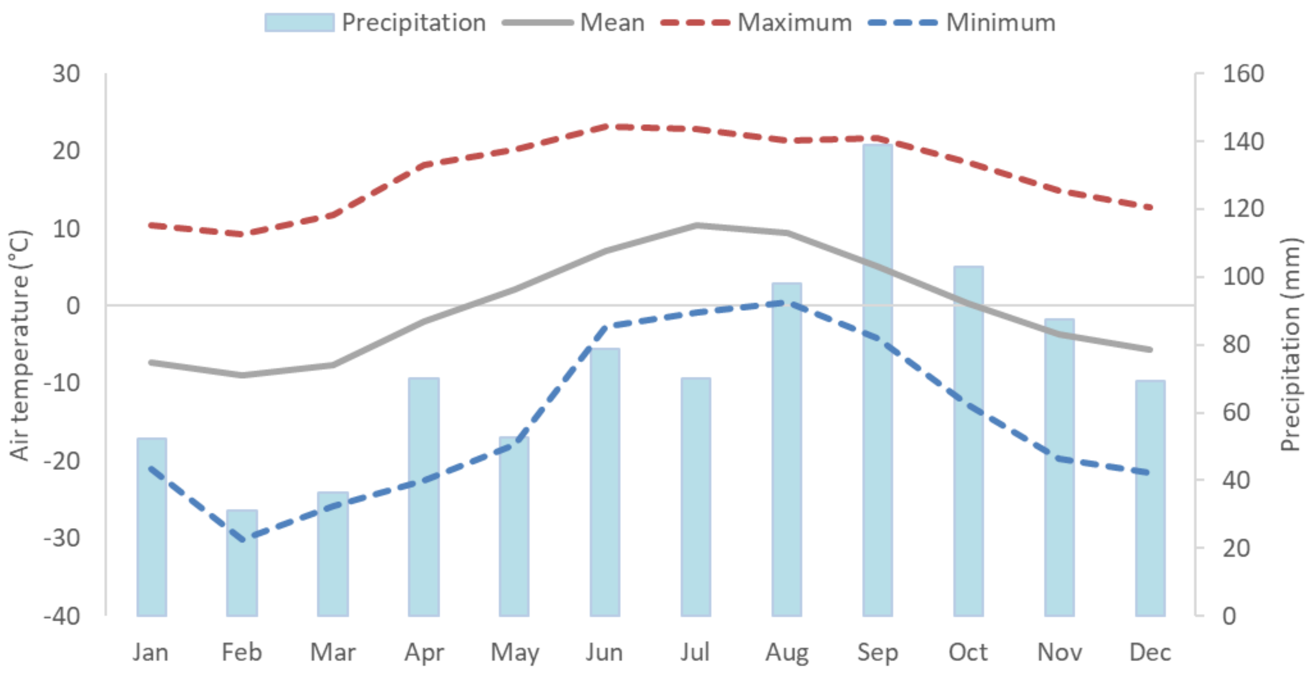


Figure 4 Monthly averaged air temperatures and precipitation measured at the Climate Stations (Asiaq) in Kobbefjord in the period 2008-2024.

The GeoBasis program has 12 active monitoring stations at eight sites in Kobbefjord. A full overview of the stations, parameters and sensors can be found in **Appendix 1**. Furthermore, the stations can be seen in Figure 5 and the related coordinates are found in Table 1. During the field season and the snow survey, additionally data is sampled manually. Apart from the gas flux monitoring stations and manual measurements, all stations measure all year round.

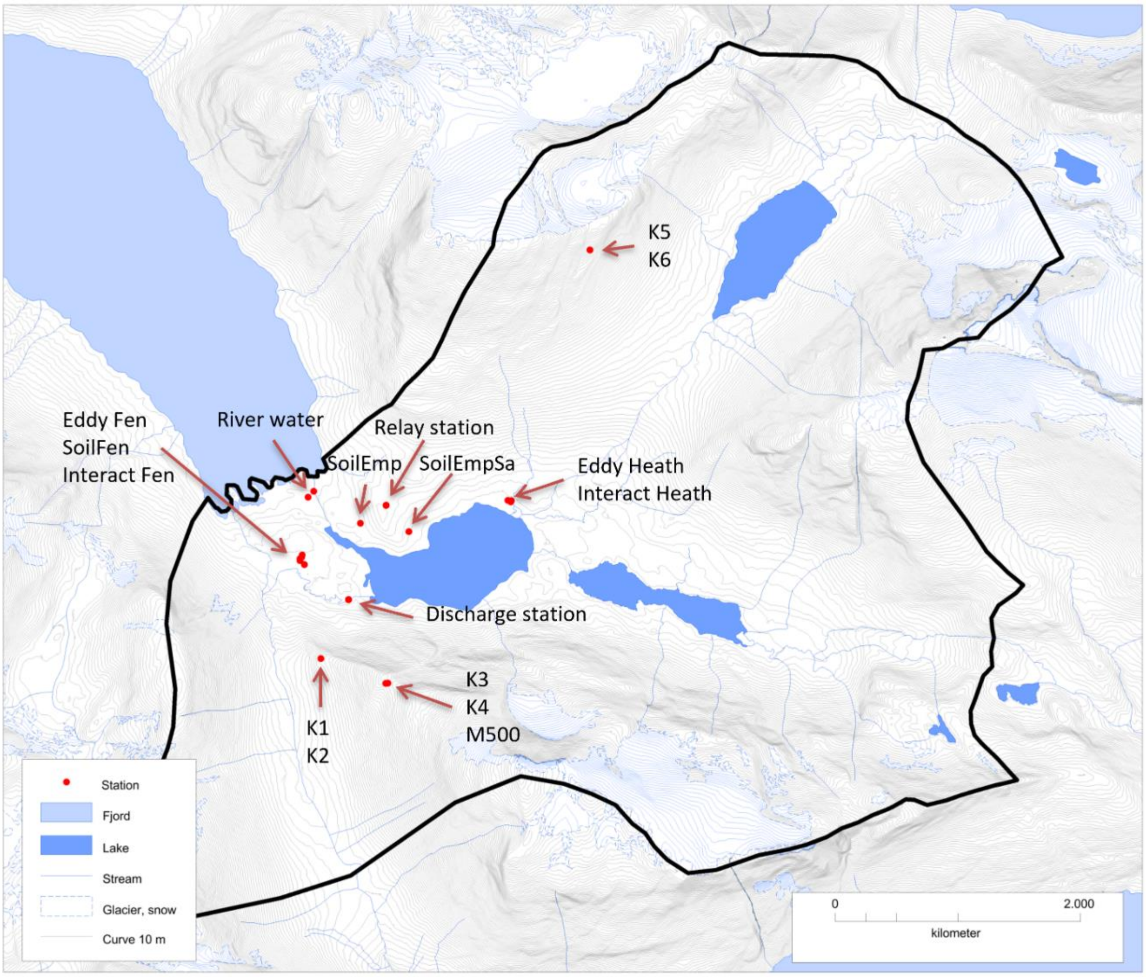


Figure 5 GeoBasis installations in Kobbefjord.

Table 1 List of the geographical coordinates of the GeoBasis installations in Kobbefjord, WGS 84.

Station	Station ID	UTM, 22 W		Lat-long, degree, min, sec		Elevation
		N	E	N	V	meter
K1		7110911.00	481363.67	64° 7'27.14"	51°22'57.83"	295
K2		7110849.33	481414.33	64° 7'25.15"	51°22'54.04"	307
K3		7110732.00	481883.00	64° 7'21.46"	51°22'19.31"	546
K4		7110739.75	481919.25	64° 7'21.69"	51°22'16.66"	533
Relay station		7112052	481857	64° 8'4.092"	51° 22'21.827"	88
M500	GB01	7110716.67	481885.33	64° 7'20.95"	51°22'19.16"	548
SoilFen	GB03	7111631.44	481236.10	64° 7'50.39"	51°23'7.54"	40
SoilEmp	GB04	7111968.61	481691.05	64° 8'1.37"	51°22'34.04"	33
SoilEmpSa	GB05	7111955.70	482106.95	64° 8'1.04"	51°22'3.28"	40
Interact Fen	I5Nf	7111669.79	481197.29	64° 7'51.60"	51°23'10.45"	40
Interact Heath	I6Nh	7112138.33	482919.19	64° 8'7.07"	51°21'3.30"	26
Eddy Fen		7111655.02	481207.91	64° 7'51.15"	51°23'9.63"	40
Eddy Heath		7112130.64	482919.98	64° 8'6.81"	51°21'3.30"	26
River water		7112227.24	481301.53	64° 8'9.65"	51°23'3.00"	9
Power Fen		7112153.74	482380.02	64° 7'52.93"	51°23'9.13"	51
Power Heath		7112114.81	482921.25	64° 8'6.32"	51°21'3.12"	25
Hut		7112182.44	481264.11	64° 8'8.19"	51°23'5.72"	16

3. Snow, ice and greenness monitoring

3.1. Introduction

Snow and ice cover are important parameters for the ecosystems in Arctic. The distribution and timing of the snow and ice cover influence the vegetation distribution and the length of the growing season, which again will affect the production of greenhouse gases such as carbon dioxide and methane. Furthermore, the snow conditions and vegetation distribution have a major effect on the thermal regime, the soil moisture content and the energy fluxes of the soil.

FOur automatic cameras are overviewing the valleys, lakes and fiord from two of the mountains surrounding the monitoring area. These cameras take pictures every day year-round. Furthermore, pictures of specific glaciers and snow patches seen from the valley are taken manually each year in mid-August. Pictures are used to validate the meteorological data from the monitoring stations, monitor special events like avalanches and storms and to determine growing seasons and the timing of ice on the lakes and fiord.

Data is not yet in the GEM database but ca be obtained upon request.

3.2. Automatic camera monitoring, K1-K6

3.2.1. Introduction

Four automatic digital cameras are installed in Kobbefjord (K1-K4). The cameras are taking pictures all year and the purpose is primarily to monitor the vegetation greenness, snow cover, fjord ice, lake ice and glaciers.

All cameras are triggered once a day (at 13:00) all year, while K1 and K2 in periods take more pictures a day. An overview is given below in Table 2.

In 2009 all camera sites except K2 were repositioned because snow built up around the cameras the two previous winters. In 2022 K3 had a new camera installed and the position angle was slightly repositioned. In 2022 the two cameras in 800 meters (K5 and K6) overviewing the two lakes in Kobbefjord were taken out of the program.

Table 2 Trigger times of automatic cameras.

Camera	Trigger time	Period
K1 and K2, 300 m a.s.l	10:00	March-October
	13:00	All year
	16:00	March-October
K3, 500 m a.s.l	9:00	All year
	13:00	All year
K4, 500 m a.s.l	13:00	All year

3.2.2. Frequency and Field Guide

The cameras in 300 and 500 meters (K1-K4) should be visited 2-4 times in the field season and occasionally during winter if possible. A description of how to get to the cameras and a guide to the different stations are found in **Appendix 2**. Use the Field Chart 3 – cameras as a checklist in the field.

3.2.3. Start up in spring

On the first visit after winter replace the SD card with an empty 32GB SD card, check time on trigger and photos, and change silica bags. If the enclosure during the season is not 100 percent dry, then change silica bags again. Otherwise, it is ok to change them only two times a year. Make sure the camera has the same position and zoom as it is supposed to.

3.2.4. Close down in fall

Make sure the camera system is OK, wires are tight, change silica bags, leave 3 bags for the winter; be sure water or snow cannot enter the enclosure. Apply silicone fat on the rubber sealing on the lid (the silicone that does not get hard when drying). Make sure there is enough space on the memory card to log photos during winter.

3.2.5. Data handling at the office

1. Check if camera has taken daily pictures. See frequency in Table 2.

2. Check all pictures for sharpness and zoom especially the latest pictures.

3. Copy pictures to their respective station folders at the office PC: *P:\B53_Nuuk_Basic\b53-06 GeoBasis\GeoBasis Stations\Cameras\KX_XXX*

4. Rename the pictures according to the description in **Appendix 2**.

5. The field charts are saved in the station folder at the office PC: *P:\B53_Nuuk_Basic\b53-06 GeoBasis\GeoBasis Stations\Cameras\Field charts*.

6. Normally a colleague from GINR will show up at Asiaq to get the pictures from the winter after the first visit to the cameras.

7. If anyone outside of Nuuk ask for the pictures they

8. If anyone outside Nuuk wants to obtain the pictures contact Karoline Nordberg Nilsson.

Figures 5 to 8 are showing the four different camera set-ups and their systems. For each camera station an automatically captured picture is shown.

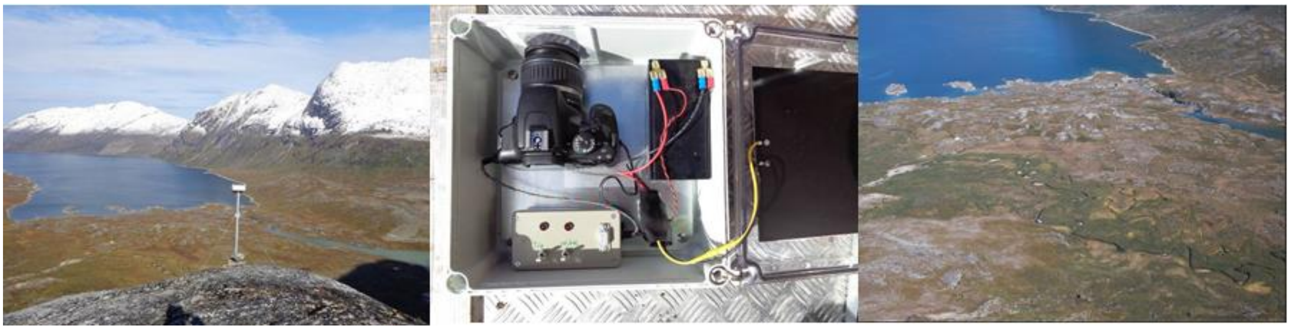


Figure 6 K1, 300 m.a.s.l. Pointing towards the fjord and fen. System 3.

Figure 7 K2, 300 m.a.s.l. Pointing towards South Valley. System 3.

Figure 8 K3, 500 m.a.s.l. Poiting towards the fiord. System 5.

Figure 9 K4, 500 m.a.s.l. Pointing towards Badesø, the heath and Qassi Valley. System 5. OBS new camera installed in 2024.

3.2.6. Camera systems and history

System 1: 2GB Hp Photosmart E427 6.9mm camera that is controlled by a Time Guard timer (EL11). Powered by a 4V 10h Cyclon battery charged by a small solar panel.

System 2: CameraBox invented by Bo Holm Rasmussen with a Canon EOS camera, triggerbox, two sets of batteries and 16 GB SD card. System 2 had a lot of problems.

System 3: Invented by Jens Gammeltoft with a Canon EOS camera, trigger box, Panasonic 3.4 Ampere battery, solar panels and 16 GB SD card. Trigger box controlled via the program: *cambox control.*

System 4: Invented by Andreas Westergaard with a Canon EOS camera, trigger box, Panasonic 3.4 battery, solar panels and 16 GB SD-card.

System 5: Canon EOS camera connected to a CR310 logger, 2 x 12V batteries connected to a solar panel and a 16 GB SD-card. The CR310 logger can be accessed remotely in the hut through an access point.

An overview of the history of the camera systems are given in Table 3

Table 3 History and systems of the automatic cameras

	System 1	System 2	System 3	System 4	System 5
K1	*2007-2011*	*2011-2013*	**2013-**		
K2	*2007-2012*	*2012-2013*	**2013-**		
K3	*2007-2022*				**2022-**
K4	*2007-2022*				**2024-**
K5	*2007-2014*		*2014-2022*		
K6	*2007-2015*			*2015-2022*	

3.3. Photos of glaciers and snow patches (August 11th)

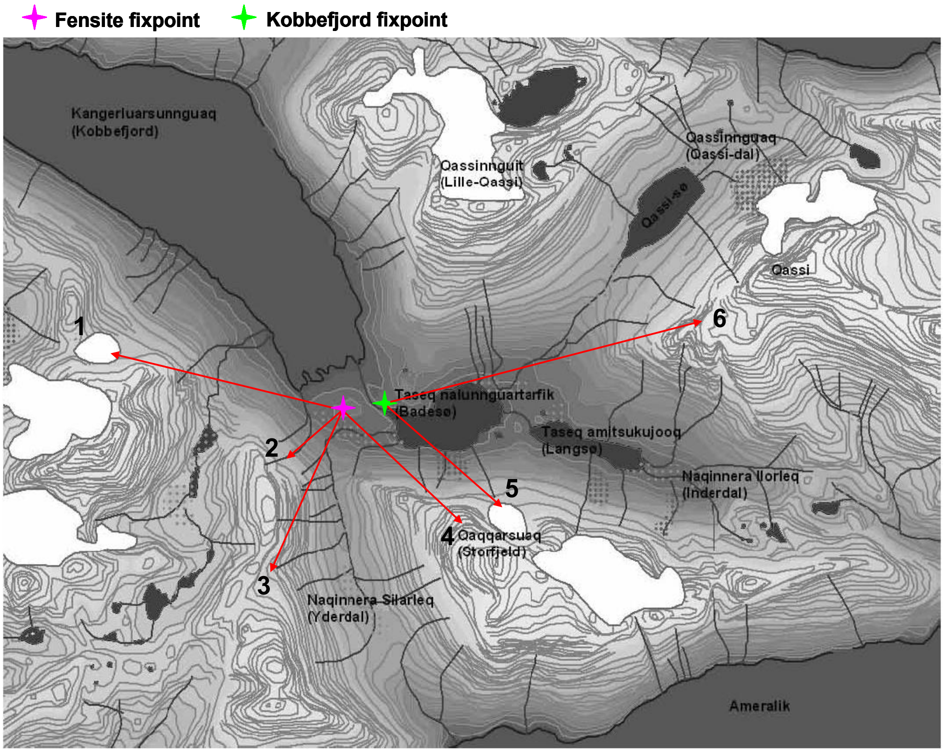


Figure 10 Overview of the glaciers and snow patches visible from the fensite fix point and Kobbefjord fix point.

3.3.1. Introduction

Digital photos of the visible glaciers and snow patches of the monitoring area are taken manually from the Fensite fix point (bench mark) and Kobbefjord fix point as close as possible to the date August, 11th (in clear weather if possible). The photos are taken with the GeoBasis digital camera. Take more than one picture of each object. The two fix points are seen in Figure 11.

Figure 11 Kobbefjord fix point at the northern side of the river (left) and Fen fix point next to the old Methane station (right).

Examples of the pictures are seen in Figure 12.

Figure 12 The three glaciers and three snow patches captured manually every year in August.

3.3.2. Frequency

Once a year on August 11th. It can be necessary to take the pictures some days before or after due to bad weather or timing. Yearly photo documentation of the glaciers and snow patches of the monitoring area has been carried out since 2010.

3.3.3. Data handling

The photos are uploaded at the office pc in the folders for each glacier or snow patch (1-6) (*P:\B53_Nuuk_Basic\b53-06 GeoBasis\GeoBasis Stations\Snowpatches photos*).

4. Microclimatology and Energy Balance

4.1. Introduction

In Kobbefjord several automatic weather stations monitor essential meteorological parameters including air temperature, relative humidity and radiation at different surfaces and elevations as a part of the GeoBasis monitoring program. Currently, three running climate stations are distributed over the monitoring site; in a fen area, in a heath area and one situated in 500 m a.s.l. Previously, two additional meteorological stations, M300 (in 300 m a.s.l) and M1000 located at the opposite side of the valley in Kobbefjord (in 1000 m a.s.l.) were part of the program, but were closed in 2021 and 2011, respectively. Historical data from these stations can be found in the GEM database.

When combining the GeoBasis and ClimateBasis stations 6 stations are currently measuring air temperature and relative humidity. Several of the stations have other overlapping measured parameters making investigations of the microclimatology in the valley possible.

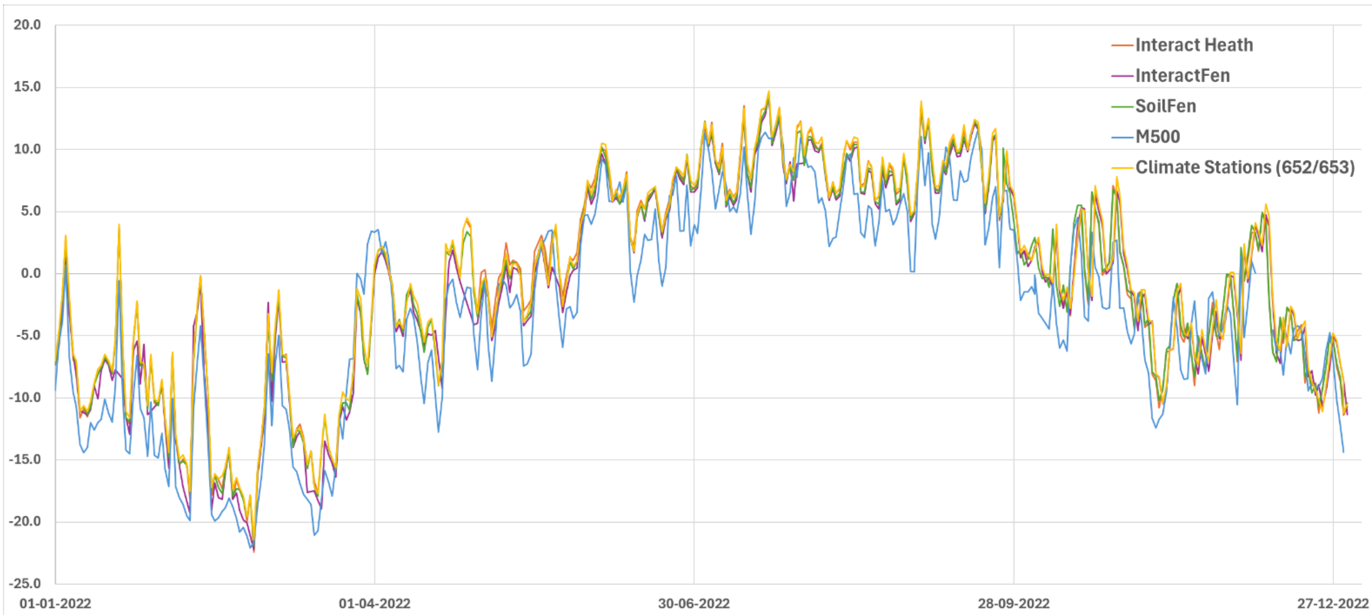


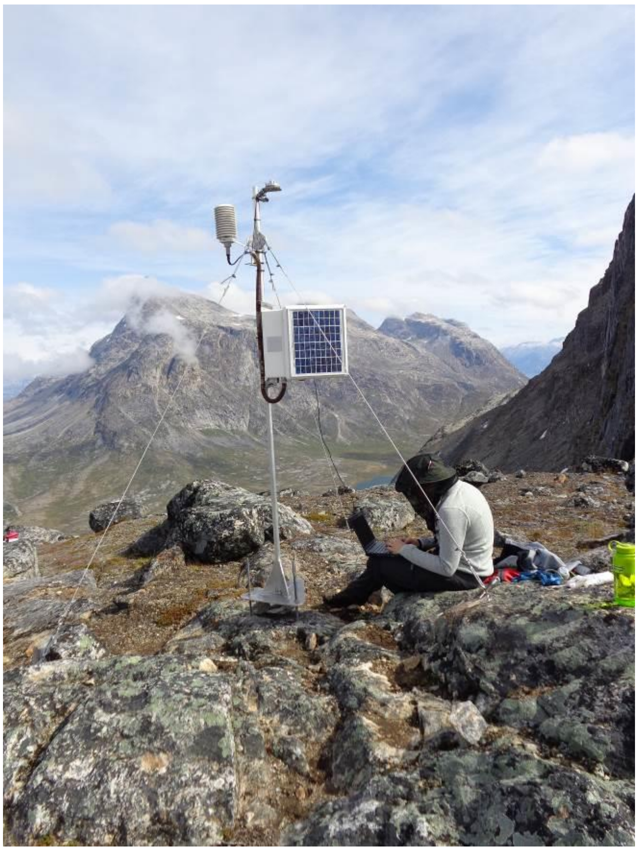
Figure 13 Daily mean temperatures from Interact Heath, Interact Fen, M500, SoilFen and ClimateBasis stations in Kobbefjord (2022).

In the GEM database the meteorological data is found under ***GeoBasis Nuuk – Meteorology***

InteractFen: radiation, temperature, humidity, wind https://doi.org/10.17897/9PZ3-WW15
InteractHeath: radiation, temperature, humidity, wind https://doi.org/10.17897/JP7F-NH56
M1000: radiation, temperature, humidity https://doi.org/10.17897/0SG6-6R56
M300: radiation, temperature, humidity https://doi.org/10.17897/JA21-6Y82
M500: radiation, temperature, humidity https://doi.org/10.17897/7MSK-4190
SoilFen 1 min: PAR https://doi.org/10.17897/BFE0-RF47
SoilFen 30 min: temperature, humidity, PAR, water vapour pressure

5 min timeseries of meteorological parameters can be obtained from M500 and SoilFen by contacting Andreas Westergaard-Nielsen or Karoline Nordberg Nilsson.

4.2. M500 (GB01)



4.2.1. Useful guides

What to bring and how to go there: **Appendix 2 Camera guide**.
Data download: **Appendix 4 Data Download CR1000 guide**.

4.2.2. Introduction

M500 measures air temperature and relative humidity in 2 m height, surface temperature and short-waved incoming radiation logged in a 5 min interval. The station is placed on the same mountaintop as K3 and K4 in 500 meters height. The work includes collecting data, data quality checks, maintaining sensors, protecting the installations and administering station metadata (present and historic sensors, what program has been running when).

4.2.3. Frequency

M500 is visited whenever K3/K4 are visited (2-4 times a year).

4.2.4. Station check

At every station visit the sensors are visually inspected (sensor in level, firmly installed, damaged, condition of wires, enclosure, solar panel and mast). When connecting to the logger, please check following parameters, listed in Table 4, display a reasonable value.

Table 4 Overview of station parameters and their naming in Loggernet.

Loggernet name	Parameter
batt_volt_Min	Battery voltage min. [V]
SW_radin_Avg	Short-waved incom. radiation [W/m^2]
AirTC_Avg	Air temperature, 2m [ºC]
RH_Avg	Relative humidity [%]
e_kPa_Avg	Vapour pressure [kPa]
SBT_C_Avg	surface temperature [ºC]

4.2.5. Start up in spring

Download data via Loggernet and afterwards change memory card. Change silica bags, 3 should be enough. If the enclosure during the season is not 100% dry, then change silica bags again, otherwise it is ok to change them only twice a year.

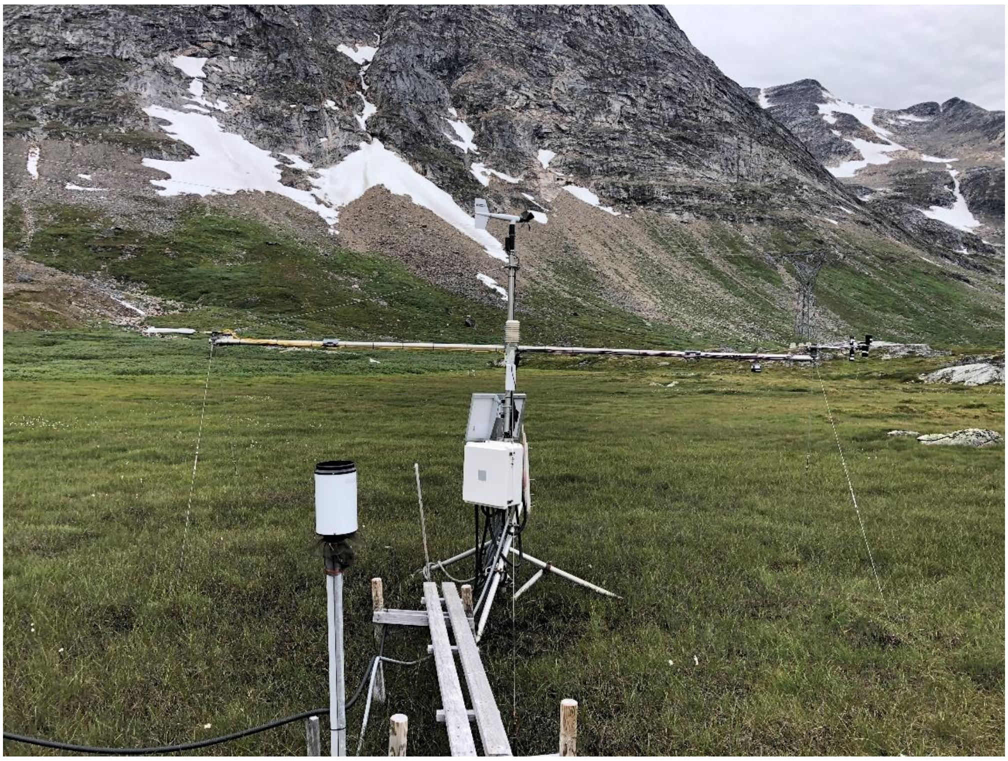
4.2.6. Close down in fall

Make sure sensors are OK, wires are tight, change silica bags, leave 4-6 bags for the winter; be sure water or snow cannot enter the enclosure. Make sure there is enough space on the memory card to log data during winter.

4.2.7. History

M500 has been running since 2007.

4.3. Interact Fen (I5Nf)



4.3.1. Useful guides

Data download: **Appendix 4 Data Download CR1000 guide**
Access from the hut: **Appendix 9 Wi-Fi network**

4.3.2. Introduction

Interact Fen is located in a grass-dominated, moist and peaty fen area in the valley. The station is one of the two automatic energy balance stations that was set up in 2011 by INTERACT. The stations are a part of a network of similar stations; in Nuuk we have station no. 5 (I5Nf) and 6 (I6Nh). Additionally, the I5Nf delivers biometric data to the Smartflux installed in Eddy Fen. GeoBasis takes care of the daily checks and updates. Interact Fen is placed in the fen, where it is very wet. Be very careful when you walk outside the boardwalk and avoid walking underneath any sensor as the vegetation is very easily damaged. Take some wood and walk on that and be extra careful under the sensors. The work includes collecting data, data quality checks, maintaining sensors, protecting the installations and administering station metadata (present and historic sensors, what program has been running when).

4.3.3. Frequency

Interact Fen is visited once every 14 days.

4.3.4. Station check

At every other station visit, the sensors are visually inspected (sensor in level (twice a year), firmly installed, damaged, condition of wires, enclosure and mast). Especially the soil sensors are important to notice if the fox has been digging or if there are any other signs that the buried sensors may be physically damaged.

You connect through the Ethernet cable attached to the logger that reads “Eddy”. If any connection errors occurs, try to connect with the micro-USB connected to the logger. When connecting to the logger, please check following parameters in Table 5 are displaying a reasonable value and no -9999 or -7999 values are shown.

Table 5 Overview of station parameters and their naming in Loggernet.

Loggernet name	Parameter
BattV	Battery voltage [V]
AirTC	Air temperature [°C]
RH	Relative humidity [%]
WindSpeed	Wind speed [m/s]
WindDir	Wind direction [degrees]
P_Air	Air pressure [mbar]
cal_SR50_SnowDepth	Snow depth [m]
Rain_mm	Liquid precipitation [mm]
SoilT_**XX**cm	Soil temperature **XX** depth [°C]
SnowT_**XX**cm	Snow temperature **XX** height [°C]
cal_NetRad_Pyrano_Up	Short-waved incoming radiation [W/m^2]
cal_NetRad_Pyrano_Lo	Short-waved outgoing radiation [W/m^2]
cal_NetRad_Pyrgeo_Up	Long-waved incoming radiation [W/m^2]
cal_NetRad_Pyrgeo_Lo	Long-waved outgoing radiation [W/m^2]
SKR1800_2018_Up_CH1_avg	RVI incoming radiation in 640nm wavelength [μmol/s/m^2]
SKR1800_2018_Up_CH2_avg	RVI incoming radiation in 860 nm wavelength [μmol/s/m^2]
SKR1800_2018_Down_CH1_avg	RVI outgoing radiation in 640nm wavelength [μmol/s/m^2]
SKR1800_2018_Down_CH2_avg	RVIoutgoing radiation in 860 nm wavelength [μmol/s/m^2]

Figure 14 Pyrano- and pyrgeometer (incoming and outgoing short- and long wave radiation).

Figure 15 Left: SR50 Snow Depth sensor, Right: NDVI sensor (Vegetation greenness).

Figure 16 Top: Young Wind sensor measuring wind speed and direction. Bottom: Air temperature and RH sensor (Vaisala, HMP155).

Figure 17 SoilVUE10 sensor measuring soil temperature, moisture and conductivity.

SoilVUE sensor: Due to the high organic content of the soil and a fluctuating water table the soil surface fluctuates slightly during the season. The top part of the SoilVUE sensor is therefore at times not in contact with the soil. Take a picture of the SoilVUE when visiting the station and measure the distance between the top of the sensor to the surface occasionally. Take very much care of the vegetation and do not step on the soil profile where the sensors are buried.

4.3.5. Start up in spring

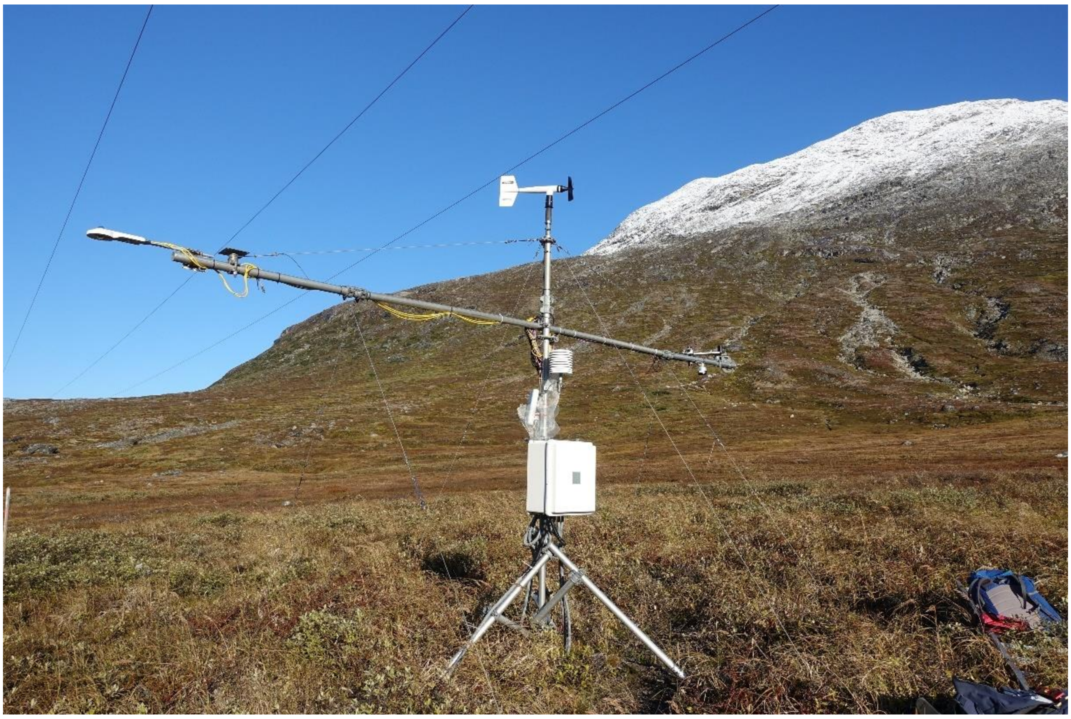
Download data via Loggernet and afterwards change memory card. Change silica bags and leave about 3-6. It has happened that water/snow have entered the enclosure during winter, so if the enclosure is not dry then dry up the enclosure, find the leakage and add silica bags if necessary. If the enclosure during the season is not 100 percent dry then change silica bags again otherwise it is ok to change them only two times a year.

4.3.6. Close down in fall

Make sure sensors are OK, wires are tight, change silica bags leave 4-6 bags for the winter; be sure water or snow cannot enter the enclosure. Make sure there is enough space on the memory card to log data during winter.

4.3.7. History
Interact Fen has been running since 2011. In 2013 the logger enclosure and program were changed. In 2021 the logger cabinet and cables were tightened up and program rewritten to match ICOS standards and a 100 cm SoilVUE10 sensor was added. In 2022 a Wi-Fi antenna was mounted, and the station can be accessed from the hut.

4.4. Interact Heath (I6Nh)



4.4.1. Useful guides
Data download: **Appendix 4 Data Download CR1000 guide**.
Access from the hut: **Appendix 9 Wi-Fi network**

4.4.2. Introduction
Interact Heath is located in a dry heath area dominated by willow (*Salix glauca)* and crowberry (*Empetrum Nigrum)*. The station is one of the two automatic energy balance stations that was set up in 2011 by INTERACT. The stations are a part of a network of similar stations; in Nuuk we have station no. 5 (I5Nf) and 6 (I6Nh). GeoBasis takes care of the daily checks and updates.

The vegetation is VERY easily damaged, especially the Empetrum plants, therefore only walk on the footpaths and enter the area along the stream. Be extra careful under the sensors. The work includes collecting data, data quality checks, maintaining sensors, protecting the installations and administering station metadata (present and historic sensors, what program has been running when).

4.4.3. Frequency
Interact Heath is visited once every 14 days.

4.4.4. Station check

At every other station visit the sensors are visually inspected (sensors in level (twice a year), firmly installed, damaged, condition of wires, enclosure and mast). Especially the soil sensors are important to notice if the fox has been digging or there are any other signs that the buried sensors may be physically damaged. Take very much care of the vegetation and do not step on the soil profile where the sensors are buried. Station data can also be checked from the hut now.

Table 6 Overview of station parameters and their naming in LoggerNet.

Loggernet name	Parameter
HedeBattV	Battery voltage [V]
AirTC	Air temperature [°C]
RH	Relative humidity [%]
SoilT_**XX**cm	Soil temperature **XX** depth [°C]
SnowT_**XX**cm	Snow temperature **XX** height [°C]
cal_NetRad_Pyrano_Up	Short-waved incoming radiation [W/m^2]
cal_NetRad_Pyrano_Lo	Short-waved outgoing radiation [W/m^2]
cal_NetRad_Pyrgeo_Up	Long-waved incoming radiation [W/m^2]
cal_NetRad_Pyrgeo_Lo	Long-waved outgoing radiation [W/m^2]
cal_SoilMoist	Soil Moisture [%]
cal_SoilHeatFlux	Soil heat flux [W/m3]
WindSpeed	Wind speed [m/s]
WindDir	Wind direction [degrees]

4.4.5. Start up in spring

Download data via Loggernet and afterwards change memory card. Change silica bags about 3 should be enough. If the enclosure during the season is not 100 percent dry then change silica bags again otherwise it is ok to change them only two times a year.

4.4.6. Close down in fall

Make sure sensors are OK, wires are tight, change silica bags leave 4-6 bags for the winter; be sure water or snow cannot enter the enclosure. Make sure there is enough space on the memory card to log data during winter.

4.4.7. History

Interact Heath has been running since 2011. In 2012, the station was moved 20 m closer to the stream because the vegetation was damaged underneath the sensors. In 2013, the logger enclosure and program was changed. In 2022, a Wi-Fi antenna was mounted, and the station can be accessed from the hut. A 50 cm SoilVUE10 sensor was installed in the soil in 2022 but first connected to the logger and program in 2023.

5. Soil monitoring

5.1. Introduction

GeoBasis Nuuk has currently three soil stations placed at different vegetation surfaces; SoilFen (moist peaty soil dominated by grasses), SoilEmp (dry, coarse-grained soil, dominated by empetrum) and SoilEmpSa (coarse-grained soil, dominated by empetrum and salix).

The stations automatically measure the thermal regime of the soil column, soil moisture in different depths and the soil heat flux. The two INTERACT stations also measure soil temperatures, soil moisture and soil heat flux, but these stations are described in section 4.

The data from the soil stations can be used to investigate the interactions between the soil conditions and the vegetation, gas fluxes and energy balance in the area. Furthermore, the influence of the snowpack on the soil thermal regime and the soil water content can be studied.

At the SoilFen station, soil water is sampled manually from two depths during the field season, to study how hydrology in turn controls the material and nutrient export from soils to surface waters. Compared to other components of the hydrological cycle, the volume of soil moisture is small; nonetheless, it is of fundamental importance to many hydrological, biological and geochemical processes.

Earlier, soil water was also collected at the heath (until 2016) and SoilEmp (until 2013), but the sampling was stopped due to too dry soil conditions.

In the GEM database the soil properties data is found under ***GeoBasis Nuuk – Soil Properties***

InteractFen SoilProperties:
Water fraction, ground water level, soil temperatures https://doi.org/10.17897/9JC3-MX20

SoilVUE Fen ElectricalConductivity:
Electrical conductivity https://doi.org/10.17897/3HY2-AC13

SoilVUE Fen SoilMoisture:
Soil moisture https://doi.org/10.17897/BTGX-QM93

SoilVUE Fen SoilTemperature:
Soil temperature https://doi.org/10.17897/AN04-ME80

InteractHeath SoilProperties:
Soil moisture, soil temperatures, soil heat fluxes https://doi.org/10.17897/9A4H-7C24

SoilVUE Heath SoilMoisture:
Soil moisture No DOI yet

SoilVUE Heath SoilTemperature:
Soil temperature No DOI yet

SoilEmp 30min:
Soil temperatures, soil heat fluxes https://doi.org/10.17897/ADJ6-WB16

SoilEmp 6h:
Soil moisture https://doi.org/10.17897/PM4G-X627

SoilEmpSa 30min:
Soil temperatures, soil heat fluxes https://doi.org/10.17897/NQ0Q-B945

SoilEmpSa 6h:
Soil moisture https://doi.org/10.17897/YWJK-7X13

SoilFen SoilProperties 30min:
Soil temperatures, surface temperature, soil heat flux https://doi.org/10.17897/N33Q-M118

SoilFen SoilWaterChemistry:
Chemical analyses of soil water https://doi.org/10.17897/JV0K-4P72

5.2. SoilFen (GB03)

Figure 18 The automatic soil station SoilFen and the soil water sampling site close to the station.

5.2.1. Useful guides

For collection and laboratory analysis of soil water: **Appendix 3 Soil water guide**

Data download: **Appendix 4 Data Download CR1000 guide**.

5.2.2. Introduction

SoilFen is one of the three automatic soil stations. SoilFen is placed in the fen and consists of an automatic station measuring soil- and surface temperatures to 75 cm depth and soil heat flux in 5 cm depth. A soil water station is located next to the automatic station. The work includes collecting data, data quality checks, maintaining sensors, protecting the installations and administering station metadata (present and historic sensors, what program has been running when) and soil water sampling.

Soil water is collected at 10 cm (three replicas) and 80 cm (three replicas) depth using soil water samplers (suction cup lysimeters) from Prenart. The suction sampler used in Nuuk is 'Prenart Super Quartz' which is made of porous PTFE (teflon) and quartz.

5.2.3. Frequency

SoilFen is visited once every 14 days. Soil water is collected 3-4 times during the season; once in the beginning of the growing season, once or twice during the growing season and once at the end of the growing season.

5.2.4. Station check

At every station visit the sensors are visually inspected (sensor in level, firmly installed, damaged, condition of wires, enclosure, solar panel and mast). Especially at the soil stations it is important to notice if the fox has been digging or there are any other signs that the buried sensors may be physically damaged. Take very much care of the vegetation and do not step on the soil profile where the sensors are buried.

Table 7 Overview of station parameters and their naming in LoggerNet.

Loggernet name	Parameter
batt_volt	Battery voltage [V]
AirTC	Air temperature [°C]
RH	Relative humidity [%]
e_kPa	Vapour pressure [kPa]
Stemp(**X**)	Soil temperature **XX** depth [°C]
SHF(**X**)	Soil heat flux [W/m3]

5.2.5. Data handling

Field Chart 4 is completed with the laboratory results from Nuuk (pH and conductivity) and is saved in folder *P:\B53_Nuuk_Basic\b53-06 GeoBasis\GeoBasis Stations\SoilFen\Soil Water Chemistry*

Soil water samples are collected in brown bottles and sent to Copenhagen by the end of the season for additional analysis. An overview of the soil water analyses is given in Table 8.

Table 8 Parameters analyzed in the GeoBasis program

Is analyzed where	*Parameter*
GEOBASIS	pH
GEOBASIS	Conductivity
GEOBASIS	Alkalinity
GEOCENTER	Chloride (Cl-)*
GEOCENTER	Nitrate (NO3-)*
GEOCENTER	Sulfate (SO42-)*
GEOCENTER	Calcium (Ca2+)
GEOCENTER	Magnesium (Mg2+)
GEOCENTER	Potassium (K+)
GEOCENTER	Sodium (Na+)
GEOCENTER	Iron (Fe2+)
GEOCENTER	Aluminum (Al3+)
GEOCENTER	Manganese (Mn2+)
BIOBASIS (Department of Biology, University of Copenhagen)	Dissolved organic carbon (DOC)*
BIOBASIS (Department of Biology, University of Copenhagen)	Ammonia (NH4+-N) *
BIOBASIS (Department of Biology, University of Copenhagen)	Dissolved total nitrogen (DTN)*
*The only parameters found in soil water samples in Kobbefjord	

5.2.6. Previous years measurements

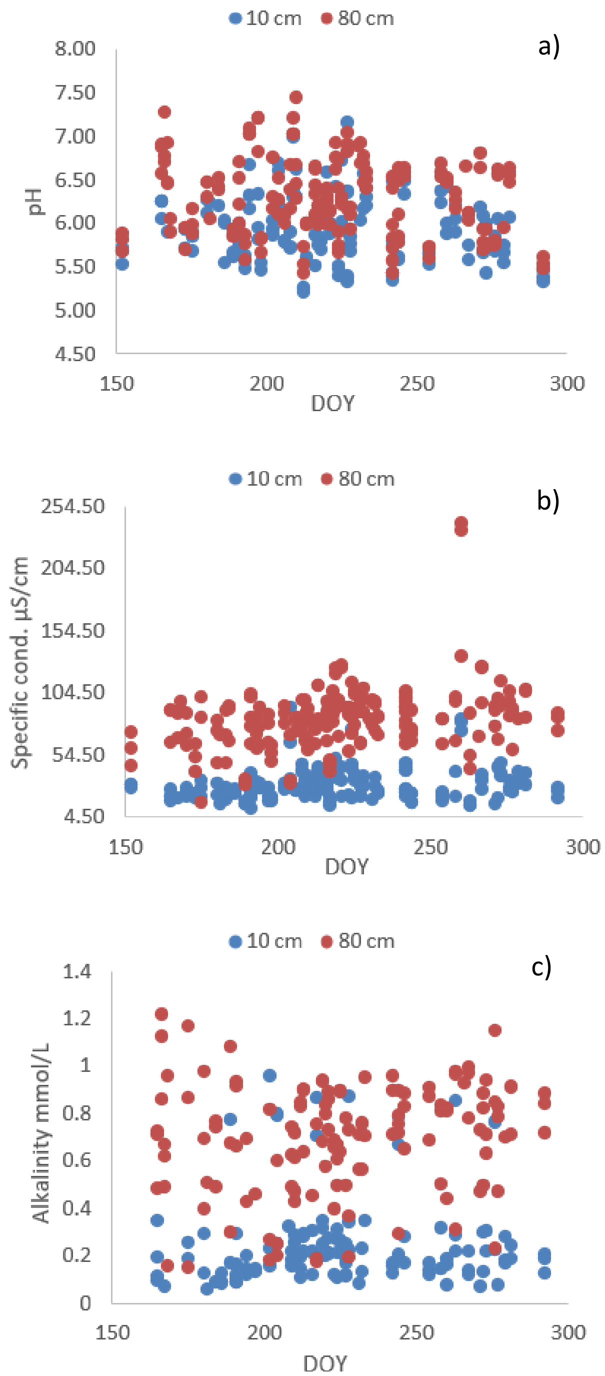


Figure 19 pH (a), Specific conductivity (b) and alkalinity measured in soil water samples from the fen from 2010-2024. Samples are collected from 10 and 80 cm soil depth.

5.2.7. Replacement of suction probes

Suction probes can work for years without any problems, but clogging and bad hydraulic contact may cause problems and require replacement. In that case follow the procedure for installation given by Prenart Equipment ApS. Installation dates are noted in the GeoBasis Field journal.

5.2.8. Labels and bottles

The water samples sent to Copenhagen must be labeled according to the following convention: GB01-20140804-80-6 (Soil water station in fen, collected 4/8-2014 from depth 80 cm, sample no. 6). If you need more labels, they are found at Asiaq:
P:\B53_Nuuk_Basic\b53-06 GeoBasis\Field Work\Field Charts_Empty\Labels til soil water.
Remember: when you print, choose "print from **magasin 5"** and use the label paper with 24 labels **no. 57159.** Place the paper with the back side upward. The bottles are found in the left drawer in the laboratory in the hut. Andreas can send or bring new bottles, when needed. Just remember to tell him.

5.2.9. Storage and transport

Keep the brown sample bottles cold and store them in the Asiaq workshop freezer and fridge as soon as possible. By the end of the season all the bottles are packed in two insulated boxes and sent to Andreas. Find shipping labels here: *P:\B53_Nuuk_Basic\b53-06 GeoBasis\Shipping\Shipping Labels*

Send the bottles as refrigerated cargo (+5°C) and frozen cargo (-18°C) with Blue Water Shipping. It is a good idea to insulate the frozen cargo box with polystyrene (flamingo) and leave some refrigeration units in it. The polystyrene can be bought in STARK – but check out the "koldlager" or the room next to the cooking equipment at the workshop before buying.

It is cheaper to send it by airmail than by ship because the shipping from Aalborg to Copenhagen is extremely expensive (around 1000 kr). Bring the boxes with the samples to Blue Water.
Remember to fill out the excel sheet with results of the soil water analysis and send it to Andreas by the end of the season. It is important for the laboratory people in Denmark.
P:\B53_Nuuk_Basic\b53-06 GeoBasis\GeoBasis Stations\SoilFen\Soilwater chemistry\field charts indskrevet

5.2.10. Start up in spring

When the ice in the fen has thawed; push down the three large metal sticks inserted in the peat for holding the wires which are stabilizing the metal stand for the solar panel + logger box + sensors to tighten the wires. Make sure that the metal stand is at a vertical level. Download data via Loggernet and afterwards change memory card. Change silica bags, about 3 should be enough. If the enclosure during the season is not 100 percent dry then change silica bags again, otherwise it is ok to change them only two times a year.

Clean the soil water bottles, lids and tubing in clean water and with a sponge and paper. Remove algae and other dirt, be careful when cleaning inside the bottle, do not use the same sponge inside the bottles. Use instead clean paper and rinse with clean water afterwards. Empty the gray tubes for water.
Spare lids are found in the soil water box in the hut.

5.2.11. Close down in fall

Make sure sensors are OK, wires are tight, change silica bags, leave 4-6 bags for the winter; be sure water or snow cannot enter the enclosure. Make sure there is enough space on the memory card to log data during winter.
Leave the 1L soil water plastic bottles at the site.

5.2.12. History

SoilFen has been running since 2007. In 2008 the station was redesigned because it was flooded. In 2008 the soil water sampling was implemented. In 2012 the boardwalk was built. In 2023 a new method for soil water sampling was tested and implemented at 10 cm depth. However, as this method was not found suitable for 80 cm sampling new suction filters will be installed in 2025 for both 10 and 80 cm depths.

5.3. SoilEmp (GB04)

5.3.1. Useful guides

Data download: **Appendix 4 Data Download CR1000 guide**.

5.3.2. Introduction

SoilEmp is one of the three automatic soil stations. SoilEmp is placed on empetrum (crowberry/revling) vegetation on the eastern side of the river. The work includes collecting data, data quality checks, maintaining sensors, protecting the installations and administering station metadata (present and historic sensors, what program has been running when).

5.3.3. Frequency

SoilEmp is visited once every 14 days.

5.3.4. Station check

At every station visit the sensors are visually inspected (firmly installed, damaged, condition of wires, enclosure, solar panel and mast). Especially at the soil stations it is important to notice if the fox has been digging or there are any other signs that the buried sensors may be physically damaged. Take very much care of the vegetation and do not step on the soil profile where the sensors are buried.

Table 9 Overview of station parameters and their naming in LoggerNet.

Loggernet name	Parameter
batt_volt	Battery voltage [V]
SM(**X**)	Soil Moisture **XX** depth [%]
Stemp(**X**) (5 and 6 do not exist)	Soil temperature **XX** depth [°C]
SHF(**X**)	Soil heat flux [W/m3]

5.3.5. Offloading data

Follow the guide given in **Appendix 4 Data download CR1000 guide.**

5.3.6. Start up in spring

Download data via LoggerNet. The memory card is changed every other year. Change silica bags. Around 6 bags should be enough. This enclosure is sometimes wet inside after winter so check if there are dew and try to dry it up. If the enclosure during the season is not 100 percent dry then change silica bags again, otherwise it is ok to change them only two times a year.

5.3.7. Close down in fall

Make sure sensors are OK, wires are tight, change silica bags leave 6-9 bags for the winter, be sure water or snow cannot enter the enclosure. Make sure there is enough space on the memory card to log data during winter.

5.3.8. History

SoilEmp has been running since 2008. The station was constructed with soil water in 2008 but in 2013 the soil water part was removed because the site was too dry.

5.4. SoilEmpSa (GB05)

5.4.1. Useful guides
Data download: **Appendix 4 Data Download CR1000 guide**.

5.4.2. Introduction
SoilEmpSa is one of the three automatic soil stations. SoilEmpSa is placed on empetrum (crowberry/revling) vegetation and Salix (willow/pil) vegetation on the eastern side of the river. The work includes collecting data, data quality checks, maintaining sensors, protecting the installations and administering station metadata (present and historic sensors, what program has been running when).

5.4.3. Frequency
SoilEmpSa is visited once every 14 days.

5.4.4. Station check
At every station visit the sensors are visually inspected (firmly installed, damaged, condition of wires, enclosure, solar panel and mast). Especially at the soil stations it is important to notice if the fox has been digging or there are any other signs that the buried sensors may be physically damaged. Take very much care of the vegetation and do not step on the soil profile where the sensors are buried.

Table 10 Overview of station parameters and their naming in Loggernet.

Loggernet name	Parameter
Batt_Volt	Battery voltage [V]
SM(**X**)	Soil Moisture **XX** depth [%]
Temp_C(**X**)	Soil temperature **XX** depth [°C]
Heatflux(**X**)	Soil heat flux [W/m3]

5.4.5. Offloading data
Follow the guide given in **Appendix 4 Data download CR1000 guide.**

5.4.6. Start up in spring

Download data via LoggerNet. The memory card is changed every other year. Change silica bags. Around 3 bags should be enough. If the enclosure during the season is not 100 percent dry then change silica bags again, otherwise it is ok to change them only two times a year.

5.4.7. Close down in fall

Make sure sensors are OK, wires are tight, change silica bags leave 4-6 bags for the winter; be sure water or snow cannot enter the enclosure. Make sure there is enough space on the memory card to log data during winter.

5.4.8. History

SoilEmpSa has been running since 2008.

5.5 Fen Surface Climate (TOMST)

5.5.1
Introduction

6 TOMST sensors are located in the fen, and measures soil moisture as well as soil, surface and air temperature, in -6 depth and +2 and +15 cm height, respectively. The large memory and high battery capacity of the sensors requires a minimum of maintenance, and the disturbance in the area of the sensors should be kept to a minimum. The work with the TOMST loggers includes collecting data, data quality checks, maintaining sensors, protecting the installations, and administering station metadata. Data is not in the GEM database but will be delivered to SoilTemp database and can also be obtained by contacting Karoline Nordberg Nilsson or Andreas Westergaard-Nielsen.

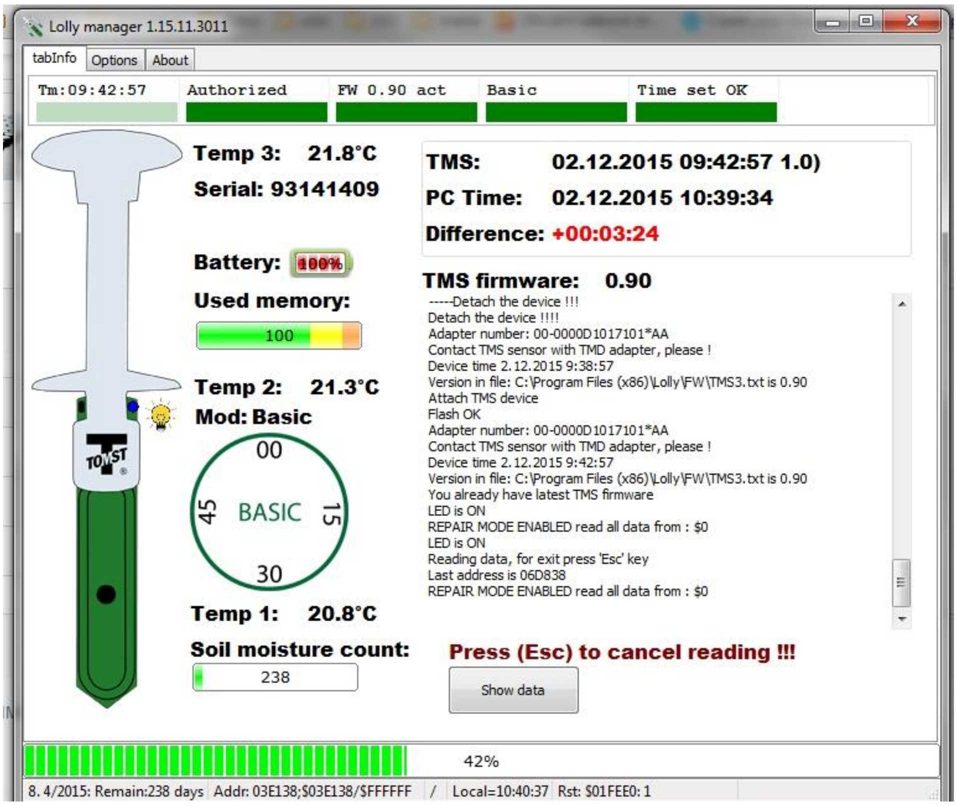
5.5.2 Frequency

TOMST is visited in the beginning and end of field season.

5.5.3 Station check

At every station visit the sensors are visually inspected but kept in place. Take very much care of the vegetation and try to walk as little as possible around in the area.

5.5.4 Data download



1) Open the Lolly Manager program on the tablet.
2) In the tab “Options” select “Read from date” and select an appropriate date.
3) Choose the right save folder: C:\Users\geobasis\Tomst_GB**X**\2023
4) Remove radiation shield from the TOMST sensor. Be careful not to pull the sensor out of the soil.
5) Attach the USB adapter to the data connector on top.
6) Data download should start automatically, and you can follow the download state in the bottom of the screen.
7) Take a screen dump of the software interface when connected to the logger and save it in the folder.

Be careful not to change the logging mode of the sensors. Before disconnecting check if the Basic mode is still the mode. This means the sensor logs every 15 minutes.

5.5.5 Start up in spring

When the ice in the fen has thawed; go out and collect data from all 6 TOMST stations.

5.5.6 Close down in fall

Make sure the sensors are placed firmly in the soil.

5.5.7 History

TOMST has been running since 2020. In 2024 new sensors were installed due to lack of memory on the old ones.

6. Gas Flux Monitoring

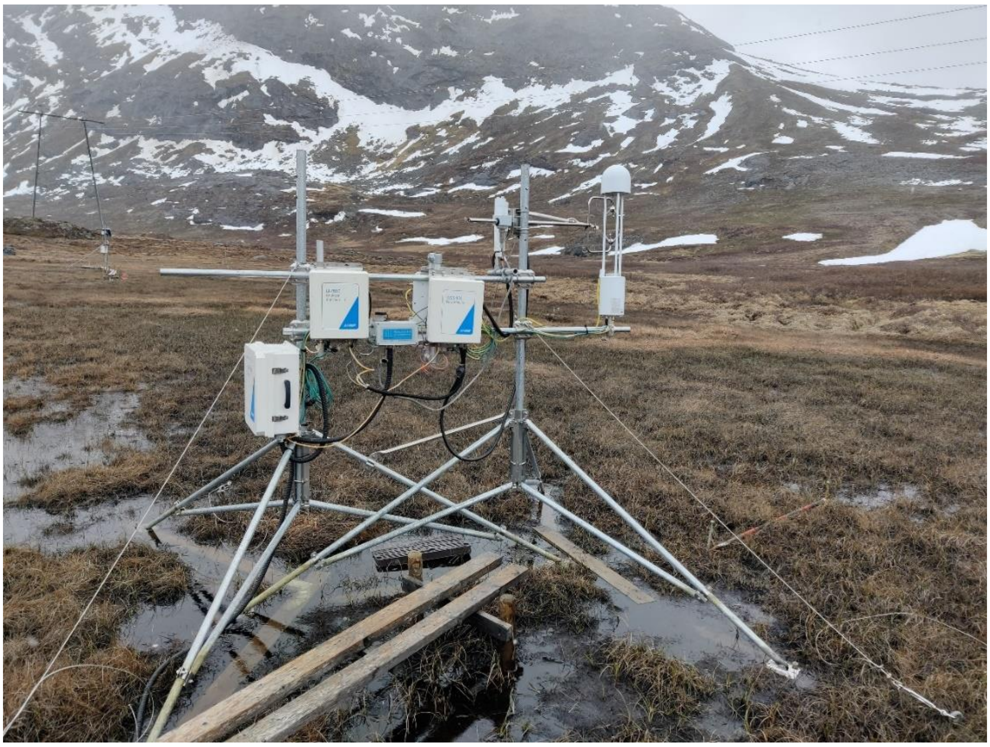
6.1. Introduction

Arctic ecosystems contain large stocks of soil organic carbon as a result of many years of net C accumulation due to slow decomposition in the cold climate. Changes in temperature and soil moisture are closely linked to the rate of decomposition in soils and will impact the magnitude of CO_2 energy fluxes. Long-term monitoring of gas- and energy exchange is therefore of importance the gain more knowledge of ecosystem feedbacks. GeoBasis Nuuk monitor greenhouse gas fluxes at the heath and in the fen in Kobbefjord using eddy covariance method, where fluxes are calculated based on the covariance between vertical wind speed and gas concentrations. The fluxes are used to calculate carbon budgets for the different vegetation types and to study the variation in fluxes under changing meteorological conditions and seasonal and annual variations. As the flux towers require a high frequency in data collection and the power supply is more instable during winter the stations are only running during the field season. From 2008 to 2020 the GeoBasis program included 6 automatic flux chambers measuring CH_4 at the fen site. In 2024 a LI-COR 7700 open path CH_4 analyzer replaced the chamber measurements for the CH_4 monitoring in the fen.

Data from the flux stations is found in the GEM database under ***GeoBasis Nuuk – Fluxmonitoring***

AutochambersFen: (2008-2020)	https://doi.org/10.17897/7ZME-8H97
EddyFen (2008-2017):	https://doi.org/10.17897/SM0M-KC26
EddyFen (2018-):	https://doi.org/10.17897/CDWM-TV93
EddyHeath:	https://doi.org/10.17897/JQ5V-X761

6.2. Eddy Fen



6.2.1. Useful guides

Maintenance and data download: **Appendix 6 Eddy Fen & Eddy Heath Guide.**

6.2.2. Introduction

The Eddy Fen station is located in the fen area close to the automatic energy balance station, Interact Fen. In order to describe the inter-annual variability of the seasonal carbon balance, net ecosystem exchange (NEE) of carbon dioxide (CO_2) and methane (CH_4) is measured using the eddy covariance method. As a new initiative in 2024 the station will be running during winter as well, however with no CH_4 sensor.

6.2.3. Frequency

Eddy Fen station is visited every 14 days.

6.2.4. Station check

At every visit the system is checked by connecting to the station through the ethernet cable, checking that measured values are in range, and no error messages have occurred. Check the station visually and listen to if the flow module is running. Wipe the mirrors of the LI-COR 7700 CH_4 open path analyzer with a moist cloth at every visit as the signal strength decreases rapidly which affects measurements.

6.2.5. Offloading data

Offload data by replacing the USB stick. Always press 'Eject' button before removing USB. Remember to only use the USB sticks designated the flux towers and format the USB before replacement.

The small LED above the USB stick indicates if the station is logging.

- Solid LED: Drive mounted, not logging.
- Rapid blink: Logging.
- Slow blink: Error, eject USB and retry.
- No LED: Drive not mounted, OK to remove USB.

Follow the guide given in **Appendix 6 Eddy Fen & Eddy Heath Guide.**

6.2.6. Calibration

Calibration test is performed during spring start up, end of season and approx. once a month if data is out of limit. Use **Appendix 6 Eddy Fen & Eddy Heath Guide.** Always perform a span test before calibration to document measurement offsets.
If sensor head is sent to factory calibration, remember to fill in correct calibration coefficients, when it is mounted again.

6.2.7. Internal chemicals and mirror cleaning

The internal chemicals should be changed every year (preferably in spring when the housing temperature is changed). If values start to look strange, it could be that the mirror needs cleaning, see **Appendix 6 Eddy Fen & Eddy Heath Guide.** The avg. signal strength is a coarse indicator of when to clean the instrument. An avg. signal strength of 100 is very clean, 80 is relatively dirty, 50 is very dirty and 0 is no signal at all. The mirror should be cleaned every year at season start.

6.2.8. Start up in spring

- Remove the fox net and place it in the hut.
- Clean window (**Appendix 6**).
- Change chemicals every year (**Appendix 6**)
- Turn on the station (on the relay inside the LI-7550 box)
- Make a calibration check (**Appendix 6**).
- Change silica bags. 3 in each enclosure.
- Tighten wires.

6.2.9. Close down in fall

Turn off the station on the relay inside the LI-7550 box. Remember to protect the station with fox net so the foxes cannot destroy the cables in the winter, when they can reach the cables due to 1 m snow. Change silica bags. Around 3-6 bags in each enclosure.

6.2.10. History

Eddy Fen has been running since 2007. In 2017 the old LI-COR 7000 had many problems, and it was decided to set up a new LI-COR system. In August 2018 a new LI-COR and a SmartFlux were installed. Since 2021 the station has been classified as an ICOS associated station. In 2023 the station was rebuilt to mount a LI7700 CH_4 Open Path Analyzer next to the LI7200 though technical issues delayed the CH_4 flux measurements until 2024. The station uses a lot of power and has historically not been running over winter. In winter 2024 the capacity of the new power setup in the fen was tested leaving the station running (without CH_4 sensor). Previously data had only been collected in the field season from May to October.

6.3. Eddy Heath

6.3.1. Useful guides
Maintenance and data download: **Appendix 6 Eddy Fen & Eddy Heath Guide.**

6.3.2. Introduction
The Eddy Heath station is located in a heath area next to Interact Heath. To describe the inter-annual variability of the seasonal carbon balance, net ecosystem exchange (NEE) of carbon dioxide (CO_2) is measured by applying the eddy covariance method. As a new initiative in 2024 the station will be running during winter as well. Previously the station was powered from May to October due to power restrictions.

6.3.3. Frequency
Eddy Heath station is visited every 14 days.

6.3.4. Station check
At every visit the system is checked by connecting to the station, checking that data is in range, and no error messages have occurred. Check the station visually and listen to if the pump is running.

6.3.5. Offloading data
Offload data by replacing the USB stick. Always press ‘Eject’ button before removing USB. Remember to only use the USB sticks designated the flux towers and format the USB before replacement.

The small LED above the USB stick indicates if the station is logging.

- Solid LED: Drive mounted, not logging.
- Rapid blink: Logging.
- Slow blink: Error, eject USB and retry.
- No LED: Drive not mounted, OK to remove USB.

Follow the guide given in **Appendix 6 Eddy Fen & Eddy Heath Guide.**

6.3.6. Calibration

Calibration test is performed during start up, end of season and app. once a month if data is out of limit. Use **Appendix 6 – Eddy Fen & Eddy Heath guide**. Always perform a span test before calibration to document measurement offsets.

If the sensor head is sent to factory calibration, remember to fill in correct calibration coefficients, when it is mounted again.

6.3.7. Internal chemicals and mirror cleaning

The internal chemicals should be changed every year (preferably in spring when the housing temperature is changed). If values start to look very strange, it could be that the mirror needs cleaning, see the Licor7200 manual (**'Li-7200, CO2/H2O analyzer, Instruction manual'**) for details. The avg. signal strength is a coarse indicator of when to clean the instrument. An avg. signal strength of 100 is very clean, 80 is relatively dirty, 50 is very dirty and 0 is no signal at all. The mirror is cleaned every year at season start.

6.3.8. Start up in spring

- Remove the fox net and place it in the hut.
- Turn on the station (connect to power in the power container)
- Make a calibration check (**Appendix 6**).
- Clean window (**Appendix 6**).
- Change chemicals every year (**Appendix 6**)
- Change silica bags. 3 in each enclosure.
- Tighten wires.

6.3.9. Close down in fall

The Eddy Cov. station is powered by the power container. Open the grey box and disconnect the red and black wire (marked with the red circles) from the samlemuffe.

Remember to protect the station with fox net so the foxes cannot destroy the cables in the winter when they can reach the cables due to 1 m snow. Change silica bags. Around 3-6 bags in each enclosure.

6.3.10. History

Eddy Heath has been running since 2012. In 2024 a new LI-COR LI7200RS and SmartFlux 2 was installed.

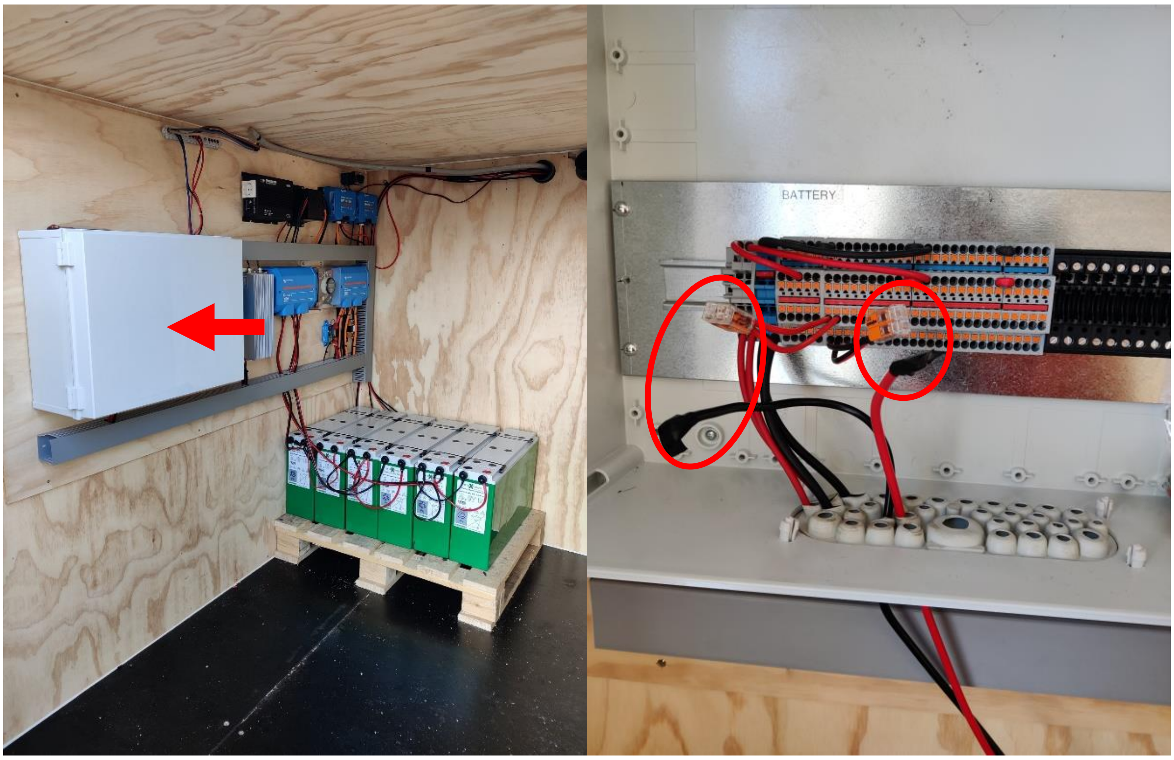


Figure 20 Power setup at the Heath location. To disconnect Eddy Heath from power, disconnect the cables in the samlemuffe in the grey box.

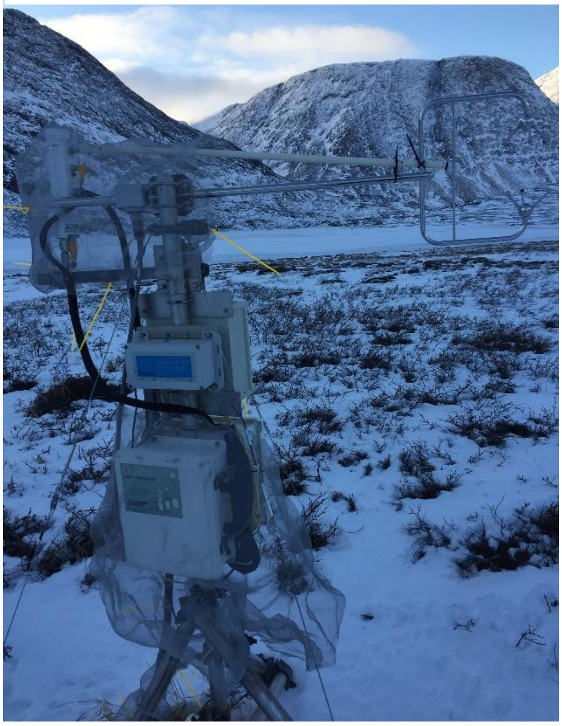


Figure 21 Winter setup for the eddy station. Loggerboxes and cables are wrapped in fox net.

7. Snow Monitoring

7.1. Introduction

Snow distribution and properties are important parameters in the control of arctic climate and ecosystem processes. The snow affects the vegetation, the length of the growing season, the thermal regime and the moisture of the soil and hence, indirectly the greenhouse gas production. It also alters the surface albedo and thereby affects the energy balance of the ecosystem, insulates the ground and is an important part of the hydrological system.

In Kobbefjord several automatic snow sensors are installed. At the heath a Snow Pack Analyzer (SPA) measured snow temperatures, densities, snow water equivalents and snow depths until 2020 but has had problems and in 2021 it was decided to close the station. Both Interact Heath and Interact Fen measure snow depths and snow temperatures in different depths (Section 4).

The six automatic cameras (Section 3.2) are used to validate data and analyze the snow distribution at a larger scale. ClimateBasis also has two snow depth sensors, SR50, at the climate stations (Figure 22), which measure values comparable to the values from Interact Heath.

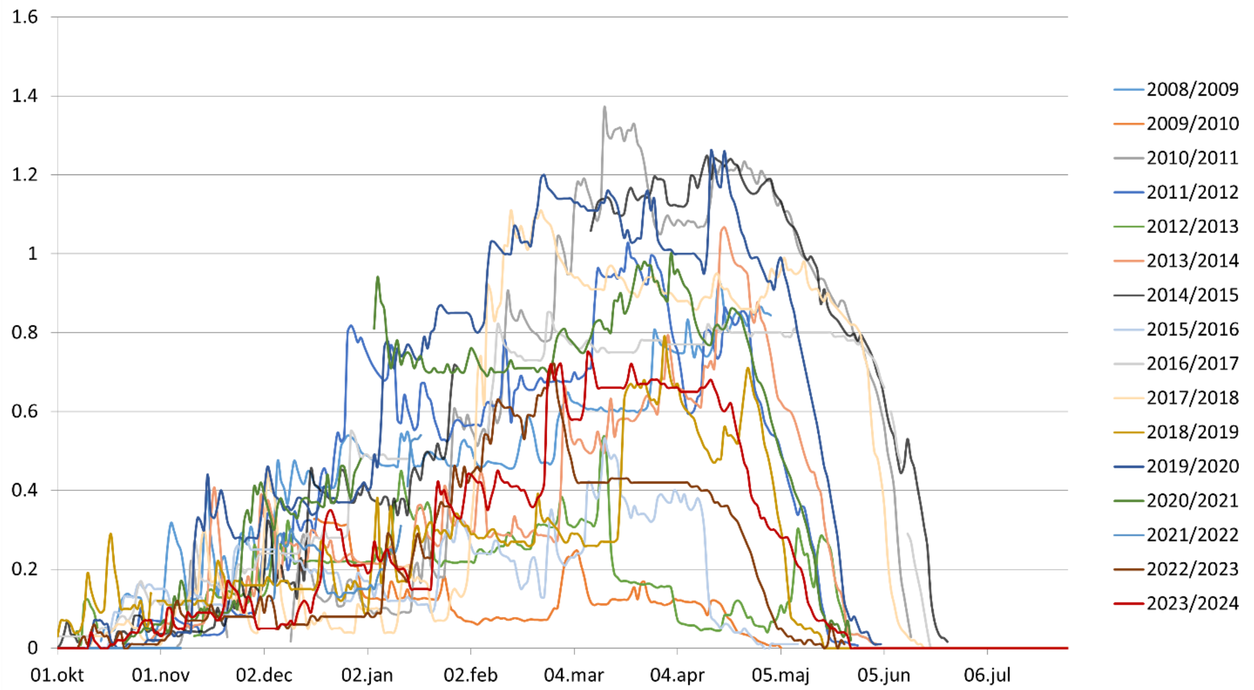


Figure 22 Snow data from the Climate Stations (652/653)

Every year in spring, a snow survey of manual measurements is conducted in collaboration with ClimateBasis and Asiaq (**Appendix 10**).

Snow data from the Interact stations is found in the GEM database under ***GeoBasis Nuuk – Snow Properties.***

InteractFen SnowProperties:	https://doi.org/10.17897/WGY8-K030
InteractHeath SnowProperties:	https://doi.org/10.17897/W8Y3-MK55

7.2. Snow Survey (spring)

7.2.1. Introduction

The snow survey in Kobbefjord is conducted in order to understand the spatial variation of the snow cover and snow properties in the fiord better. Snow pits are made close to the automatic stations of the GeoBasis and ClimateBasis monitoring programs and data can be used to investigate how the snowpack influences the underlying ground and vegetation and the energy balance of the area.
The survey is done as a cooperation between ClimateBasis (Asiaq) and GeoBasis.
Data from the survey is not available in the GEM database but is published each year in an Asiaq Report. Contact Kirsty Langley or Karoline Nordberg Nilsson for that.

7.2.2. Frequency

The survey is done as close to the snow depth maximum as possible. It is, however, difficult to find the best timing. Until 2015 two surveys were done for most snow seasons. In 2016 almost all snow was gone by the time of that year's single survey and it was suggested to start having two surveys again, but the procedure has not yet been changed.

7.2.3. Tasks

The snow survey includes:

- Snow pits (stratigraphy, temperature, density) at four-five locations
- Cross transects of 2 x 100 m (snow depth measurements with DGPS at every 2 m) at each snow pit site
- Several travel transects (snow depth measurements with probe at every 50 m) across the valley
- Two grids (snow depth measurements with probe)
- Since 2018 a drone flight covering the main sites has been conducted to create an orthophoto and DEM

While in the fiord for the snow survey, the GeoBasis stations should be checked, data offloaded and distances from snow depth sensors to snow surface should be measured together with the snow depth close to the sensors. Before the snow survey it is important to make a list of other relevant GeoBasis tasks in the fiord. Heavy equipment (garbage and other) can be transported in winter with snowmobile or sleds!

Remember to bring as much of the equipment for the snow survey as possible by the end of the summer field season. It is much easier to bring the equipment by boat in autumn than carry it over the fiord ice during winter.

The manual and guides for the Snow survey is found here:
\\ASIAQFIL001\Projekt\B53_Nuuk_Basic\b53-04 Snemonitering\Info
And in **Appendix 10 – Snow survey info**.

7.2.4. History

The snow survey in Kobbefjord has been done at least once per snow season since 2009.

8. River Water Monitoring

8.1.1. Introduction

The river water in Kobbefjord by the research station is much diluted and carries very little suspended material. GeoBasis monitors seasonal variations in the river water electro chemistry by measuring the river's pH, temperature and conductivity (Figure 23). Data is not in the GEM database but can be obtained by contacting Karoline Nordberg Nilsson or Andreas Westergaard-Nielsen.

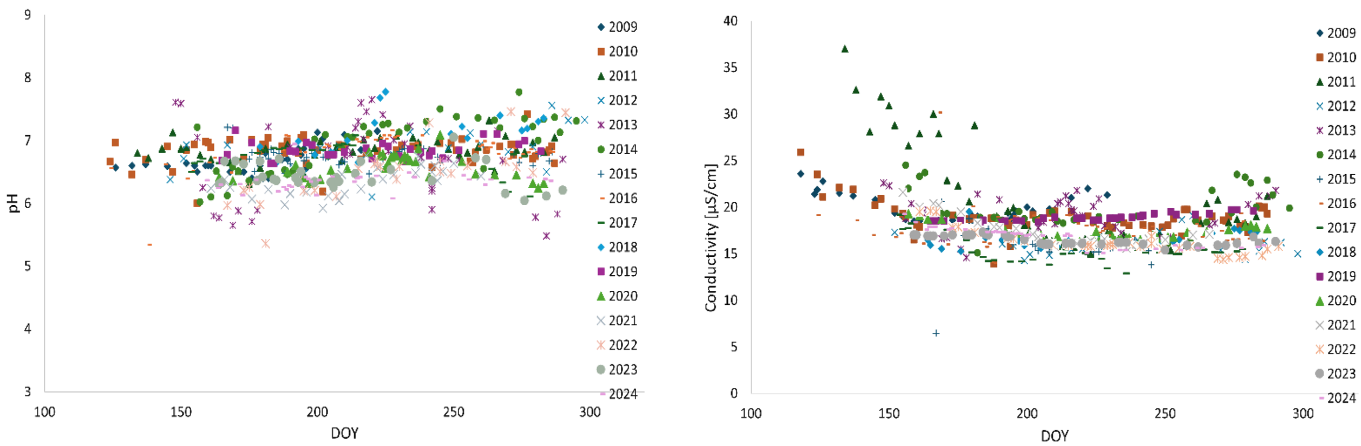


Figure 23 pH and electrical conductivity measured from the river from 2009 to 2024.

8.1.2. Frequency

The river water electrochemistry is measured every day you are in the Kobbefjord during the field season and occasionally during winter. Temperature and conductivity are still measured directly in the river.

Since 2024 a water sample is taken once per week, run through a GF 3.1 µm filter and frozen down. In the end of the season the samples are send to BIO KU for analysis together with the soil water samples.

8.1.3. Station check

Conductivity measurements are in the range of 12 and 35µS cm^{-1} usually decreasing slightly during the growing season. pH of the water samples usually lies in the range of 5.5 to 7.5.

See **Appendix 5 – River water guide** for a detailed guide of measurements**.**

8.1.4. Data handling

The notebook notes are written into a digital version located here:

..\..\..\GeoBasis Stations\River Water Chemistry\field charts indskrevet\River_water_indskrevet.xls or it can written directly into the excel sheet using the field tablet.
By the end of the season the excel document is sent to Andreas.
If any water samples are taken, the date and number of the sample should be registered in an excel sheet as well, as documentation for the person handling the sample in Copenhagen.

8.1.5. Start up in spring

Bring pH calibration solutions and the 'suitcases' with conductivity probe and the pH analyser together with the pH sensor to Kobbefjord and start measure as early as possible. If the air temperatures are still low then wait to bring the solutions until the temperature stays above 0 degrees and take the suitcases with you back to Asiaq every time.

8.1.6. Close down in fall

Calibration solutions should be brought to the office, as they are sensitive to low temperatures. The 'suitcases' with the instruments should also be brought back to Asiaq for winter storage. Order new calibration solutions if the old ones are expiring for next season and bring the pH and conductivity electrodes and meters with you to Copenhagen for testing/calibration.

8.1.7. History

Measurements in the river have been done since 2009. In 2012 we stopped taking water samples from the river because there were no minerals or sediments in the river. However, weekly sampling of river water is resumed in 2024 and send for water analysis at BIO KU in the end of the field season for analysis of the same parameters as for the soil water samples. From 2018 a bottle of water is brought back to hut where the pH is measured in the afternoon.

9. Power supply

9.1. Introduction

All GeoBasis stations in Kobbefjord are primarily powered by solar and wind energy.
At the two bigger sites in Kobbefjord, the Heath and the Fen, a power container, with six 200Ah batteries, is installed at each site producing power to the stations through three solar panels and a windmill.

9.2. General safety precautions when working with batteries

1) Always touch the plastic part of the wire when working with electricity.
2) Never let the (+) and (-) touch each other.
3) Always connect (+) to (+) and (-) to (-). Never the other way around.
4) Never let metal parts touch both (+) and (-) at the same time.
5) If the electrical installation is submerged in water, make sure all power is OFF before you approach. If you're unsure, don't touch the installation.

9.3. Power Fen

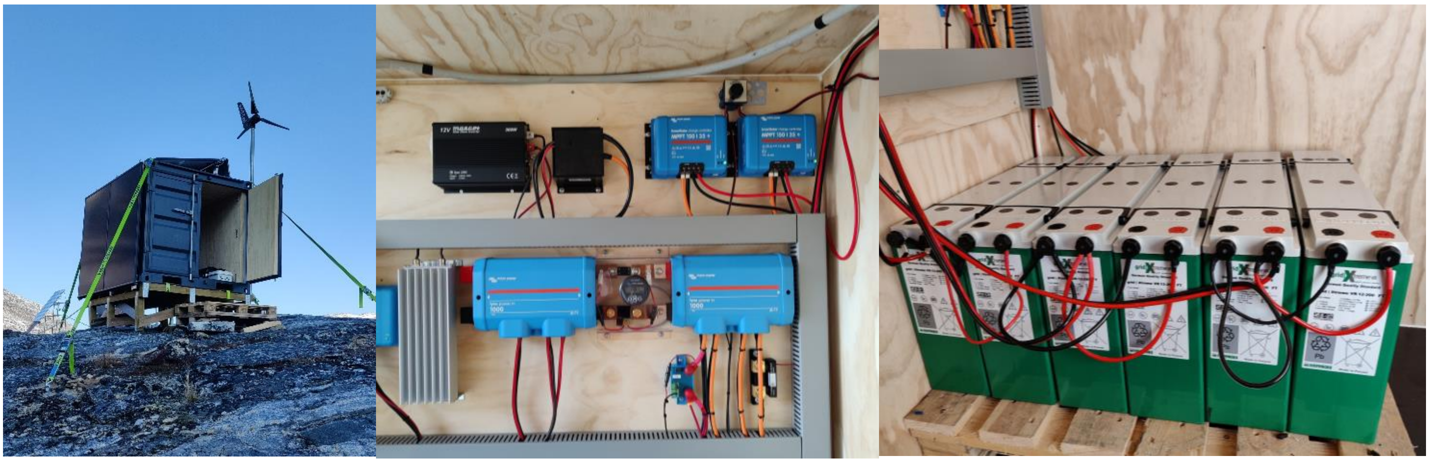


Figure 24 New power setup in the fen installed in 2024

Figure 25 Old power setup in the fen. Instruments are not connected to these batteries.

9.3.1. Introduction

Power Fen supplies the Eddy Fen station and the Interact station. There are three solar panels and one windmill producing power to six batteries. **A lot of power is stored in these batteries and only qualified staff should do technical work on this system.**

The consumption of the stations: Eddy Fen around 4 A (without CH_4 sensor), Interact Fen around 0.3 A.

9.3.2. Frequency

Power Fen is visited at every visit in the Fen.

9.3.3. Station check

We can connect to the power system through the app Victron Connect.

1) Turn on Bluetooth and open the app Victron Connect.

2) Choose unit to connect to (SmartSolar = Solar panels, SmartShunt = Windmill).

3) Make sure the voltage is around 24-28V.

4) Take screenshot of “Tilstand” and “Trends”.

9.3.4. Batteries

The battery bank consists of 6 * 200 Ah batteries, connected so they deliver 24V. Each battery weighs around 60 kg.

9.3.5. Power for field tablet

It is possible to charge the field tablet in the container if needed. Remember to turn off the switch for charging when it’s not in use as it will drain the batteries.

9.3.6. Winter

The Interact mast in the fen is running during the winter. Since 2024 the Eddy covariance stations is also running during winter.

9.3.7. Start-up and shut-down off power supply

If you need to shut of the power supply, it is very important to make sure that the flux station and Interact station are closed down.

Update this section with instructions.

9.3.8. History

From 2008 to 2023 the fen site has been powered by a battery bank run by solar panels and windmills. Due to data gaps and more power consuming equipment this power setup was replaced by the power container in 2023.

9.4 Power Heath

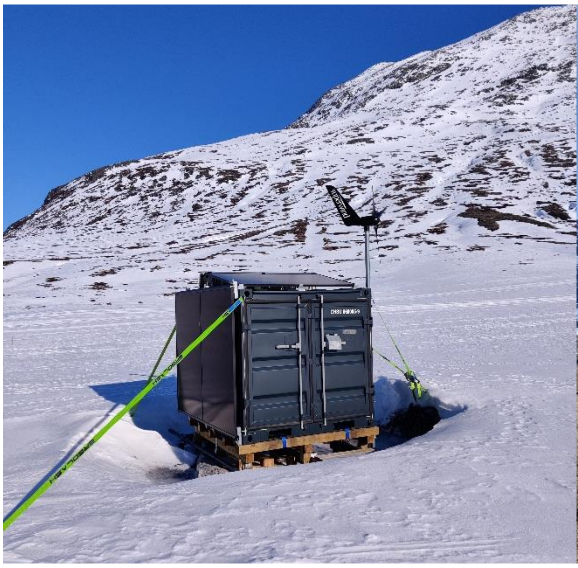


Figure 26 left: New power setup in the heath. No stations are connected in spring 2024.

Figure 27 right: Old power setup in the Heath. Interact Heath is still connected to two of the batteries per spring 2024.

9.4.1 Introduction

Power Heath supplies the Eddy Heath station and Interact Heath. Currently, spring 2025, both the old and new system is used to power the two stations. **A lot of power is stored in these batteries and only qualified staff should do technical work on this system.** The old system in the black box (one solar panel to two batteries) is powering the Interact Heath station and the eddy is powered by the new power setup in the container (three solar panels and one windmill to six batteries.

The old battery bank consists of ten 65 Ah batteries, where two batteries connected a solar panel supply power for Interact Heath, while eight batteries connected to one solar panel supply power to Eddy Heath (see sketch below). Two solar panels are now only connected to a solar regulator each and not to the batteries.

Consumption: Eddy Heath around 4 A and Interact Heath around 0.3 A.

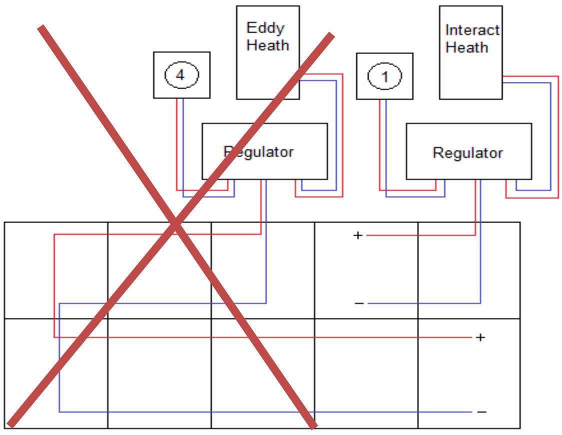


Figure 28 Diagram of battery connection at the old setup.

9.4.2 Frequency

Both the old and new power system in the Heath is visited at every visit at the Heath.

9.4.3 Station check (old system)

Write down in the field journal:

- **SOC:** How many % the batteries are filled.
- **BAT:** The voltage on the batteries.
- **IN:** How much the solar panels produce.
- **OUT:** How much energy the stations use.

9.4.4 Station check (new system)

We can connect to the power system through the app Victron Connect.

1) Turn on Bluetooth and open the app Victron Connect.

2) Choose unit to connect to (SmartSolar = Solar panels, SmartShunt = Windmill).

3) Make sure the voltage is around 24-28V.

4) Take screenshot of "Tilstand" and "Trends".

9.4.5 Batteries

Old system: Two 65 Ah batteries are connected to one solar panel and power the Interact mast. The voltage on the batteries should be around 12.5-14.

New system: The battery bank consists of 6 * 200 Ah batteries, connected so they deliver 24V. Each battery weighs around 60 kg.

9.4.6 Power for field tablet

It is possible to charge the field tablet in the container if needed. Remember to turn off the switch for charging when it's not in use as it will drain the batteries.

9.4.7 Winter

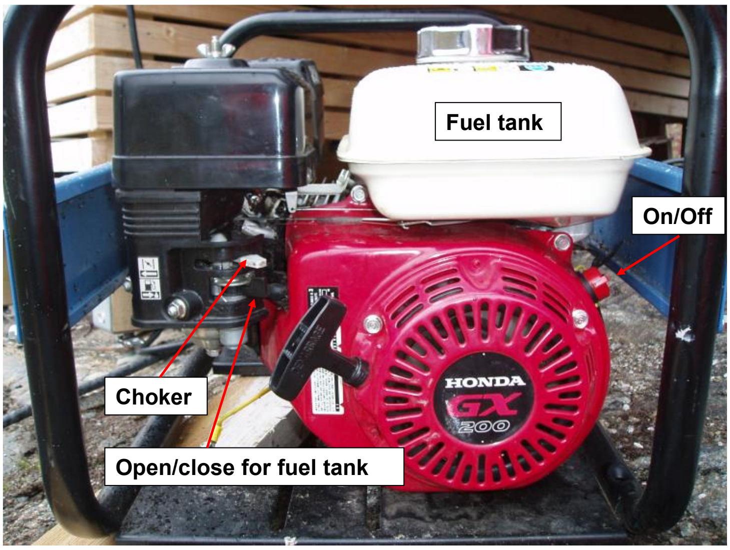
Interact mast is running through the winter connected to one of the solar panels. Since 2024 Eddy Heath is also running during winter.

9.4.8 History

In 2011 the Heath site was built, and from 2011 to 2013 the power was delivered by an Efoy fuel cell. The system was very unstable and destroyed by frost. In 2013 a wind generator was set up together with a small solar panel charging four batteries. In 2014 the four big solar panels were set up and the extra four batteries were added to the battery bank. In 2016 a small shelter was built for the batteries. In late 2020 the wind generator was blown away in a storm. In 2023 the power setup was replaced by a power container to secure a more stable power supply.

9.5 Generators

Currently we do not use the generators to charge batteries for the instruments.



The generators are stored in the generator hut. Fuel is found in the generator hut. Every year there are some issues with the generator, if you experience this try going through the 'trouble-shooting' list further down.

9.3.9. Starting the generator

1. Place the generator just outside the generator hut on the left side of the door on the wooden terrace.
2. Fill the fuel tank with petrol (benzin) from the red jerry cans; use a funnel (right wall inside the generator hut).
3. Switch the On/Off bottom to On.
4. Open for the fuel by sliding the black tap to the right.
5. Place the Choker halfway to the left.
6. Start the generator by pulling the handle in the string a few times – if it doesn't start wait a minute (for the fuel to run into the generator) - then pull again.
7. Move the choker to the right when the generator is started and the revolutions will increase.
8. Let the generator run for a minute before plugging in the plug for what you are charging.

9.5.1 Shutting down the generator:

1. Disconnect the cable for what you are charging.
2. Close the fuel by sliding the black tap to the left.
3. Switch the On/Off bottom to Off.
4. Place the generator in the generator hut.

9.5.2 Troubleshooting

Problems with the generator can be due to several issues. Here are some suggestions for initial check:

- If the generator had been on recently, you might have to turn off the choker to be able to turn it on.
- Check if there is oil on the generator.
- Check if oil and fuel has mixed (generator has been 'drowned').
- Check if there is water in the fuel (will stand out as small, flat bobbles with a different color).
- Check if the generator engine produces enough watt to cover us (check V and A in the charging box, V*A = W). The E3200 generator should cover 2200W, but not more than 75% of this should be used.

Otherwise ask the boatmen for help!

10. End of season

10.1. Shipping

Usually there is a lot of equipment to be send to Denmark every winter. Talk with Andreas to find out what to send. Use the Clip-Lok box to send bigger instruments or equipment with Royal Arctic Line. Call +299 349100 for booking or use information from previous bookings to fill out the booking formula here:
http://www.ral.dk/bookingcenteret/bookingformular/.
Remember to order a delivery from Århus to Copenhagen and a pickup at Asiaq by calling RAL.

The informed value on all the packages has to be around 1000 kr. and not more than 3999 kr., because then we have to pay taxes.
Remember to write at the label of the Clip-Lok box, that the equipment is only send to Denmark for calibration and that it will be send back to Greenland.
A Clip-Lok box has the dimensions: H = 82 cm, W = 80 cm, L = 120 cm. It will be weighed by RAL.

Soil water/river water: One -18 and one +5 insolated package (find insolation at the workshop and remember to mark the boxes) are sent to Andreas with Blue Water Shipping (see section 19.3 for location). For more information send an email to air_GOH@bws.dk. The water samples are picked up at the office by Blue Water.

Shipping labels is found in the folder:
P:\B53_Nuuk_Basic\b53-06 GeoBasis\Shipping\Shipping Labels

Previous bookings can be seen in the folder:
P:\B53_Nuuk_Basic\b53-06 GeoBasis\Shipping\Fragtkvitteringer

Use HS-code 22019000 (natural water) if requested by BlueWater.

10.2. Data control

In the field: If possible, all data should be briefly checked in the field or the hut. Check if the time stamp is right, the values look reasonable and if there are any error values (-7999 or -9999).
During the season: Data should be imported to Wiski and quick-checked as soon as possible after it has been collected; this makes the work after the field season easier and enables you discover problems as soon as possible. If some parameters are not yet created in Wiski, they should be. The Asiaq staff can help you with that.
After the field season: The final quality check (QC) of GeoBasis data is not as comprehensive as the QC of ClimateBasis data. However, the GeoBasis data should be compared with similar data from the other stations in Kobbefjord (including 652/653), with the time lapse pictures and with data of previous years. It is of great importance that we don't distribute incorrect data!
The QC is done in Wiski and it is very important that data corrections are well documented with remarks.

Help to QC can be found here: *"F:\Klima_Hydrologi_Miljoe\Procedurer\Datakvalitetssikring\Procedure for quality control - all_english.doc"* and here: *F:\Klima_Hydrologi_Miljoe\Procedurer\Datakvalitetssikring*

When QC is done, it should be sent to Jonas Kofoed Rømer to be uploaded to the database. The procedure for uploading data changes from year to year. Ask Jonas how to do it.

10.3. Data delivery to the GEM database

Every year data from the GeoBasis stations is delivered to the GEM database. The delivery is done in spring (normally March or May) the following year. This means that data from the season 2022/2023 is delivered in spring 2024. Follow the instructions in *P:\B53_Nuuk_Basic\b53-06 GeoBasis\Data GEMDB* and update the document for each year *P:\B53_Nuuk_Basic\b53-06 GeoBasis\Data GEMDB\2020\Notat og parameteroversigt* Note any major problems or changes in the metadata document and send the updated version to Jonas. The metadata document must be saved as a new version each year and placed in the data delivery folder. Always make sure that new routines and procedures are well documented after each field season.

10.4. Equipment

Fill out the "Closedown at end of field season" document and store it here: *P:\B53_Nuuk_Basic\b53-06 GeoBasis\Field Work\End of Field Season*

Repair broken equipment and order equipment that we need for next season.

10.5. Year summary

- Make the power point presentation year summary that are found in the Annual Reporting folder: *P:\B53_Nuuk_Basic\b53-06 GeoBasis\Annual Reporting\GeoBasisAnnualMeeting*
  Write down all important changes which have been done for the stations, what is not working and what should be fixed before next season. Send the Power Point document to Andreas or present it at the annual GeoBasis meeting in Copenhagen/Roskilde in December/January.
- Update the figures and tables found in the folder: *P:\B53_Nuuk_Basic\b53-06 GeoBasis\Annual Reporting\Reporting KU* and send them to Andreas.
- Update field day overview and send to logistician at GINR: *P:\B53_Nuuk_Basic\b53-06 GeoBasis\Annual Reporting\Reporting GINR*

10.6. Field journal

Save the finished field journal as a PDF and send it to Andreas and whomever should be interested.

10.7. GeoBasis manual

Update the GeoBasis manual and appendices! Make sure to save the new updated versions also on the field tablet and print new hard copies for the hut and the stations if needed.
The copies at the stations should be laminated!

10.8. Station Sensors

Update the document **Appendix 1 Station sensors**. It is very important that we have an overview of all sensors and serial numbers in the field and for how long they have been used.

11. Office routines

11.1. Introduction

The frequent field work in the GeoBasis program require disciplined office routines in order to organize data, metadata and to plan new field work. This section gives an overview of the GeoBasis office routines at Asiaq.

11.2. Station portfolio

Each of the GeoBasis stations has both a physical portfolio and a computer folder. The physical folder holds general information about the station:

1. General information [Map Coordinates, purpose, establishment dates, communication].
2. Field visits [Field Charts].
3. Map/Drawings [Especially buried installations].
4. Program [current and historic .Cr1-files and the associated .fls-files are located here].
5. Diagram [current and historic wiring diagram of the station].
6. Data check [analysis of data, graphs].
7. Sensors [calibration sheets, serial numbers of current and historic sensors].
8. Miscellaneous.

11.3. Station folder

The computer folders are located on this path: *P:\B53_Nuuk_Basic\b53-06 GeoBasis\GeoBasis Stations\...*

Each station folder has this structure:

1. Raw data [contains raw data]
    - Raw data from the dataloggers are stored in a csv and TOA5. The CSV files are named according to this convention: GBXXIDMMM_YYYY-DOY_YYYY-DOY.dat. The year and day numbers refer to the first and last record of the data file. The file is set to be write protected. It is very important that you name the files the same way as earlier.
2. Diagram/program [copies of current and historic .Cr1-files and .fsl-files]
    - When changing a program on a station it is important to keep record of the files and dates. When retrieving a program from a datalogger it is called: ANK_YYYYMMDD.cr1 When uploading a new program to a datalogger it is called: AFG_YYYYMMDD.cr1.
    - Each uploaded program has a corresponding .fsl file, which describes the headers of the comma-separated array of numbers. (If changes to the output tables are needed, remember to update the .fsl file and the data exchange numbers in the WISKI database.)
    - Also the wiring diagram is associated with the program and it should always be updated. Remember to make a copy when changing the station setup.
3. Print screen
    - Every time data is downloaded, the print screens are saved in this folder.

11.4. Pictures

The pictures from Kobbefjord are stored in the photo database *P:\B53_Nuuk_Basic\b53-06 GeoBasis\Photo database.* Each station has its own folder where pictures from that specific station are saved. Remember to delete bad pictures and turn the pictures the right way when uploading them to the folder.

11.5. Data and field charts

11.5.1. WISKI database

Data from some of the stations are stored and edited in the Wiski (W7) database. Importing data to the database via the automatic data importer is relatively simple:

The updated .fsl file is placed in this folder: *\\ASIAQ014\kidsm\input\Campbell1-FSL*

The data file is edited so that its name is accurately the same as the .fsl file ('GB01ID5.dat' corresponds to 'GB01ID5.fsl'). The data files can easily have an extension (normally a date) following an underscore. For instance GB01ID5_20170810.dat can be imported. Remember that Wiski reads CSV format files and not TOA5.

Station	**Status**
M300	Not added to database
M500	All data in the database
M1000	ClimateBasis Station
SoilFen	All data in the database
SoilEmp	All data in the database
SoilEmpSa	All data in the database
Interact Fen	Most of the data in database. New parameters in 2018 should be added
Interact Heath	Data from a period is in the database, data after change in program has to be added

Not all data is quality controlled in W7. Data before 2017 is therefore imported to Wiski from the GEM database and stored in the import time series. These timeseries are quality controlled.

11.5.2. Conversion from binary to CSV or TOA5 files

If the card from a CR1000 has been changed the data should be converted. Help for this can be found in **Appendix 4**.

11.5.3. Update the field tablet time:

Once per week the field tablet time has to be synchronized with WGWT =UCT-3 hours via this home page:

www.worldtimeserver.com/clocks/

11.5.4. Field Charts

Once in a while the Field Charts are collected from Kobbefjord and digitized (values/information from field charts are written in Excel) in the office at Asiaq. The hardcopies of the field charts are stored in a portfolio in the office. It is important that you check that you write in the field charts the same way as the previous years with same units and details – use the previous year as a template.