Airborne remote sensing in Svalbard

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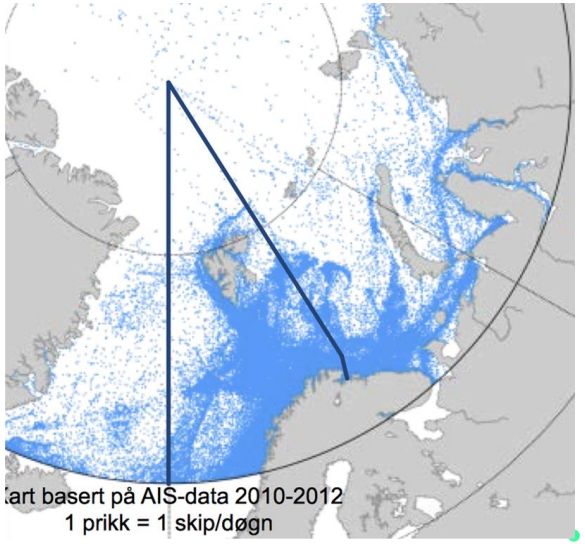
Agenda

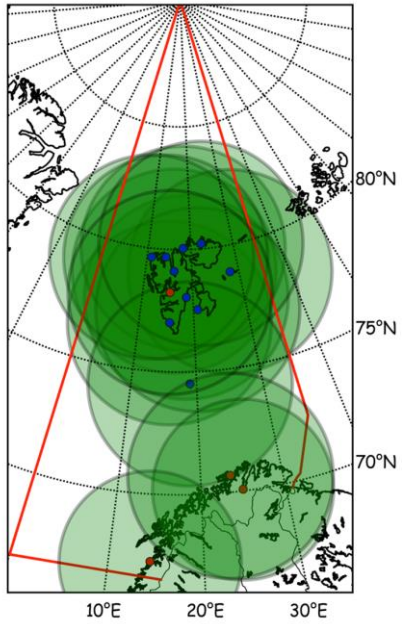
- Status and recent development
- SIOS call for remote sensing data
- Future plans: Radar

Arguments for a pod on the Dornier

- The platform is already on Svalbard, providing logistic support for Station nord, Ny-Ålesund and Svea
- It is a cost effective tool for dedicated remote sensing missions
- It can be used for collecting research data combined with “normal” flights
- It can help fill a gap in the emergency preparedness system for the high north



More than 80% of activity in the Arctic within the “Norwegian” sector, defined by the joint SAR within the Arctic council.



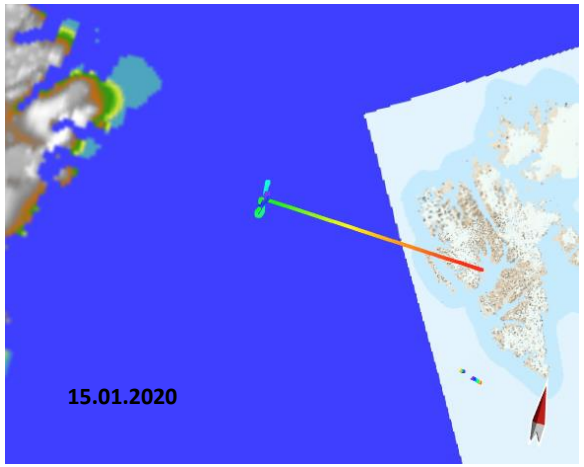
(Sarinor – wp3 report, 2016)

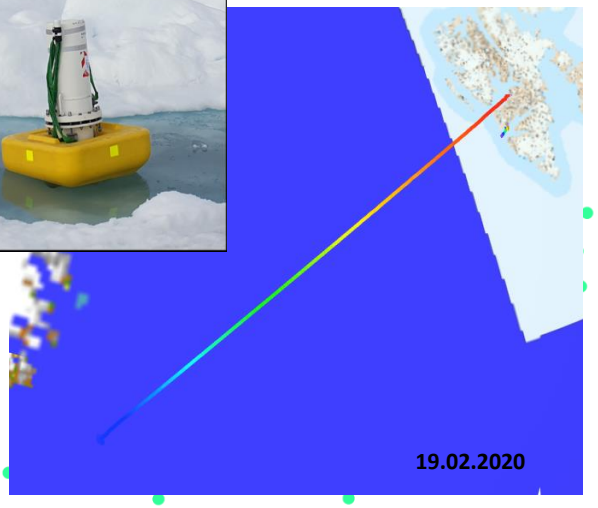
Dornier as an airborne relay during SAREX 2020

- Big SAR excersize planned for this week but cancelled due to COVID-19
- Provide high bandwith connection to assets participating in the excersize
- Train the pilot set up and operate the relay system
- Yet another application of the platform, benefitting the Svalbard community
- Filling a gap in emergency preparedness system in the high north:
  - **Communication and Situational awareness**

Collecting data from drift buoys

- ArcticABC (Jørgen Berge UiT)
  - The Buoys are designed and assembled by Pedro De La Torre, NTNU.
- 15. January 2020
  - 300 km NE of Longyearbyen
  - Radio on the Buoye never responded
- 19. February 2020
  - 1080 km SE of Longyearbyen
  - All data (4GB) succesfully collected





Collecting data from drift buoys

A success, finally!

The Buoye team after landing in Bodø

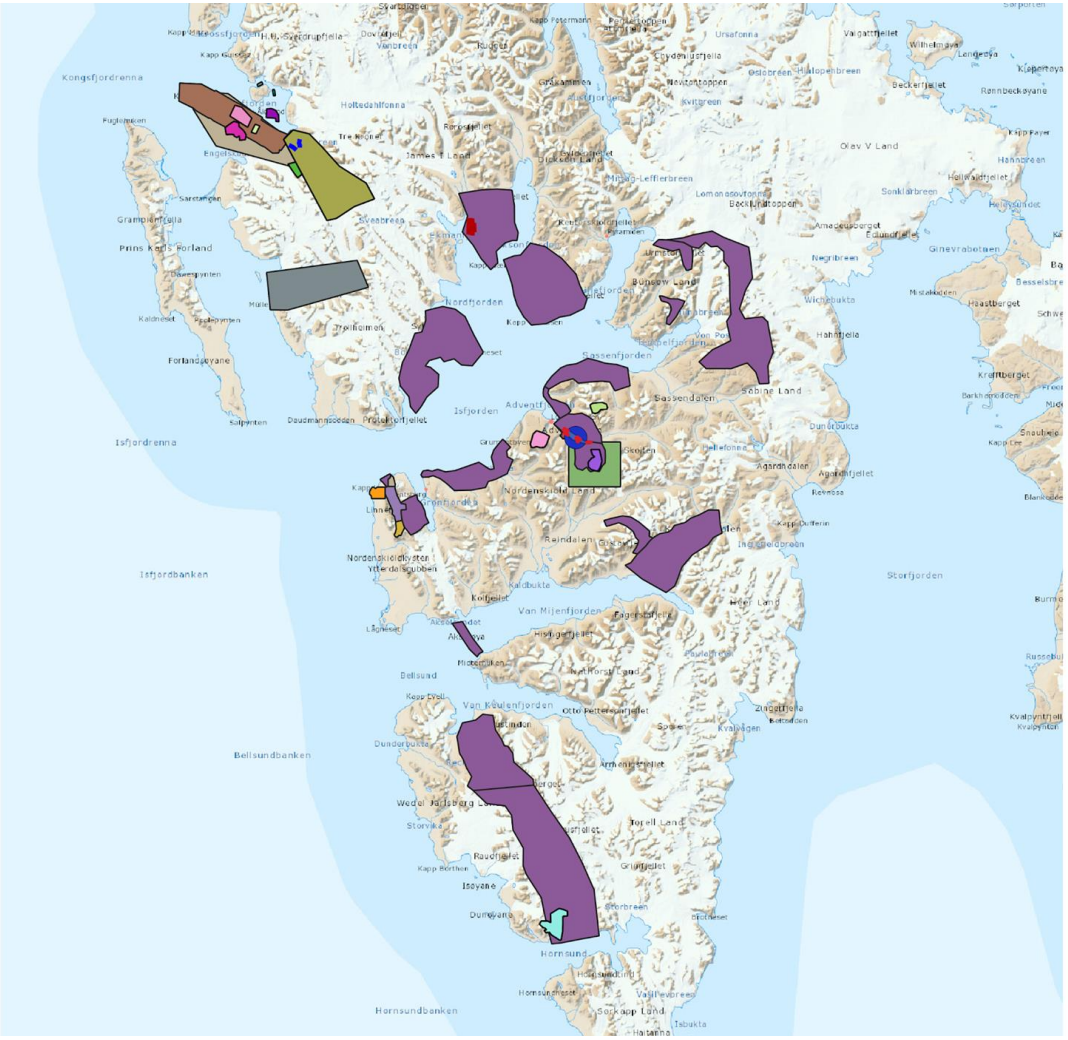
Test campaign in September 2019

In need of high-resolution images of your field site?

LAST UPDATED: AUGUST 23, 2019

Unique opportunity for SIOS members in the end of August – apply now!

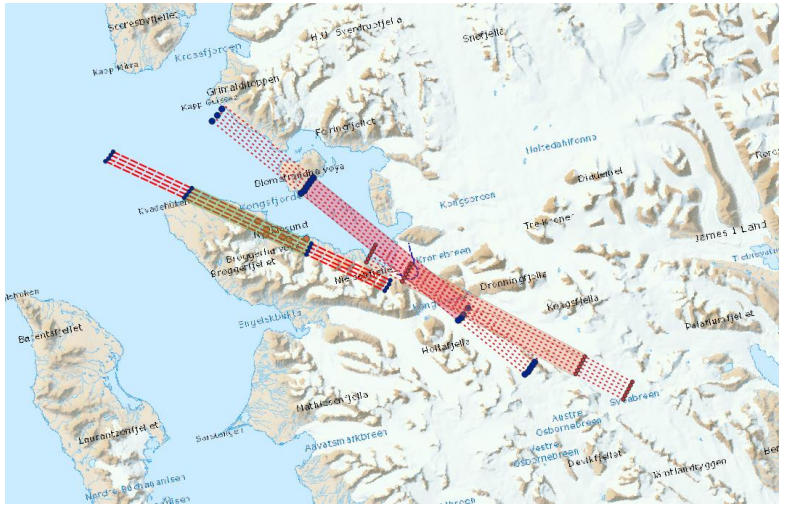
Norce is offering a unique opportunity for SIOS members to have their areas of research interest overflown as part of the data validation tests for the newly installed optical sensors on the Dornier platform. The test flights are taking place at the end of August, so you must repond quickly to take advantage of this offer!



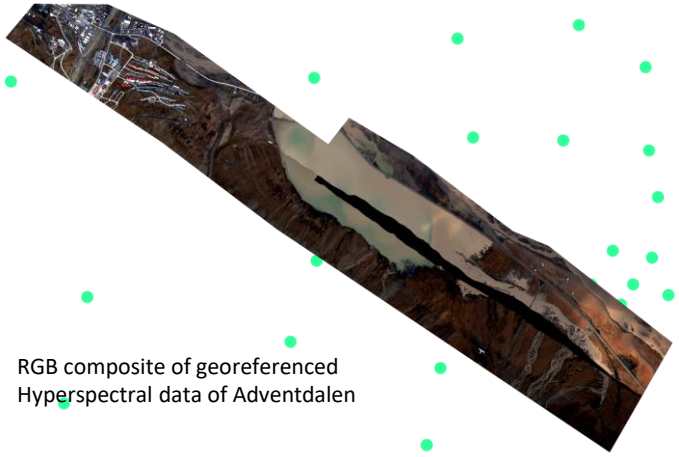
~50 requests

Test campaign in September 2019

- Mapped some prioritized areas
  - Kongsvegen
  - Cora
  - Adventdalen and part of Longyearbyen
  - Longyearbyen airport (Boresight)
  - Ny-Ålesund covered in 30 minutes (Nlive Link)
- Bad weather for 3 days!



Typical flight lines generated from Interesting areas submitted by researchers prior to the Septmeber campaign



RGB composite of georeferenced Hyperspectral data of Adventdalen

Test campaign in September 2019

Lessons learned and things to improve

- Many of the requests were partly overlapping or close
  - Possible to combine multiple requests on a single flight.
- Even cloud cover are excellent conditions
  - When we can operate under them
- Generating flightlines and importing them into the autopilot is manual labour with risk of entering wrong coordinates.
  - We can improve this work process significantly.
- The direct geocoding for the previews in Nlive are rotated.
  - Its fixed now but the results in Nlive has to be recalculated.

Test campaign in September 2019

Lessons learned and things to improve

- Moving data from the aircraft over to a server is cumbersome
  - We have assembled two computer systems for this purpose. They are ready.
- We need a place to put the data which can be accessed by the SIOS community

Pilot Remote Sensing Sevice-2020

SIOS's Announcement of Opportunity (AO) in Airborne Remote Sensing

Inviting project proposals for acquiring aerial imagery and hyperspectral data using SIOS's airborne remote sensing platforms

- Exiting oppurtunities. Apply for it!
- 50 Megapixel RGB camera (IXU-150, PhaseOne)
  - Up to 2 images/sec
  - 10 cm ground resolution for 800 m swath width from 1000 m altitude.
- Hyperspectral imager (VNIR-1800, Norsk Elektro Optikk)
  - 30 cm ground resolution for 600 m swath width from 1000 m altitude.
  - Spectral resolution of < 5 nm in full range from 400 – 1000 nm
  - Maximum storage of 1TB, representing 1hr of continuous recording

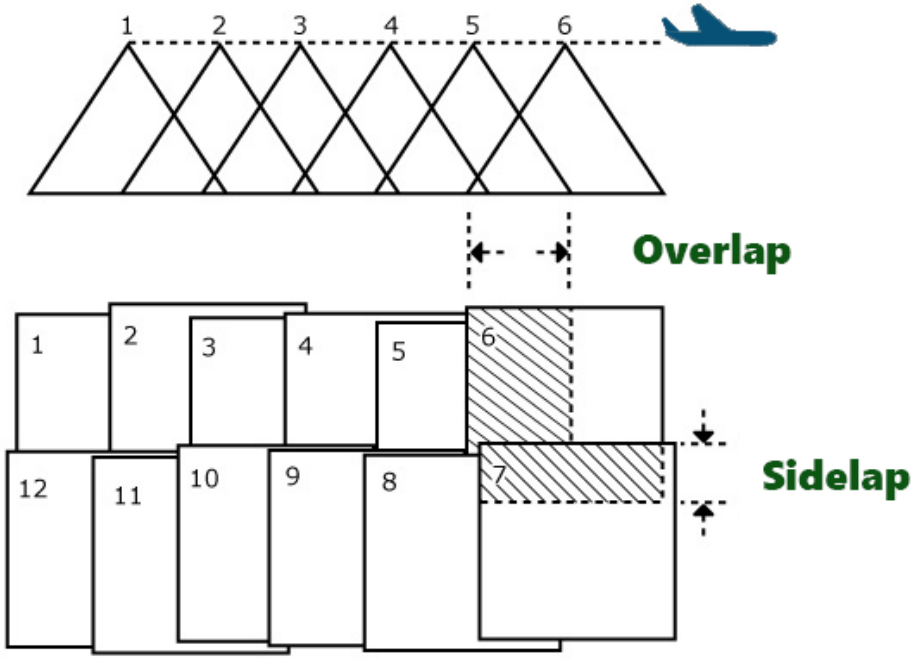
Mission planning

- Be very specific when generating the ROIs and explain the usage
  - Overlap and resolution
- We will then generate the flightlines to fit your ROI

Coraholmen i Ekmanfjorden

Planning

- Resolution requirements determine flight altitude
- The use determines overlap and side lap
  - 3D model requires 80% overlap / side patch
  - Regular mapping requires 25% (VNIR)
- Overlap and height determine the distance between each image: **TRIG_DIST**
- Side laps and height determine how close flight lines we need
- Flight lines are calculated by software
  - Camera, lens, heading, height, overlap and side lap



Coraholmen i Ekmanfjorden

NyAalesund1

Target groundspeed (kts): 160
Target altitude (ft): 3300

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LT□(NDD□MM.mm,□EDD□MM.mm)
NA1L1:□N78□51.34,□E12□28.11
NY1L3:□N78□51.11,□E12□27.53
NY1L5:□N78□50.92,□E12□26.63
NY1L7:□N78□50.75,□E12□25.80
NY1W1:□N78□54.35,□E12□04.96
NY1W3:□N78□54.14,□E12□04.26
NY1W5:□N78□53.93,□E12□03.52
NY1W7:□N78□53.74,□E12□02.85
NY1W2:□N78□58.86,□E11□29.47
NY1W4:□N78□58.68,□E11□28.49
NY1W6:□N78□58.50,□E11□27.49
NY1W8:□N78□58.34,□E11□26.59
NY1L2:□N79□01.78,□E11□05.87
NY1L4:□N79□01.60,□E11□04.97
NY1L6:□N79□01.40,□E11□04.08
NY1L8:□N79□01.26,□E11□02.97
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DEC□(NDD.ddddd,□EDD.ddddd):
NA1L1:□N78.85562,□E12.46849
NY1L3:□N78.85189,□E12.45876
NY1L5:□N78.84872,□E12.44380
NY1L7:□N78.84589,□E12.42999
NY1W1:□N78.90579,□E12.08269
NY1W3:□N78.90237,□E12.07093
NY1W5:□N78.89881,□E12.05867
NY1W7:□N78.89562,□E12.04750
NY1W2:□N78.98100,□E11.49121
NY1W4:□N78.97806,□E11.47489
NY1W6:□N78.97504,□E11.45820
NY1W8:□N78.97231,□E11.44320
NY1L2:□N79.02971,□E11.09786
NY1L4:□N79.02664,□E11.08280
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NY1L8:□N79.02108,□E11.04955
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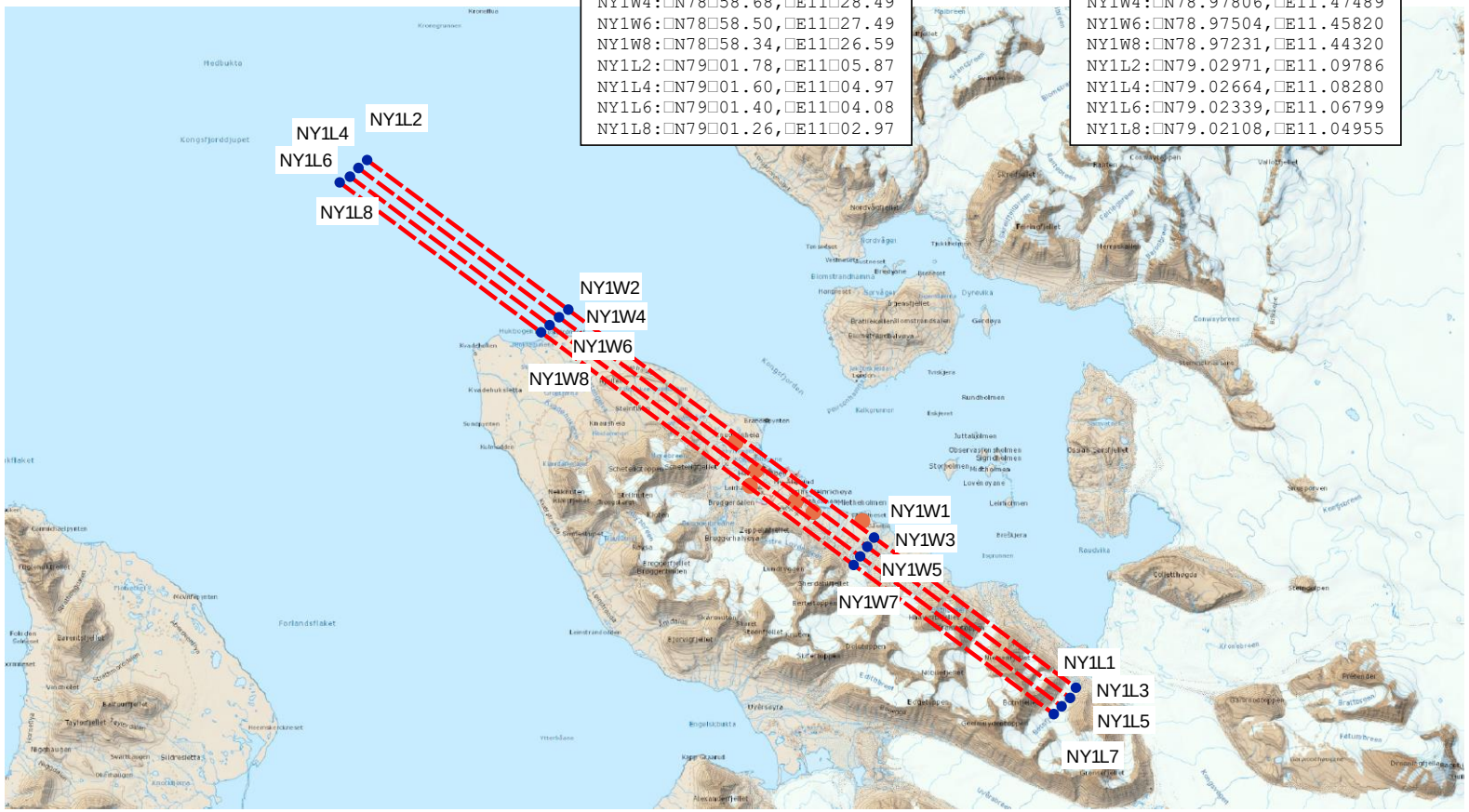
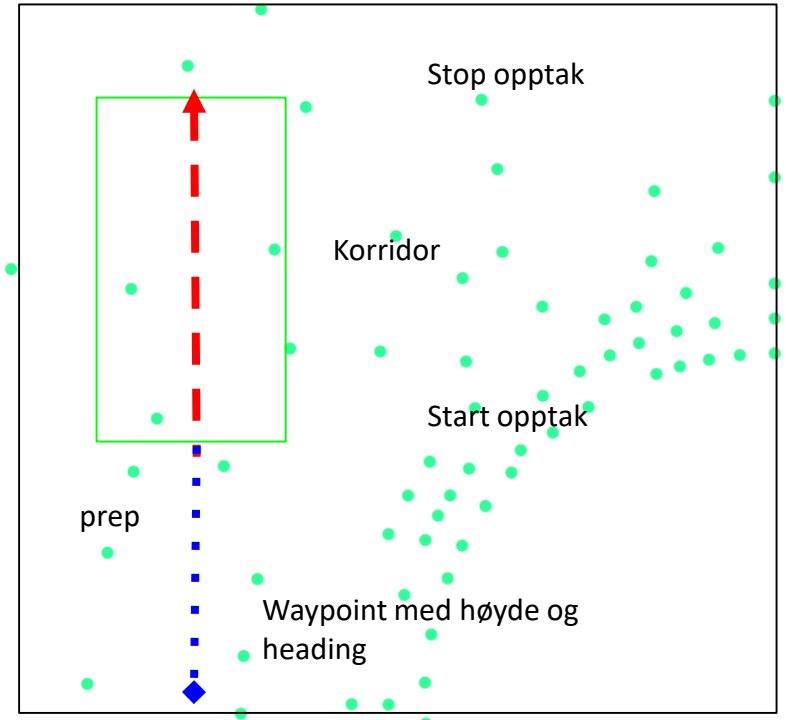


Semi automatic operation

- Pilot responsibility:
  - Planning with regard to next flightline and programming of the FMS
  - Start of payload before takeoff but after generator start
  - **Status and control of payload via iPad**
    - Name of next flightline / waypoint (same name as in FMS)
    - Shutdown at the end of the mission
- Ground Crew (after last flight for the day)
  - Connect ground power and payload computers on (including wifi)
  - Dump data to ground computer via. Ethernet cable
- NORCE responsibility:
  - Software maintenance
  - Processing and validation of geocoding
  - Sharing data with SIOS (Metadata via. Nlive)

Automatic instrument control

- Software detects when aircraft is lined up on an active fligth line
- Manual or automatic exposure setting
- Altitude and speed determines trigger
- Cancel recording
  - Out of the corridor
  - Max number of spectrograms (VNIR)



Radar onboard the Dornier

- All weather capabilities and significantly increase the operational window of the Dornier science mission
- Major modification is already approved (If the antennas can fit inside the pod)
- Two alternatives:
  - Single frequency and single polarization
  - Full polarimetric and dual frequency (X and L-band)

Radar onboard the Dornier

- X-band (9.5 GHz)
  - High resolution (< 10cm) for smal target detection; Sea ice, maritime survailance, search and rescue
  - Only single pass
- L-band (1.2-1.4 GHz):
  - Medium resolution (~50 cm)
  - Repeat pass interferometry !!!
    - Surface motion and geohazard
    - Tomography for glacier and ice cap subsurface mapping
    - Interesting in a periglacial landscape to quantify SMC and depth of the active layer in freezing and thawing season.
  - Providing a platform that can collect essential Calibration and Validation data for satellite SAR missions such as ROSE-L and NISAR.

Thank you for your attention