# The ICECAPS-MELT Platform

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# Introduction

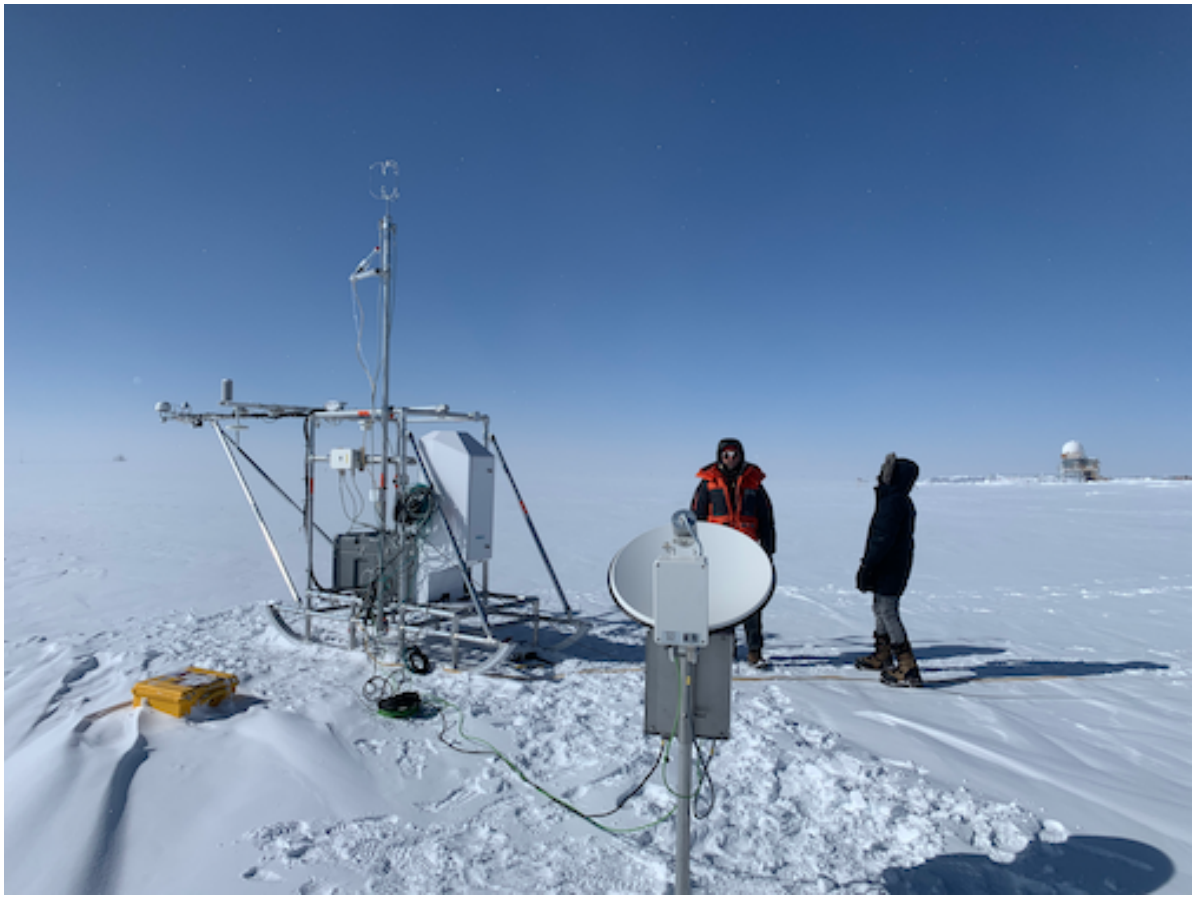

Figure 1: Siku's first deployment at Summit Station

This documentation provides information on the instrument platform for NSF's Arctic Observing Network (AON) ICECAPS-MELT project. The Integrated Characterization of Energy, Clouds, Atmospheric state, and Precipitation at Summit (ICECAPS) is a long-term experiment that has been conducted at Summit Station, Greenland since April 2010. The MEasurements along Langrangian Transects (MELT) is the most recent sub-project of ICECAPS, which was funded for 2022-2024.

The first version of instrument platform is called **Siku**, which is the Greenlandic word for

ice.

Siku includes the following instruments:

| Instrument | Acronym |
|---|---|
| Cincoze computer | Cincoze |
| Automated Surface Flux Station | ASFS |
| Ground Penetrating Radar | GPR |
| Micro Rain Radar (MRR) | MRR |
| Microwave Radiometer | MWR |
| SIMB3 thermistor string | SIMB3 |
| Vaisala (CL61) Depolarization Lidar | VDL |

Note that the Cincoze is the main computer system that controls the platform. All of the other instruments interface to it. In addition to controlling the platform, the Cincoze handles all of the raw data archival.

The ASFS itself is composed of a series of additional instruments:

| ASFS Instruments | Acronym |
|---|---|
| Broadband Radiometers | BRad |
| Meteorological instrument (T,P,U) | Met |
| Metek Sonic Anemometer | Metek |
| Licor gas analyzer | Licor |
| Global Positioning System | GPS |
| Flux plates | FPlt |

# Getting Started

This chapter describes some basic tasks related to operating the platform and how to copy data.

## Startup and Shutdown of the Platform

### Startup

To power on (start up) the instrument platform, ensure that it is plugged into AC 110-V power. Then remove the cover of the gray platform control box, and press the power button on the Cincoze computer. The image below shows the front of the Cincoze computer with the small silver power button in the upper right. Once the power button is pressed, the icon on the button should turn green.

### Shutdown

To power off (shutdown) the instrument platform, log onto the Cincoze computer using the instructions in **?@sec-loggingIn** below and type

```
poweroff
```

Type the iceman password, `iceman`, if prompted.

## Ethernet Access

Before connecting to the platform through the Cincoze computer, one will have to have a direct ethernet connection to the Cincoze. This may be accomplished usijg one of several different setups:

### Skylink satellie link

TBD


Figure 2: The front of the Cincoze computer with power off; power icon is not green

### MissionLink satellite link

TBD

### Summit Station network

To connect to the Cincoze via the network at Summit Station, one must first log into local network at Summit. There are a couple of different possibilities for how to do this:

- First remotely log into another computer that is already conneccted to the Summit Station network (e.g., dataman).
- Connect to the local wifi network while at Summit Station.

### Verizon HotSpot

The ICECAPS-MELT project has a Verizon HotSpot that will be connected to the instrument platform when it is deployed in Boulder, Colorado. Researchers will be able to connect to this hotspot using a cellular connection and then log in to have a direct internet connection to the platform. The login credentials are:

- SSID: icecaps
- p: RavenBound

> **Warning**
>
> `Typically one must NOT be connected to a virtual private network (VPN) when trying to acces`

## Logging into the Cincoze computer

Once you are connected to a device that has a direct connection to the Cincoze, type the following command to SSH to the Cincoze:

```
ssh iceman@xxx.xxx.xxx.xxx
```

where xxx.xxx.xxx.xxx can be found in the following table:

| Connection | IP address |
|---|---|
| Skylink | ???.???.???.??? |
| MissionLink | ???.???.???.??? |

| Connection | IP address |
|---|---|
| Summit | 192.168.98.50 |
| Verizon | ???.???.???.??? |

Enter the password for the iceman account (which is `iceman`), if prompted. This should log you into the Cincoze. The Cincoze uses a Linux-based operation system, so one can issue normal Linux commands from the Cincoze prompt.

> **Warning**
>
> `Be careful when executing Linux commands on the Cincoze computer.`

## Checking the System Status

The platform is operated using System Services in Linux.

- To view all of the system services running on the Cincoze, type:

  ```
  systemctl status | less
  ```

> **Note**
>
> `The addition of "| less" allows one to scroll up and down.`

- To view the status of only those processes run by the iceman user (assuming that you're logged in as iceman), type:

  ```
  systemctl --user status | less
  ```

- To view the status of a particular process, type:

  ```
  systemctl --user status mrr
  ```

  - To see a full list of the various processes running on the Cincoze to support the platform, see

## Internal Network

Once you're logged onto the Cincoze computer, you can connect to other instruments using the IP addresses listed below:

| Device | Local IP | Summit IP | Username | Password |
|---|---|---|---|---|
| Cincoze Computer | 192.168.1.10 | 192.168.98.50 | iceman | iceman |
| Skylink Certus Modem | 192.168.111.1 | | | |
| Windows VM | 192.168.1.166 | | | |
| CR1000X Logger | 192.168.1.120 | | | |
| Licor 7500DS Gas Analyzer | 192.168.1.15 | | | |
| Smart Flux | 192.168.1.221 | | | |
| Phoenix EEM-MA370 Energy Meter | 192.168.1.32 | | | |
| MODBUS relay for logger reboot | 192.168.1.97 | | | |
| APC power supply | 192.168.1.11 | | apc | lar2022 |
| Ground Penetrating Radar | 192.168.1.161 | | root | root |
| Metek MRR-Pro | 192.168.1.20 | | mrruser | metek |
| Vaisala CL61 data | 192.168.1.111 | | n/a | n/a |
| Vaisala CL61 maintenance | 172.17.0.2 | | admin | lar2022 |

Currently, one must use the `sshpass` command to connect. Below is an example command to connect to the MRR from the Cincoze computer

```
sshpass -p "metek" ssh mrruser@192.168.1.20
```

> **Note**
>
> Note that this command uses the IP address and password from the table above.

## Retrieving data

Below is a description of the data directory on the Cincoze computer. The base directory is /home/iceman/data/. The data in the sub-directories contain near data from the various platform instruments that is copied to the Cincoze in near-real time.

```
home
    iceman
        data
 |   |      asfs
 |   |   |      raw
 |   |   |      realtime
 |   |      cl61
 |   |      energymeter
 |   |      mrr
```

---

To sychronize data from the Cincoze computer to your local computer, one can use the Linux `rsync` command.

```
# Example for syncing the entire CL61 data
rsync -av --rsh=ssh iceman@192.168.98.50:/home/iceman/data/cl61/ /Users/vonw/data/icecaps/pla
```

---

To copy a subset of data from the Cincoze to your local computer, one can use `sftp`.

```
# Example for copying energy data for a given day; single file.
rsync -av --rsh=ssh iceman@192.168.98.50:/home/iceman/data/energymeter/energymeter.sled.level
```

> **Note**
>
> Note that the IP address used in the above rsync commands will vary depending on what mode

To synchonize data from instruments to the Cincoze, one can also use the `rsync` command, but one must include the `sshpass` command:

```
# Example for copying data from the MRR to the Cincoze for data archival
rsync -avz --progress --partial -e 'sshpass -p "metek" ssh' mrruser@192.168.1.20:
/media/mmcblk0p1/data/ /home/iceman/data/mrr
```

# Services

The instrument platform uses Linux services to manage all the instruments. For instance, services can be used to turn certain instruments off or on. Services can also be scheduled to perform certain tasks, like data transfers or backups.

The operation of Linux services are logged into the system journal, so the system journal is a complete record of how the instrument platform services were used during a particular time period, such as a field experiment. The system journal can be used to determine the history of activity of a particular service.

The services for the instrument platform are stored in

```
/home/iceman/.config/systemd/user
```

Here is a complete list of services for the instrument platform as of 21 May 2023:

```
Permissions Size User   Date Modified Name
.rw-r--r--   172 iceman  1 Mar 04:36  asfssync.service
.rw-r--r--   157 iceman  1 Mar 04:36  asfssync.timer
.rw-r--r--   221 iceman 20 May 11:28  datamansync.service
.rw-r--r--   157 iceman 20 May 11:23  datamansync.timer
drwxr-xr-x     - iceman 21 May 13:27  default.target.wants
.rw-r--r--   467 iceman 22 Jul  2022  emacs.service
.rw-r--r--   326 iceman 17 May 15:26  energymeter.service
.rw-r--r--   415 iceman 20 May 15:17  gpr-data-transfer.service
.rw-r--r--   194 iceman 18 May 19:49  gpr-data-transfer.timer
.rw-r--r--   427 iceman 20 May 11:20  gps-data-collect.service
.rw-r--r--   330 iceman 20 May 01:05  midnight.service
.rw-r--r--   181 iceman 21 May 13:26  midnight.timer
.rw-r--r--   266 iceman 18 May 19:29  mrr-data-transfer.service
.rw-r--r--   186 iceman 18 May 19:32  mrr-data-transfer.timer
.rw-r--r--   314 iceman 19 May 12:58  mrr.service
drwxr-xr-x     - iceman 22 Mar 02:43  multi-user.target.wants
.rw-r--r--   226 iceman 15 Dec  2022  mvp_emulator.service
.rw-r--r--   499 iceman 16 Dec  2022  mwr.service
.rw-r--r--   370 iceman 22 Mar 02:45  phonehome.service
```

```
.rw-r--r--  1.8k iceman  1 Mar 01:05  qemu@.service
.rw-r--r--   572 iceman 21 May 13:19  simba-data-collect.service
.rw-r--r--   365 iceman 19 May 12:58  vdl.service
.rw-r--r--   586 iceman 16 May 22:29  vnc.service
```

To view any of these services while logged into the Cincoze computer, type

```
# For instance, asfssync.service
less /home/iceman/.config/systemd/user/asfssync.service
```

Typically, services run scripts on the Cincoze to accomplish certain tasks. Scripts written for the instrument platform are stored in

```
/home/iceman/scripts
```

The directory structure for scripts is

```
home
    iceman
        scripts
|   |       apc
|   |       asfs
|   |       gps
|   |       misc
|   |       mrr
|   |       mvp
|   |       mwr
|   |       platform
|   |       simba
|   |       vdl
```

> **Note**
>
> Navigate to this link to learn more about Linux services.

## Using the System Journal

> **Note**
>
> The system journal is described here.

Some useful commands for accessing information from the system journal are:

```
journalctl --user -b -u mrr
```

which is an example that lists all the activity of the `mrr` service since the last boot, and

```
journalctl --since="2023-05-10 12:00:00" | grep mrr
```

which lists all the activity of the `mrr` service since 10 May 2023 at 12 UTC.

# Configuration

## Windows Virtual Machine (Windows VM)

To configure certain instruments, it is necessary to login into a Windows virtual machine that is setup on the Cincoze computer. To do this from your local computer, you will use a VNC viewer. Before connecting via VNC, you will need to execute the following command to forward the port from the VM to your local computer:

```
ssh -L 5901:localhost:5901 iceman@192.168.98.50
```

This will create an SSH tunnel from your local computer to the Cincoze computer, and then log you in to the Cincoze. Enter the password for the iceman account, if prompted. Once you're logged in, use a VNC client on your local computer to make a VNC connection to:

```
localhost:5901
```

Enter the password for the iceman account again, if prompted. Your VNC client should then show the desktop of the VM on the Cincoze.

Once you have access to the Windows VM desktop, you will be able to configure the ASFS, MRR and MWR as described below.

### Automated Surface Flux Station (ASFS)

### Micro Rain Radar (MRR)

- How to set "comment" and "site_name" using MRR GUI on VM

### Microwave Radiometer (MWR)

## Command Line Interface (CLI)

### Ground Penetrating Radar (GPR)

### SIMB3 thermistor string (SIMB3)

### Vaisala (CL61) Depolarization Lidar (VDL)

- How to set latitude and longitude using maintenance port via the CLI

## APC Internet-Enabled Power Strip

The instrument platform uses an APC internet-enabled power strip to turn certain instruments on and off. The table below lists the instruments and which port of the power strip it uses. The Cincoze computer has a Linux script that can be used to turn any of the port on or off.

| Port | Instrument |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | Vaisala CL61 |
| 7 | |
| 8 | Micro Rain Radar |