PROMICE | GC-NET

AWS data within information networks like WMO GCW

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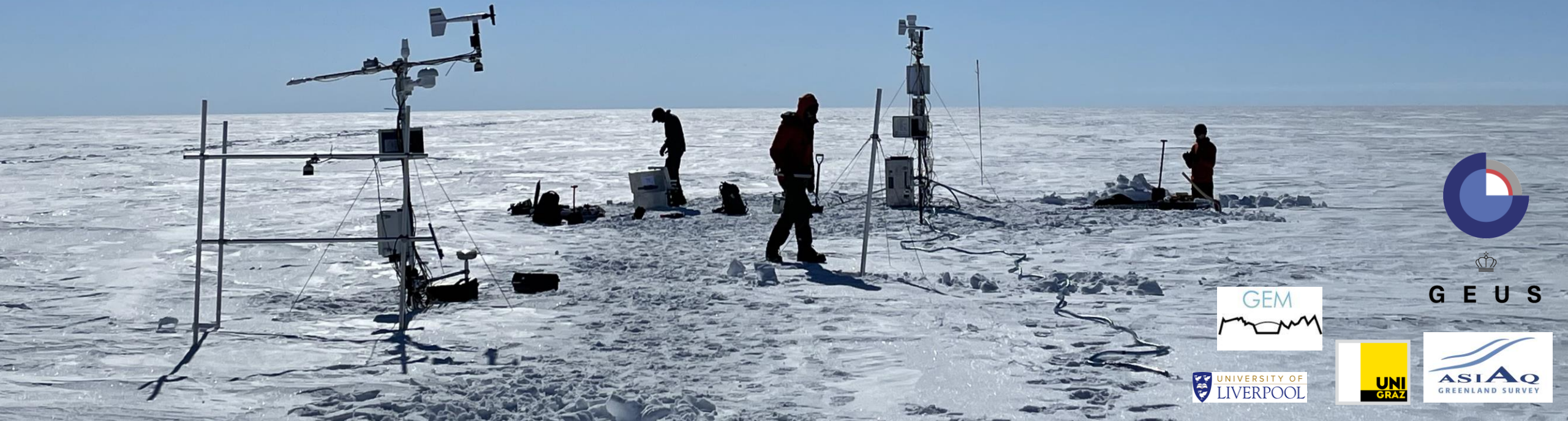

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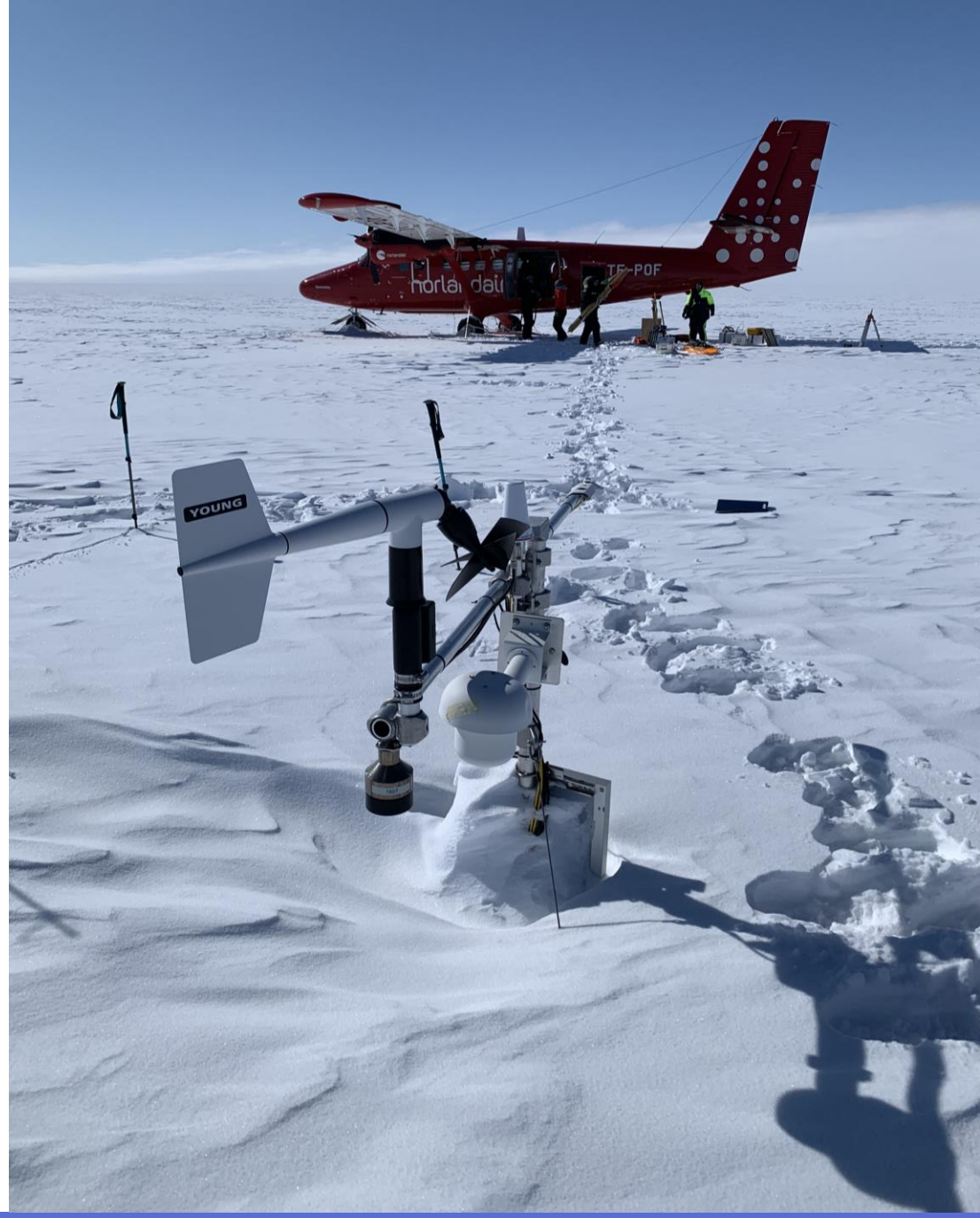
ASIAQ GREENLAND SURVEY

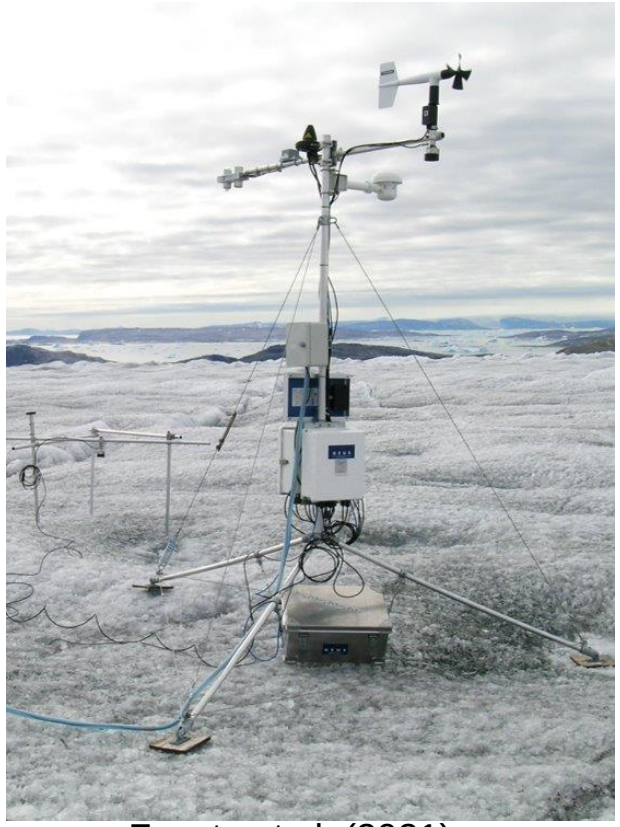
Agenda

- Automatic weather station network
  - Processing pipeline
  - Data products
- Alignement with FAIR principles
  - Metadata conventions (CF, ACDD)
  - File formats (NetCDF)
  - Data access services (THREDDS, OpeNDAP)

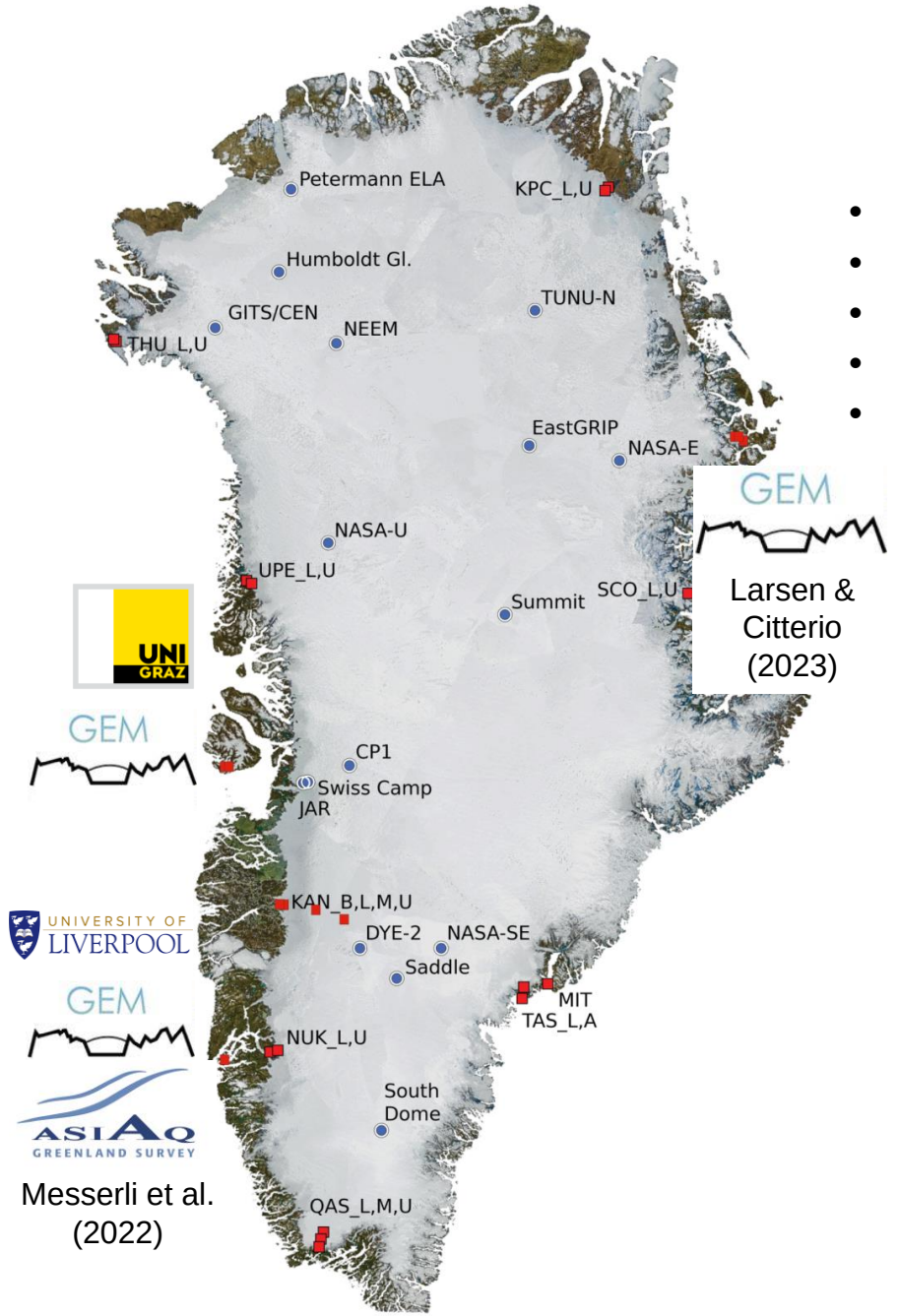


PROMICE

- Programme for Monitoring of the Greenland Ice Sheet
- Peripheral ice sheet monitoring since 2007
- One-boom tripod design
- Ablation zones



Fausto et al. (2021)



Messerli et al. (2022)

Larsen & Citterio (2023)

GC-NET

- Greenland Climate Network
- Interior ice sheet monitoring since 1995
- GEUS assumed responsibility in 2020
- Two-boom mast design
- Accumulation zones

Measurements

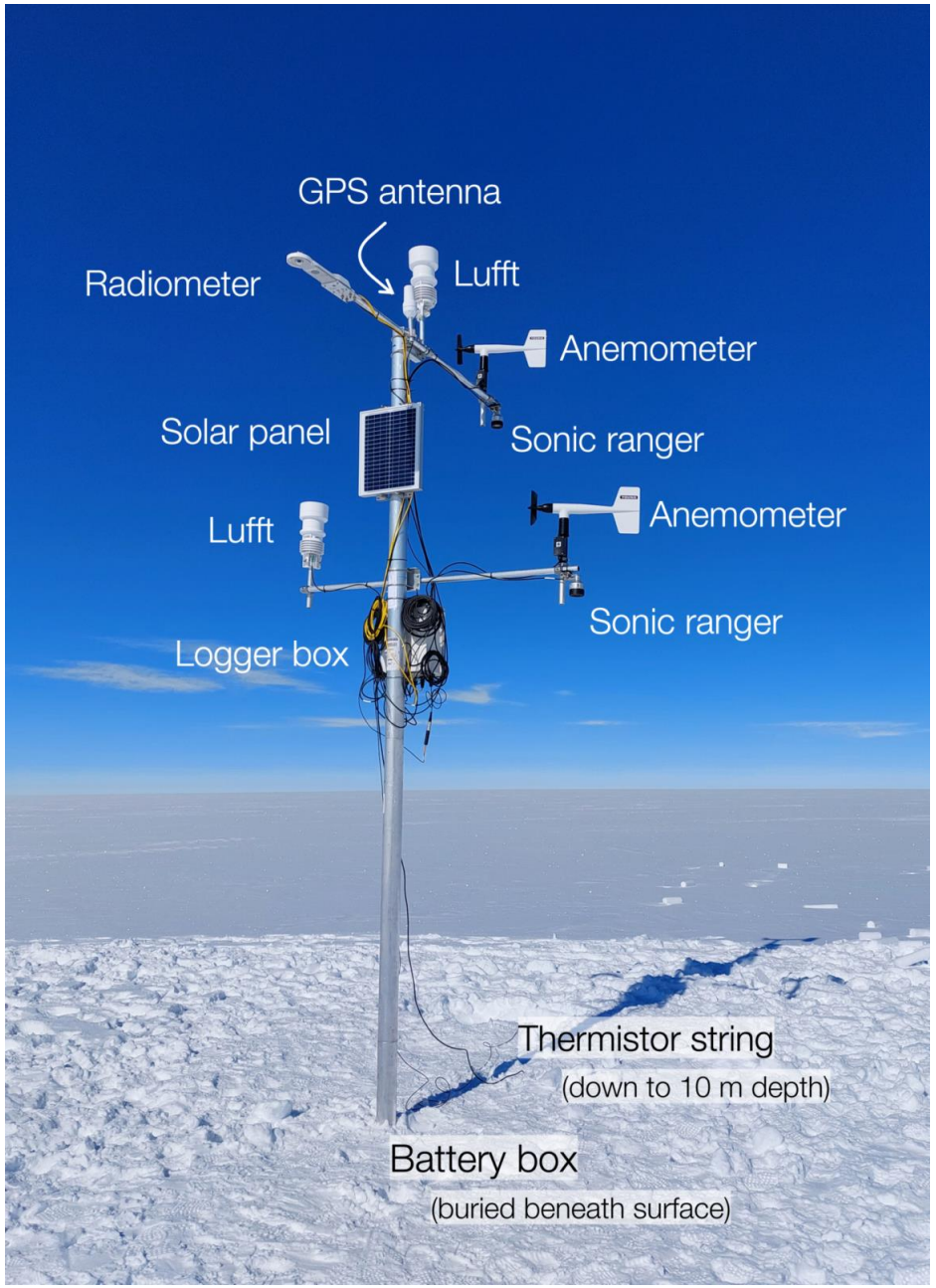


Figure: Anja Rutishauser, https://tinyurl.com/438ruhne

- Air temperature
- Relative humidity
- Wind speed and direction
- Precipitation
- Radiation (shortwave and longwave)
- Snow height and ablation
- Position/elevation
- Snow/ice temperature in the upper 10 m

i. Hourly measurements transmitted via Iridium
ii. 10-minute measurements collected from the field

Data Processing pipeline

- Near real time data product

- Calibration
- Automatic quality control
- Manual asynchronous quality control
- Noise filtering
- Gap filling
- Derived variables

- Open source

PyPromice

Station Data Processing

Level 0

Raw, unprocessed measurement data transmitted or manually retrieved

Station metadata and calibration coefficients

Level 1

Physical units instead of engineering units

Time and station specific calibration

Level 2

Flags and adjustments from QC

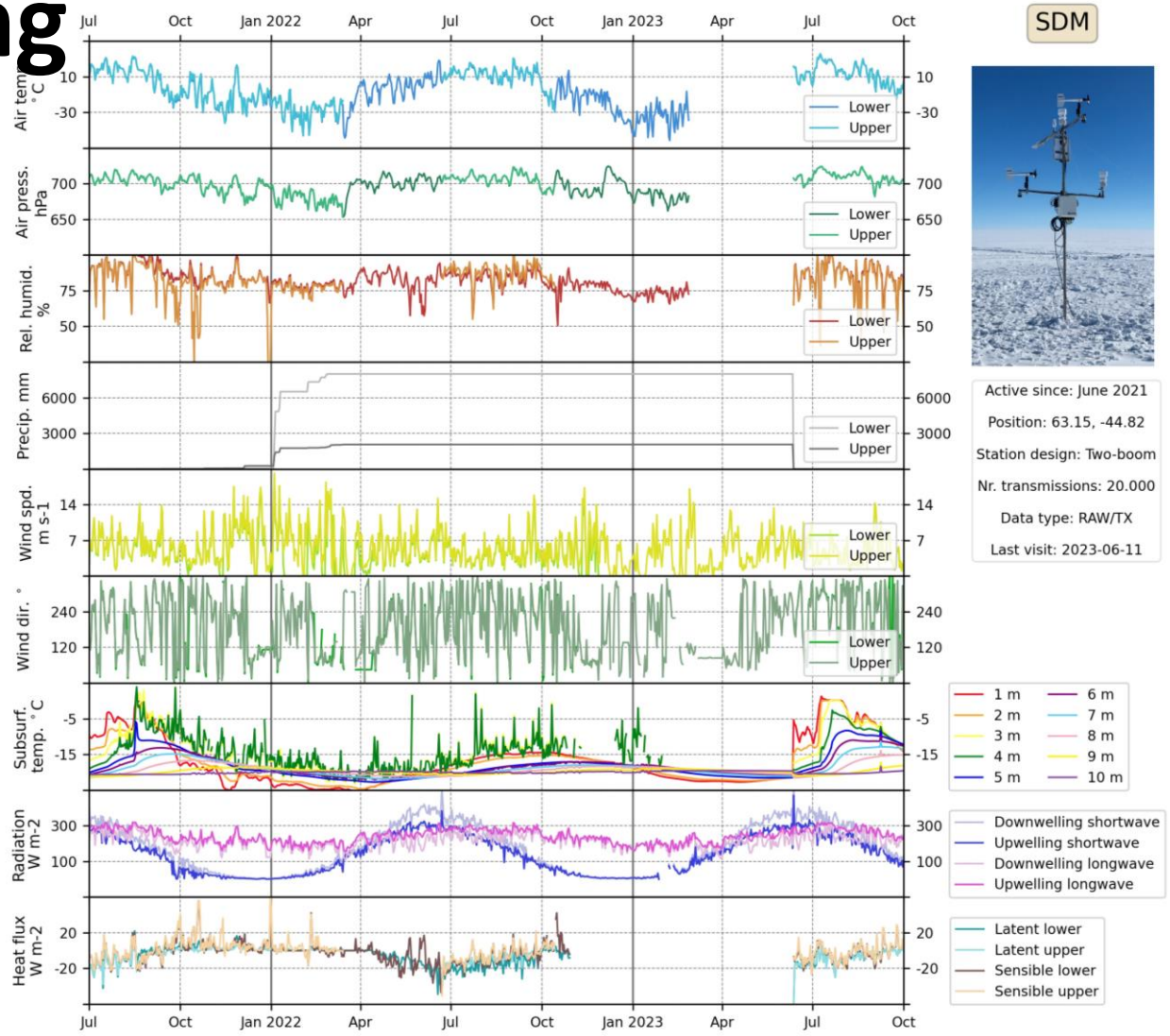
Automatic and manual

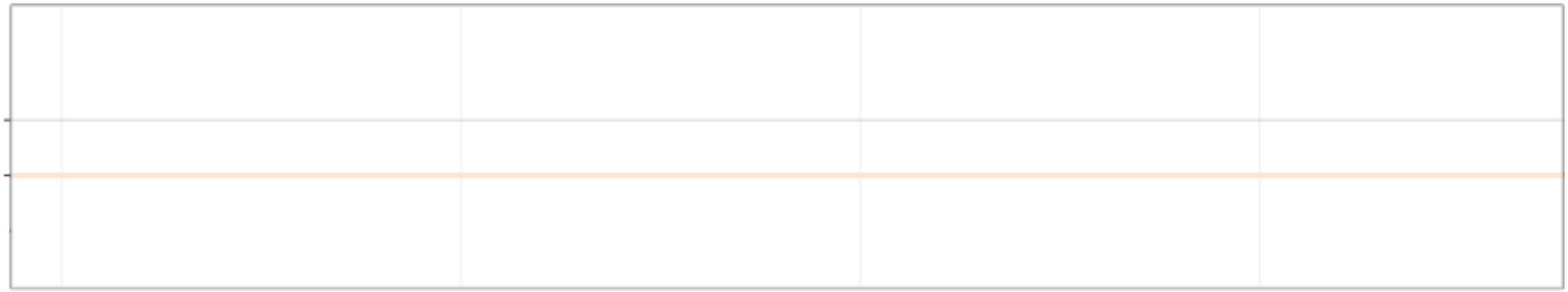
Derived variables

Level 3

Derived variables

Gap filling





Data Products

Site data - Level 3

- Temporal resolution: hourly, daily, and monthly averaged
- Combines data from multiple stations within the same site
- Provides a continuous dataset spanning longer periods

Station data - Level 2

- Hourly Averaged Data
- Lower latency

Fileformats

- NetCDF with dataset and variable metadata
- CSV

Metadata Conventions

CF Convention (Climate and forecast)

- Dataset metadata
- Variable names and units

ACDD (Attribute Convention for Data Discovery)

- Dataset metadata

Dataset metadata

title: AWS measurements from CEN2 station processed to level 2. Hourly average

Institution: Geological Survey of Denmark and Greenland (GEUS)

id: dk.geus.promice.station.CEN2.L2.hourly

keywords: GCMDSK:EARTH SCIENCE > CRYOSPHERE >…

geospatial_lat_min: 77.181844

geospatial_lat_max: 77.182058

Variables

standard_name: air_pressure

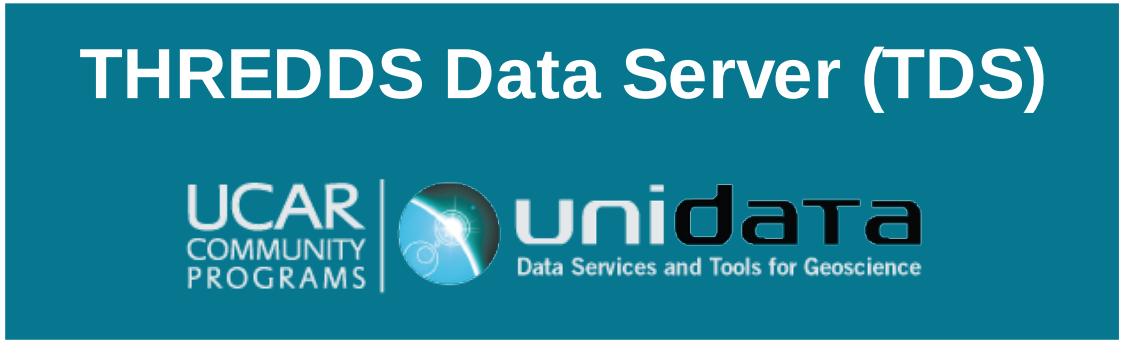
long_name: Air pressure (upper boom)

units: hPa

coverage_content_type: physicalMeasurement

coordinates: time

Publishing Services

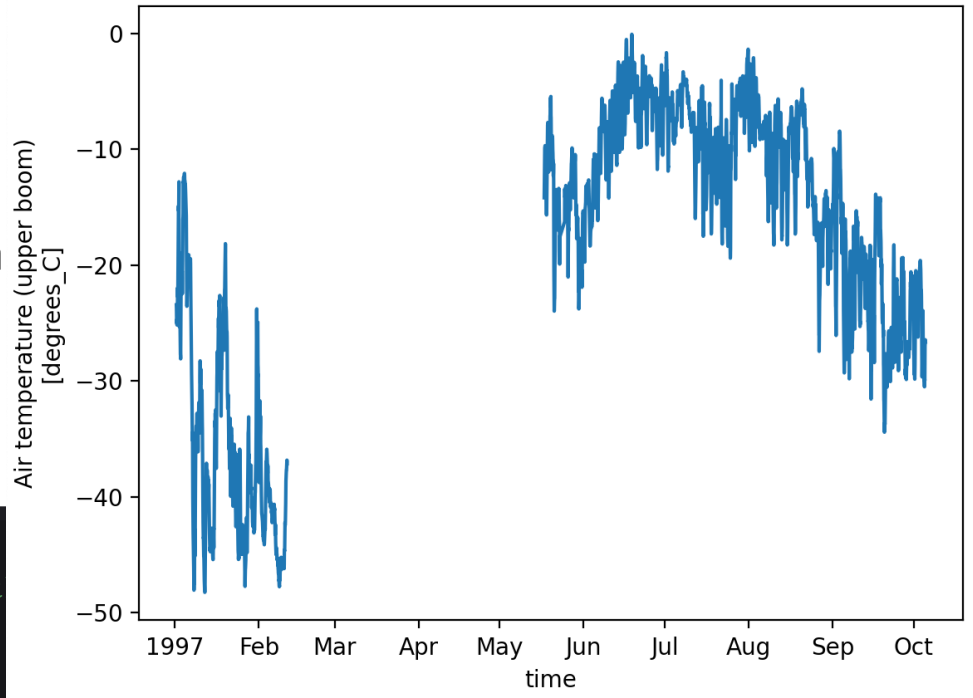


THREDDS

- Updated hourly with nea
- OPeNDAP
  - Remote access
  - NetCDF metadata
  - Query and downloa

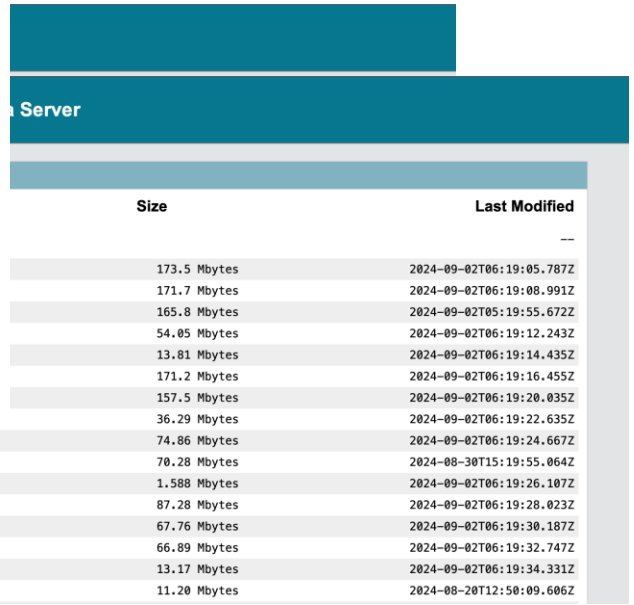
THREDDS Data Server (TDS)

UCAR COMMUNITY PROGRAMS | unidata
Data Services and Tools for Geoscience



us.dk

```
# OPeNDAP URL for the dataset
url = 'https://thredds.geus.dk/t
l3sites/netcdf/hour/CEN_hour.nc'
# Open the dataset using xarray
ds = xarray.open_dataset(url)
# Slice and plot temperature for 1997
ds.sel(time='1997')['t_u'].plot()
```

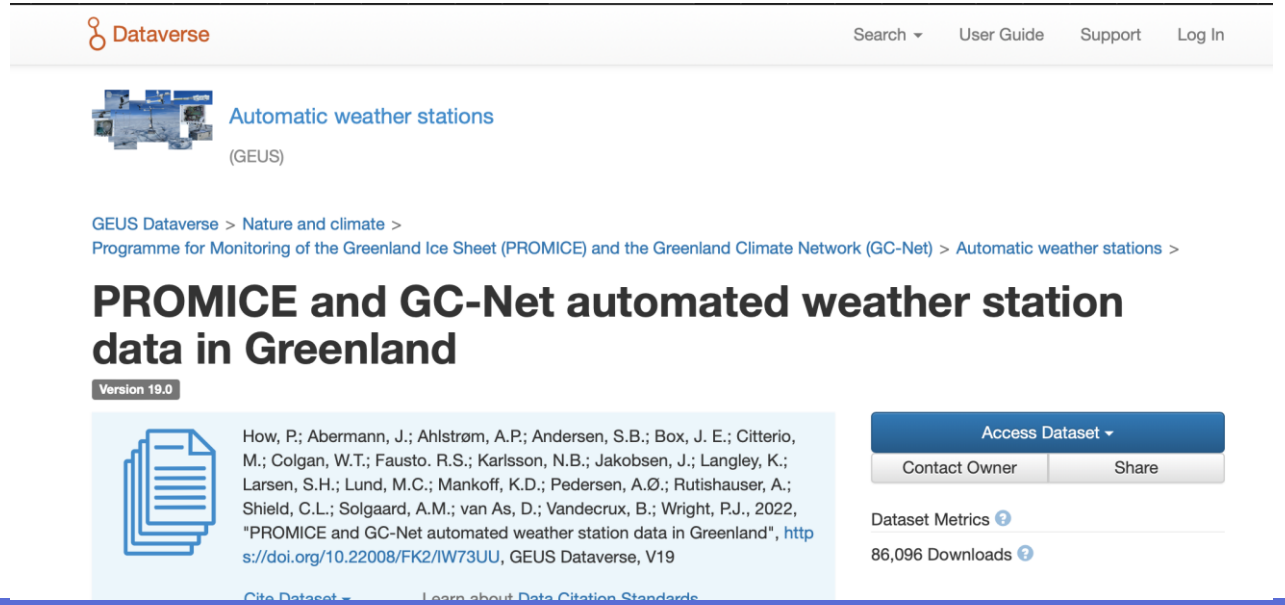


Dataverse

- Updated monthly with all datasets
- DOI Integration
- Target URL for the DOI address resolver

The Dataverse® Project

https://dataverse.geus.dk

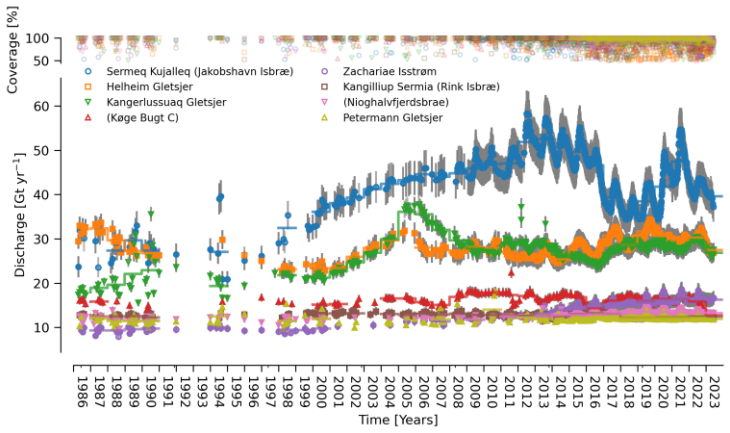


FAIR and interoperatbility with GCW

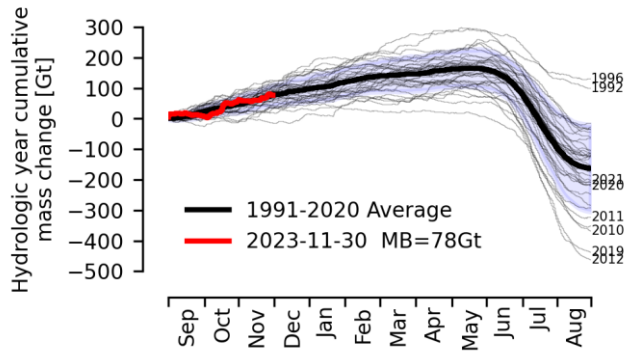
- Metadata: CF conventions and ACDD
- Dataformats: NetCDF
- Data access services: THREDDS with OPeNDAP
- Open source software: PyPromice

Data Products

Ice Discharge

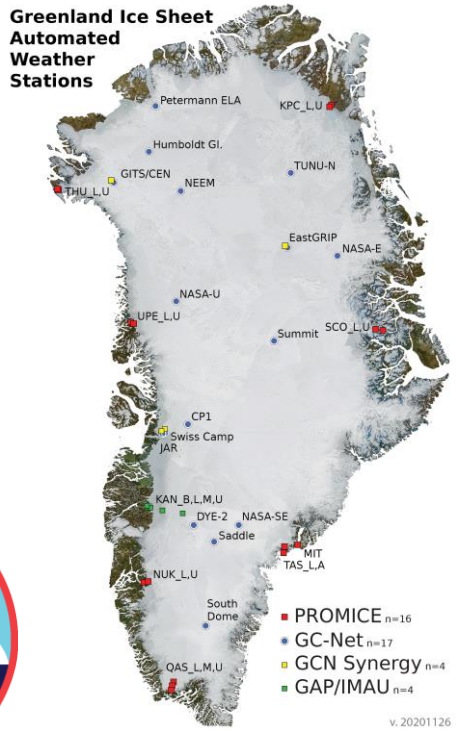


Ice Sheet Mass Balance

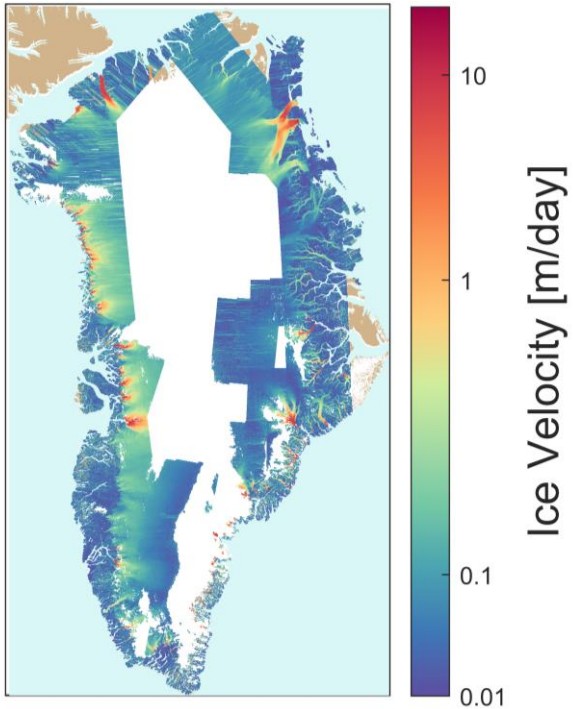


SICE

Automatic Weather Stations



Greenland Ice Velocity from Sentinel-1



Solgaard et al. (2023)