

Finse - Infrastructure and research activities

UiO : LATICe

Land-ATmosphere Interactions in Cold Environments



UiO : University of Oslo

The Hive Initiative



J. F. Burkhart, S. Filhol, A. Fouilloux, T. Schuler, J. Hulth

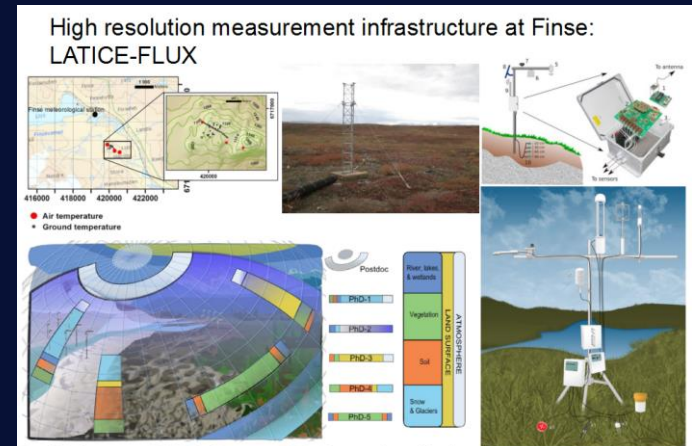
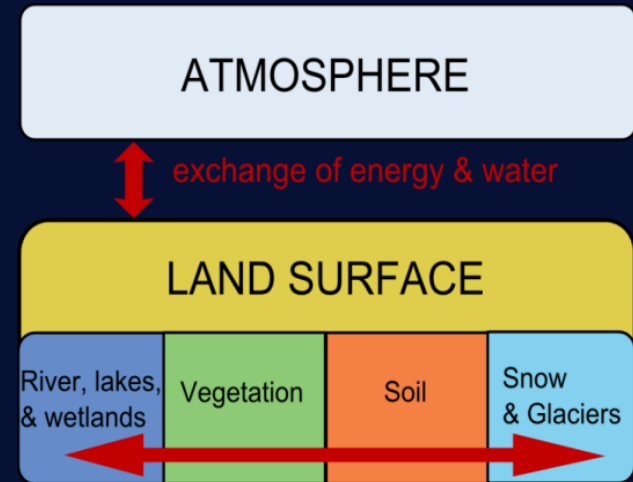
and

UiO : **LATICE**

Land-ATmosphere Interactions in Cold Environments

Describe activities at Finse related to achieving LATICE objectives:

- Improve Earth Surface Modeling
- Surface-Energy Balance
- Land-Atmosphere feedbacks at regional scale
- Cold environments (snow, ice, permafrost, vegetation)
- Modeling studies driving observational experiments
- Bridging across scales



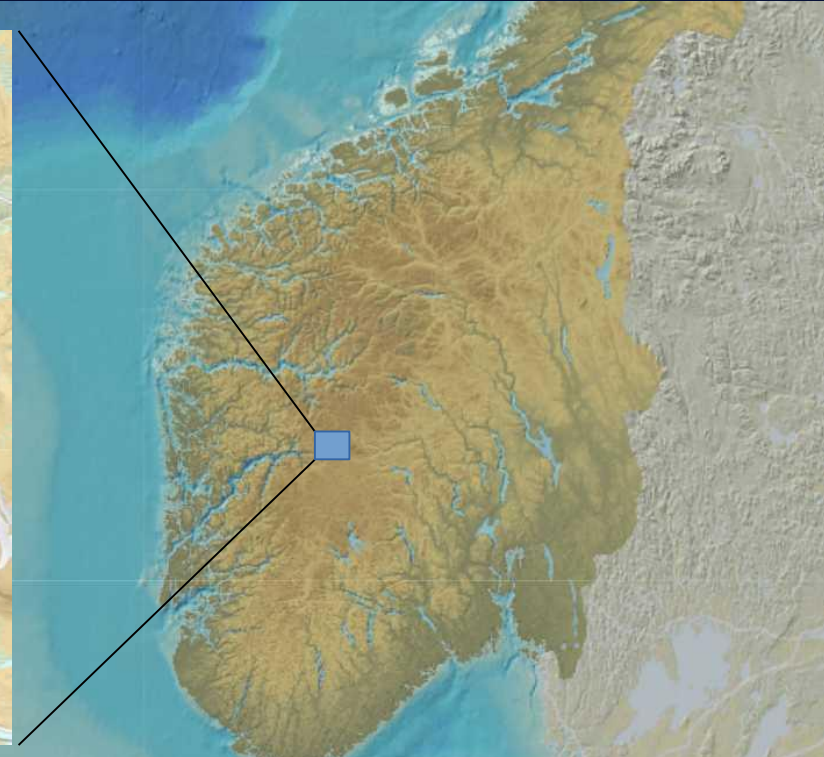
Aim

Why Finse?

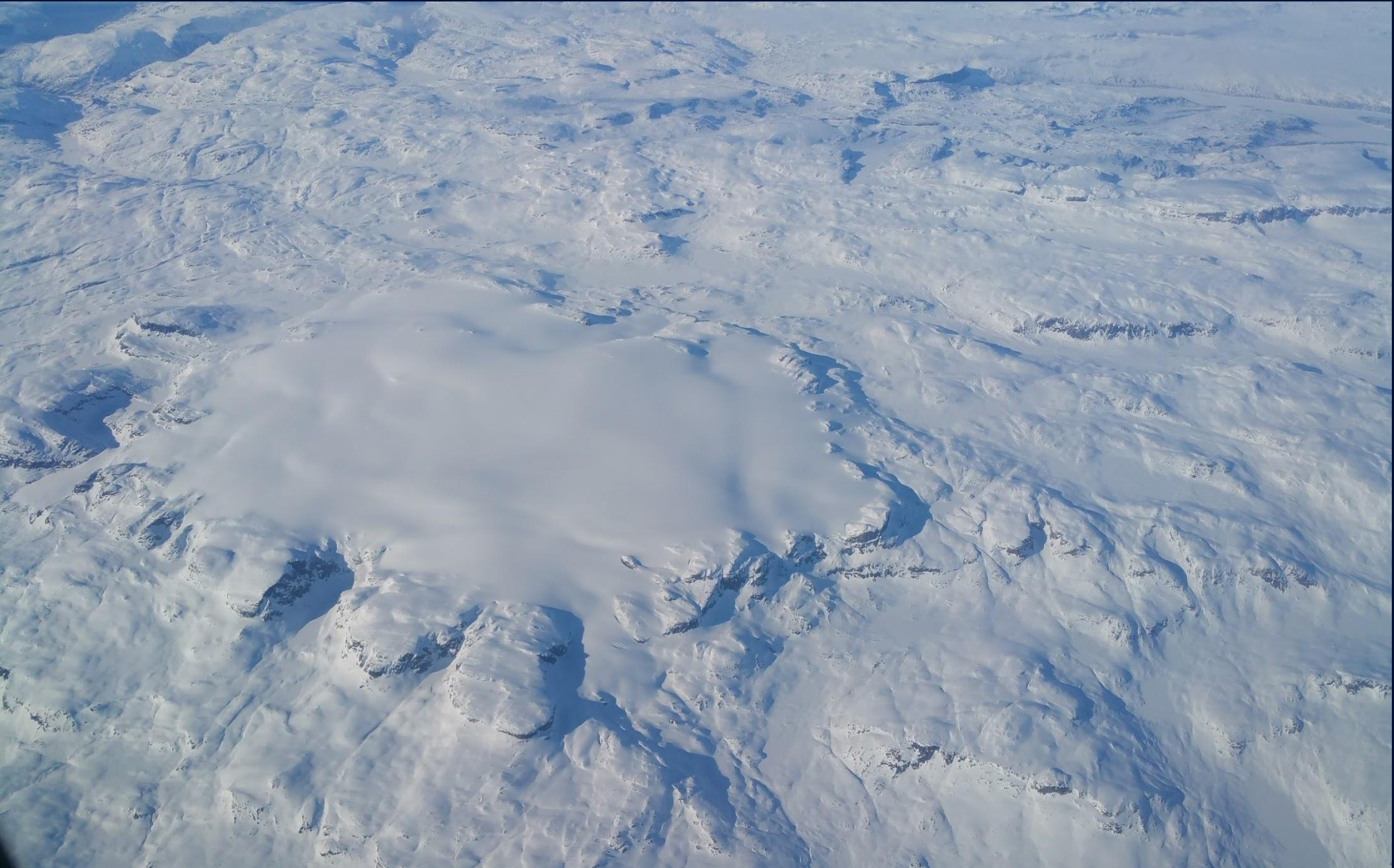
- Several existing sites in Norway for 'earth system' studies
- No history of hydrometeorology
- Complex environment, high winds, alpine
- Logistics: limited road access

Motivations for Establishing the Site

High resolution measurement infrastructure at Finse Alpine Research Center: LATICE-FLUX



High resolution measurement infrastructure at Finse Alpine Research Center: LATICE-FLUX



Why Finse?

- 'built-in' collaboration between UiB and UiO
- High interest from Met Norway for collaboration on 'climate tower'
- Strong interest in glacial dynamics from NVE and hydropower community
- Complex environment, high winds, alpine – unique
 - Logistics: limited road access – train access!!

Motivations for Establishing the Site

Competency

- Developing competencies in blowing snow modeling/instrumentation
- Improving climate modeling downscaling for high elevation catchments and precipitation on glacier in Norway
- Improve current state of mountain hydrology
- Linking modeling/grid scale to observation scale
- Distributed hydrometeorological observations

Motivations for Establishing the Site

High resolution measurement infrastructure at Finse: LATICE-FLUX



UiO LATICE-FLUX

- eddy-covariance system

UiO LATICE-WSN

- Distributed snow and hydrologic mxs

Met Norway

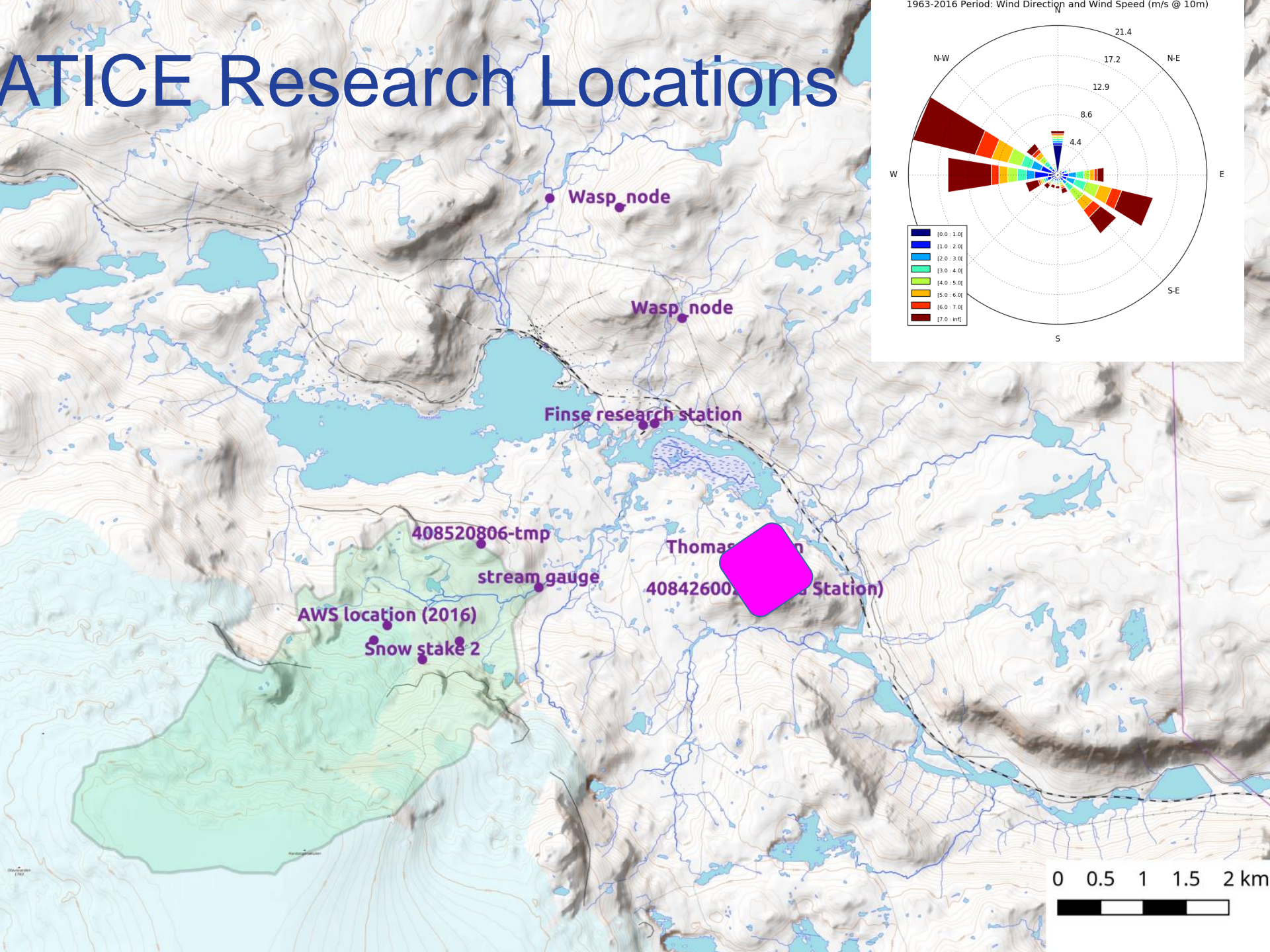
- Climate Reference Station

NVE & UiO

- Discharge



ATICE Research Locations





Flux/Climate Tower

Met Norway Climate Reference Station (see right)

Wind in 10 m: GILL 2-d sensor with 150 W heating power.

Air temperature: Pt_100 element in MET screen in 2 and 10 m.

Air Humidity; Vaisala HMP155 in MET screen in 2 m.

Ground surface temperature; IR sensor in approx 4-5 m high (e.g. Campbell SI-111).

Snow depth sensor; Laser type HMS30 from LUFFT; in ab 5 m high (measure direction free with angle between 15 to 45 deg).

Precipitation amount sensor; Geonor weight sensor.

Precipitation detector; Thies optical Yes/No sensor.

LATICE-FLUX adds eddy-covariance system

Li-COR 7200 CO₂ / H₂O flux

CSAT 3D anemometer

Total radiation instrument: CNR4 in approx 4-5 m high (near eddy-cov instrument high).)

Soil Measurements:

4 thermistors, 2 heat plates; 1 soil moisture 2-5 cm deep depending on the surface consistency

The Wireless Network

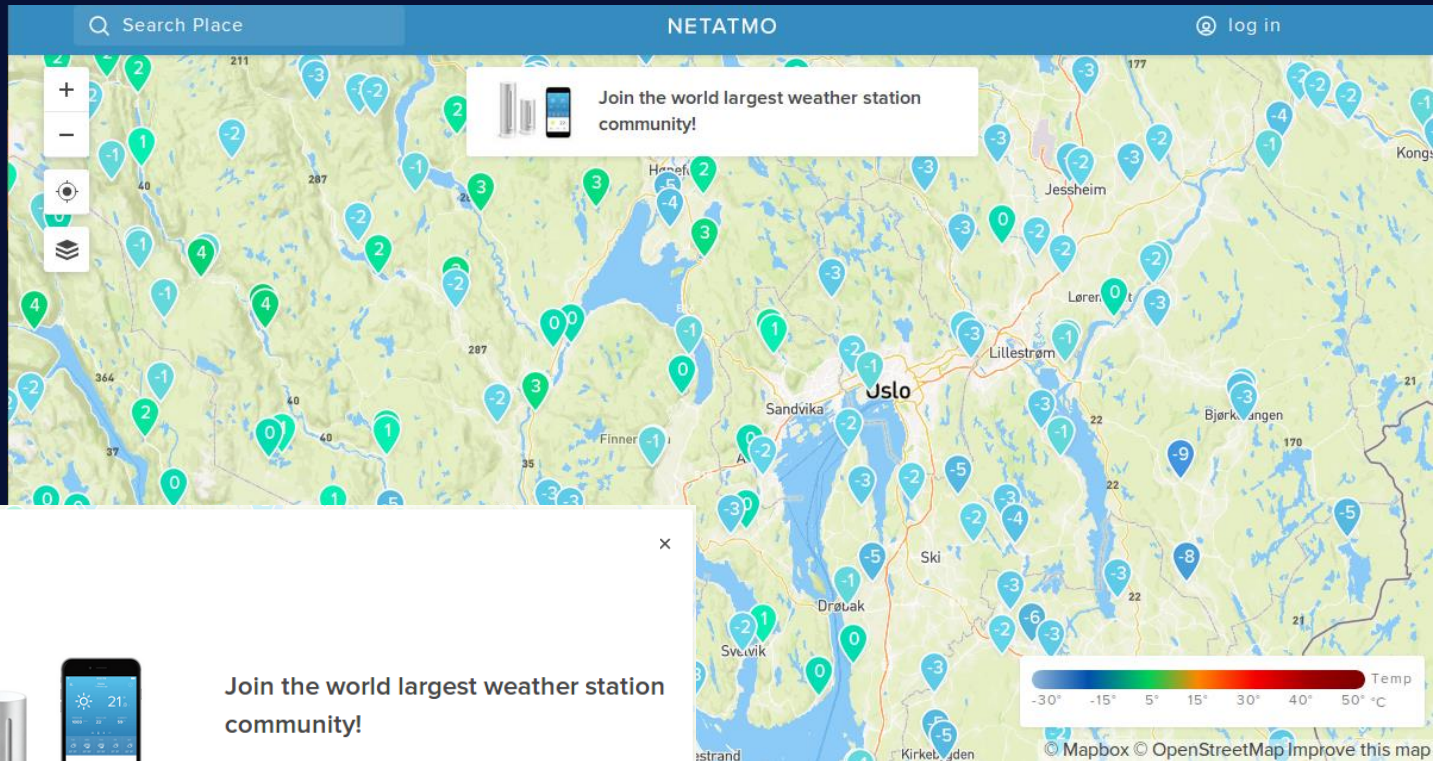


Logger specifications:

- Arduino based
- Low power consumption
- C++ programming
- Open source software/hardware
- Analog/digital sensors
- Low cost



Introduction



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Introduction

ARDUINO

HOME BUY SOFTWARE PRODUCTS EDUCATION RESOURCES COMMUNITY HELP

WHAT IS ARDUINO?

BUY AN ARDUINO

LEARN ARDUINO

BLOG

BUILDING INTERACTIVE PLANT LAMPS WITH ARDUINO

ARDUINO

> ARDUINO

> WEB EDITOR

> CODE ONLINE!

```
void setup(){  
  }  
void loop(){  
  }
```

PROJECT HUB

ADD PROJECT

SEARCH PROJECTS

Third Eye for the blind
Project tutorial by Muhammed Azhar
15,284 views 15 comments 44 respects

Make your first Arduino robot - The best beginners...
Project tutorial by Muhammed Azhar
25,680 views 11 comments 61 respects

Motion Controlled Color Changer!
Project tutorial by Arduino "having11" G...
4,884 views 16 comments 9 respects

Multiple mode Environmental Sensor...
Project tutorial by ConsoleTeam
9,291 views 13 comments 40 respects

Smart Garden
Project showcase by Patel Dipen
12,411 views 12 comments 42 respects

Home Smart Home
Project tutorial by Syed Sanoor
53,831 views 8 comments 164 respects

Temperature Control V1

Arduino Temperature Control
Project tutorial by panthait
7,989 views 10 comments 19 respects

How to Measure Air Quality on OpenSensors
Project tutorial by OpenSensors.io
10,228 views 8 comments 57 respects

Current Temperature on 8*8 LED Dot Matrix
Project showcase by Nekhil ravi
4,686 views 9 comments 32 respects

Ultrasonic Range Detector Using Arduino and SR-04F
by RZtronics
7,728 views 8 comments 20 respects

Arduino UNO Mini-Weather Station
Project tutorial by Igor Fonseca Albuquerque...
13,144 views 7 comments 41 respects

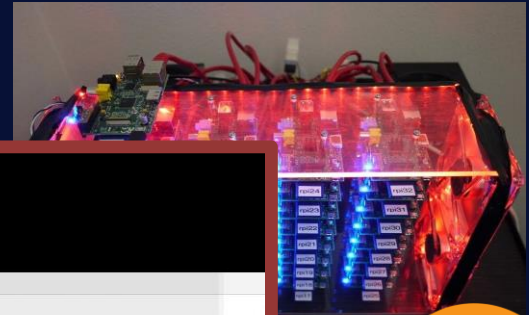
Fresca Versatile Temperature Controller
Project in progress by Leo
1,761 views 11 comments 12 respects

What is Arduino?

Arduino is an open-source electronics platform based on easy-to-use hardware and software. **Arduino boards** are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the **Arduino programming language** (based on **Wiring**), and the **Arduino Software (IDE)**, based on **Processing**.



Introduction



CAMPBELL SCIENTIFIC
WHEN MEASUREMENTS MATTER

Products Solutions Support About Search Log In

Also known as: data loggers, data recorders, or DAQs

About Dataloggers and Data Acquisition Systems

Dataloggers are an essential component in data acquisition systems. They can scan a wide variety of measurement sensors, perform any programmed calculations, convert the data to other units of measurement, and store the data in memory. Dataloggers can also transmit the data for analysis, sharing, and reporting, as well as control external devices. [Learn more](#)

[Watch the Video](#)

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CR300 Datalogger

The CR300 is a multi-purpose, compact measurement and control datalogger. This small, low-cost, high-value datalogger offers fast communications, low power requirements, built-in USB, and excellent an...[read more](#) [Learn more](#)

CR310 Datalogger with Ethernet

The CR310 is a multi-purpose, compact, low-cost measurement and control datalogger that includes an integrated 10/100 Ethernet port and removable terminal connectors. This entry-level datalogger,...[read more](#) [Learn more](#)

CR800 Measurement and Control Datalogger

BLOG **DOWNLOADS**

RASPBERRY PI

A small and affordable computer that you can use to learn programming

BUY A RAS **KOMPLETT**
TRUSTED BY YOU SINCE 1996

Alle produkter

Her er du: Forsiden > Datastyr > PC

Raspberry Pi 3

1.4GHz Quad Core CPU
RAM,WiFi,BT,4xUSB2.0

Produktnr.: RASPBERRY PI 3 MOD

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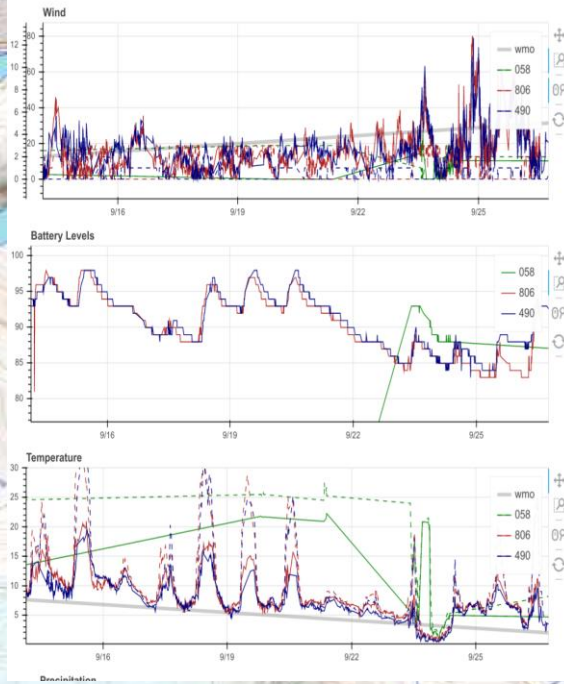
BUILD YOUR OWN!

BLOG

Real Time LATICE WSN Data Browser

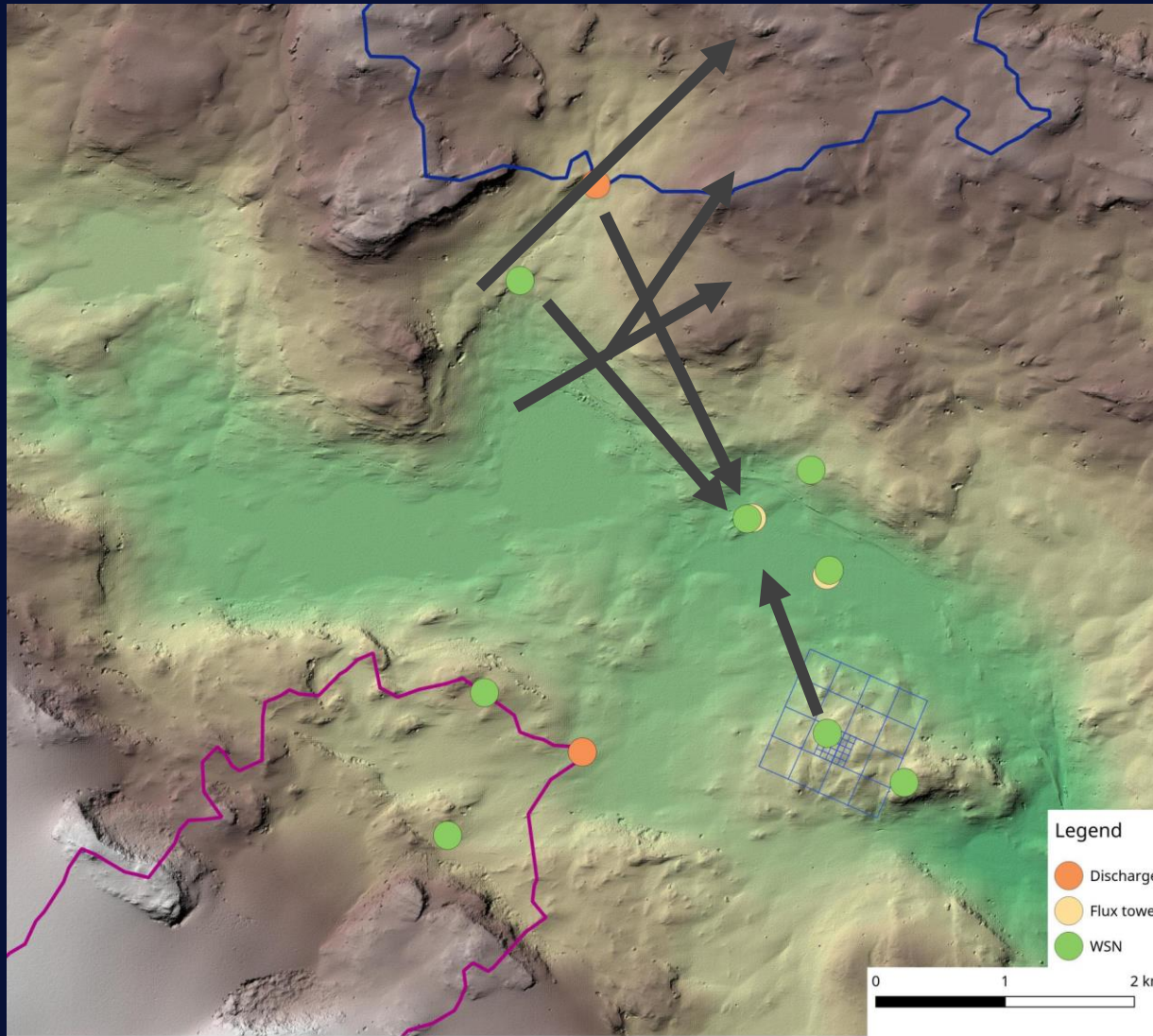
Note: this site is in development and will be frequently changing. Please don't bookmark this URL

Read more about the [LATICE](#) project





In house experience





In house experience

Sensor



Logger unit



Local server

Finally... data visualisation

Database

Django administration

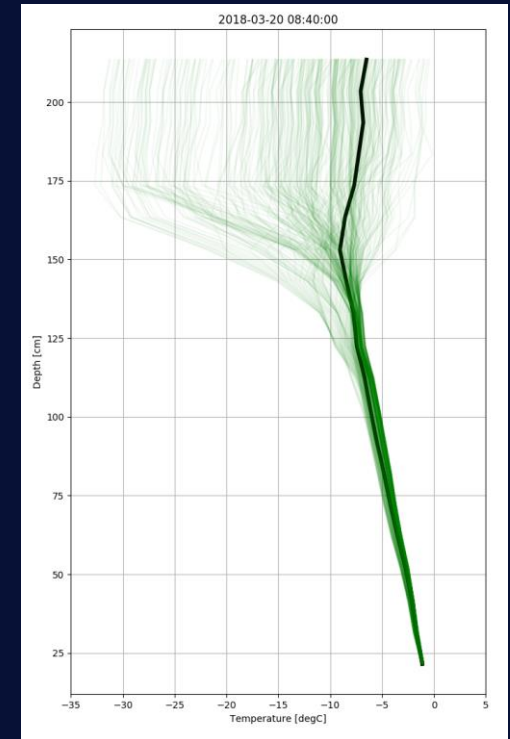
WELCOME, SIMON

Home · Wsn · Frames

Select frame to change

Action: [-----] Go 0 of 100 selected

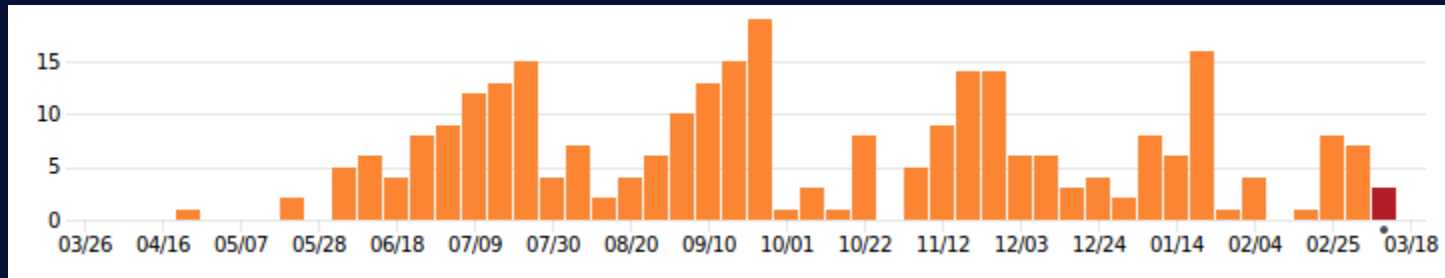
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<input type="checkbox"/> 2018-03-19 09:55:00 +0000	{'serial': 3390197892757083161, 'source_addr_long': 5526146538669856}	{'bat': 96, 'frame': 185, 'ds1820': [-1.0625, -10.0625, -17.0625, -28.0625, -41.0625, -53.0625, -64.0625, -78.0625, -93.0625, -109.0625, -127.0625, -130.0625, -118.0625, -63.0625, -19.0625, -12.0625, -4.0625, 1.9375, -3.0625, 2.9375], 'received': 1521453603}
<input type="checkbox"/> 2018-03-19 09:50:00 +0000	{'serial': 3390197892757083161, 'source_addr_long': 5526146538669856}	{'bat': 96, 'frame': 184, 'ds1820': [-1.0625, -10.0625, -17.0625, -27.0625, -41.0625, -53.0625, -64.0625, -78.0625, -93.0625, -109.0625, -128.0625, -130.0625, -119.0625, -69.0625, -22.0625, -15.0625, -8.0625, -3.0625, -8.0625, -2.0625], 'received': 1521453603}



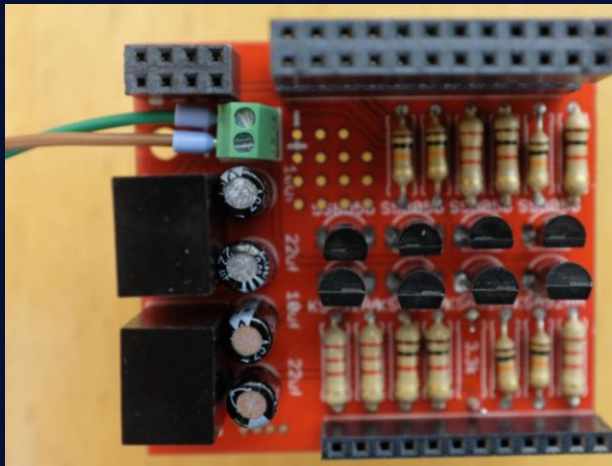


In house experience

Number of Git commit

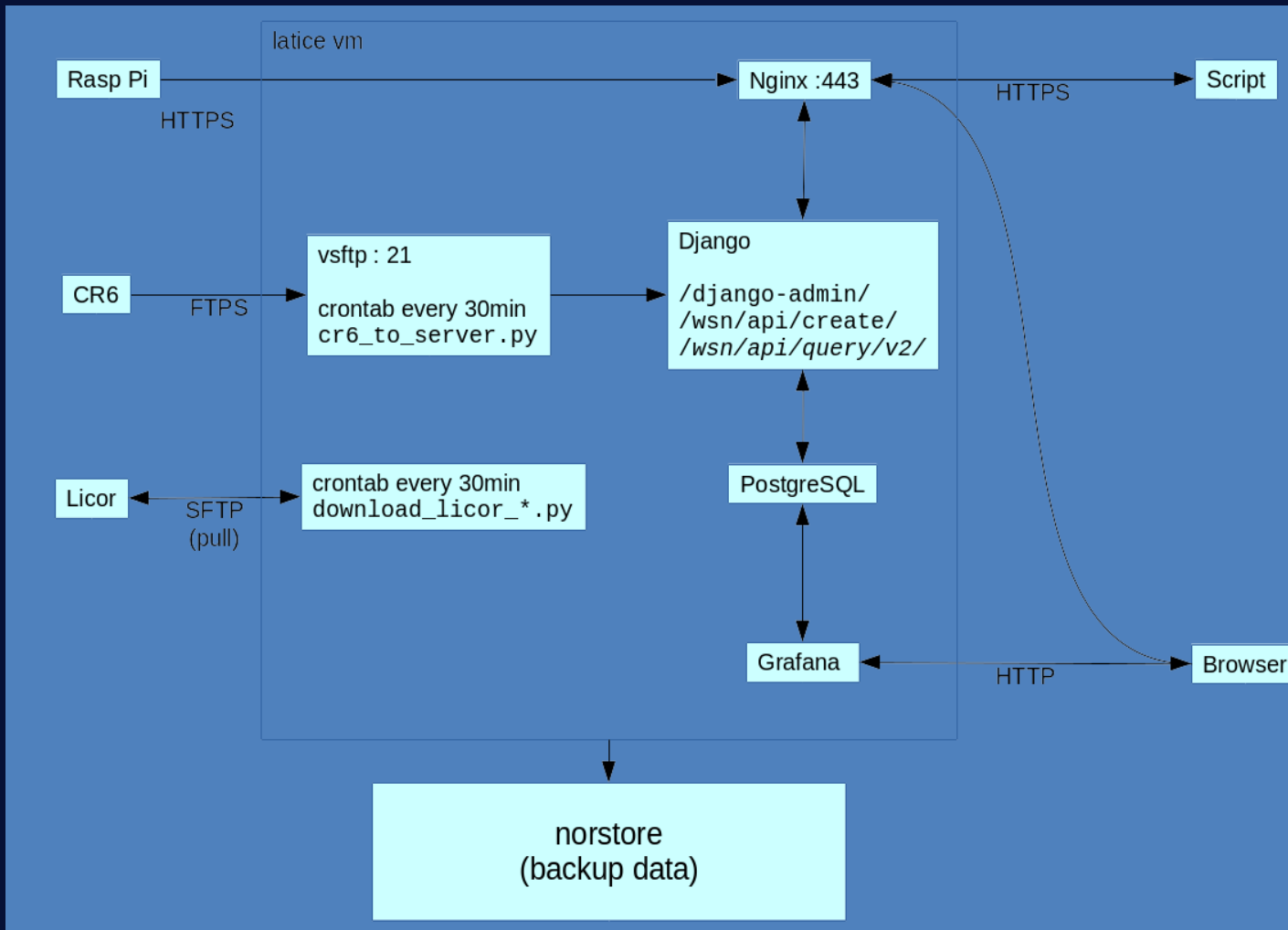


Hardware development





In house experience

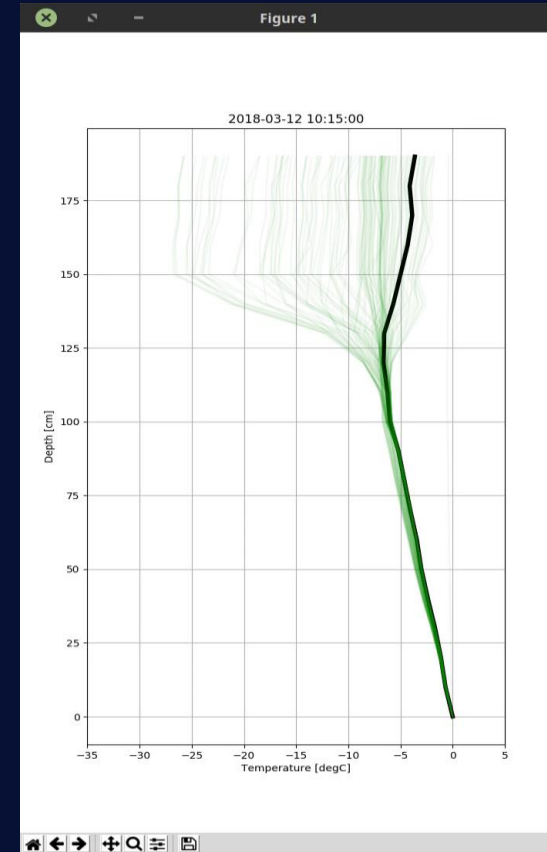




Specific Case I

Custom made sensor and logger

Off the shelf





Specific Case II

Custom time-lapse camera kit:

- Snow cover extent at melt in catchment with discharge measurements
- recording snow drift profile at the flux tower

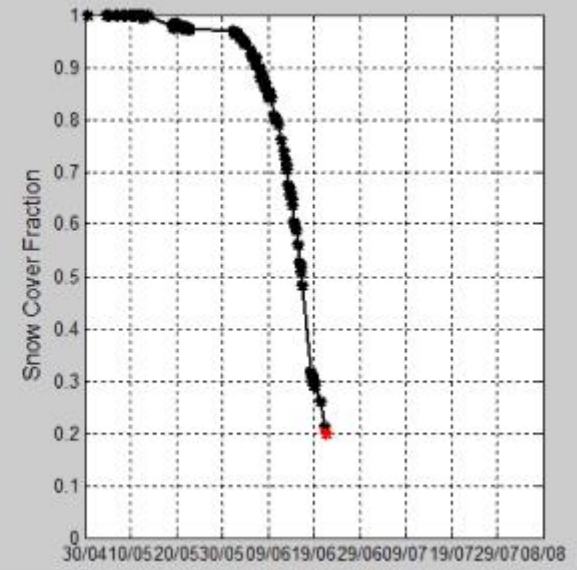
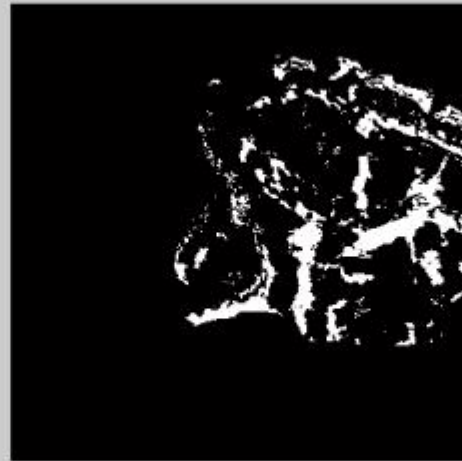
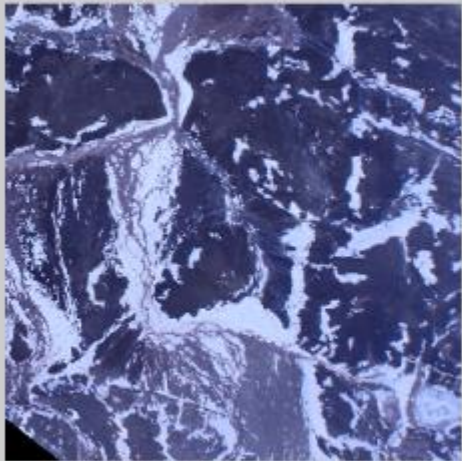
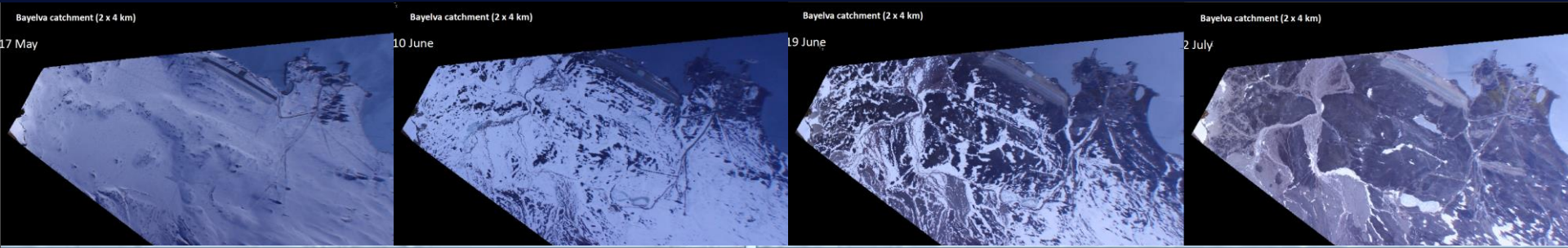
Kit consisting of:

- High resolution camera (22MPix), and high dynamic range (critical for snow photography)
- Flexible and integrated in the wireless network
- Possible to trigger camera based on external sensor
- Complete kit <9000NOK

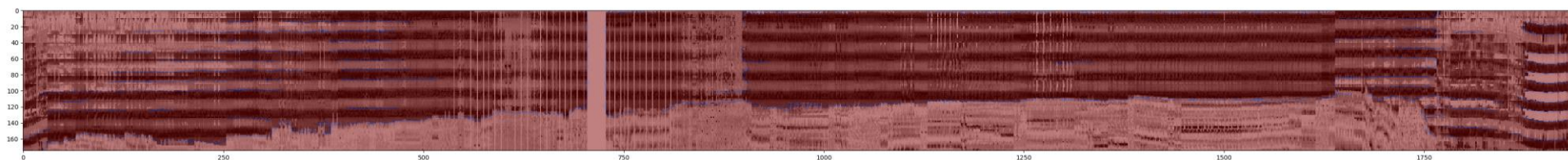
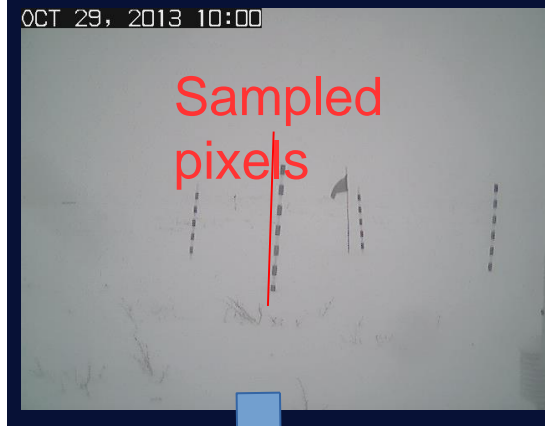
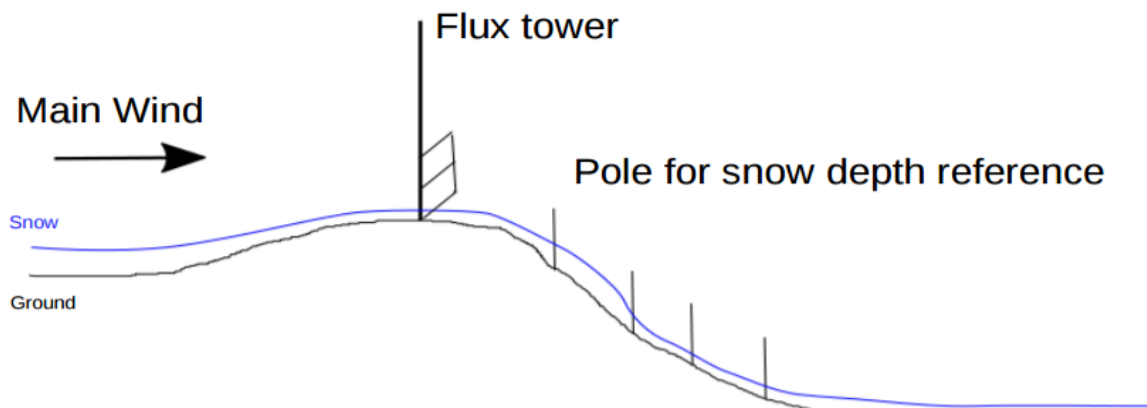


Characterize Coefficient of Variation in Ny Ålesund

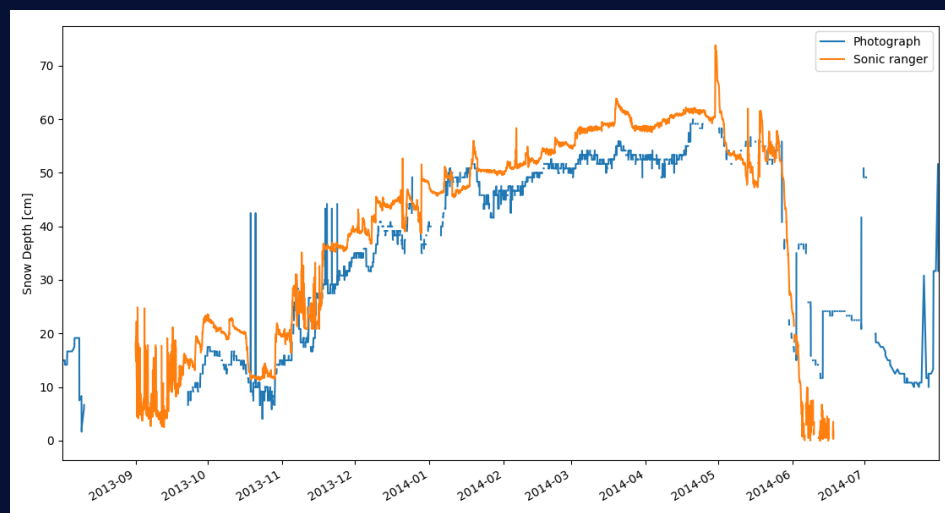
Sebastian Westermann, Kjersti Gisnås
& Kjetil Schanke Aas



Drift monitoring by extracting snow depth from time-lapse camera



Testing method on data from
Innavait, Alaska



Summary and path forward...

Summary:

A new site for physical sciences in Finse :

Blowing snow, hydrology, climate downscaling, ...

Development of innovative measurement techniques

Low-cost wireless AWS to capture better representation of spatial variability

Structure from Motion, UAV based, Time-lapsed based

A seed for collaboration,

Existing ties between UiO and UiB

Collaboration between Geosciences and Informatics Departments

Collaboration between Academic, Operational Agencies (NVE, Met), Industry

Hopefully many more...

Future Developments:

New Modeling Initiatives:

Explore model performance

Evaluate different validation approaches

Expand remote sensing capabilities / validation

Wireless Network:

Obtaining a robust back bone network of station

Infill site with specialized stations for snow, hydrology

Synchronizing observations to an online open-access database in realtime

Snow Specific Capabilities:

Repeated snow depth mapping UAV/lidar

Installation of sensors for quantifying drifting snow flux

Installation of time-lapse cameras for snow drift monitoring, and Snow Cover Extent



The Hive Objectives

Establish a hub of individuals and groups at UiO interested and utilizing IoT technologies

- Share experiences and knowledge across research groups/departments
- Develop in-house technology adapted to our need
- Develop competences



Phase I

1. Identifying individuals and groups at UiO and associated to UiO:

Departments

Openzone, Simula, Research Bazar

2. Seminar at UiO:
Second half of August

3. Continue development @ Finse



Phase II

1. Seminars

2. Hackaton style projects:

Invite Geoscience/IFI students to form groups and project

3. Toward sharing resources (labs,) for students, establish a UiO platform to share



Conclusion

1. Establishing a UiO hub for sharing experiences and resources across departments
2. Develop an in-house platform and workflow for that suites custom project ideas
3. initiate student projects involving geoscience-technology aspect

Thank you!

UiO : LATICe

Strategic Research Initiative

Contributing Projects & Funding:



Contributions:

Snow Model Validation

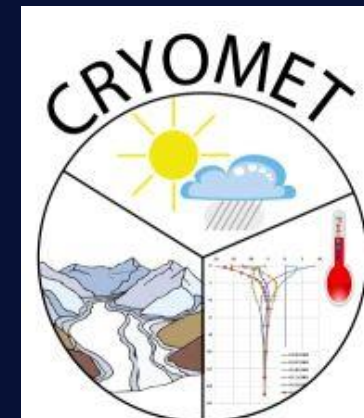
Simon Filhol (UiO)

Snow Cover Fraction Mapping

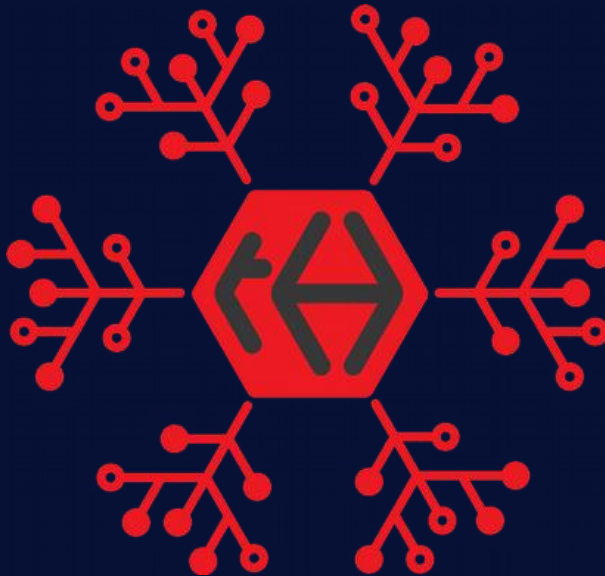
Kjersti Gislås (NGI)

& Kjetil Schanke Aas (UiO)

EvoGLAC



Thanks!



A particular thanks to:

- The Faculty of Mathematics and Natural Sciences to support this project as part of the eInfrastructure projects
- The Department of Geosciences
- the UH-iaaS infrastructure

Contact:

John F. Burkhart

Department of Geosciences, UiO

john.burkhart@geo.uio.no

