Svalbard Integrated Arctic Earth Observing System - Infrastructure development of the Norwegian node – revised

SIOS-InfraNor - revised

SIOS
SVALBARD INTEGRATED ARCTIC
EARTH OBSERVING SYSTEM

Photo: Malin Daase

An international research infrastructure

SIOS dropped from ESFRI roadmap

The Svalbard Integrated Arctic Earth Observing System (SIOS)

- **A consortium** of institutions with research infrastructure in & around Svalbard

An independent international organisation

- **An observing system** for Earth System Science (ESS)

Focus on processes and interactions
Long term observations

***C**limate **E**cological **O**bservatory for **A**rctic **T**undra* (COAT)

COAT is a *long-term*, *ecosystem-based* and *adaptive* observation system. It aims to unravel how climate change impacts arctic tundra *food webs,* and to enable prudent science-based management.

COAT is a long-term research initiative for real-time detection, documentation and understanding of climate impacts on terrestrial arctic ecosystems. By integrating existing and new longterm ecological data series, COAT ensures the integrity of these time-series, expands and integrates them to a fully ecosystem-based observation system and makes the system/data/knowledge widely available to scientists, managers and the general public. With the focus on ecosystem services and biodiversity, the scientific approach of COAT is in line with recent international calls to adopt ecosystem-based, long-term monitoring to climate impact research in the Arctic.

InfraNor

Based on new and existing research infrastructure owned by its member institutions, SIOS will aid in addressing Earth System Science questions related to Global Change.

The proposed project *SIOS-InfraNor* aims to expand and improve the Norwegian node of SIOS and COAT

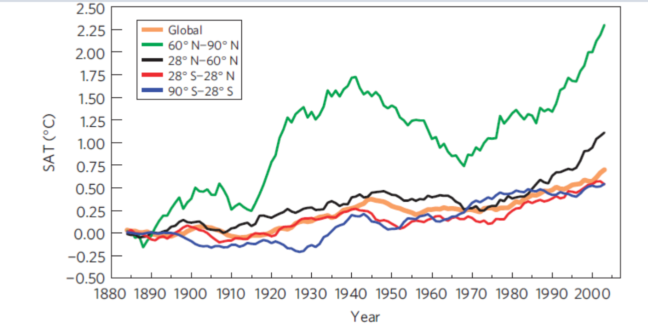
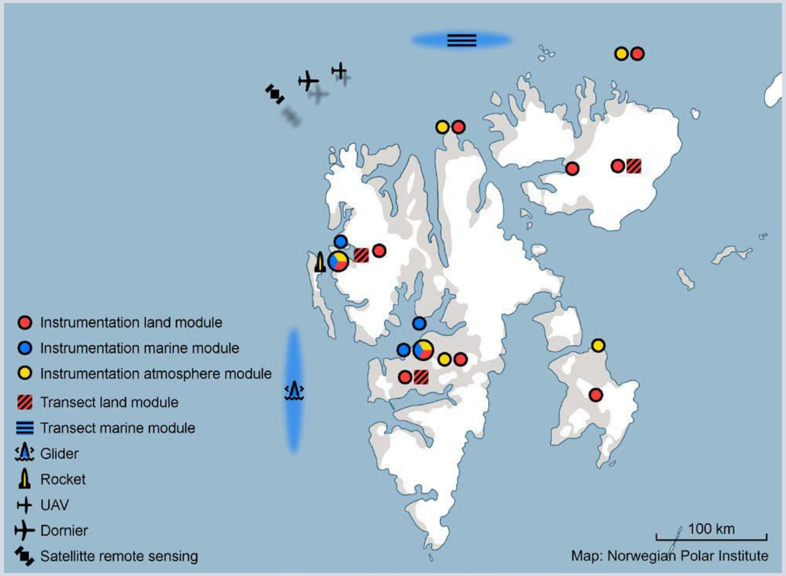


Figure 2 | Area-weighted mean observed surface temperatures[39,40] over the indicated latitude bands. The values are nine-year running means relative to the 1880–1890 mean. Correlations (R^2) with the global mean over 1931–2007 by region are: 0.94 tropics, 0.61 SHext, 0.86 NHml and 0.53 Arctic.



The evaluation of the originally submitted applications *SIOS-InfraNor* (200MNOK) and *COAT Infrastruc-ture+* concluded that the two should be combined and scaled down to match a total budget of 90MNOK. Only the Svalbard component of *COAT Infrastructure+* (~15 MNOK) should be included.

Here the Svalbard part of the *COAT Infrastructure+* application is imbedded into the *SIOS-InfraNor* project description. In this way the close link to the SIOS consortium is retained and the governing statutes and its ANNEXES made applicable to the project. All institutions in the project will be members of SIOS. To keep the integrity of the COAT project, a revised project description for the Svalbard part of the *COAT Infrastruc-ture+* project is appended.

Table 1: Overview over original and revised sums requested from RCN

Total sum requested from RCN in original application	*199.9 MNOK*
Total sum requested from RCN for COAT Infrastructure+ Svalbard	*15 MNOK*
Revised sum requested from RCN for the merged project	90.27 MNOK
Additional items included in revised sum: Instrument #61 (K-lander)	3 MNOK
Interoperability adjustments to the COAT Digital infrastructure	1 MNOK
Revised total sum requested from RCN	**94.27 MNOK**

SIOS consortium projects must adhere to the SIOS data policy (https://www.sios-svalbard.org/Documents).

To secure interoperability between the two systems the COAT digital infrastructure needs to be made compatible with the SIOS data management structure. This is a task that is regarded as an extra effort outside the tasks of the project and an extra 1 mill NOK to accom-modate this are required.

The Norwegian Space Centre has offered to fund selected instruments separately with a total sum of 13 mill NOK. These instruments are not included in this application, but will be part of the InfraNor project.

Within each module, each instrument or instrument-carrying platform has its own owner and responsible institution; only metadata and data access are the responsibility of SIOS-KC.

***Module 1*: Atmosphere, Leader: Dr GH Hansen (NILU)**

***Module 2*: Land, Leader: Dr Å Pedersen (NPI)**

***Module 3*: Ocean, Leader: Professor J Berge (UiT)**

***Module 4*: Common infrastructure, Leader: Associate Professor R Storvold (NORUT)**

***Module 5*: Data management, Leader: Dr Ø Godøy (Met.no)**

***Module 6*: Management, Leader: Dr Heikki Lihavainen (SIOS)**

Table 7: Total budget overview of *SIOS-InfraNor* during the procurement phase (years 1-5). For an overview of the operation phase, see budget attachment.

		2018	2019	2020	2021	2022	Total
Module 1	From RCN	10051	4710	4786	486	486	20519
	Total cost	12169	7131	5370	686	686	26042
Module 2	From RCN	9751	11203	4929	2517	1917	30316
	Total cost	17735	16661	10078	5572	5049	55095
Module 3	From RCN	11568	6366	1385	1461	1420	22200
	Total cost	12868	8666	3285	3611	3020	31450
Module 4	From RCN	4175	297	71	71	71	4685
	Total cost	4525	737	540	540	540	6882
Module 5	From RCN	1900	1900	1800	1700	1700	9000
	Total cost	3400	2900	2800	2700	2200	14000
Module 6	From RCN	1600	1600	1450	1450	1450	7550
	Total cost	4600	4600	4450	4450	4450	22550
Total budget *SIOS- InfraNor* Procurement Phase (years 1-5)							156019

From research council 94 270 MNOK

Activity	2018				2019				2020				2021				2022				2023	2024	2025	2026	2027
RI	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**					
3.1.1																									
3.1.2																									
3.1.3																									
3.2.1																									
3.2.2																									
3.2.3																									
3.2.4																									
3.2.5																									
3.3.1																									
3.3.2																									
3.3.3																									
3.4																									
Module 5																									
Module 6	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**					
LGM																									
PGM																									
TechStaff																									
Synthesis & Progress																									
ProgEval																									
AF																									

Figure 4: Time-schedule and milestones phase 1 (2018-2022) – procurement (light grey), validation and deployment (grey) and phase 2 (2023-2027) - operation (dark grey). The activity number refers to the subchapters in chapter 3. LGM: Leader group meetings, PGM: Partner group meetings, TechStaff: Technical staff, ProgEval: Progress Evaluation, AF: Arctic Frontiers conference.

Project owner is the SIOS Svalbard AS on behalf of SIOS2 . The project manager is the SIOS director. The SIOS director is head of the SIOS-KC, with administrative, logistical and advisory support staff at his disposal.

A leader group consisting of the SIOS director and the other five module

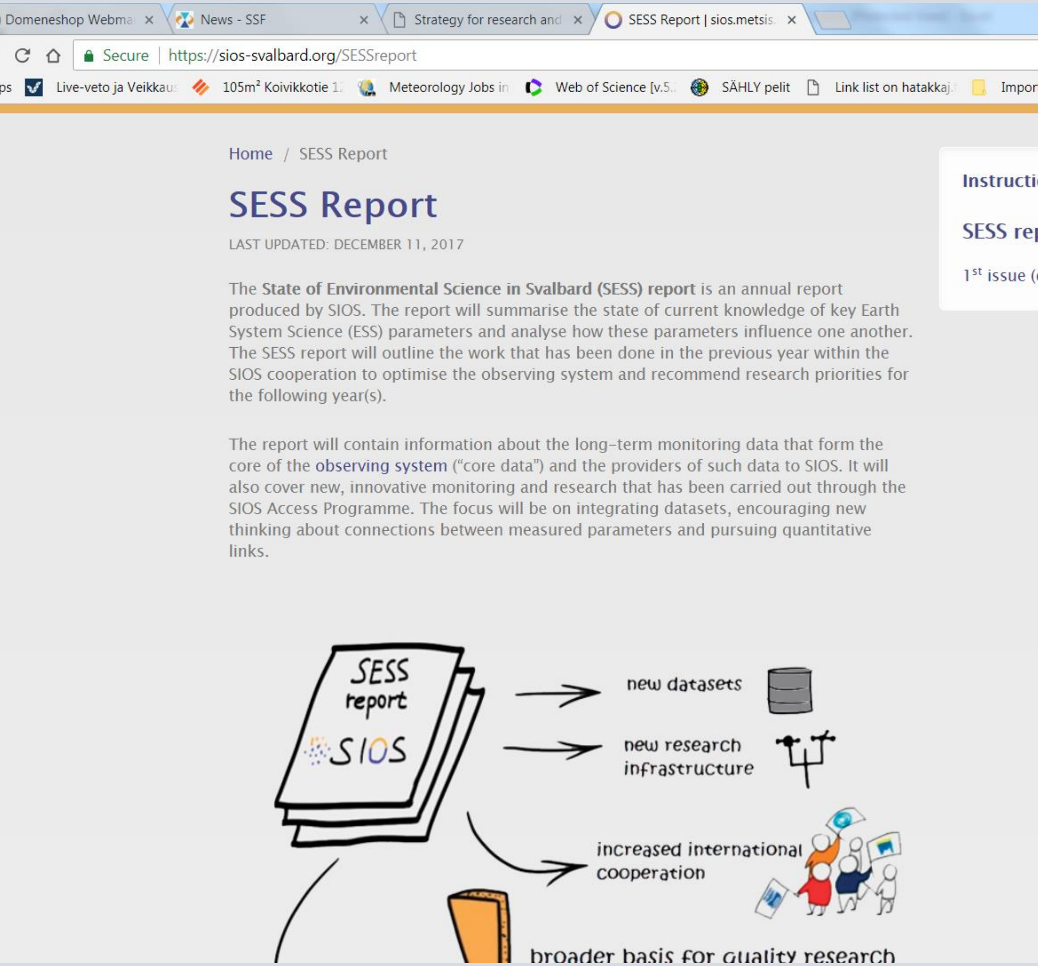
The leader group will be jointly responsible for making budget priorities, ensuring that the implementation plan is followed and making the strategic decisions needed to ensure the success of SIOS-InfraNor.

The leader group will have regular meetings (web) **at least every second** week in the initial part of the project; later in the project period meetings will be according to need.

At least two meetings (in person) each year will be hosted by UNIS or other partner institutions. Importantly, in order to ensure the engagement and direct involvement of the module leaders in the management of the project, some salary for the first 5-year period is earmarked through the project.

The partner group consisting of one representative from each of the partner institutions (IMR, MET, NERSC, NGU, NILU, NINA, NIVA, NORUT, NPI, NVE, UNIS, UiB, UiO, UiT) will function as a “general advisory board” for the project during the first five-year period, during which SIOS will host a joint meeting once a year.

During the second five-year period (operational phase), the partners will only meet for a mid-term evaluation and a final closing meeting in 2026.



Domeneshop Webma | News - SSF | Strategy for research and | SESS Report | sios.metsis

Secure | https://sios-svalbard.org/SESSreport

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Home / SESS Report

SESS Report

LAST UPDATED: DECEMBER 11, 2017

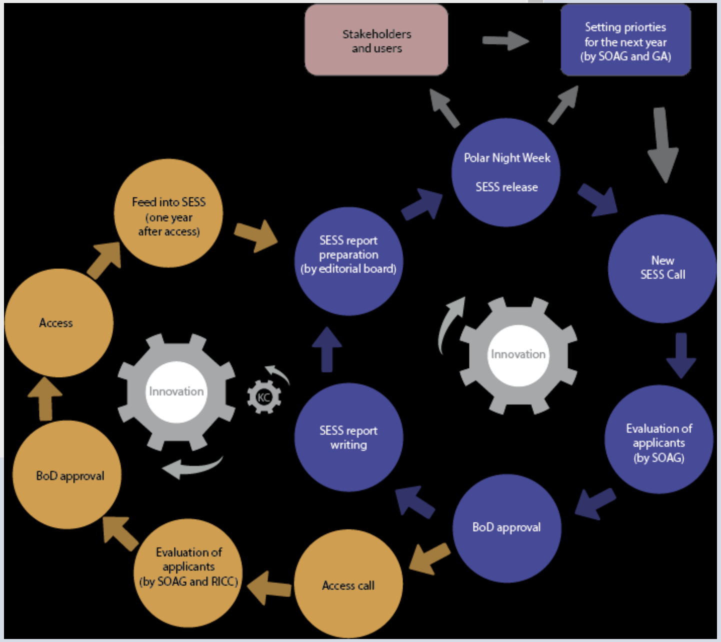
The **State of Environmental Science in Svalbard (SESS) report** is an annual report produced by SIOS. The report will summarise the state of current knowledge of key Earth System Science (ESS) parameters and analyse how these parameters influence one another. The SESS report will outline the work that has been done in the previous year within the SIOS cooperation to optimise the observing system and recommend research priorities for the following year(s).

The report will contain information about the long-term monitoring data that form the core of the observing system ("core data") and the providers of such data to SIOS. It will also cover new, innovative monitoring and research that has been carried out through the SIOS Access Programme. The focus will be on integrating datasets, encouraging new thinking about connections between measured parameters and pursuing quantitative links.

Instructions to Authors

SESS reports

1st issue (due 2018)



The preliminary SESS report in 2018 will be made accessible in early summer and will contain contributions from funded SESS project proposals submitted to the SIOS pilot call in 2018.

However, SIOS should encourage other relevant research groups to contribute with additional chapters both to the preliminary report and also to the final SESS report which will be released in December during the SIOS Polar Night Week in Longyearbyen.

Nota bene: that the annual wheel is designed such that priorities in coming years can only be based on entries in the previous years SESS report.

Editorial Board		
NN		
NN		
NN - APECS representative		
SESS report chapters - funded		
Hanne Christiansen		permafrost
Jean-Charles Gallet		snow cover
Manuel Bensi		ocean-atmosphere interaction
David Pearce		microbiology
Angelo Viola		Lower atmosphere
Finlo Cottier		Oceanography
SESS report chapters - potential additional contributors		
Boyan Petkov		UV O3 (UV-ICARE)
Marion Maturilli		Meteorology
Åshild Pedersen		Terrestrial ecology (COAT)
Jøran Moen		Ionosphere (GCI CUSP)
Martin Edwards		Marine ecology (plankton)
Mike Retelle		Hydrology
????		Nansen legacy?

Spend the money!!! Much easier for you, us and RCN!!!

Table of milestones by end of August together with module leaders,

We will send doodle for the first leader group meeting before midsummer leaders (Georg Hansen, Jørgen Berge, Åshild Pedersen, Rune Storvold, Øystein Godøy)

12:00 - Lunch

13:00 - Data management (Øystein Godøy)

14:00 - Project administration - contracts, invoicing, reporting requirements, milestones etc. (Inger Jennings)

14:15 - BREAK

14:30 - COAT as a core element of the terrestrial biosphere part of SIOS (Åshild Pedersen)

14:40 - Unhanded platforms (Gliders) and Ferryboxes in marine research (Stig Falk-Petersen, Kai Sørensen)

14:50 - Weather stations as part of an integrated, multidomain monitoring network (Ketil Isaksen)

15:05 - InfraNor in the context of SIOS as a whole - bringing in an international perspective (Hanne Christiansen)

15:15 - InfraNor - contributions to the SESS report (Heikki Lihavainen)

15:30 - AOB

SIOS-InfraNor
Module 1 - Atmosphere

Georg H. Hansen[1], Lars-Anders Breivik[2], Ketil Isaksen[2], Jøran I. Moen[3], Chris Hall[4], Markus Fiebig[1], Stelios Kazadzis[5]

[1]NILU-Norsk institutt for luftforskning, [2]Meteorologisk institutt, [3]Universitetet i Oslo, [4]UiT – Norges arktiske universitet, [5]PMOD-WRC (Switzerland)

Overview

Atmospheric module initially rather fragmented:

- Upgrade of an existing network of meteorological stations (basic infrastructure for all modules)
- Large investments in campaign-type activities in upper atmosphere/ space research, complemented by upgrade of long-term monitoring instruments
- Complementation of an existing comprehensive international lower atmosphere and climate observation network
- Reduction of the SIOS-InfraNor budget has further increased this fragmentation, with major investment focus on the upper atmosphere rocket initiative

Verlegenhuken

8 m a.s.l.

Upgrade of Automatic Weather Stations (AWS)

Verlegenhuken & Edgeøya

- Short and long wave radiation sensors (pyranometer, pyrgeometer)
- Infrared Surface (skin) temperature
- Snow depth measurements
- New tower and energy supply (combined solar power and wind turbines)

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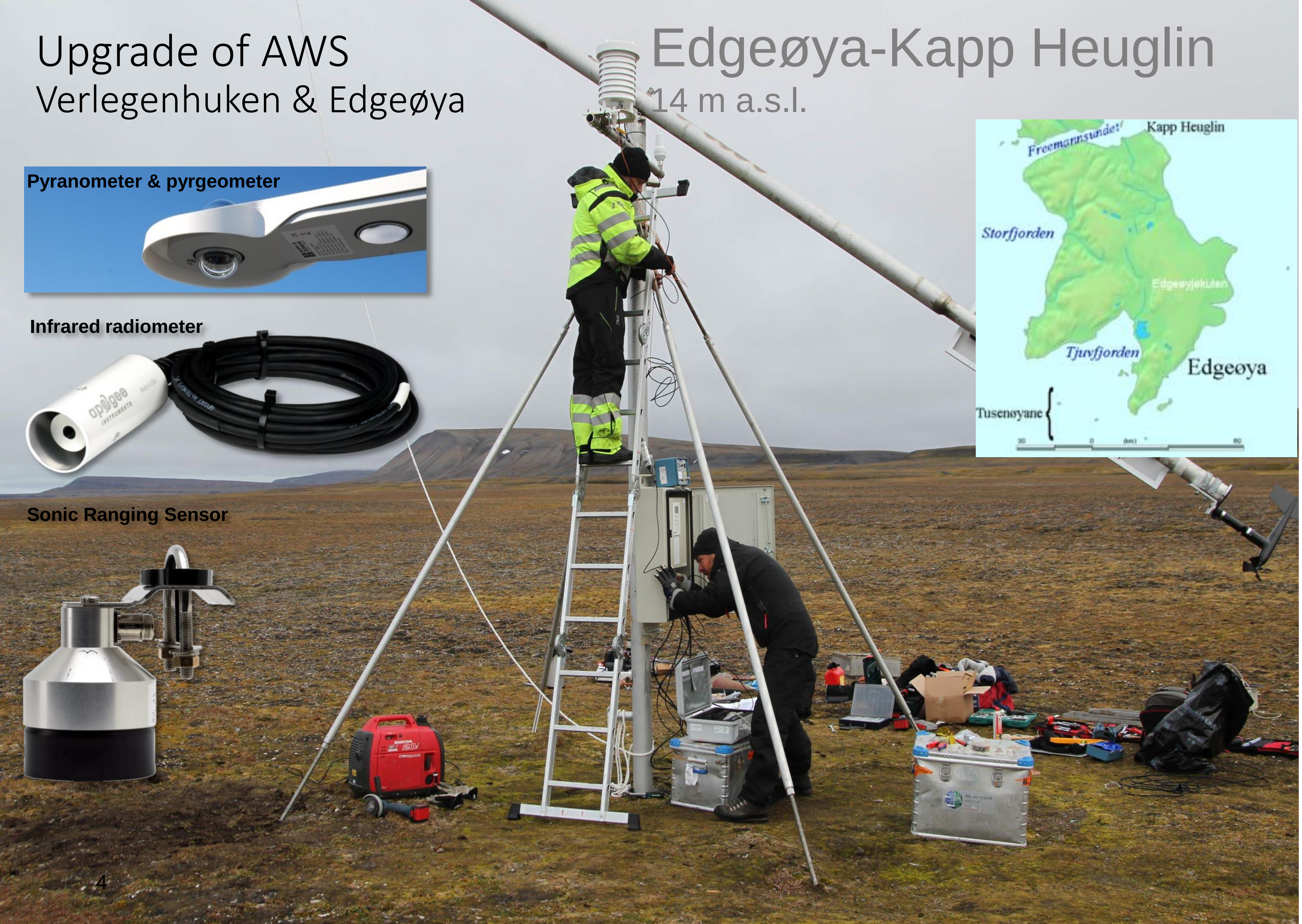
Upgrade of AWS
Verlegenhuken & Edgeøya

Edgeøya-Kapp Heuglin
14 m a.s.l.



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Time plan:

- **Ongoing:** planning and specification of modifications
- **Autumn 2018:** Establishment of a test station near Longyearbyen to get experience with new set-up, energy requirements
- **August 2019:** Installation of new sensors at the selected stations in connection with general inspection of stations.

SIOS InfraNor Rocket

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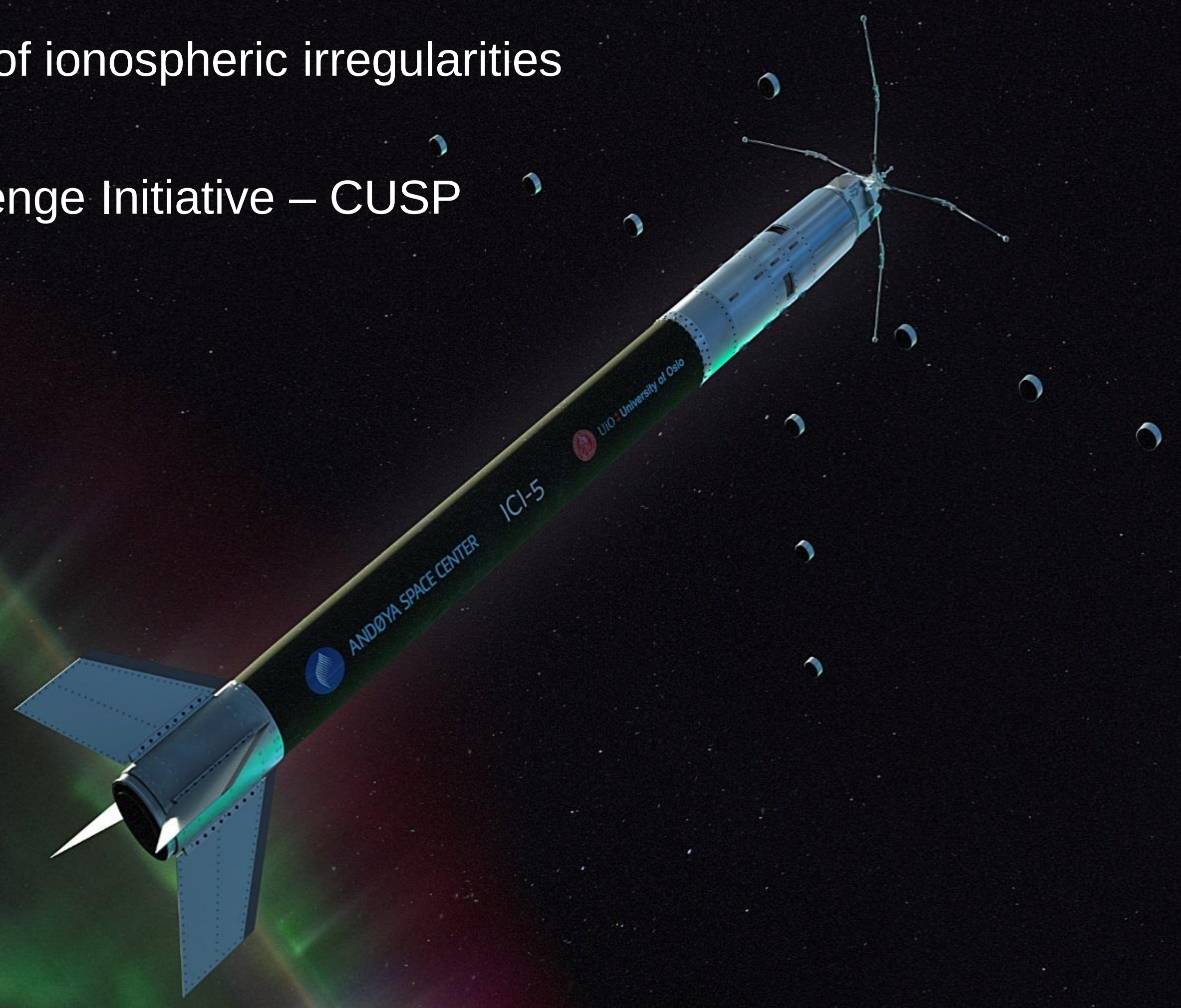
ICI-5 :

4D in-situ observations of ionospheric irregularities in the CUSP

Part of the Grand Challenge Initiative – CUSP project

Dec 2019



The Grand Challenge Initiative – CUSP project

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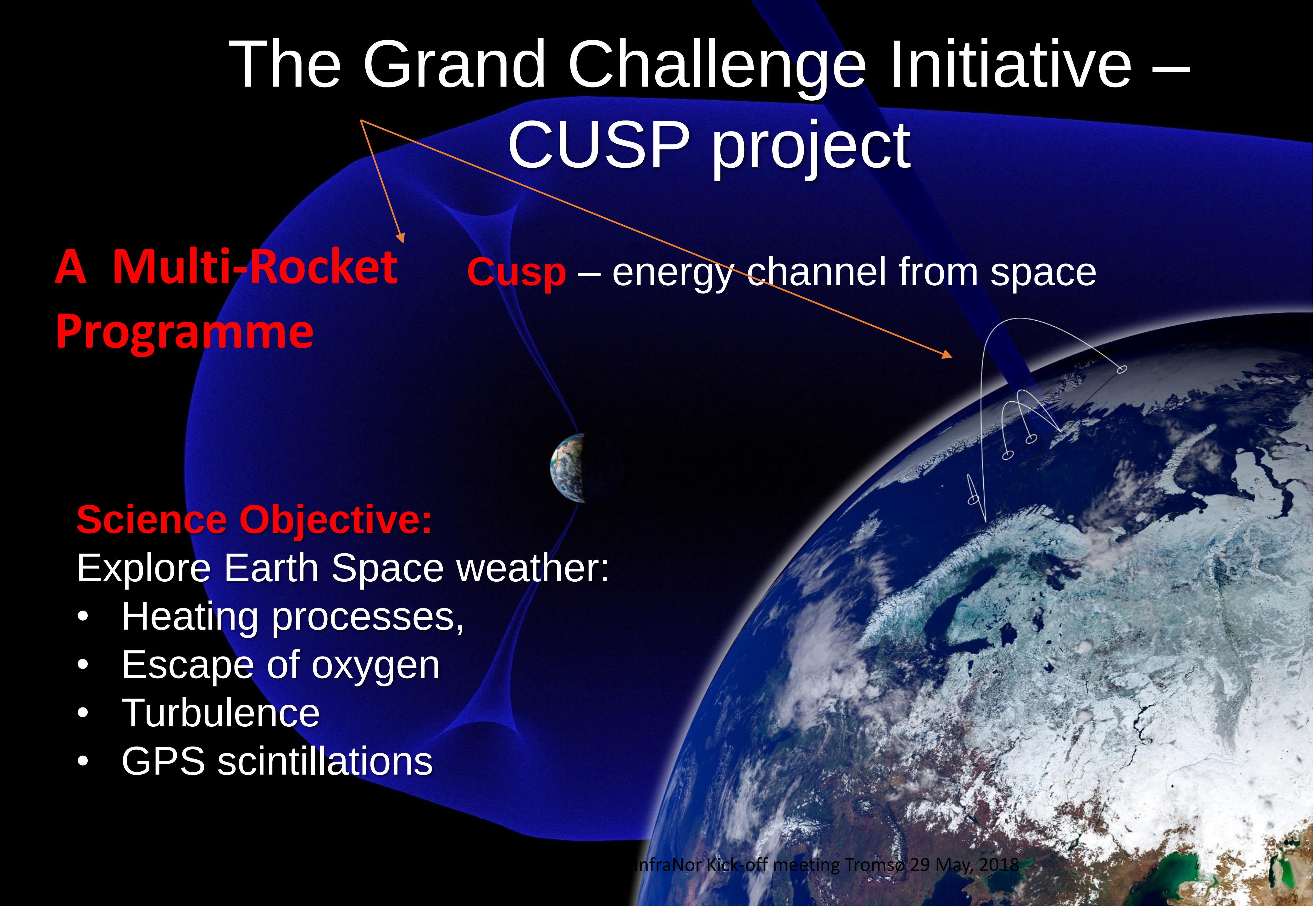

A Multi-Rocket Programme

Cusp – energy channel from space

Science Objective:

Explore Earth Space weather:

- Heating processes,
- Escape of oxygen
- Turbulence
- GPS scintillations

GCI: 8 missions, 11 rockets

- March 2018 Andøya
  NASA 51.001 & 51.002 Larsen AZURE - 2100 – 2200 UT
- December 2018 Andøya
  NASA 52.003 & 52.004 Kletzing TRICE 2 - 0700 – 1100 UT
- December 2018 Ny-Ålesund
  NASA 35.039 & 35.040 Rowland VISIONS 2 - 0800 – 1200 UT
- January 2019 Ny-Ålesund
  JAXA Saito SS520-3 - 0700 – 1100 UT
- January 2019 Andøya
  NASA 52.005 LaBelle CAPER 2
- January 2019 Andøya
  NASA 46.018 Koehler G-Chaser - 0700 – 1100 UT
- November – December 2019 Andøya
  NASA XX.XXX Conde C-REX 2 - 0800 – 1200 UT?
  For November 30 the window would be 0842 – 1058 UT
- December 2019 Ny-Ålesund
  ICI5 Moen - 0800 – 1200 UT

Photo: Kolbjørn Blix

ICI-5 instrumentation

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- m-NLP : multi –Needle Langmuir Probe system – UiO
- 4DSpace 12 daughter sub-payload module (UiO/ASC)
- BSM : Bifocal Sensor electron spectrometer (10eV-2keV) U Iowa
- EFW : Electric Field and Wave Experiment, UiO
- FGM : Flux Gate Magnetometer U Alberta/U Iowa
- SRADS: Sounding Rocket Attitude Detection System, UiO

Funding : Does not include scientific instruments

C#		Funding	2017	2018	2019	2020	SUM
4	Payload	2.1 own		115	215		330
4	Payload	2.3 NSC	2000				2000
4	**Payload**	**2.5 RCN**		**760**	**2000**		**2760**
5	Campaign	2.1 own				373	373
5	Campaign	2.3 NSC			2000		2000
5	**Campaign**	**2.5 RCN**				**4300**	**4300**
6	Motor	2.1 own					
6	Motor	2.3 NSC					
6	**Motor**	**2.5 RCN**		**3336**	**2224**		**5560**
		Total					17323

UiO : 703 kNOK NSC : 4000 kNOK **SIOS-InfraNor : 12620 kNOK**

ICI-5 Time plan

1Q-2Q 2018 :	Design review meeting
3Q 2018-2Q 2019:	Instrument production
1Q 2019 :	1st Integration
3Q 2019 :	2nd Integration and env. tests
4Q 2019 :	Campaign Ny-Ålesund

Launch Window:
24 November- 8 December 2019
07:00-12:00 UT (10-15MLT)

SOUSY MST radar upgrade

(UiT – The Arctic University of Norway, PI: Chris Hall)

We have a web page for the SOUSY radar with pictures of the outside / inside and links to data:
http://radars.uit.no/sousy/index.html

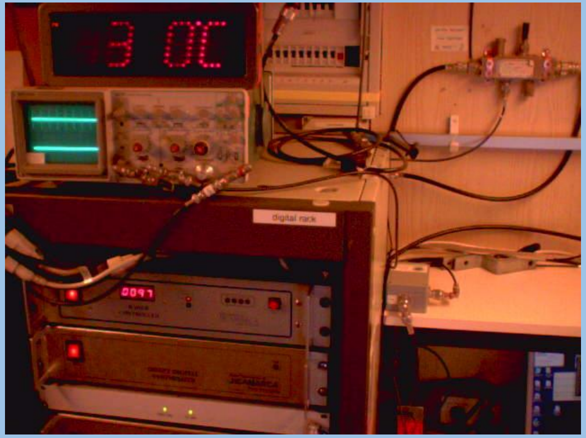
The plan is to:

1. replace the cabling to each of the Yagis,
2. improve the working conditions (containers) to make the system more reliable (and added value creating more capacity for guest instruments)
3. replace the data acquisition with a state-of-the-art ATRAD system – compatible with the equipment already in use including the meteor radar
4. replace the transmitter, including providing a reserve unit

…all (hopefully) allowing us to get echoes low in the **troposphere** and upwards to the **PMSE**, and with the possibility to use SOUSY as a 503MHz **riometer** as well.

Antenna array – 356 Yagis - improvement #1

From radar container roof towards the road – improvement #2



Upgrade data acquisition systems & transmitters – improvements #3 & 4

BUDGET OVERVIEW - SOUSY UPGRADE

1. CABLING – REPAIR OF EXISTING ANTENNA ARRAY
   a. All new cables and connectors from containers out to antenna elements: **kNOK 380** (calculated in-house using documentation on cable topology from Max-Planck-Institute, price incl. VAT since cables and connectors must be assembled in Tromsø)

1. RADAR SYSTEM UPGRADE: **kNOK 904** (non-committal offers from supplier)

1. RESERVE TRANSMITTER UNIT:**kNOK 301** (non-committal offers from supplier)

1. BUILDING / INFRASTRUCTURE UPGRADE: **kNOK 1795 (offers to be invited from suitable contractors)**

Aerodynamic Particle Sizer (APS) for Zeppelin

- Measures coarse range particle number size distribution
  ($0.6\ \mu m < D_p < 20\ \mu m$)
- Provides aerodynamic particle size, i.e. significantly less systematic uncertainty as compared to optical sizing.
- Together with existing mobility size spectrometer, covers particle size distribution of full aerosol size range
  ($0.01\ \mu m < D_p < 20\ \mu m$)
- Instrument ordered
- To be installed at Zeppelin during 4th quarter of 2018

news & views

nature climate change 3, 443

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ATMOSPHERIC SCIENCE

Dust ma

Climate change is amplifie
particles and other aerosol

Peter Knippertz

Tiny dust particles originati
the world's deserts are cer
not the first things that sp
mind for most people when thir
about the polar regions. Althou
has long been known that dust c
transported over very long dista
the many different roles that the
particles play in the climate syst
only recently been fully appreci
Their impacts reach from effects on
radiation, clouds and precipitation, to the
fertilization of ecosystems and associated

scribes how dust

-2)

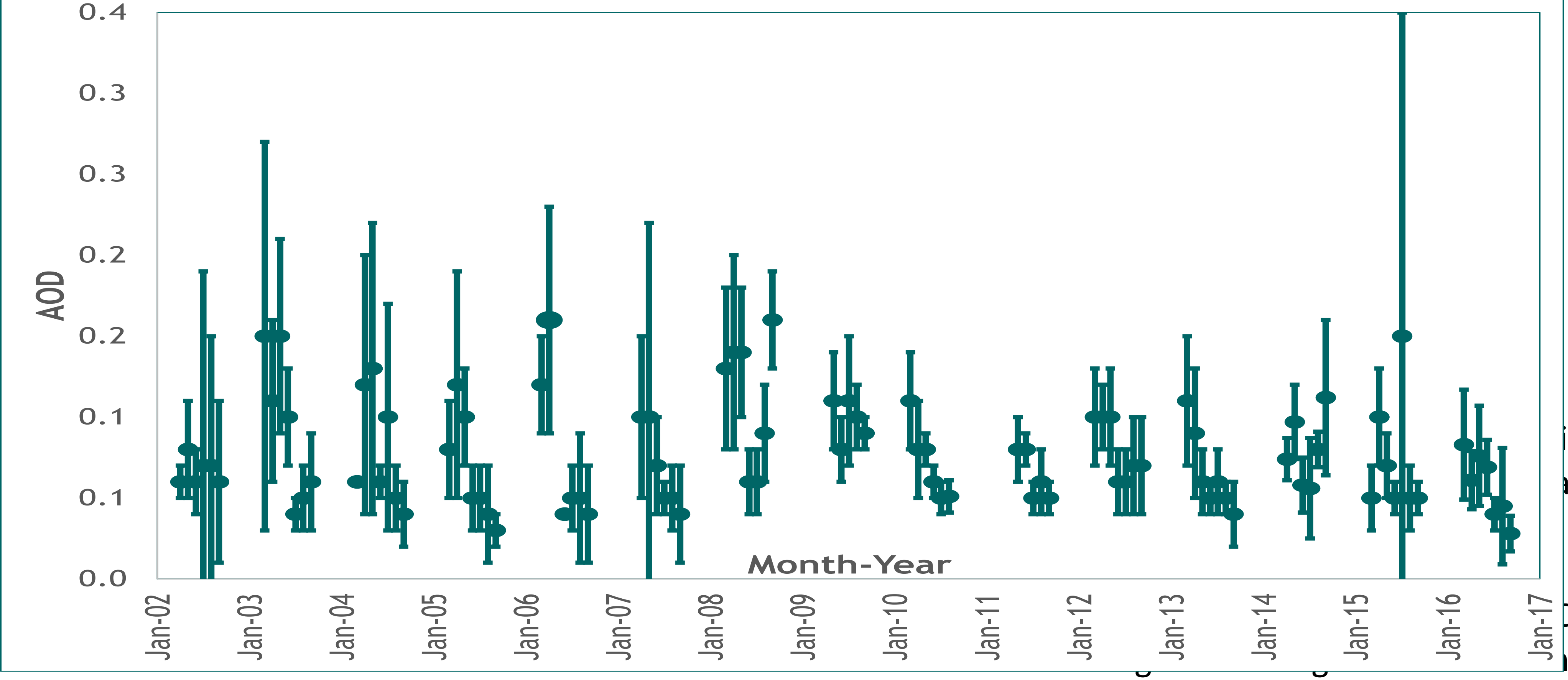
Number of surface in situ observations (standard traceable) of coarse-range particle size distribution in the Arctic archived in World Data Centre for Aerosol:

0

°E

25° W   0°

Zwaaftink et al., ACP 17,



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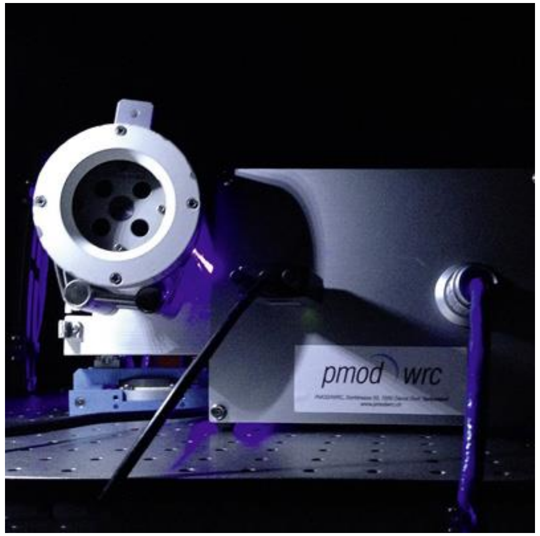
in Ny-Ålesund
and PMOD-WRC

D) on 4
t in direct-sun
configuration

- Due to illumination requirements measurements limited to period mid-March to beginning of October, no turbidity information from Arctic winter/polar night
- Alternatives: lunar, star photometry
- Challenge: brightness of light source (moon: $<10^{-5}$ sun intensity, stars: $<10^{-11}$ sun intensity)



Lunar Precision Filter Radiometer (PFR)

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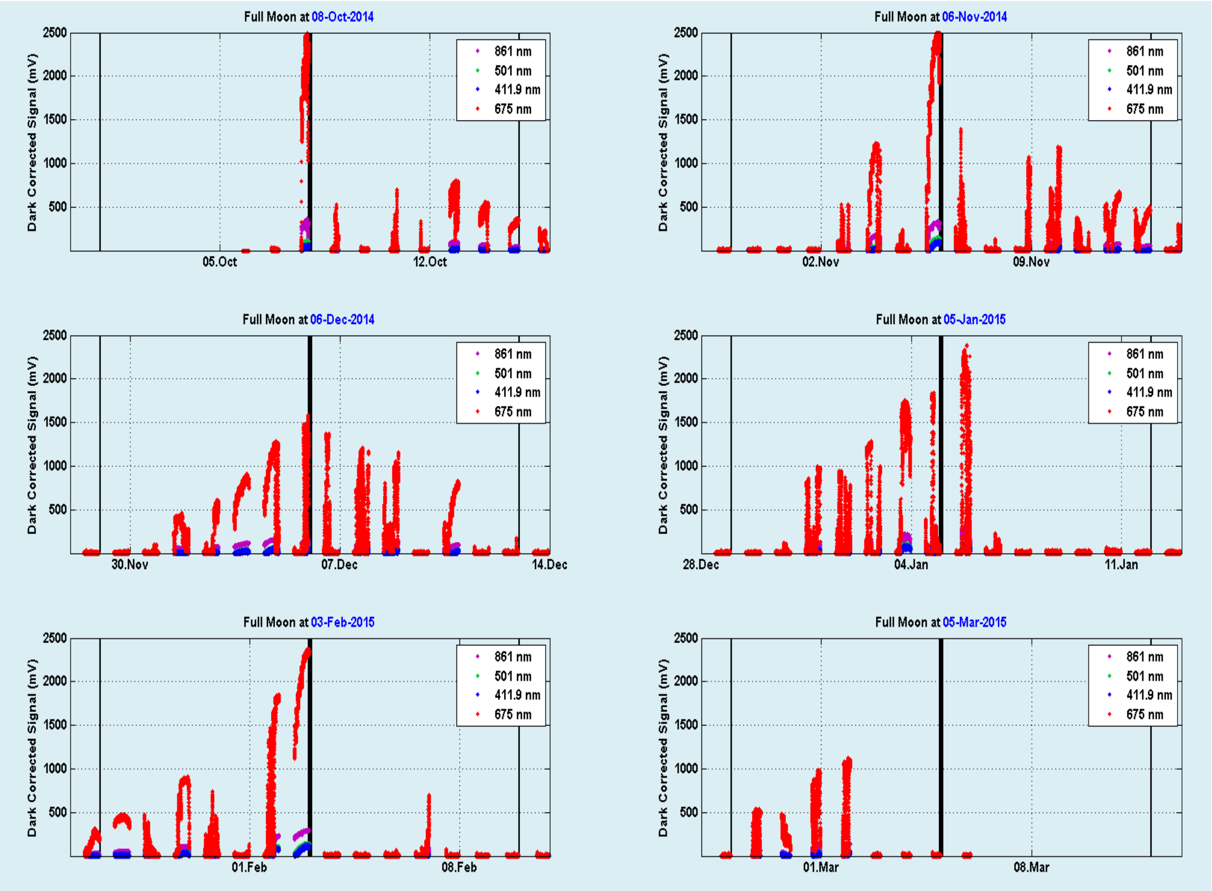


6 full moon cycles measured: October 2014 to March 2015 (Ny Alesund)

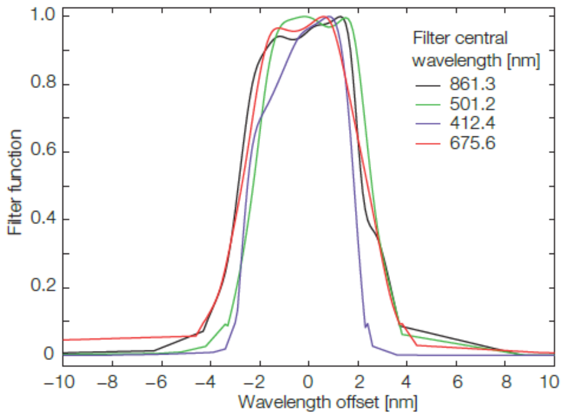
Lunar Arctic Project (March 2014 – June 2015)

- funded by the Svalbard Science Foundation
- aimed to close the gap in the annual cycle of the arctic aerosol climatology and to develop Svalbard as a satellite validation site.
- PMOD/WRC: modification of an existing PFR and its deployment at Ny Ålesund (aim: lunar irradiance measurements with an uncertainty of less than 5% (k = 2))
- October 2015: upgrading of prototype lunar PFR – increase of sensitivity by a factor 10 in 3 of the 4 channels
- Further deployments of lunar PFR at Ny Ålesund:
  - December 2015 to February 2016
  - November 2016 to February 2017

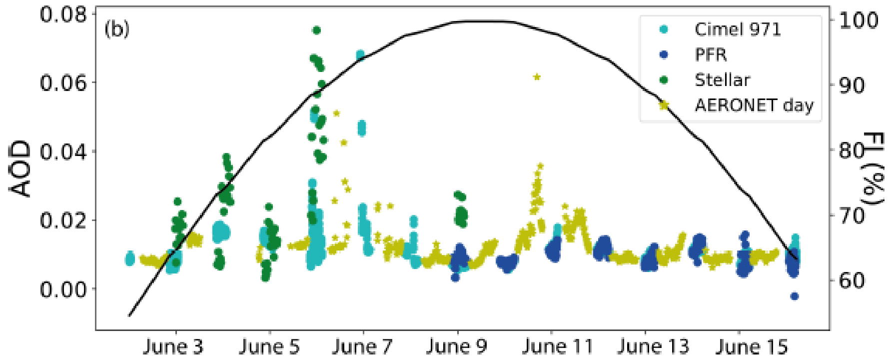
➔ monitor AOD during the Arctic winter, in collaboration with partners from NILU (Norway), ISAC/CNR (Italy), AWI (Germany), NOAA/CIRES (US), and IGF/PAS (Poland)

Lunar PFR

Aerosol Optical Depth: 412.4, 501.2, 675.6, 861.3 nm
Moon-pointing on tracker
FOV 1.3 deg., FWHM = 5nm
Calibration each Summer at Davos or Izana, Spain
Upgrade 2017: sensitivity increase through improvments on the optical aperture and increase of the electronic gain.



Lunar PFR filter function characterization



Lunar AOD (at 675 nm) comparison in Tenerife, July, 2017. Barreto et al., 2018 under review

<u>Plan</u>:
re-deployment of the existing instrument on an annual basis during the winter months, calibration at PMOD during summer
2018: calibration ongoing; re-deployment in Ny-Ålesund in September/October

Summary

- AMS upgrade: in two stages – test operation in Longyearbyen 2018/19, to be moved to remote sites in 2019
- ICI rocket campaign: as scheduled
- SOUSY radar upgrade: to some degree this year, while bid-dependent upgrade (buildings) might have to be postponed to 2019
- APS: instrument ordered, to be deployed by end of this year
- Re-deployment of lunar PFR is planned as scheduled in proposal
- In total: **no deviations from schedule!**

Module 2 - Terrestrial

The SIOS land module

Åshild Ø. Pedersen
Norwegian Polar Institute
COAT Svalbard lead / SIOS landmodule lead
Researcher/terrestrial ecologist
SIOS Kick-off meeting 29.5.2018

Agenda

- Goals of the land module
- Content and focus
- COAT – an integrated core component of SIOS
- Summary of instruments and institutions

Goals

The overarching goal of SIOS is to address the coupled Arctic system and support Earth System Models, but for the process of instrument implementation, a discipline-based modular approach is most reasonable.

In the **land module**, we suggest establishing a joint Arctic Terrestrial Observatory that combines the following key scientific topics:

- glaciology
- snow and ground ice
- hydrology
- permafrost
- biosphere

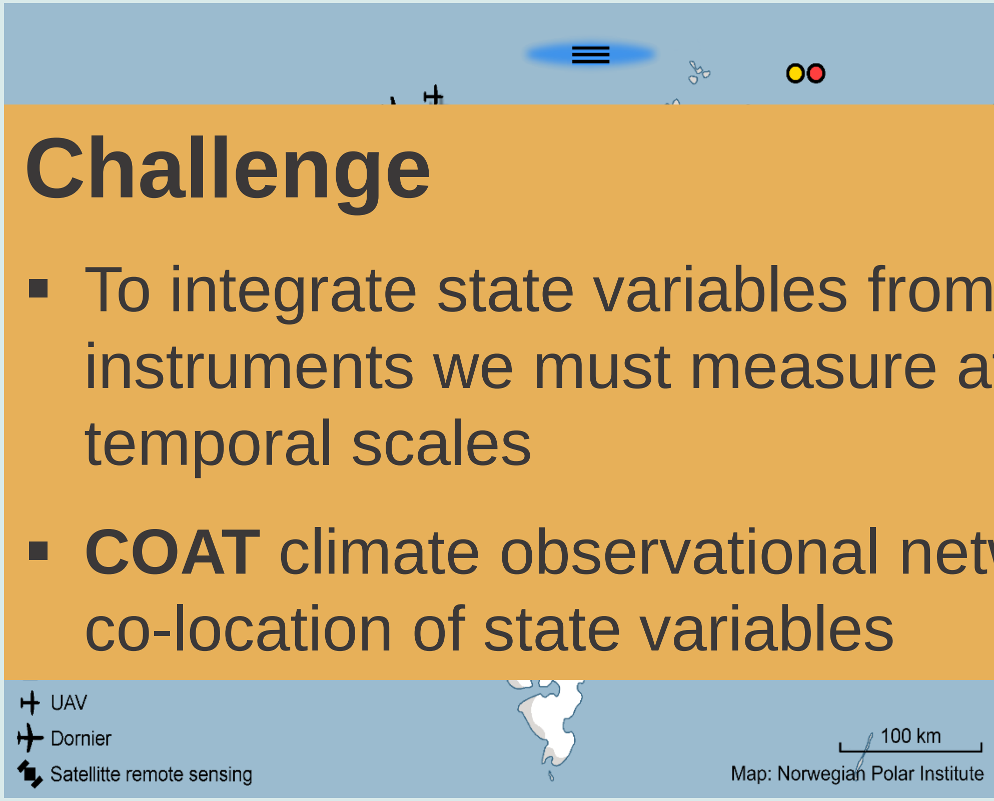
COAT

A core element of the terrestrial biosphere part of SIOS

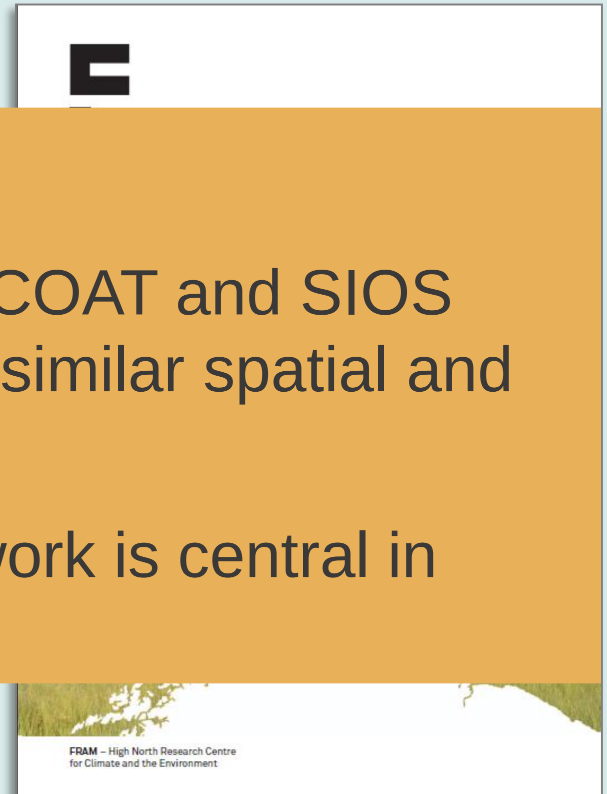
1. **COAT** is a system for long-term ecological research (LTER) and monitoring of arctic ecosystem.
2. **COAT** builds on and expands the ongoing research and long-term monitoring of the tundra ecosystem in Svalbard.
3. **COAT** applies a «**food-web approach»** that targets climate sensitive species and functional groups.
4. **COAT** focuses on 2 drivers of ecosystem changes **«climate change»** and «local management».

Study regions

SIOS regions of Kongsfjorden and Isfjorden



COAT regions



Challenge

- To integrate state variables from COAT and SIOS instruments we must measure at similar spatial and temporal scales
- **COAT** climate observational network is central in co-location of state variables

Land module in numbers…

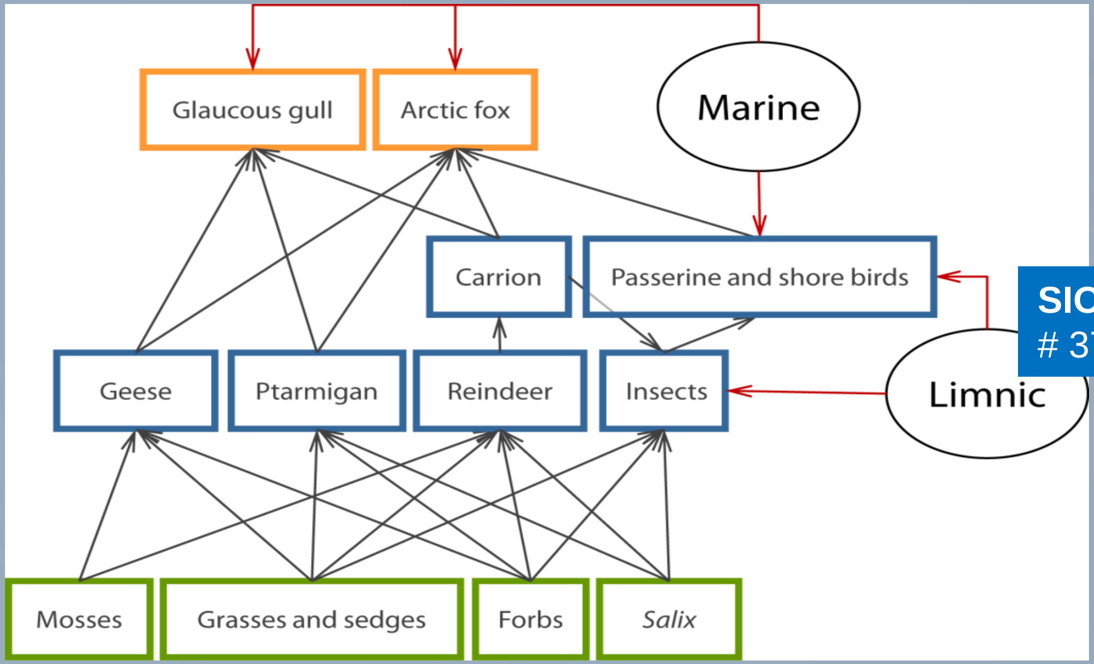
- RCN ≈ 30 mill.
- COAT ≈ 15 mill. + 10 mill. Tromsø Forskningsstiftelse
- Additional from NSC ≈ 11 mill.
- 7 insitutions
- 21 instruments
- 5 COAT food-web monitoring modules
- > 77 tundra state variables
- COAT Climate observational network – 6 NL and 3 west coast

The land module has a great potential for demonstrating integrated monitoring efforts across diciplines where the main compartments within the tundra food-web and the geophysical environment are targeted

The COAT core applies a «**food-web approach»** that targets climate sensitive species / functional groups that are and/or can be locally managed

COAT Climate observational network + SIOS Snow and Glaciology
35, 42, 43, 68, 69, 76

COAT + SIOS Biosphere
44, 45, 49, 51, 52, 53, 70-75, 77



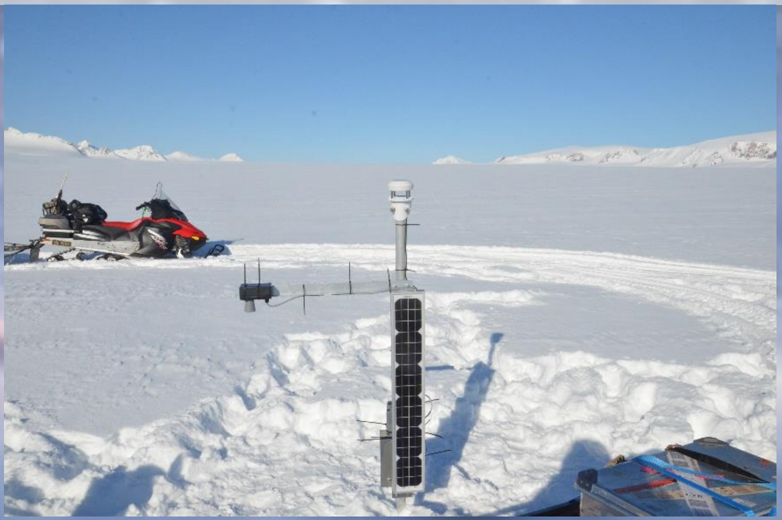
SIOS Hydrology
37

SIOS Permafrost # 31, 41

COAT Climate observational network + SIOS Snow and Glaciology
35, 42, 43, 68, 69, 76

35, 76 (NPI J. C. Gallet)

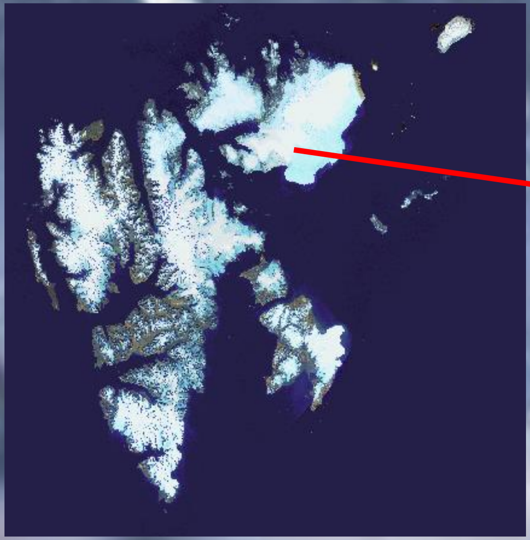
- **Purpose:** Record basic snow parameters on glaciers and land (snow depth, snow temp, albedo, air temp-humidity-wind speed and direction)
- **Implementation:** Install 15 to 20 stations around Ny-Ålesund on glaciers, 5-10 stations in Austfonna
- Tight link to COAT module stations
- **Time series existing:** Snow and ice monitoring on Brøggerhalvøya / Ny-Ålesund and Austfonna

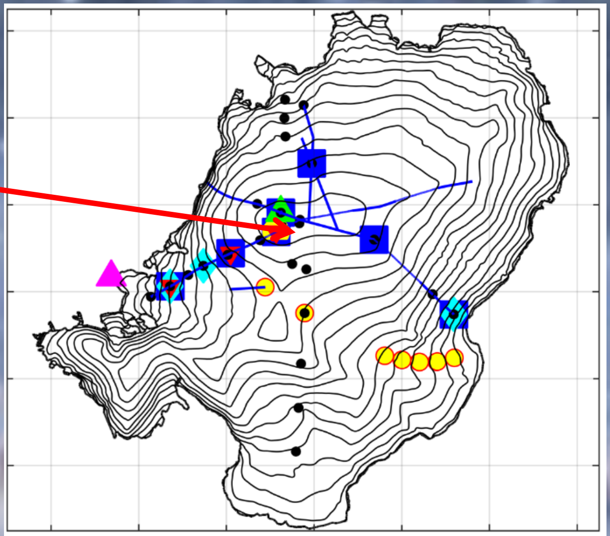


COAT Climate observational network + SIOS Snow and Glaciology
35, 42, 43, 68, 69, 76

69 (UiO J. O. Hagen)

- Meteorological time series over glaciated terrain, above and below the glacier equilibrium line
- Standard AWS + snow measures
- Time series (2004)

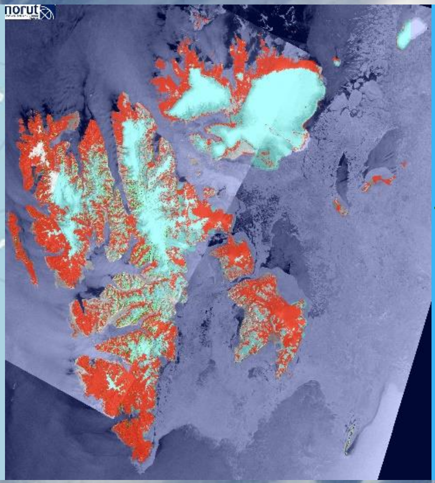


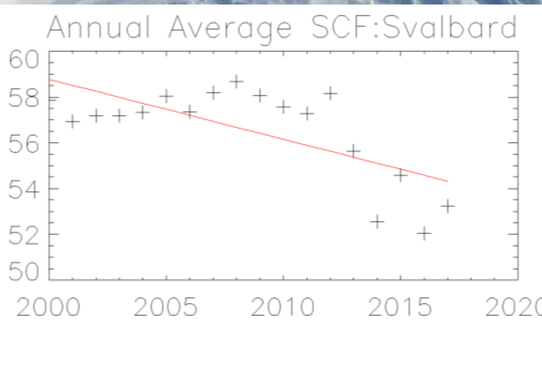


COAT Climate observational network + SIOS Snow and Glaciology
35, 42, 43, 68, 69, 76

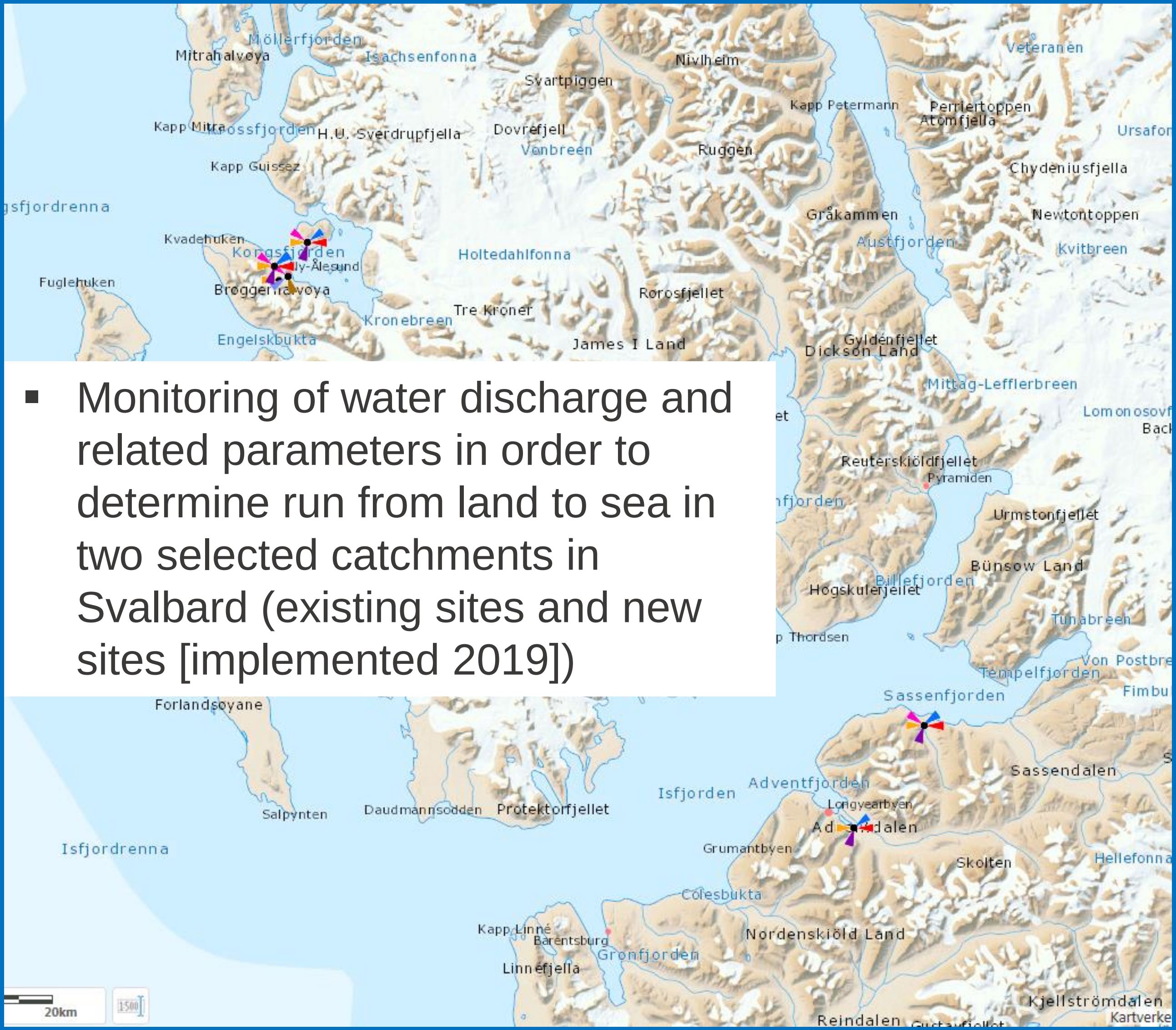
 # 42, 43 (NORUT M. Eckerstorfer, E. Malnes)

- Snow parameter retrieval using remote sensing satellites (# 42)
- Snow parameter retrieval using remote sensing satellites (# 43)
- Field campaign and historical data collection
- Process time-series of snow data (1990-2020)





SIOS Hydrology # 37 (NVE – K. Mevold)



- Monitoring of water discharge and related parameters in order to determine run from land to sea in two selected catchments in Svalbard (existing sites and new sites [implemented 2019])

COAT + SIOS Biosphere # 44, 45, 49, 51, 52, 53, 70-75, 77

- 77 state variables by COAT – fieldbased surveys and from automated instruments
- 6 SIOS instruments

COAT + SIOS Biosphere # 44, 45, 49, 51, 52, 53, 70-75, 77

Herbivore exclosures
(#75 – V. Ravolainen)
To separate effects of reindeer and geese on vegetation under changing climate

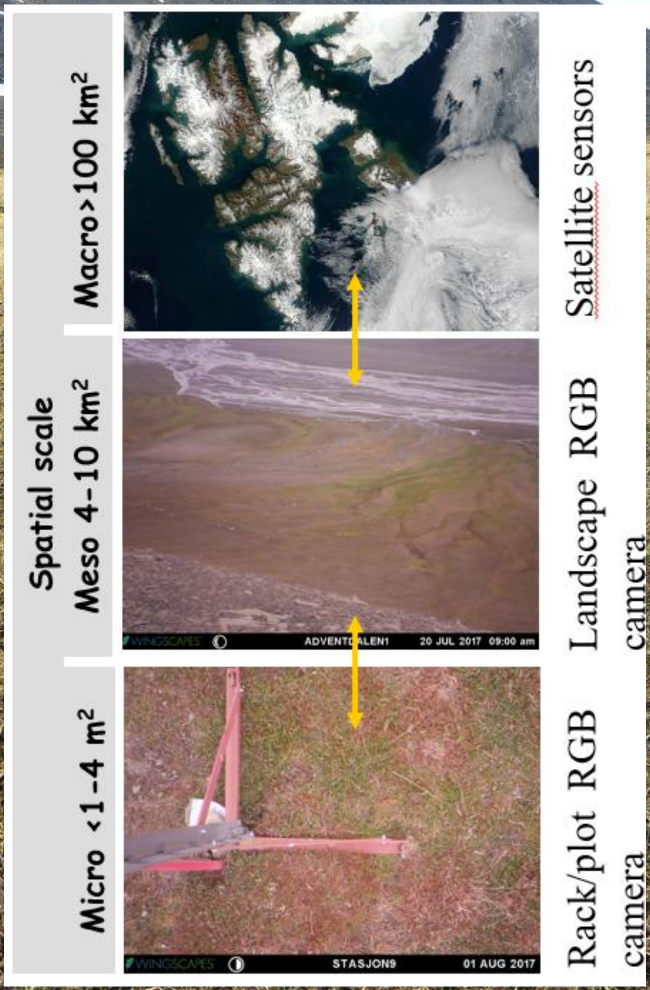
Telemetric equipment
(# 72 – E. Fuglei, Å. Ø. Pedersen, A. Stien)
To monitor spatial responses of animals to changes in their habitats

Automatic cameras
(# 70 - V. Ravolainen and E. Fuglei)
To monitor abundance, predation, vegetation etc.

COAT + SIOS Biosphere # 44, 45, 49, 51, 52, 53, 70-75, 77

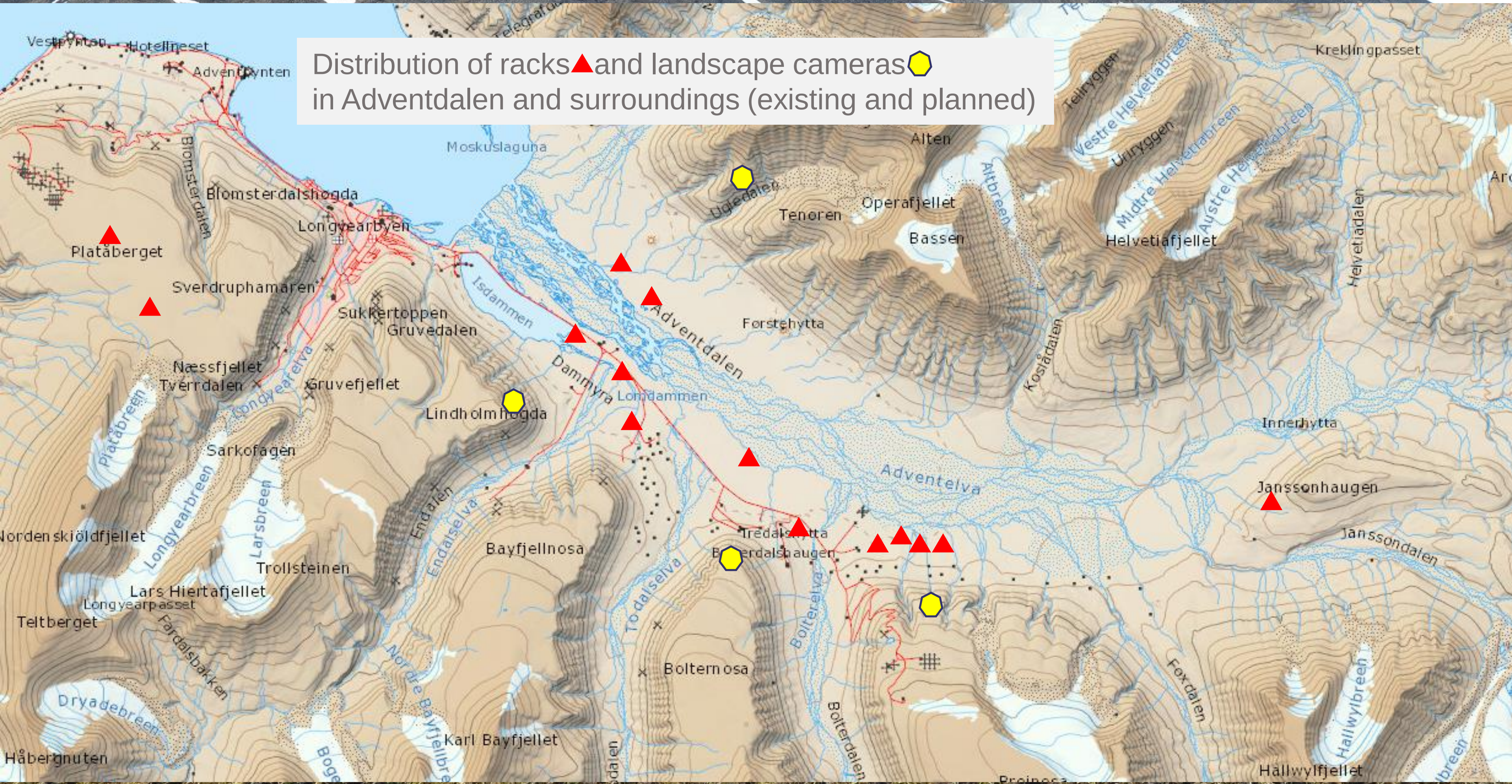
 # 44 (UiT – L. Nilsen), # 45, 51, 52, 53 (Norut - S.R. Karlsen, B. Johansen), # 49 (NINA – H. Tømmervik)

- Establishment of an automatic system for monitoring and mapping vegetation and environmental seasonal changes on Svalbard
  - Recording biophysical changes of vegetation indices, soil temperature and moisture etc.
  - Established cooperation COAT vegetation



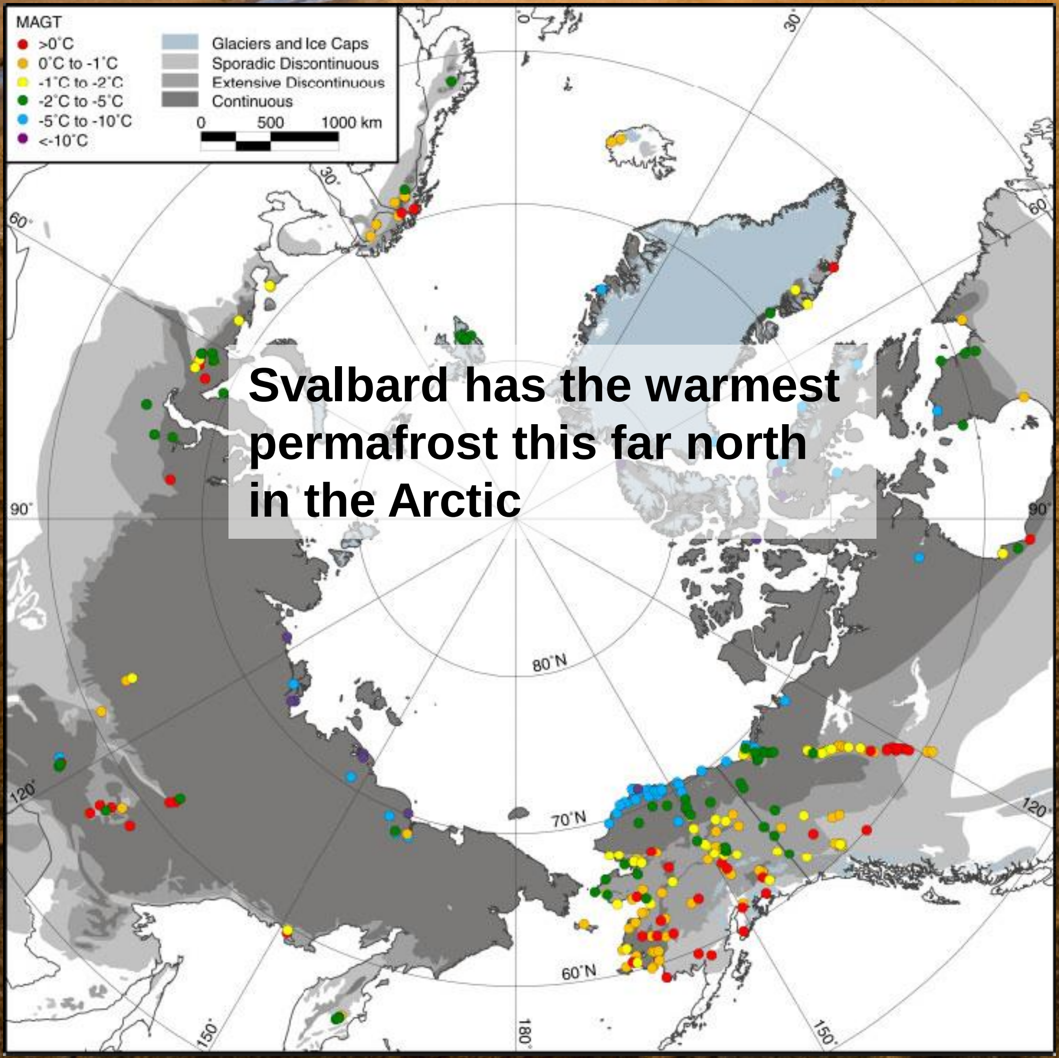
COAT + SIOS Biosphere # 44, 45, 49, 51, 52, 53, 70-75, 77

Distribution of racks and landscape cameras
in Adventdalen and surroundings (existing and planned)



SIOS Permafrost # 31, 41

41 (UNIS H. H. Christiansen)



Svalbard has the warmest permafrost this far north in the Arctic

Goal – to improve permafrost observations in Svalbard

Existing drill rig to be upgraded/ expanded to drill cores from different types of sediment and bedrock

Adventdalen,
Svalbard,
April 2012

SIOS Permafrost # 31, 41

 # 41 (UNIS H. H. Christiansen)

- Upgrade deep boreholes at:
  - (Kapp Linne) and link to exist existing AWS
  - 8 existing boreholes near Longyearbyen
- Establishing one borehole that penetrates the permafrost to about 200 m depth in the Adventdalen area
- Collaboration with met.no on their permafrost instrument # 31 initiated

Implementation – land

- Continuation of time series (immediately) and establishment of new data series within 2-3 years time period of SIOS InfraNor
- 1-3 field seasons with field campains for cal-val studies (1919-2021)
- Pilot studies (2019-2020)

«COAT Svalbard Infrastructure +» 2016-2020

TROMSØ FORSKNINGSSTIFTELSE

SIOS
SVALBARD INTEGRATED ARCTIC EARTH OBSERVING SYSTEM

Forskningsrådet
The Research Council of Norway

Thank you!

COAT TEAM

UiT – Arctic University of Norway
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University of Aberdeen
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Helen Anderson

Århus University
Jesper Madsen

SIOS LAND MODULE

MET
Ketil Isaksen

NINA
H. Tømmervik

NORUT
S.R. Karlsen, B. Johansen,
K.A. Høgda, R. Storvold,
M. Eckerstorfer, E. Malnes

NPI
E. Fuglei
J. C. Gallet
J. Kohler
V. Ravolainen

NVE
K. Mevold

UiO
Jon Ove hagen

UiT
L. Nilsen

UNIS
H. H. Christiansen

SIOS InfraNOR

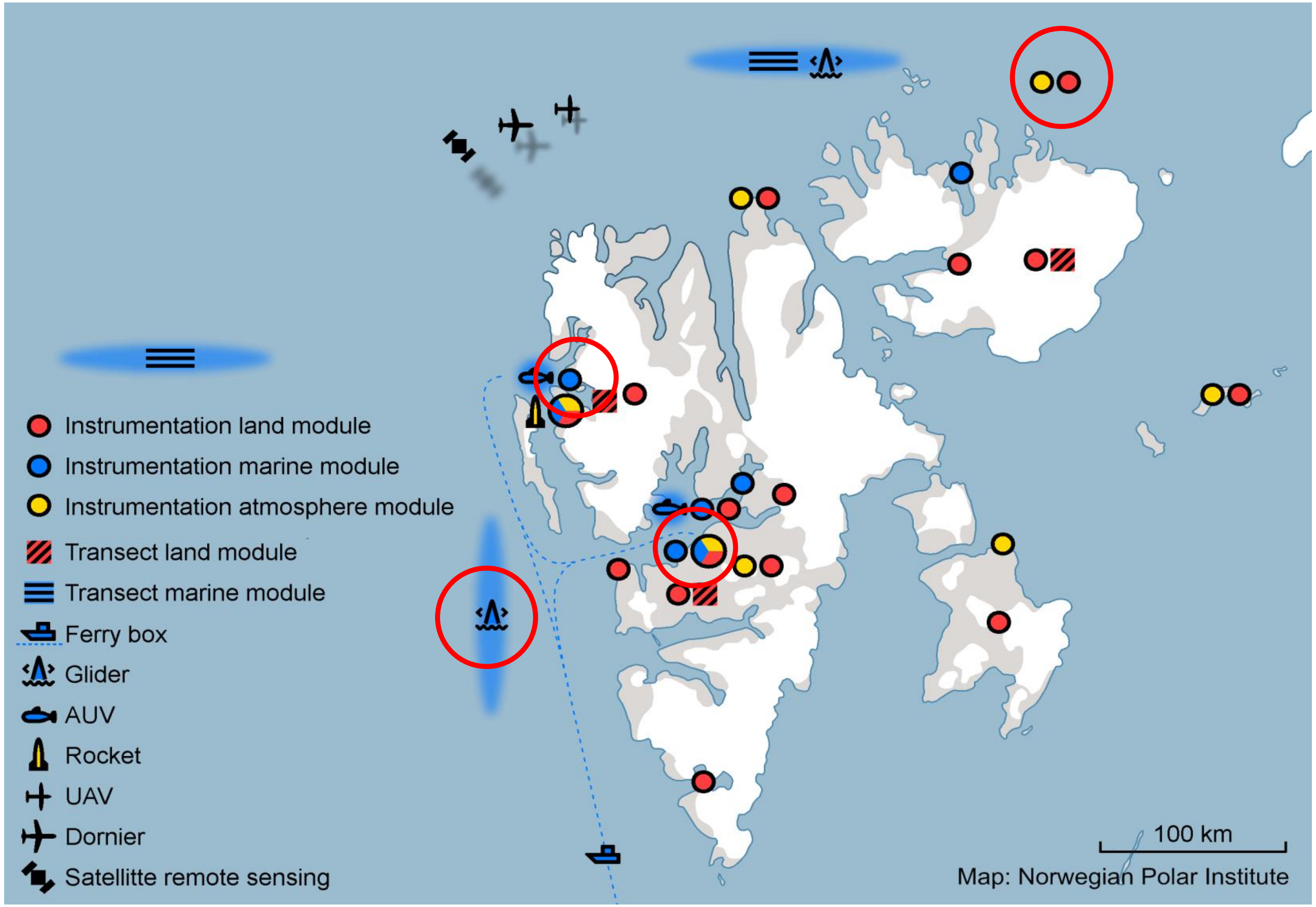
Marine module

Professor Jørgen Berge

ID#	Description	Owner	Cost
56	Ferrybox onboard M/S Norbjørn for continuous measurements of physical and biological data between Tromsø and Longyearbyen	NIVA	5950 (2300)
57	Mooring array in the Fram Strait to measure Arctic Ocean outflow, sensors of physical, biochemical and biological relevance	NPI	21250 (6500)
58	Mooring array north of Svalbard to measure Arctic Ocean inflow, sensors of physical, biochemical and biological relevance. Combined with #59	IMR	11350 (6500)
59	Mooring array north of Svalbard to measure Arctic Ocean inflow, sensors of physical, biochemical and biological relevance. Combined with #58	NPI	8250 (6000)
60	Oceanographic gliders to operate in the fjords and off-shelf west of Svalbard	UiB	9000 (6000)
61	K-landers to measure methane and other greenhouse gas exchange from the sea floor to the sea surface	UiT	12300 (6000)
62	Oceanographic moorings in Kongsfjorden and Rijpfjorden for physical, biochemical and biological time series studies	UiT	13500 (5000)
63	Oceanographic mooring in Isfjorden for physical, biochemical and biological time series studies	UNIS	11600 (5000)
64	Oceanographic mooring in Adventfjorden for physical, biochemical and biological time series studies	NIVA	1000 (700)
65	Waveglider - a platform with capabilities of carrying biological and physical sensor packages for use in the fjord on the west coast of Svalbard	NTNU	6250 (3000)
66	Autonomous underwater vehicle for use in process studies inside the fjords and under sea ice	NTNU	9900 (6000)
	Total cost of Module 3 (allocation from NFR in brackets)		110349 (53000)

22.2mill

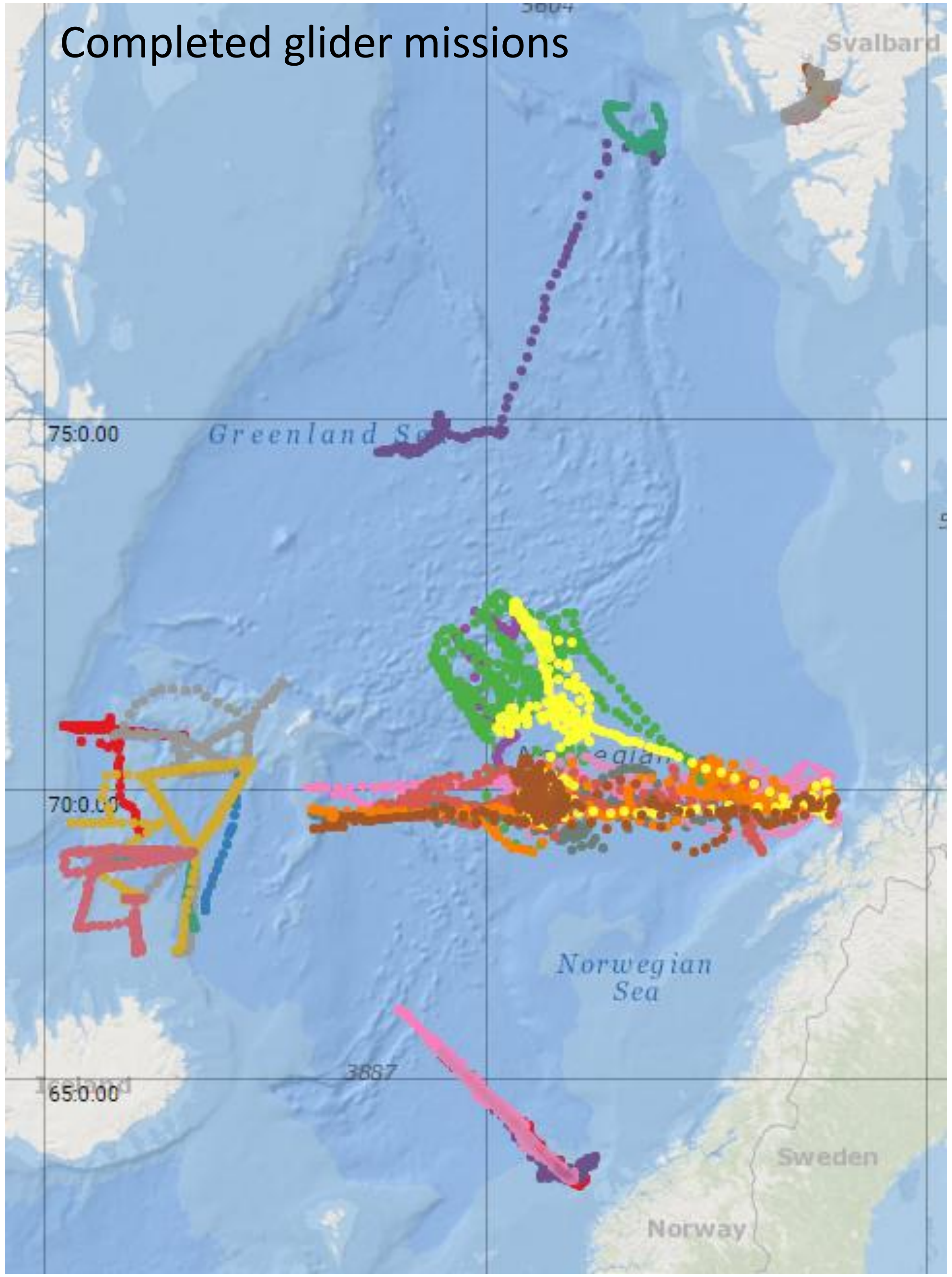
ID#	***Description***	***Owner***	***Cost***	
58	Mooring array north of Svalbard to measure Arctic Ocean inflow, sensors of physical, biochemical and biological relevance. Combined with #59	IMR	14000 (5500)	84%
59	Mooring array north of Svalbard to measure Arctic Ocean inflow, sensors of physical, biochemical and biological relevance. Combined with #58	NPI	7250 (5000)	
60	Oceanographic glider to operate in the fjords and off-shelf west of Svalbard	UiB	9000 (3000)	
61	K-lander to measure methane and other greenhouse gas exchange from the sea floor to the sea surface	UiT	9300 (3000)	50%
62	Oceanographic mooring in Kongsfjorden for physical, biochemical and biological time series studies	UiT	7250 (2500)	
63	Oceanographic mooring in Isfjorden for physical, biochemical and biological time series studies	UNIS	9100 (2500)	
64	Oceanographic mooring in Adventfjorden for physical, biochemical and biological time series studies	NIVA	2000 (700)	100%
	Total cost (10 years) of Module 3 (allocation from RCN in brackets)		70550 (22200)	



Instrumentation land module
Instrumentation marine module
Instrumentation atmosphere module
Transect land module
Transect marine module
Ferry box
Glider
AUV
Rocket
UAV
Dornier
Satellitte remote sensing
100 km
Map: Norwegian Polar Institute

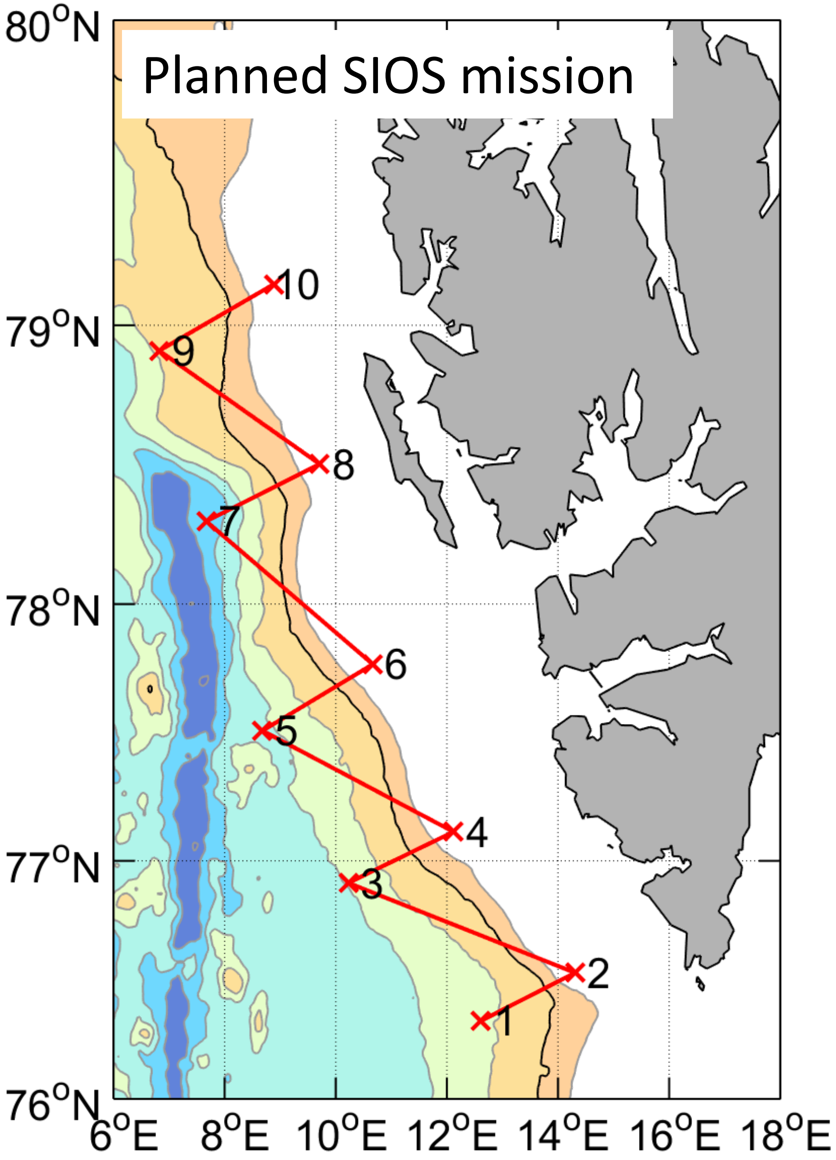
NorGliders: Norwegian National Facility for Ocean Gliders

- http://norgliders.gfi.uib.no
- Formerly NACO (Norwegian Atlantic Current Observatory), NFR-funded infrastructure project in 2011
- As of today, 5 Kongsberg Seagliders, 2 TDW Slocums
- Piloting tool & Gliderpage developed at GFI
- A Glider Lab and 24/7 operation team of pilots
- Real-time data delivery
- Completed missions in Norwegian Sea, Svalbard, Iceland and Greenland Seas



Status in SIOS

- 1 ocean glider will be procured and operated West of Spitsbergen (see map)
- Procurement process is initiated and planned to be completed in 3 months



K-Lander 30 observatory

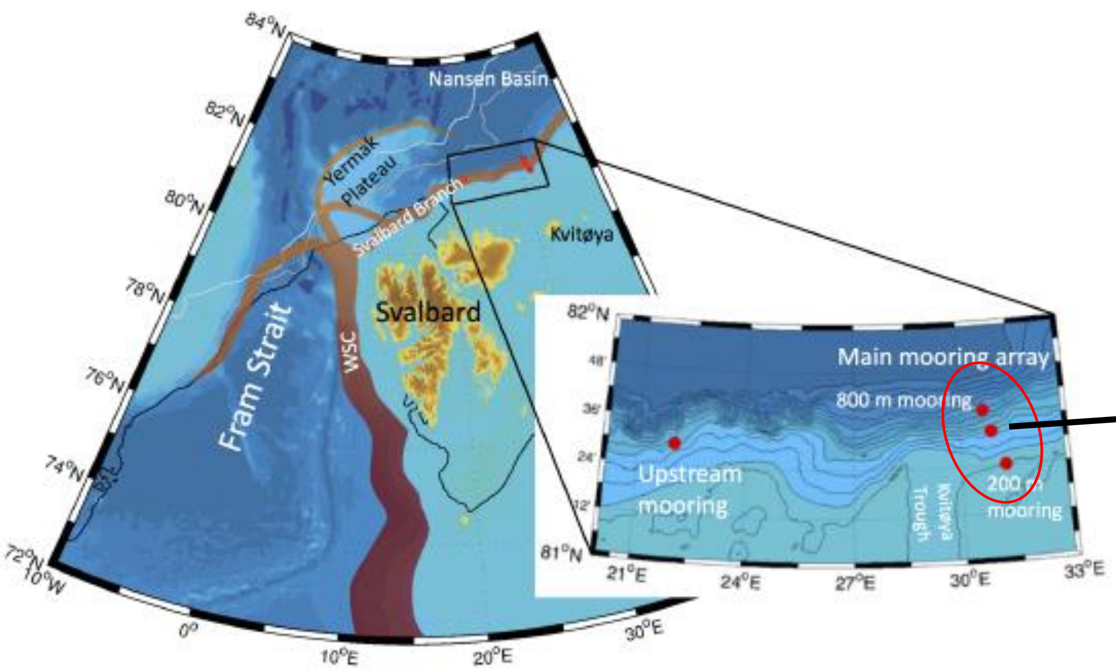
Goal

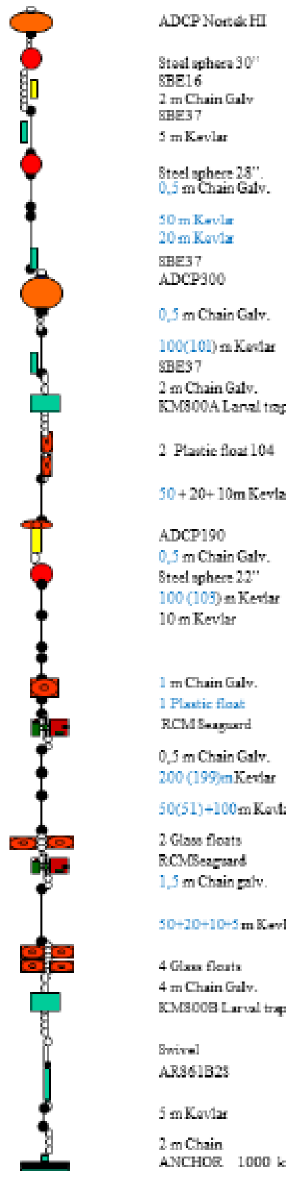
- Estimate methane release and associated physical parameters on a 90m depth area offshore Svalbard
- Continue 2-year time series
- Based on K-landers developed and deployed in collaboration with Kongsberg Maritime

Status

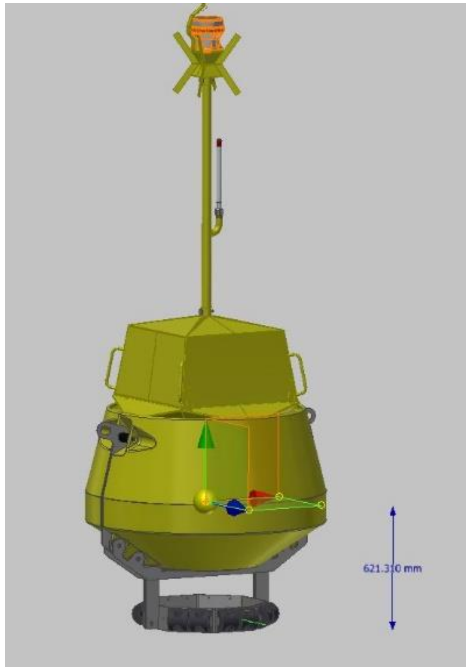
- All instruments sent to manufacturer for calibration and maintenance
- Most of instruments back in Tromsø
- In the process to upgrade the lander – takes time
- Still unsure whether a deployment next summer is possible
- Possibility with Kronsprin Haakon?

Atlantic Water inflow along the continental slope North of Svalbard





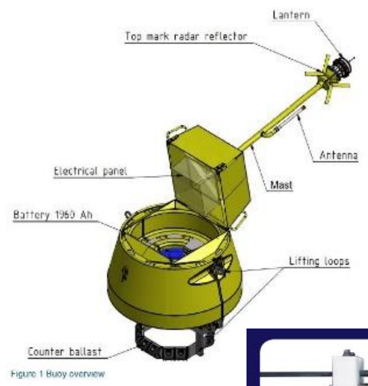
- Planer for instrument- og utstyrskjøp er klare, rammavtaler på plass. Venter på kontrakt.
- Vi satser på å ha tre godt utstyrte rigger ute til enhver tid, med fysikk-instrumentering hovedsakelig fra NP og BGC fra HI.
- Utsettingstokt blir i 2019 – hadde håpet å komme i gang i år men pga kansellerte tokt med Kronsprins Haakon må vi holde oss til den opprinnelige planen fra prosjektforslaget.

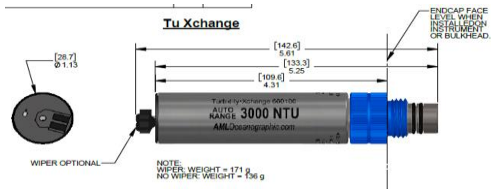


NIVA Buoy in Adventfjorden

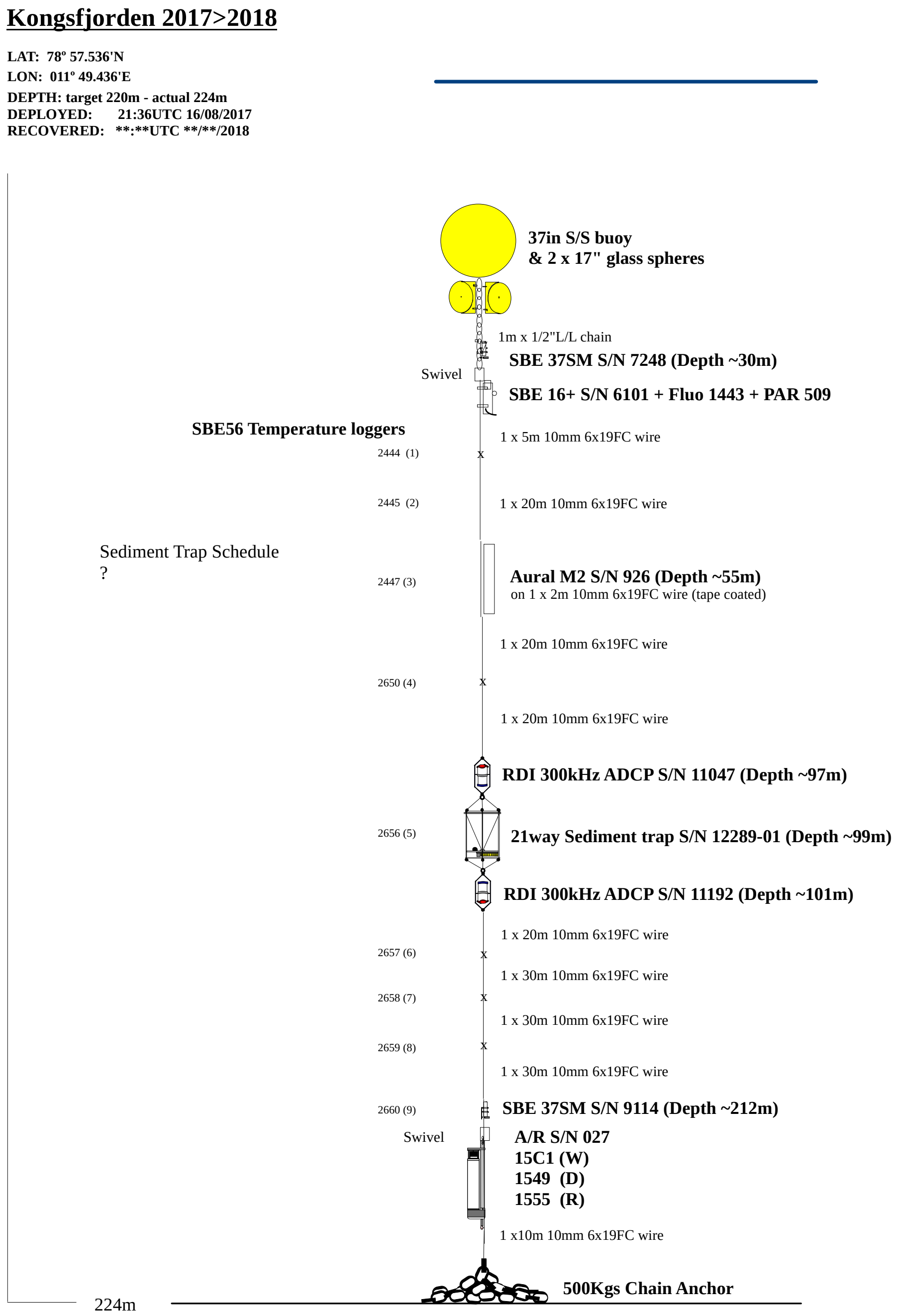
- Bouy available at NIVA.
- Most sensors ordered:
  - Temperatur/salinity (SBE-CTD), Turbidity (AML), Scattering/Fluoresence (ECO-triplet), Oxygen (Aanderaa), Ramses Hyperspektral radiometers, Datalogging and GPS/Compass to be discussed
- Ready for shipping to Svalbard in July.
- Practical issues with deployment to be agreed.

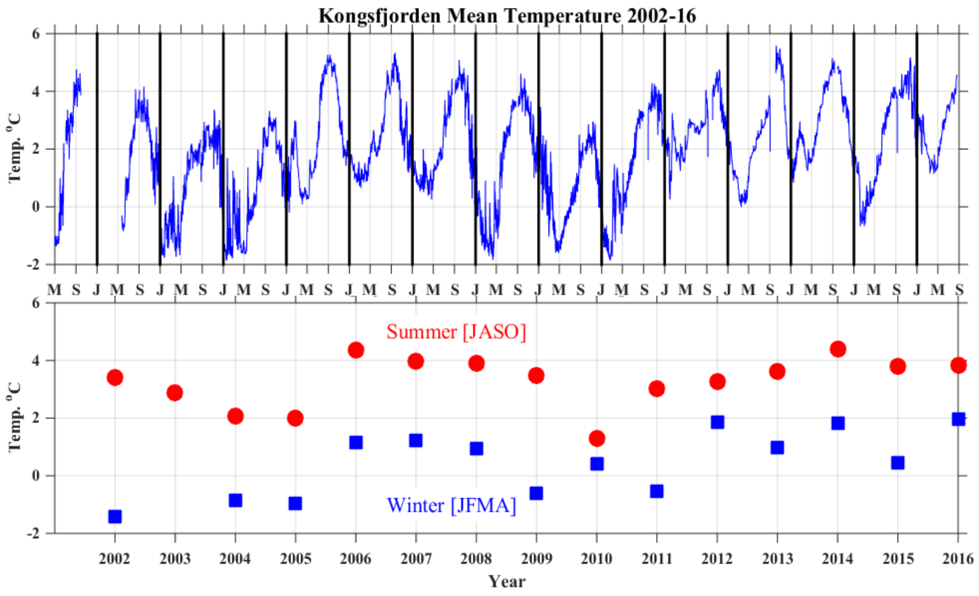
EIVA

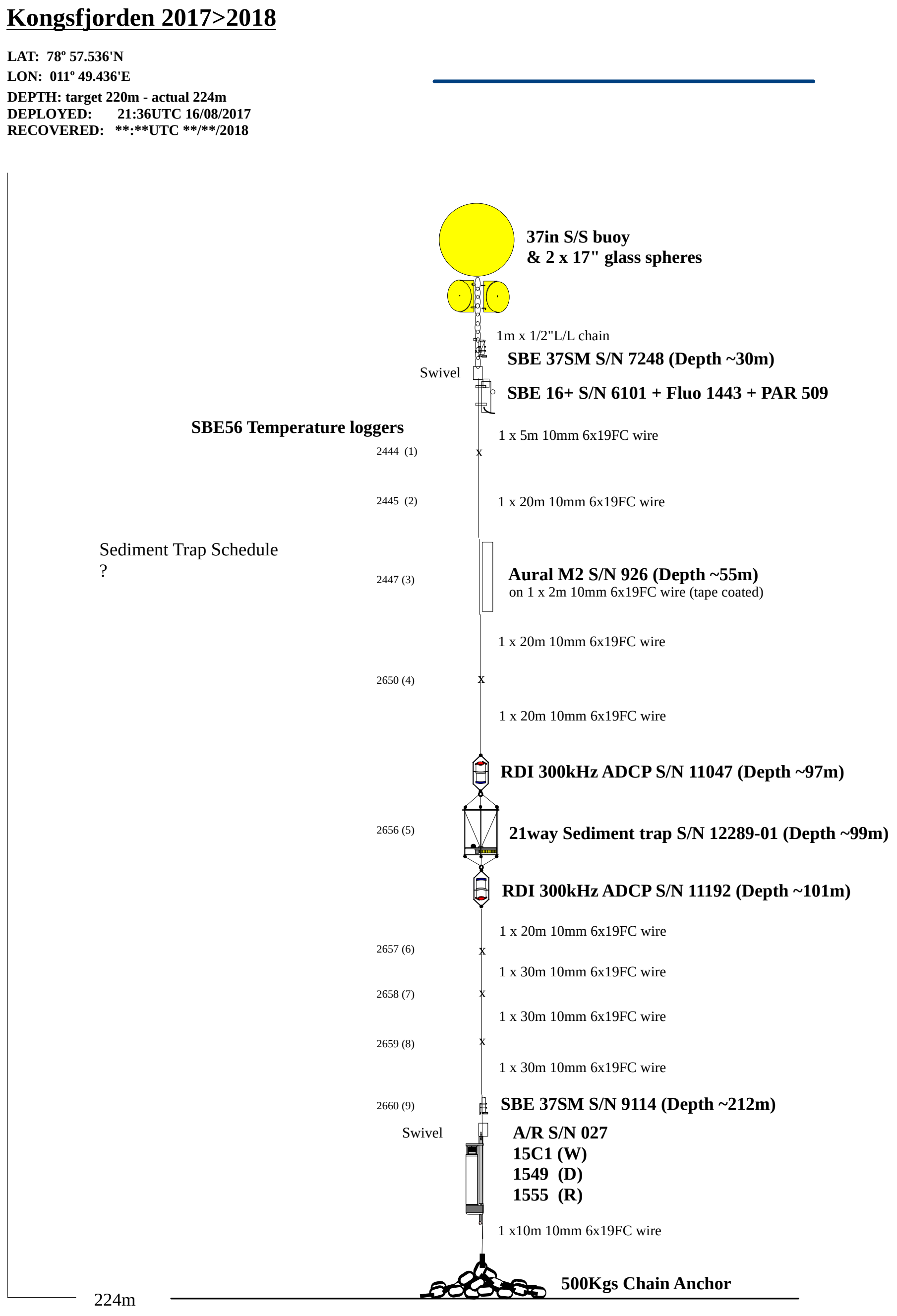




Observatories in Kongsfjorden and Isfjorden







Observatories in Kongsfjorden and Isfjorden

- Observatories *in operation*
- Instrumentation upgrades 2018-2019
- Complex data, pilot project (Kongsfjorden) in order to enable easy and quick transfer of data to make them available to user groups

SIOS InfraNor
Common Infrastructure Module

Rune Storvold, Norut

Common Infrastructure Module

18	**Instruments to be installed in Dornier DO228 POD, airborne SAR, VNIR hyperspectral Imager, vis/NIR aerial camera and laser scanner.**	**Norut**
19	Two medium size multirotor drones with NDVI, RGB and thermal cameras	Norut

Status Dornier Pod

- Pod produced and ready for certification flight
- PhaseOne 50 mpx Aerial Camera installed
- NEO Hyspex VNIR 1800 installed (30 cm resolution)
- X-band SAR adapted and under final testing (10 cm ground resolution)
- INS system installed, Kongsberg SEATEX AIS
- Radionor Communication System installed
- Sensor control and logging system installed, some work to be done.
- Calibration and validation of system still to be done

Initial airborne data products

- Spectral Radiance 400-1000nm orthomaps
- σ_0-backscatter orthomaps

Capability Lufttransport Dornier

- Approx. 20 flights per year to Station Nord from Longyearbyen
- Weekly flights Ny-Ålesund and Svea from Longyear
- Available for charter

- <u>Dornier 228-212NG</u>
- Normal range: 1300 NM
- Max endurance: 6:45 hours
- Max T/O Mass: 6200 Kg
- Max altitude: 15000 feet
- Cruise speed: 180 knots
- Maximum speed: 200 knots
- Seat capacity: 2 pilots / 17 passengers

Status Multirotor Drones

- 2 DJI Inspire drones deployed at UNIS,
  - 25 min flight time.
  - 4km RLOS range
  - Field deployable with hardend transport case to facilitate snowmobile or other field transport means
  - Can be operated down to -20 deg C and 10 m/s wind
- Thermal IR, RGB and NDVI sensors purchased and ready for use
- Personnel at UNIS trained to operate and operating agreement made for UNIS to operate under Norut's operator permit

ASUF Operating Facility NyA

- Small heated hanger and shop
- OPS room
- Aircraft radio
- Marine VHF radio

Status report and plans for Module 5 Data Management

Øystein Godøy

29. mai 2018

Navn Etternavn, Svalbard

SIOS

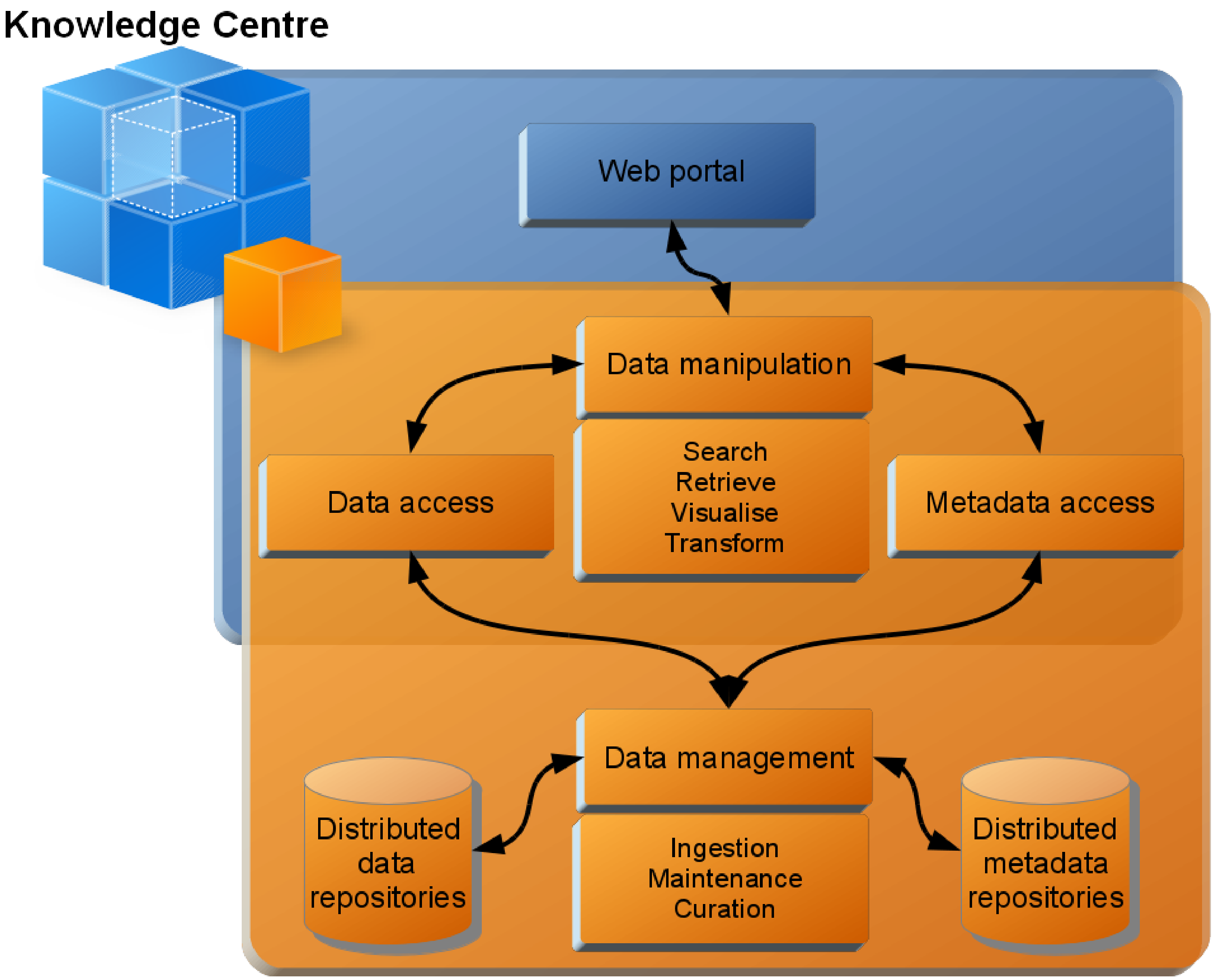
SVALBARD INTEGRATED ARCTIC EARTH OBSERVING SYSTEM

Background

- The SIOS Data Policy promotes free and open access to data.
- It is a requirement that scientists and projects utilising the SIOS Infrastructure also adhere to the SIOS Data Policy and deposit data in a data centre contributing to the SIOS Data Management System (SDMS).
- *The main focus of SIOS-InfraNor data management is to ensure that the data generated by the proposed instrumentation are properly taken care of and shared through SDMS.*
- SDMS is a physically distributed data management system. This implies that data are managed by a number of data centres contributing to SIOS.
- To ensure a functional system, SIOS relies on internationally approved standards for documentation of and access to data.

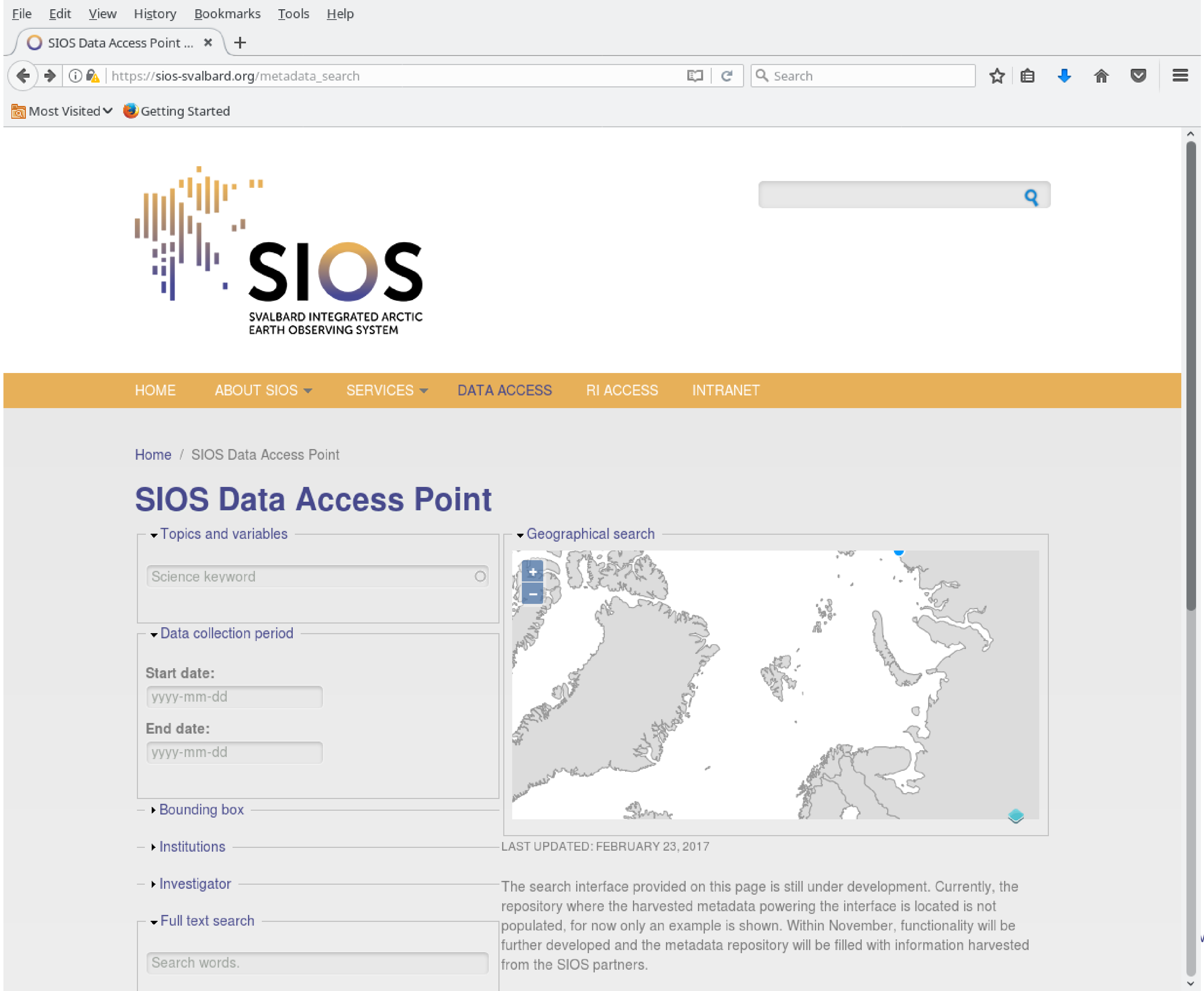
Principles

- Utilisation of standards allows integration with discipline-specific (e.g. WMO Information System) and regional (e.g. Copernicus Marine Environmental Monitoring Service) data management systems.
- Development of the SDMS technical infrastructure is aligned with current efforts of e.g. the combined SAON/IASC Data Committee and builds on the experience of distributed data management during the International Polar Year.
- SDMS is a metadata driven data management systems where datasets are documented and encoded using a limited number of standards. This limitation of standards supported is necessary to establish a sustainable system.
- Non-standardised or non-complying subsystems or data cannot be integrated with SDMS.
- Costs related to data documentation and encoding as well as long-term data preservation and publishing of data are included in the data management module.
- The central search interface and data access point of SDMS are already covered by the SIOS-KC project.



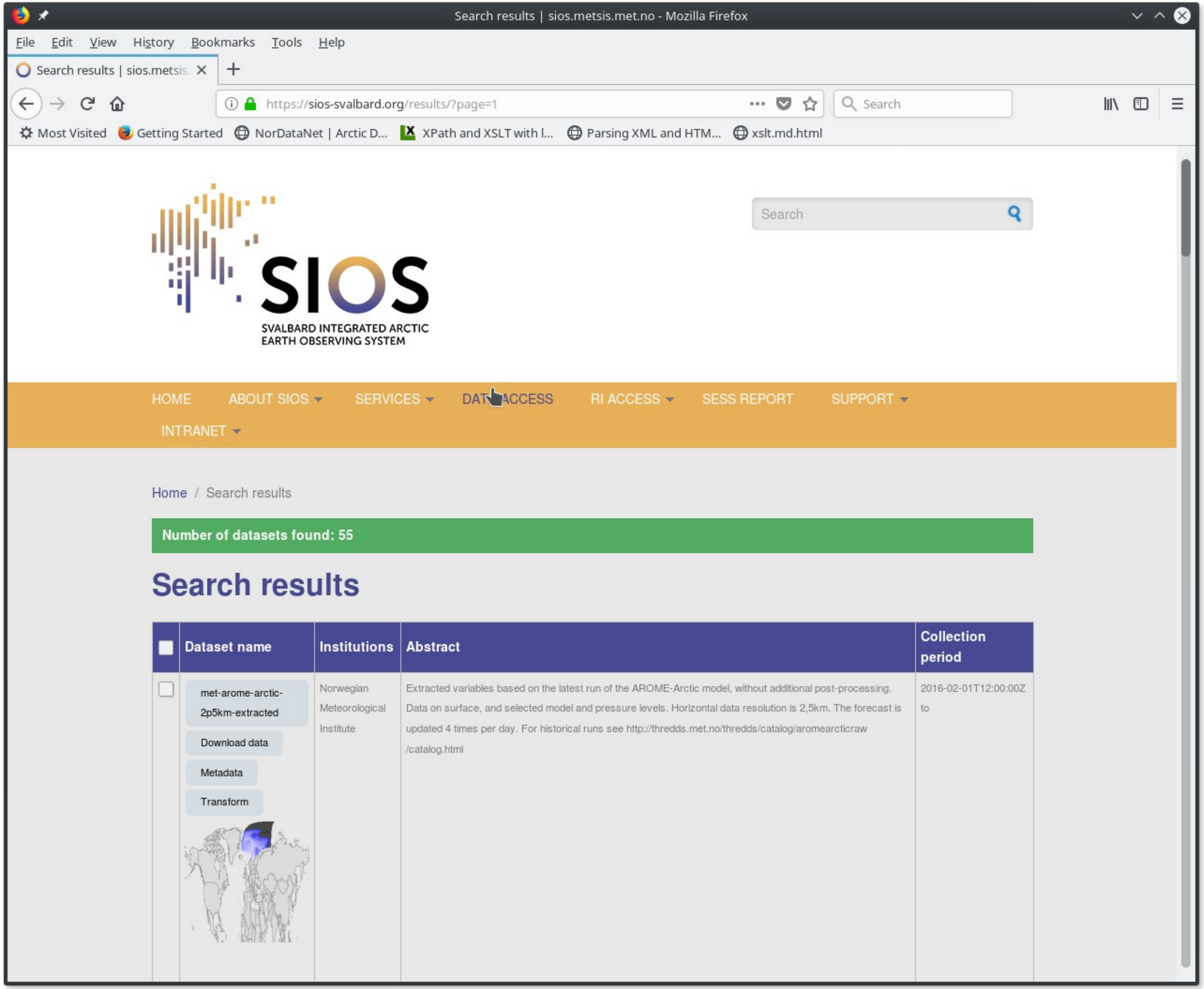
SIOS

www.sios-svalbard.org



SIOS

www.sios-svalbard.org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Home / Search results
Number of datasets found: 55
Search results
Dataset name
Institutions
Abstract
Collection period
met-arome-arctic-2p5km-extracted
Download data
Metadata
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Norwegian Meteorological Institute
Extracted variables based on the latest run of the AROME-Arctic model, without additional post-processing. Data on surface, and selected model and pressure levels. Horizontal data resolution is 2,5km. The forecast is updated 4 times per day. For historical runs see http://thredds.met.no/thredds/catalog/aromearcticraw/catalog.html
2016-02-01T12:00:00Z to

Search results | sios.metsis.met.no - Mozilla Firefox

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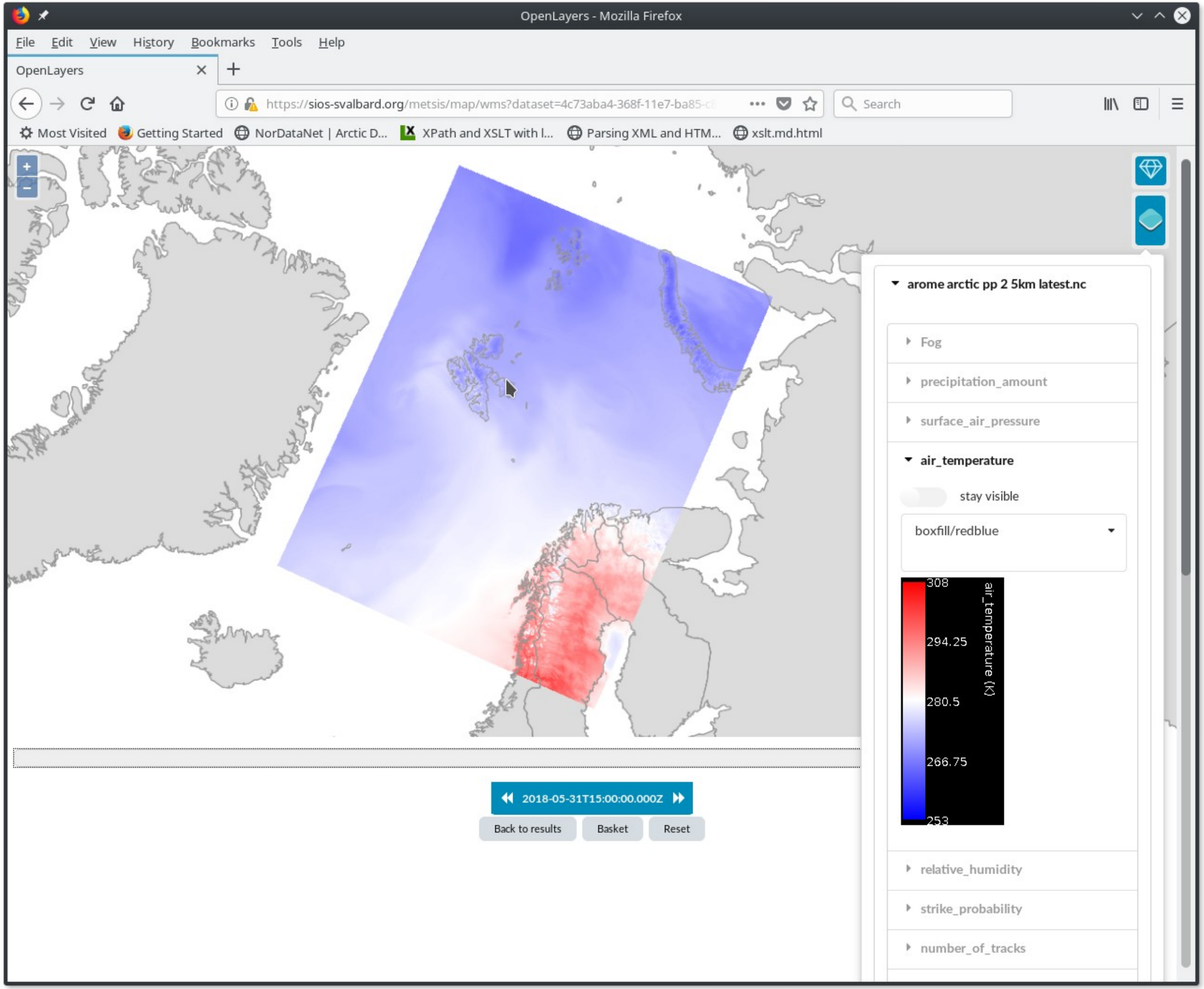
Search results | sios.metsis

https://sios-svalbard.org/results/?page=1

Most Visited | Getting Started | NorDataNet | Arctic D... | XPath and XSLT with l... | Parsing XML and HTM... | xslt.md.html

	Dataset name	Institutions	Abstract	Collection period
☐	met-arome-arctic-2p5km-forecast Download data Metadata Transform 	Norwegian Meteorological Institute	Post processed forecasts based on the latest run of the AROME-Arctic model. Parameters like temperature, cloud cover, precipitation and wind have gone through additional post-processing. Horizontal data resolution is 2,5km. The forecast is updated 4 times per day. For historical runs see http://thredds.met.no/thredds/catalog/aromearcticpp/catalog.html	2016-02-01T12:00:00Z to
☐	Downwelling surface radiative fluxes at Bjørnøya Download data Metadata Transform	Norwegian Meteorological Institute	Test dataset!!! Downwelling surface radiative fluxes observed at the meteorological station at Bjørnøya Island in the Barents Sea. Measurements are made using Kipp and Zonen CMP21 and CGR4 pyranometers and pyrgeometers. Daily maintenance is performed by the meteorological personnel at the station. Data are averaged over the last minute and the time is set to UTC. This data set has been collected with support from the Norwegian Research Council. This data set has been collected with support from the Norwegian Research Council. The quality control performed is rudimentary and the dataset will be updated.	2015-12-16T14:07:00Z to 2016-08-16T09:05:00Z
☐	CarbonBridge August 2014: Zooplankton abundance and size structure along transect C crossing the Fram Strait Metadata			2014-08-16T12:00:00Z to 2014-08-16T12:00:00Z
☐	CarbonBridge		Continuous data on zooplankton abundance and biovolume were collected in concert with data on the	2014-08-16T12:00:00Z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Search
Most Visited
Getting Started
NorDataNet | Arctic D...
XPath and XSLT with l...
Parsing XML and HTM...
xslt.md.html
arome arctic pp 2 5km latest.nc
Fog
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stay visible
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308
294.25
280.5
266.75
253
air_temperature (K)
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number_of_tracks
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Transform dataset | sios.metsis.met.no - Mozilla Firefox

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Transform dataset | sios.m

https://sios-svalbard.org/metsis_fimex?dataset_id=4c73aba4-368f-11e7-ba85-c8

Most Visited Getting Started NorDataNet | Arctic D... XPath and XSLT with l... Parsing XML and HTM... xslt.md.html

Dashboard Content Structure Appearance People Modules Configuration Reports Help Hello **steingod** Log out

Add content Find content Structure Blocks Performance Edit shortcuts

Title (discovery metadata): met-arome-arctic-2p5km-forecast

Abstract (discovery metadata): Post processed forecasts based on the latest run of the AROME-Arctic model. Parameters like temperature, cloud cover, precipitation and wind have gone through additional post-processing. Horizontal data resolution is 2,5km. The forecast is updated 4 times per day. For historical runs see http://thredds.met.no/thredds/catalog /aromearcticpp/catalog.html

The e-mail address to send the results to

Send results to: *

o.godoy@met.no

Select spatial extent

Select temporal extent

Select variables

	Name	Standard name	Long name	Units
☐	longitude	longitude	longitude	degree_east
☐	latitude	latitude	latitude	degree_north
☐	relative_humidity_2m	relative_humidity	Screen level relative humidity (RH2M)	1
☐	surface_air_pressure	surface_air_pressure	Surface air pressure	Pa
☐	x_wind_10m	x_wind	Zonal 10 metre wind (U10M)	m/s
☐	y_wind_10m	y_wind	Meridional 10 metre wind (V10M)	m/s
☐	air_pressure_at_sea_level	air_pressure_at_sea_level	Mean Sea Level Pressure (MSLP)	Pa
☐	precipitation_amount_acc	precipitation_amount	Accumulated total precipitation	kg/m^2
☐	wind_speed_of_gust	wind_speed_of_gust	Wind gust	m/s
☐	fog_area_fraction		Fog	1
☐	land_area_fraction	land_area_fraction	Land-Sea Mask (LSM)	1

Process

- Data are submitted to data centres contributing to the SIOS Data Management System (SDMS).
  - This ensures interoperability at the metadata and data levels, as well as long-term data preservation.
- The SIOS Data Portal, embedded in the SIOS website, provides unified data search and retrieval options.
- SIOS-InfraNor will be fully implemented into the SIOS Data Management operations which are funded through SIOS-KC.
- However, in order to ensure that all data are fully streamlined and compatible with each other and the SIOS data portal, we also include a total of 8 million NOK in funding for data management. These costs have been allocated to each dataset generated by the new infrastructure, and data centres handling those datasets.
- For some datasets, there is no dedicated data centre identified.
  - These data will be handled through the SIOS Knowledge Centre and resources have been set aside to support this utilising the Norwegian Infrastructure for Research Data (NIRD).

Status ongoing work

- Identification of encoding standards for various types of data
- Identification of actual datasets to be delivered

Open issues

- Establish
  - a detailed overview of the datasets to be delivered,
  - where datasets will be delivered,
  - how datasets will be encoded,
  - how datasets will be served
- Identify gaps for datasets

Data management

Øystein Godøy

SIOS
SVALBARD INTEGRATED ARCTIC
EARTH OBSERVING SYSTEM

Photo: Christiane Hübner

Making Your Research Easier and Cheaper

The 5 P's matter!

Prior

Planning

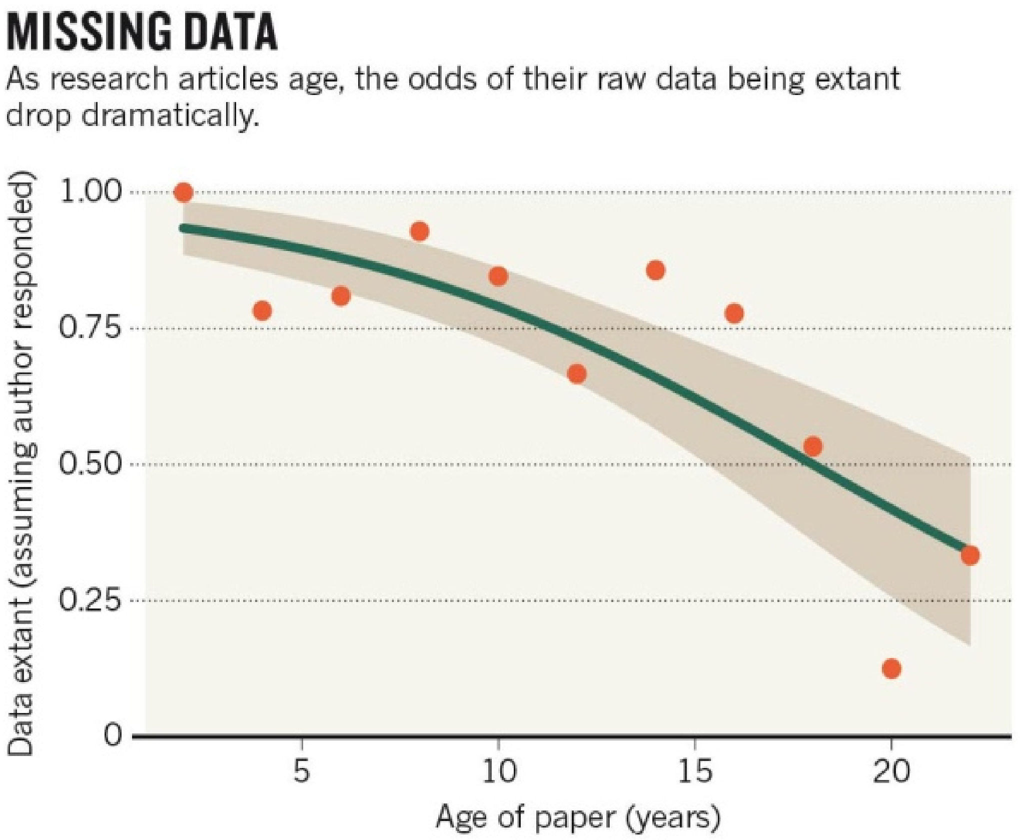
Prevents

Poor

Performance!

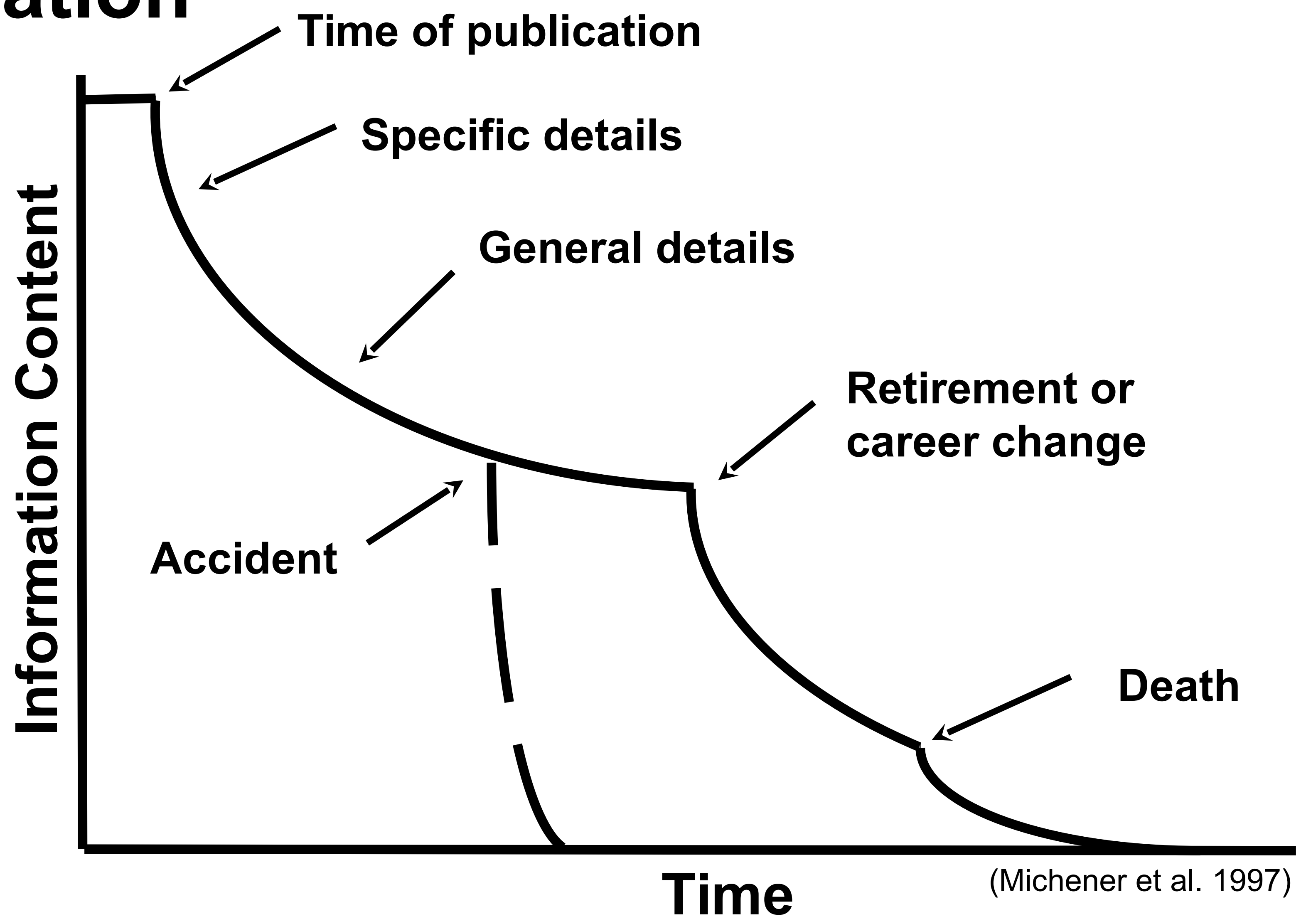
Loosing scientific data

- Decline can mean 80% of data are unavailable after 20 years.
  - Gibney and Van Noorden (2013), Nature



Ruth Duerr, NSIDC, 2013 ESIP Material

Poor data practice results in loss of information



(Michener et al. 1997)

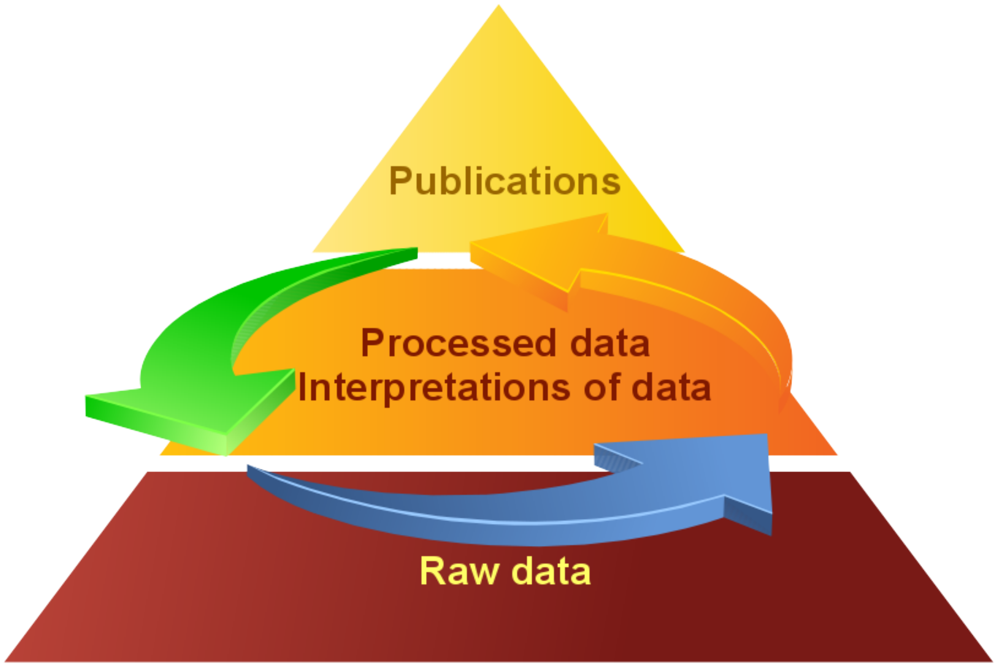
Why bother with structured data management?

- Science paradigms
    - according to Jim Gray
  - empirical science
  - theoretical science
  - computational science
  - data exploration science

- Maximise public investment in data collection and production
- Promote scientific collaboration
- Promote interdisciplinary science
- Promote scientific transparency
- Leave a legacy

All scientific data online

Source: Jim Gray on eScience:
A Transformed Scientific Method



- Many disciplines overlap and use data from other sciences
- Science, government agencies and companies get a broader data background
- Internet can unify data, software and literature
- Go from literature to computation to data back to literature
- Information is at your fingertips for everyone and everywhere
- Potentially Increased Scientific Information Velocity
- Potentially Huge increase in Science Productivity

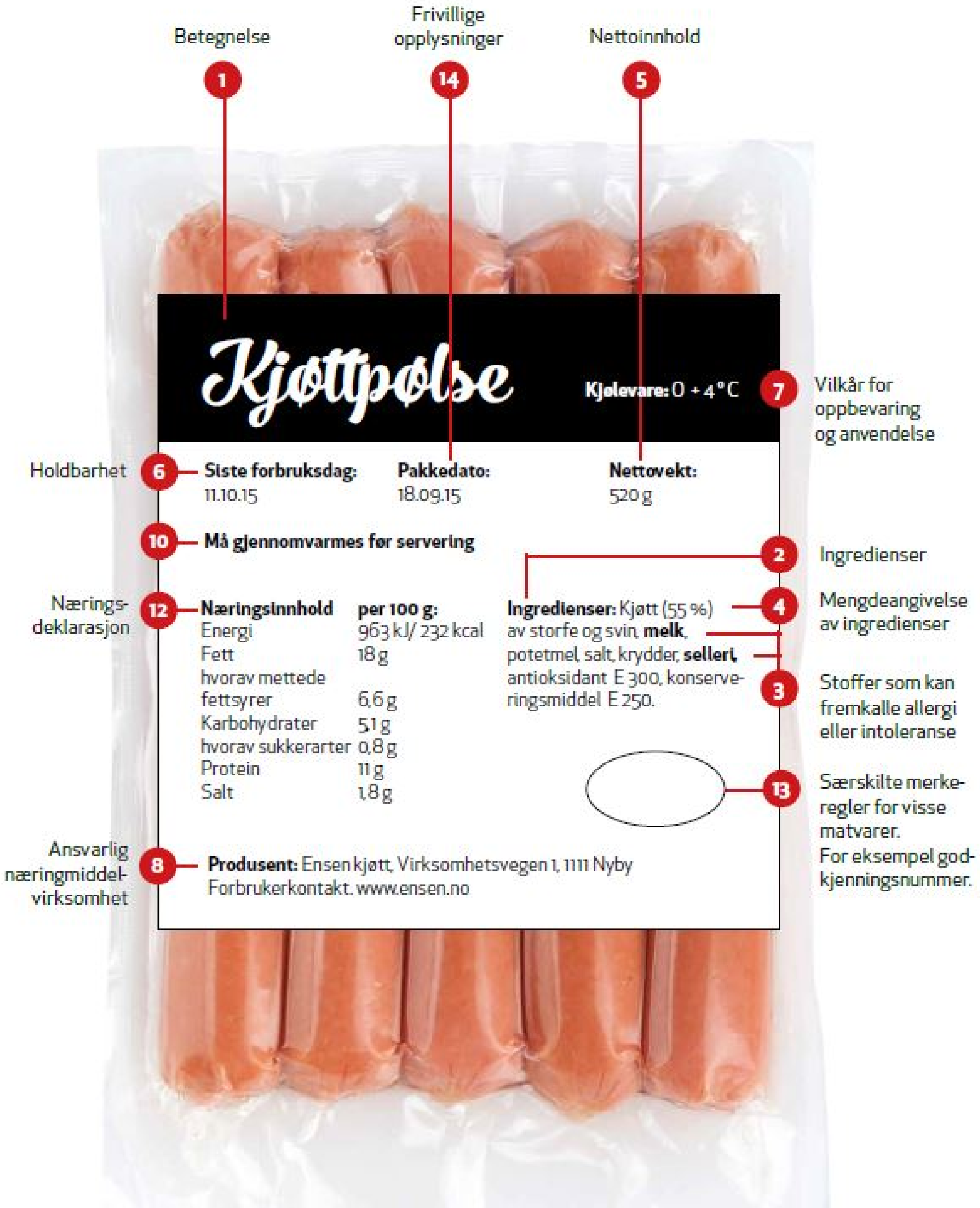
The FAIR Guiding Principles for scientific data management and stewardship

- To be Findable:
  - F1. (meta)data are assigned a globally unique and persistent identifier
  - F2. data are described with rich metadata (defined by R1 below)
  - F3. metadata clearly and explicitly include the identifier of the data it describes
  - F4. (meta)data are registered or indexed in a searchable resource
- To be Accessible:
  - A1. (meta)data are retrievable by their identifier using a standardized communications protocol
  - A1.1 the protocol is open, free, and universally implementable
  - A1.2 the protocol allows for an authentication and authorization procedure, where necessary
  - A2. metadata are accessible, even when the data are no longer available
- To be Interoperable:
  - I1. (meta)data use a formal, accessible, shared, and broadly applicable language for knowledge representation.
  - I2. (meta)data use vocabularies that follow FAIR principles
  - I3. (meta)data include qualified references to other (meta)data
- To be Reusable:
  - R1. meta(data) are richly described with a plurality of accurate and relevant attributes
  - R1.1. (meta)data are released with a clear and accessible data usage license
  - R1.2. (meta)data are associated with detailed provenance
  - R1.3. (meta)data meet domain-relevant community standards

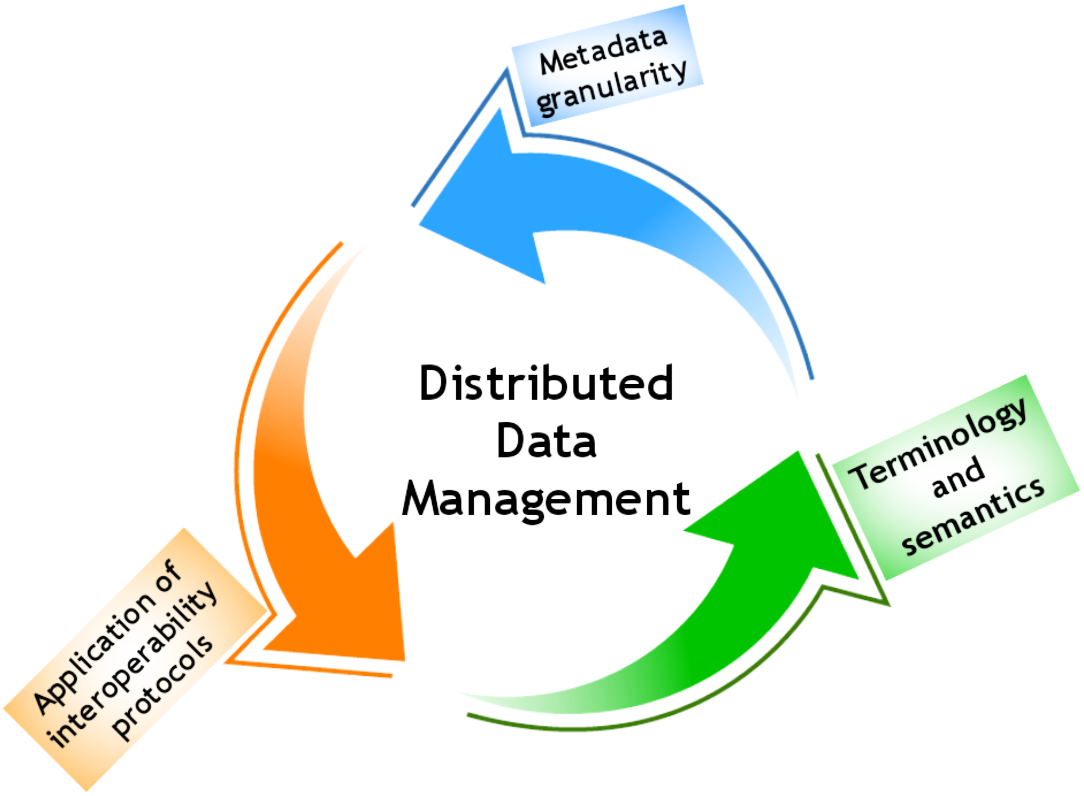
Types of metadata

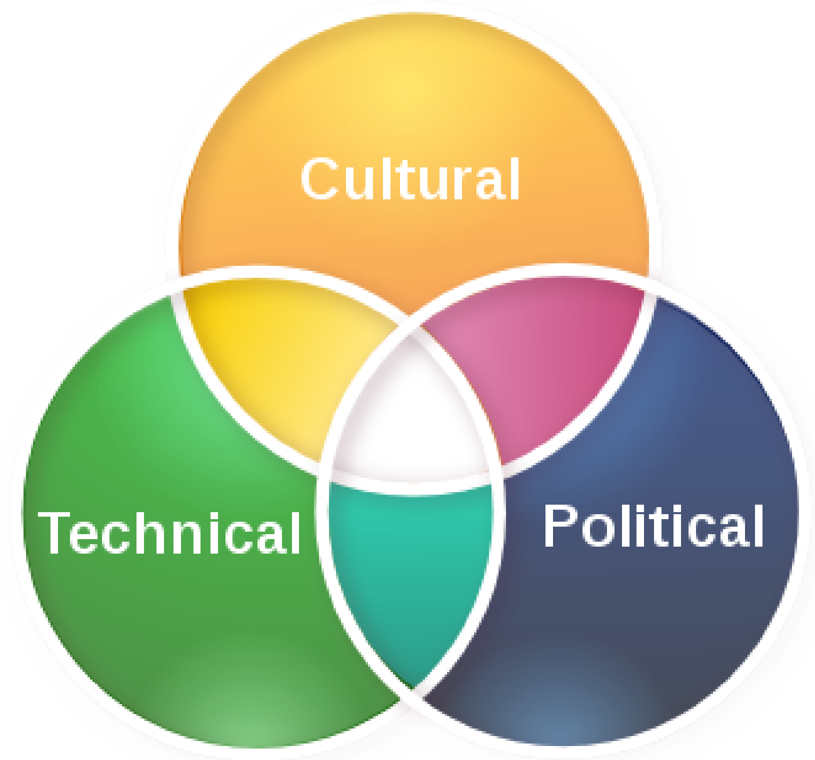
- Discovery metadata
  - ***who*** measured, simulated or analysed ***what***, ***where***, and ***when*** as well as ***conditions for reuse*** and ***access mechanisms*** for the data
  - to enable users to find appropriate data for the task
- Use metadata
  - ***identification of the variables/parameters*** generated, ***units of variables/parameters***, how ***missing values*** are encoded, definition of ***grid and map projections*** for gridded data, ***methodology applied in space or time*** to achieve the values in a dataset etc
  - to enable users to properly understand the data found

Eksempel på merking



Challenges

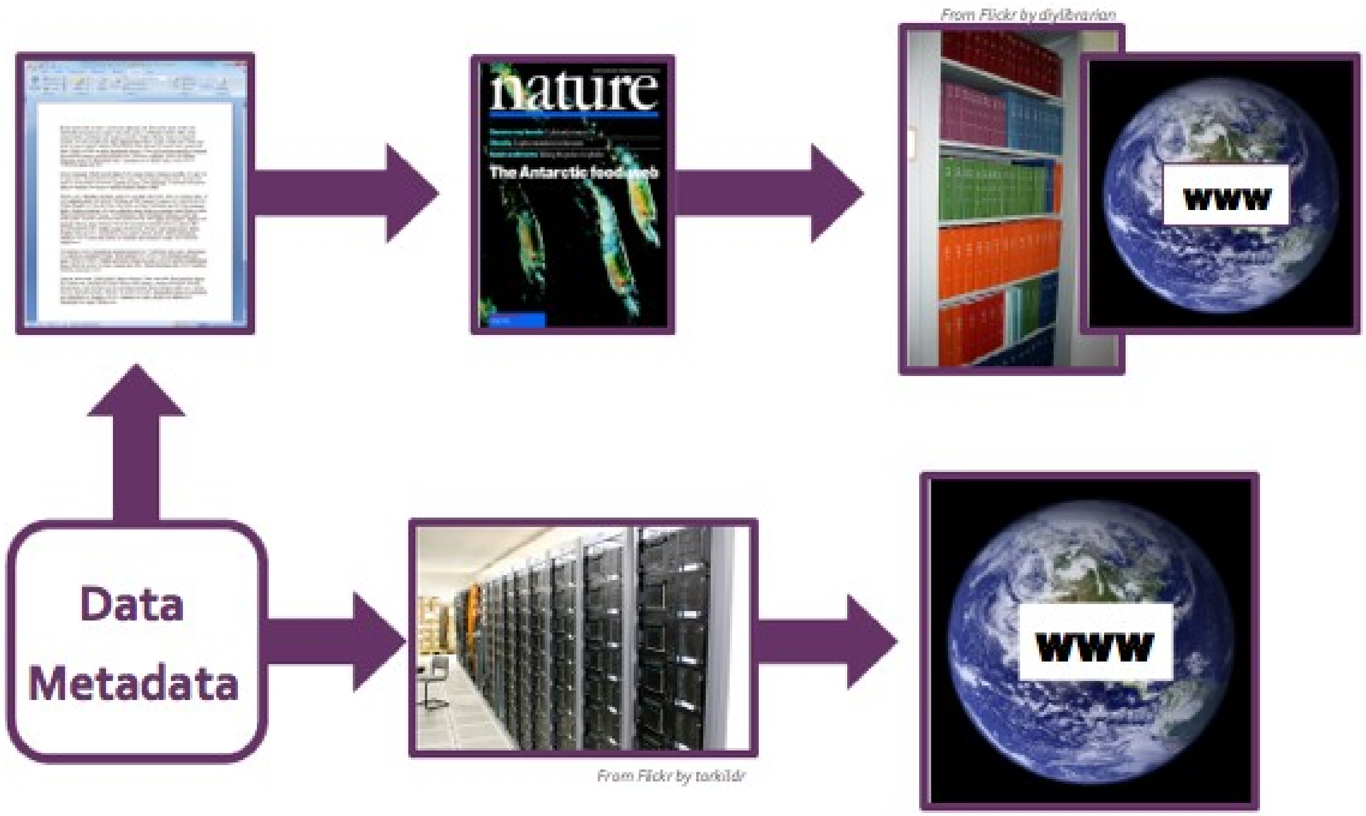

Metadata granularity
Distributed Data Management
Terminology and semantics
Application of interoperability protocols


Cultural
Technical
Political

The reality today

Recreated from Klump et al. 2006

The vision for the future



Recreated from Klump et al. 2006

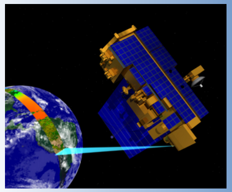
New science

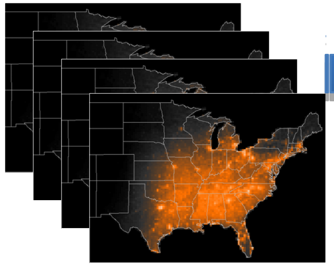
eBird

Land Cover

Meteorology

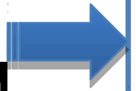
MODIS – Remote sensing data



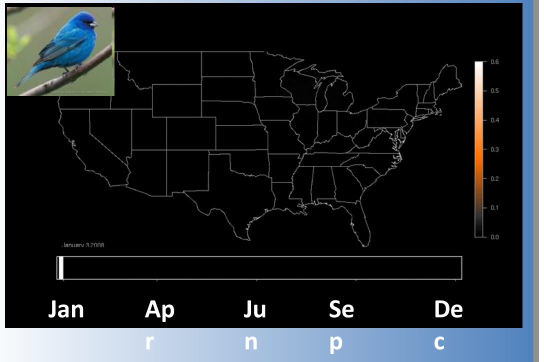


$$F(X,s,t)=\frac{1}{n(s,t)}\sum_{i=1}^{m} f_i(X,s,t)I(s,t\in\theta_i)$$

Spatio-Temporal Exploratory Models predict the probability of occurrence of bird species across the United States at a 35 km x 35 km grid.



Model results



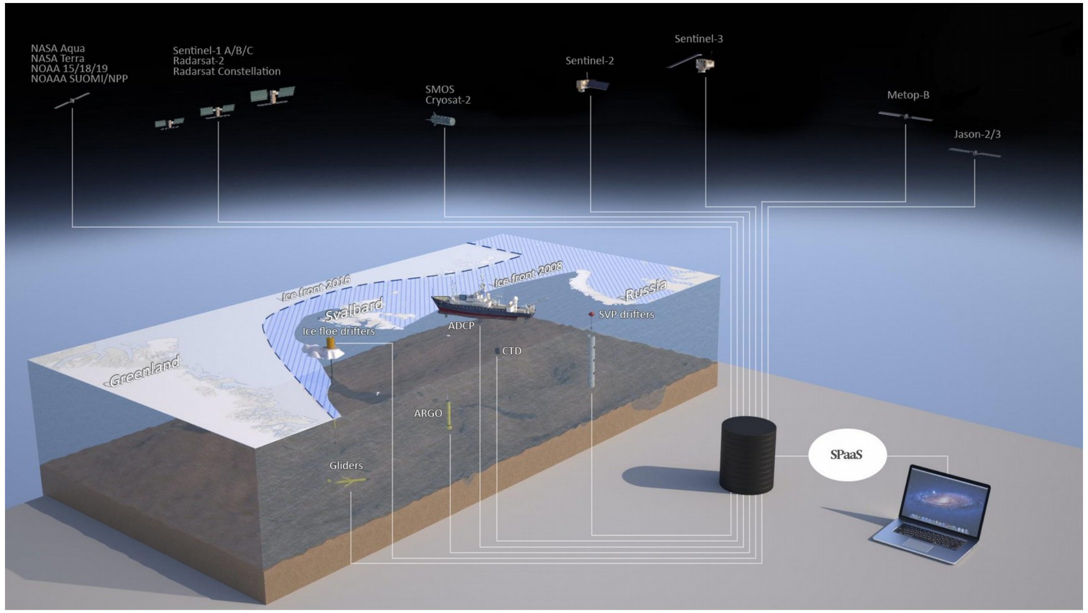
Potential Uses-

- Examine patterns of migration
- Infer impacts of climate change
- Measure patterns of habitat usage
- Measure population trends

By re-using data collected from a variety of sources – eBird database, land cover data, meteorology, and remotely sensed by NASA – this project was able to compile and process the data using supercomputing to determine bird migration routes for particular species.

Moving towards

- Data management required by funding agencies
- Integration of data centres
- Work flow management
- Funding agency requirements
  - Projects must have a data plan
  - Data underlying scientific publications have to be open
  - Data plan (DCC)
    - Data summary
    - FAIR data
      - Making data findable, including provisions for metadata
      - Making data openly accessible
      - Making data interoperable
      - Increase data re-use
    - Allocation of resources
    - Data security
    - Ethical aspects
- Scientific Platforms
  - European Open Science Cloud

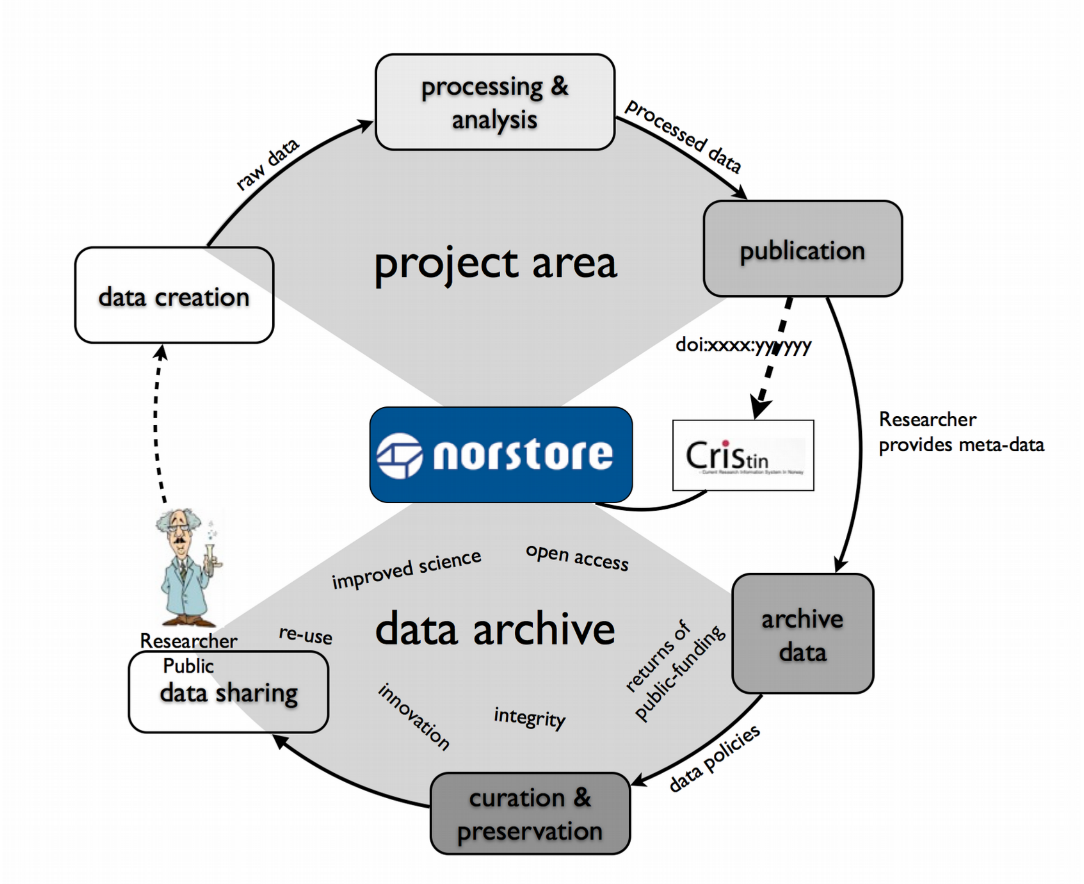


Courtesy of Morten W. Hansen, NERSC

Benefits of standardised documentation

- Why not use the “Google” approach?
- Science is based on a shared terminology
  - There will never be only one proper way of documenting
  - There will always be a need for brokering
- Data and metadata must be connected
  - To find data
  - To use data
- Standardised documentation and formatting
  - enables the possibility to filter datasets
  - enables the possibility to link datasets
  - enables standardised applications to analyse data
  - enables users to use the data
- Need to be pragmatic…
  - And let computers do the boring part
  - But humans need to instruct computers

Data in context

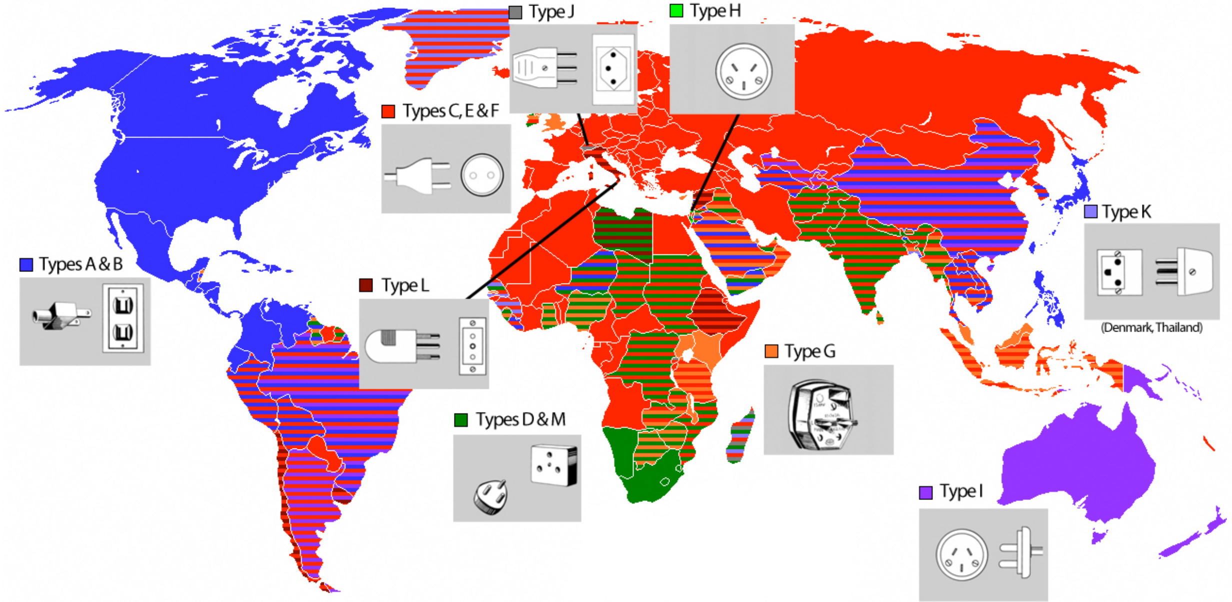


- What's the meaning of a number?
  - Basic metadata are needed for any use of data
- Data can be used in different ways
  - For adequate use of data, adequate information about the data is critical
- The whole is more than the sum of the pieces
  - Smart combination of information has a much larger potential than single observations
- Make data talk together
- Make data traceable
- Make data count

Courtesy
Andreas Jaunsen
NorStore

Benefits of standardisation

- Makes life easier
  - Promotes reuse of efforts
- Promotes a common understanding of content
  - Improves performance
  - Reduce risk
  - Promotes sustainability
  - Encourage innovation
  - Reduce cost
  - Improve quality



From HobbyProjects

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SIOS Data Access Point ...

https://sios-svalbard.org/metadata_search

Search

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HOME ABOUT SIOS SERVICES DATA ACCESS RI ACCESS INTRANET

Home / SIOS Data Access Point

SIOS Data Access Point

Topics and variables

Science keyword

Data collection period

Start date:

yyyy-mm-dd

End date:

yyyy-mm-dd

Bounding box

Institutions

Investigator

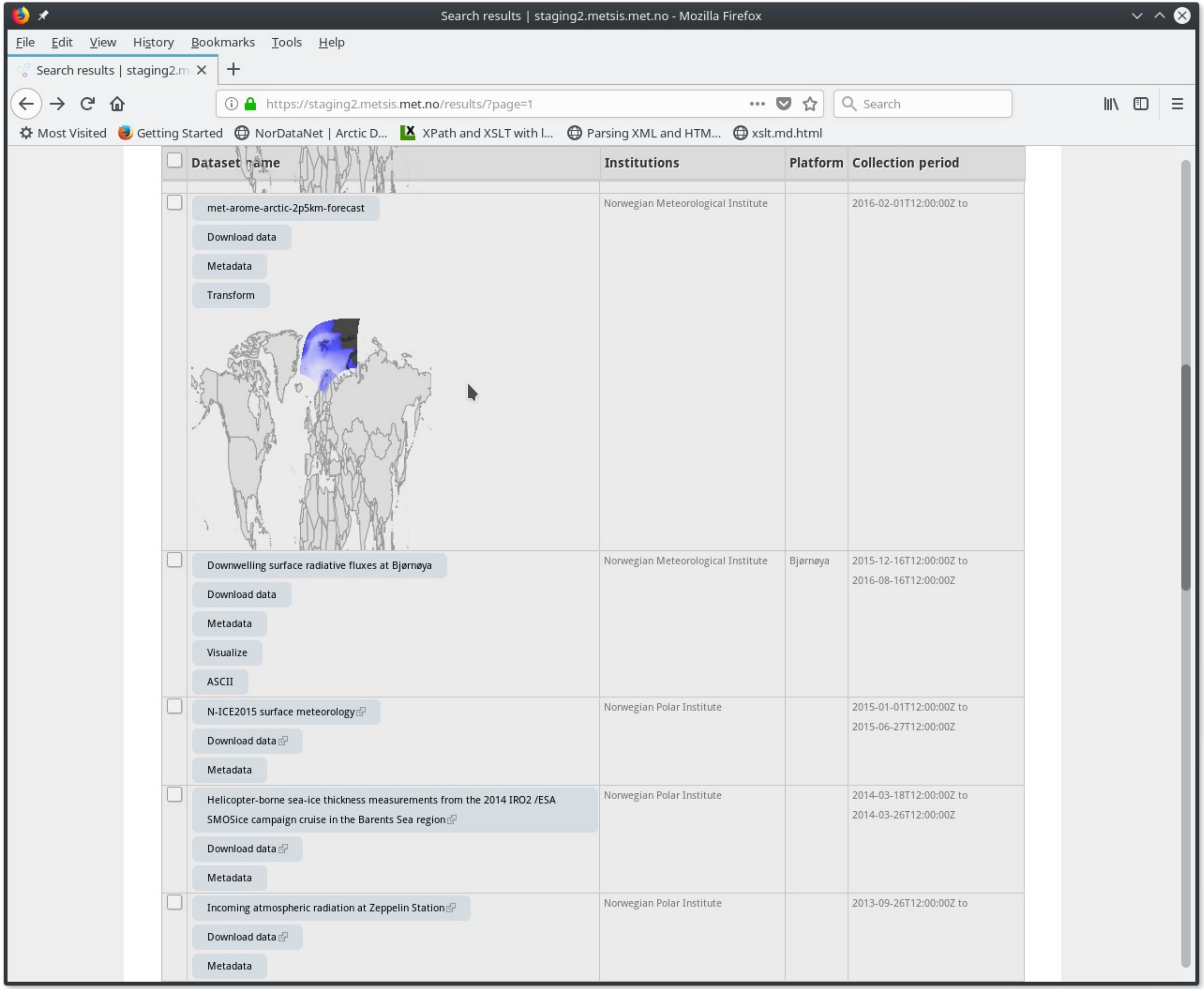
Full text search

Search words.

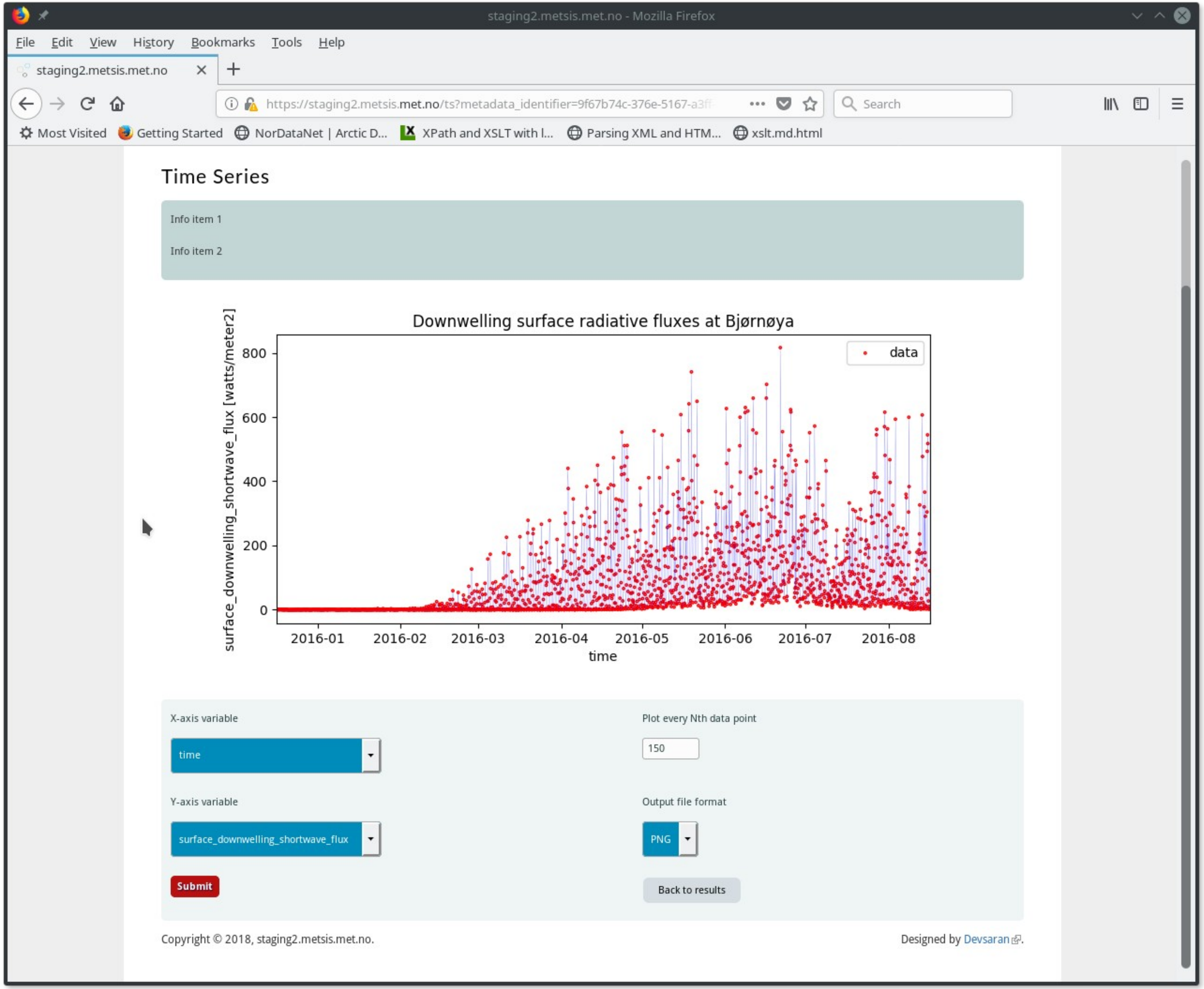
Geographical search

LAST UPDATED: FEBRUARY 23, 2017

The search interface provided on this page is still under development. Currently, the repository where the harvested metadata powering the interface is located is not populated, for now only an example is shown. Within November, functionality will be further developed and the metadata repository will be filled with information harvested from the SIOS partners.


Search results | staging2.metsis.met.no - Mozilla Firefox
File Edit View History Bookmarks Tools Help
Search results | staging2.m
https://staging2.metsis.met.no/results/?page=1
Search
Most Visited Getting Started NorDataNet | Arctic D... XPath and XSLT with l... Parsing XML and HTM... xslt.md.html
Dataset name
Institutions
Platform
Collection period
met-arome-arctic-2p5km-forecast
Download data
Metadata
Transform
Norwegian Meteorological Institute
2016-02-01T12:00:00Z to
Downwelling surface radiative fluxes at Bjørnøya
Download data
Metadata
Visualize
ASCII
Norwegian Meteorological Institute
Bjørnøya
2015-12-16T12:00:00Z to 2016-08-16T12:00:00Z
N-ICE2015 surface meteorology
Download data
Metadata
Norwegian Polar Institute
2015-01-01T12:00:00Z to 2015-06-27T12:00:00Z
Helicopter-borne sea-ice thickness measurements from the 2014 IRO2 /ESA SMOSice campaign cruise in the Barents Sea region
Download data
Metadata
Norwegian Polar Institute
2014-03-18T12:00:00Z to 2014-03-26T12:00:00Z
Incoming atmospheric radiation at Zeppelin Station
Download data
Metadata
Norwegian Polar Institute
2013-09-26T12:00:00Z to

SIOS


staging2.metsis.met.no - Mozilla Firefox
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staging2.metsis.met.no
https://staging2.metsis.met.no/ts?metadata_identifier=9f67b74c-376e-5167-a3f
Search
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Parsing XML and HTM...
xslt.md.html
Time Series
Info item 1
Info item 2
Downwelling surface radiative fluxes at Bjørnøya
surface_downwelling_shortwave_flux [watts/meter2]
800
600
400
200
0
data
2016-01
2016-02
2016-03
2016-04
2016-05
2016-06
2016-07
2016-08
time
X-axis variable
time
Plot every Nth data point
150
Y-axis variable
surface_downwelling_shortwave_flux
Output file format
PNG
Submit
Back to results
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https://staging2.metsis.met.no/csv?metadata_identifier=9f67b74c-376e-5167-a3

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Staging2.metsis.met.no

Home | basket | Get Data | Polyglot | Support

Home »

CSV

	Standard name	Units
☑	surface_downwelling_shortwave_flux	watts/meter2
☑	surface_net_downward_longwave_flux	watts/meter2
☑	time	seconds since 1970-01-01 00:00:00 UTC

Output format

CSV

Submit

Back to results

The SIOS Data Management System

- A core effort in building SIOS is the integration of existing data centres into a unified system.
- Each data centre has its own procedures and technical solutions tailored to the needs of that data centre.
- SIOS will not change this, but bridge,
  - using internationally accepted interoperability standards and technologies.
- Integration through a dedicated working group involving all partners with data centres.
  - Implementation through SIOS KC

- The most challenging task is brokering of semantic information and interoperability at the data level.
- In order to fully understand and use the data made available thorough knowledge of the observation facilities and their procedures is required.
- SIOS is following the efforts of WMO Integrated Global Observing System (WIGOS) developing a metadata representation of observations and measurements for this purpose.
  - Will follow this path for description of observation facilities

SIOS

SIOS Data Sharing Principles

- The SIOS data sharing principles are as follows:
  I. There will be full and open exchange of data, metadata and products shared within SIOS, recognizing relevant international instruments and national policies and legislation;
  II. All shared data, metadata and products will be made available through the SIOS Data Management System (SDMS), with minimum time delay and at minimum cost;
  III. All shared data, metadata and products should be distributed free of charge or no more than the cost of reproduction;
  IV. Data access may be restricted when data release could compromise the confidentiality of human subjects or cause harm to endangered species or other vulnerable subjects;.

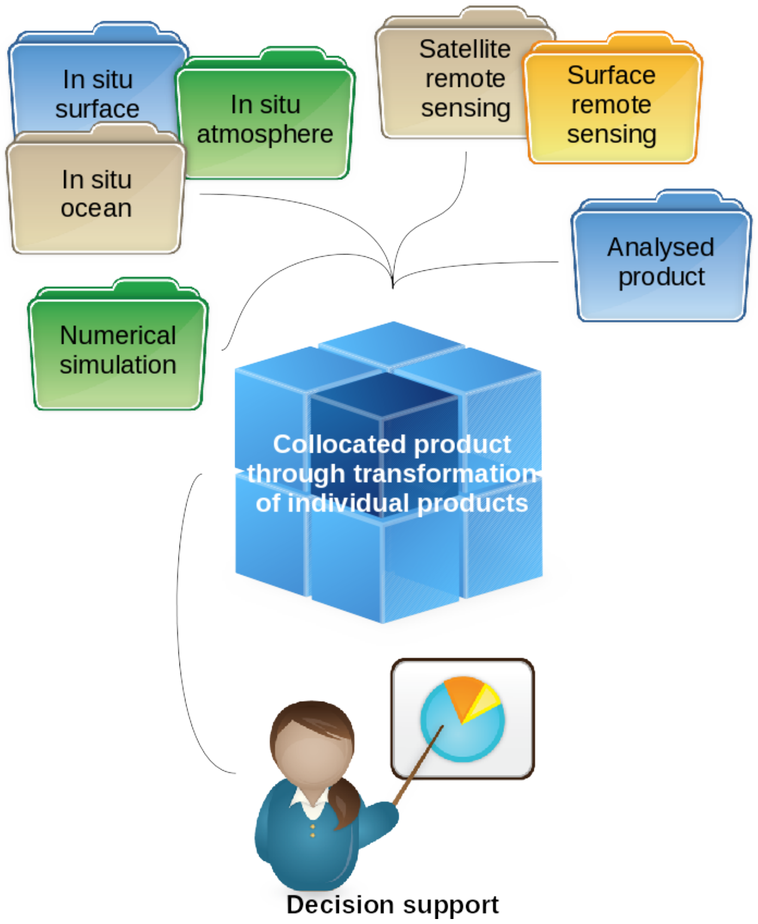
SIOS Data Policy - Attribution

- Users of data supplied through SIOS shall acknowledge in any publication or any other derived work, the contribution made by those who have created and worked up the data. If the data licence does not specify how best to do this, data should be formally cited using the citation text provided on the dataset's landing page or in its metadata.
- Those who retrieve data through SIOS shall acknowledge SIOS as follows:
  - Contains data retrieved through SIOS (year).

Ownership of data

- This depends on the contract between the funding agency and the institution affiliated with the scientist
- For RCN and H2020, ownership lies with the institution
    - Not the individual scientist

Approach

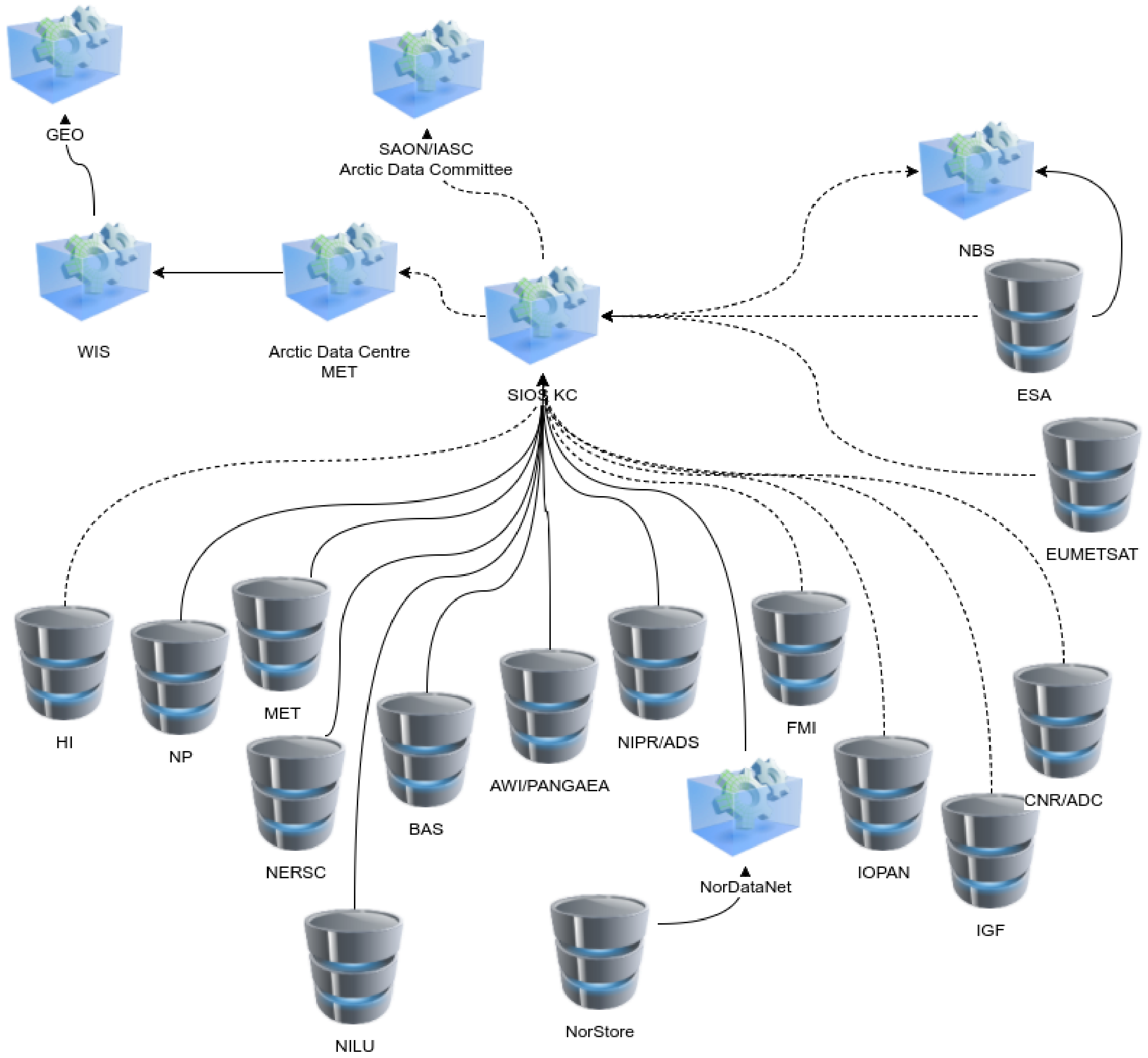


- Dataset oriented
  - Metadata driven
- Open data space
  - Higher order services offered when the data space can be constrained
- Net centric
  - Linkages with other data centres is vital
  - Implies brokering of metadata and data
- Interdisciplinary
  - Dataset agnostic in the open data space

SDMS basic principles (first version)

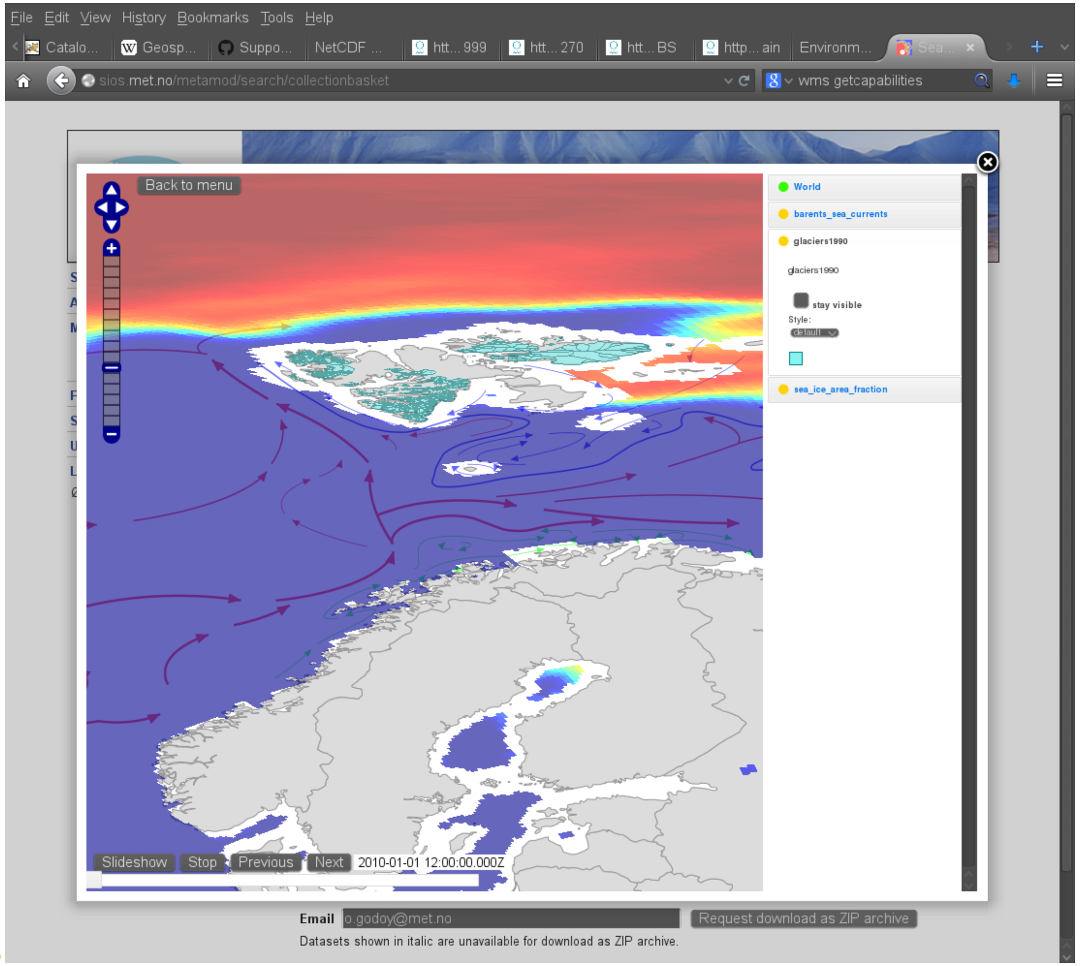
- Discovery metadata harvesting using OAI-PMH
  - Serving GCMD DIF or ISO19115
  - Transformed into MMD
    - Discovery metadata extended with configuration metadata
  - Indexed using SolR
- The search model is based on GCMD Science Keywords
  - Mapping of concepts during harvesting
    - Relying on SKOS
- Data submission through well developed documentation,best practices, interfaces and tools
- Long term preservation of data sets through mandated data archives

- Functionality in prioritized order
  - Data discovery through human and machine interfaces
  - Simple data retrieval of data in the form served
  - Data visualisation
  - Data transformation services, including sub-setting, reformatting,and re-projecting to ease scientific use of the data sets collected



- OAI-PMH
  - Cost efficient
    - to implement
    - to maintain
  - Reuse
    - add new metadata formats
- OPENDAP
  - Cost efficient
  - RESTful
    - Standardized
  - allows utilization of data streams,
    - Direct integration in analysis tools without data download
  - avoiding housekeeping
    - when integrating datasets
- OGC WMS
  - for visualization of gridded data
  - can also do on the fly using OpeNDAP
- Other potential technologies
  - OGC SWE

Demonstrator



- Developed during the preparatory phase
- Integrates
  - AWI/PANGAEA (DE)
  - Norwegian Polar Institute (NO)
  - Institute of Marine Research (NO)
  - British Antarctic Survey (UK)
  - Norwegian Meteorological Institute (NO)
- OAI-PMH
  - GCMD DIF
  - ISO19115

Best Practices

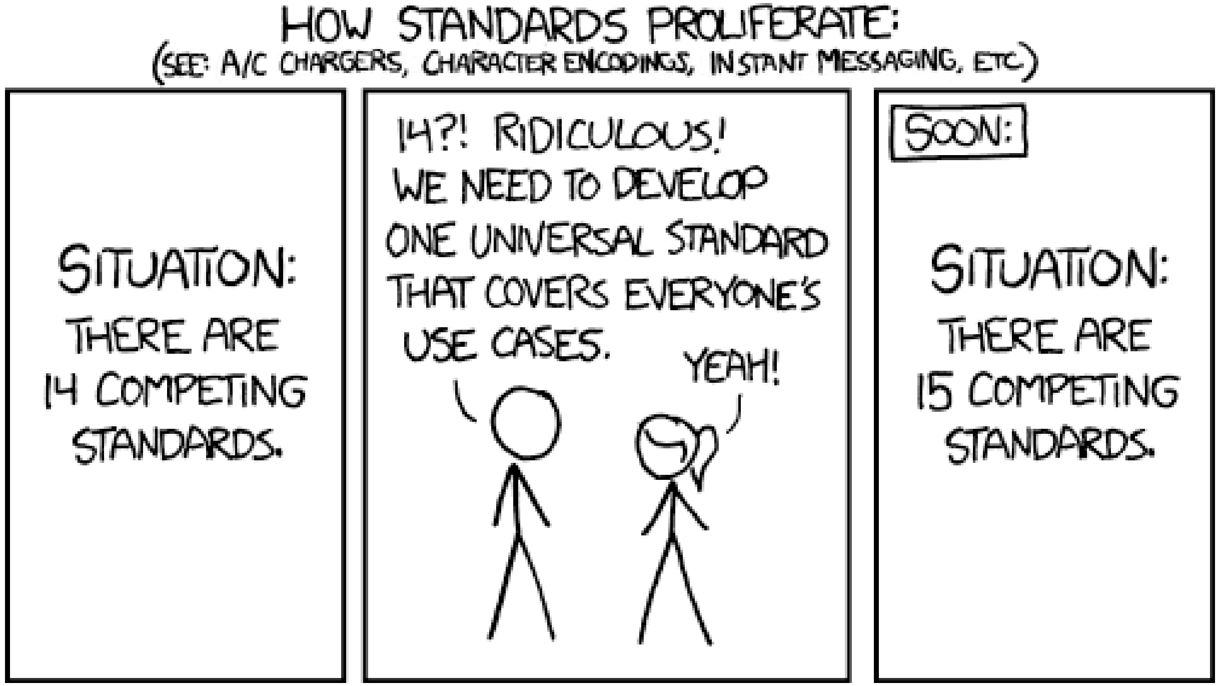
- Document and publish data using standards
- Promote data use via journals, presentations and meetings
- Solicit feedback from data users and address identified issues
- Monitor publications and websites for data use and address misapplications

Data Formats: Choosing and Adopting Community Accepted Standards

- Most projects (rightly so) focus on the content of their data files, you need to consider the format as well.
- Since you captured or created the data, and stored them in your own files, you know
  - how the data are organized,
  - how to read them,
  - how to use them,
  - characteristics of the data that could constrain their use.
- The goal of a good data format is to make it easier for others to read the data too.
- Many hours have gone into developing standards for formats – try to learn from them.

Why use community standards

- If you try to develop your data format from scratch, you will forget something.
- Build on the experience and improvements built into the community standards over years of use.
- Tools and analysis software natively support reading community standard data.
- Reduce development effort and support reuse.
- Positive feedback – they are more likely to be adopted by others.



http://xkcd.com/927/

Use self describing data formats

- Self-describing data formats have become a well accepted way of archiving and disseminating scientific data.
- Before self-describing data formats became widely used, each project often invented their own data formats, often raw binary or even ASCII.
- These approaches had a number of problems:
  - Machine dependent byte ordering or floating point organizations
  - Required a ‘key’ to be able to open the file and read the right data.
  - A new custom reader is needed for each different data organization. Working in a new language could be very difficult since you have to redevelop the reader anew.

File Edit View Bookmarks Settings Help

```
netcdf radflux_bjornoya {
dimensions:
        time = UNLIMITED ; // (3847970 currently)
        strlen25 = 25 ;
variables:
        double time(time) ;
                time:long_name = "time of the observation" ;
                time:short_name = "time" ;
                time:standard_name = "time" ;
                time:units = "seconds since 1970-01-01 00:00:00 UTC" ;
                time:axis = "T" ;
        char stationid(strlen25) ;
                stationid:long_name = "name and/or stationnumber used as identif
ier" ;
        float latitude ;
                latitude:long_name = "latitude" ;
                latitude:short_name = "latitude" ;
                latitude:standard_name = "latitude" ;
                latitude:units = "degree_north" ;
                latitude:valid_min = -90.f ;
                latitude:valid_max = 90.f ;
        float longitude ;
                longitude:long_name = "longitude" ;
                longitude:short_name = "longitude" ;
                longitude:standard_name = "longitude" ;
                longitude:units = "degree_east" ;
                longitude:valid_min = -180.f ;
                longitude:valid_max = 180.f ;
        float ssi(time) ;
                ssi:long_name = "shortwave irradiation at the surface" ;
                ssi:short_name = "ssi" ;
                ssi:standard_name = "surface_downwelling_shortwave_flux" ;
                ssi:_FillValue = -999.f ;
                ssi:units = "watts/meter2" ;
                ssi:cell_method = "time: mean (last minute)" ;
        float ssisenstemp(time) ;
                ssisenstemp:long_name = "temperature of the surface shortwave ir
radiation sensor" ;
                ssisenstemp:short_name = "ssisenstemp" ;
                ssisenstemp:_FillValue = -999.f ;
                ssisenstemp:units = "degC" ;
                ssisenstemp:cell_method = "time: mean (last minute)" ;
        float dli(time) ;
                dli:long_name = "difference between downward atmospheric longwav
e irradiation and emitted CGR4 irradiance" ;
                dli:short_name = "dli" ;
                dli:standard_name = "surface_net_downward_longwave_flux" ;
                dli:_FillValue = -999.f ;
                dli:units = "watts/meter2" ;
                dli:cell_method = "time: mean (last minute)" ;
        float dlisenstemp(time) ;
                dlisenstemp:long_name = "temperature of the surface longwave irr
adiation sensor" ;
                dlisenstemp:short_name = "dlisenstemp" ;
                dlisenstemp:_FillValue = -999.f ;
                dlisenstemp:units = "degC" ;
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                battery:_FillValue = -999.f ;
                battery:units = "V" ;
                battery:cell_method = "time: min (last minute)" ;
:
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Bjørnøya : ncdump

File Edit View Bookmarks Settings Help

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                        "2016-01-01 revision" ;
                :title = "Downwelling surface radiative fluxes at Bear Island" ;
                :abstract = "Downwelling surface radiative fluxes observed at th
e meteorological station at Bear Island in the Barents Sea. Measurements are mad
e using Kipp and Zonen CMP21 and CGR4 pyranometers and pyrgeometers. Daily maint
enance is performed by the meteorological personnel at the station. Data are ave
raged over the last minute and the time is set to UTC. This data set has been co
llected with support from the Norwegian Research Council. The quality control fo
cus on the radiative parameters, thus sensor temperatures may contain errors." ;
                :topiccategory = "ClimatologyMeteorologyAtmosphere" ;
                :keywords = "Radiative Flux" ;
                :gcmd_keywords = "Atmosphere > Atmospheric Radiation > Shortwave
 Radiation\n",
                        "Atmosphere > Atmospheric Radiation > Longwave Radiation
" ;
                :area = "Barents Sea" ;
                :activity_type = "Land station" ;
                :PI_name = "<D8>ystein God<F8>y" ;
                :contact = "o.godoy@met.no" ;
                :institution = "Norwegian Meteorological Institute" ;
                :url = "http://www.met.no/" ;
                :product_name = "radiative fluxes" ;
                :Platform_name = "Bj<F8>rn<F8>ya" ;
                :project_name = "iAOOS-Norway/IPY-THORPEX" ;
                :start_date = "2008-04-01 13:14 UTC" ;
                :stop_date = "2015-12-16 12:50 UTC" ;
                :distribution_statement = "Restricted to iAOOS-Norway" ;
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                :northernmost_latitude = 74.5166667 ;
                :westernmost_longitude = 19.01666667 ;
                :easternmost_longitude = 19.01666667 ;
                :quality_statement = "Quality controlled" ;
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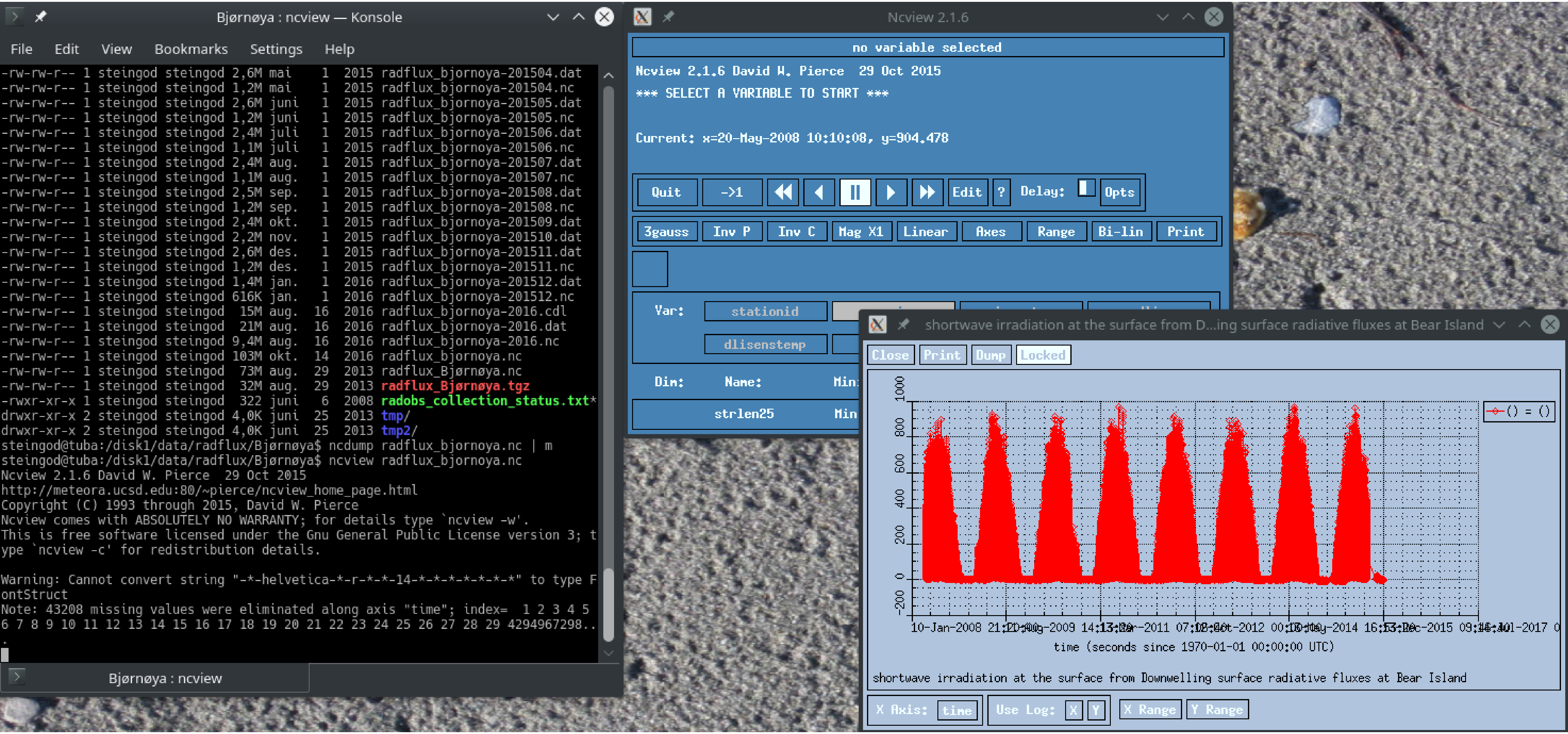
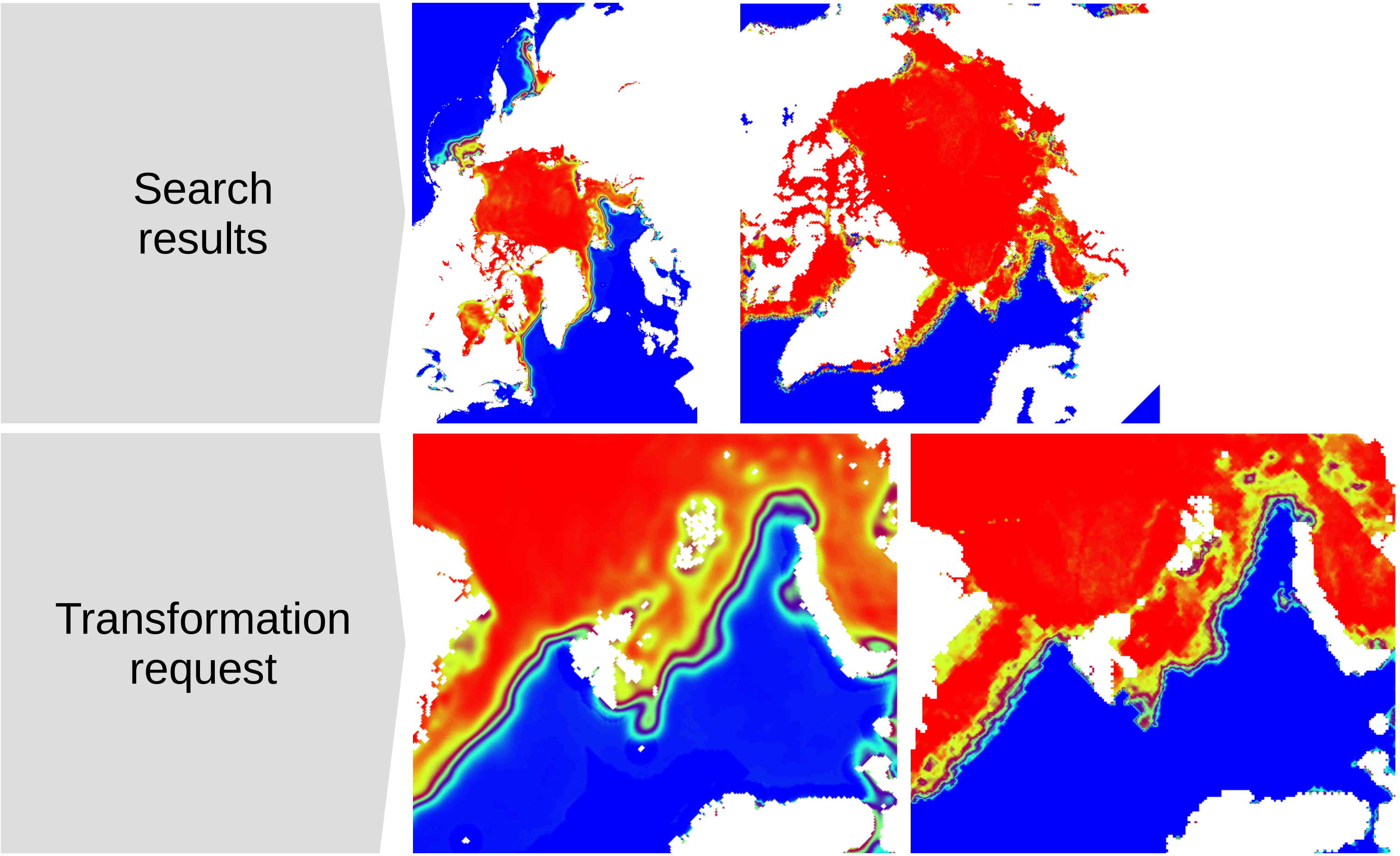
Bjørnøya : ncdump



www.sios-svalbard.org

Transformations

Transformations allow users to do
comparisons of products and to extract
tailored products for their specific need



NetCDF

- NetCDF is a container you can put almost anything into
- Standardised formulations exist for
  - Gridded data
  - Timeseries
  - Trajectories
    - Including time series of trajectories
  - Profiles
    - Including time series of profiles
- Can easily be served as data streams using OPeNDAP
- Can be integrated directly in tools like
  - R
  - Matlab
  - Ferret
  - Python
  - Excel
    - Check e.g. NETCDF4Excel on GitHub
- If you access data through OPeNDAP you do not have to download data

Data Collection, Entry, and Manipulation

- Goals of Data Entry
  - Create quality data sets that are:
    - Valid
    - Organized to support ease of use and reuse

CC image by Travis S on Flickr

Example: Poor Data Entry

data.xls

	A	B	C	D	E	F	G	H	I	J	K	L
1	Site	Date	Plot	Species	Weight	Acult		Rodent Trapping 3/15/2010				
2	DeepWell	2/13/2010	1	DIPO	12.1	j		Site	Plot	Adult	RodentSp	Weight
3	Deep Well	Feb-10	2	Pero	13.22	j		DW	1	y	Pero	12
4	rioSalado	2/13/2010	1a	pero	16	N		RS	2	j	PERO	escaped <15
5	riuSladu	"	1*	CleGap	18.92	gut away		RS	3	n	Clegap	91
6				Mean1	15.06							
7												
8												
9												
10												
11												
12	Rodent Trapping		MJK & ALN	10-Apr-10								
13	Site	Plot	Adult	Species	grams	Ccmments						
14	deep well	1	y	woodrat	13							
15	riosalado	2	y	PERO	24.5							
16	riosalado	3	y	Clegap	91							

Sheet1

- Inconsistency between data collection events
  - Location of Date information
  - Inconsistent Date format
  - Column names
  - Order of columns

Example: Poor Data Entry

data.xls

	A	B	C	D	E	F	G	H	I	J	K	L
1	Site	Date	Plot	Species	Weight	Acult		Rodent Trapping 3/15/2010				
2	DeepWell	2/13/2010	1	DIPO	12.1	j		Site	Plot	Adult	RodentSp	Weight
3	Deep Well	Feb-10	2	Pero	13.22	j		DW	1	y	Pero	12
4	rioSalado	2/13/2010	1a	pero	16	N		RS	2	j	PERO	escaped <15
5	rioSladu	"	1*	CleGap	18.92	gut away		RS	3	n	Clegap	91
6				Mean1	15.06							
12	Rodent Trapping		MJK & ALN	10-Apr-10								
13	Site	Plot	Adult	Species	grams	Comments						
14	deep well	1	y	woodrat	13							
15	riosalado	2	y	PERO	24.5							
16	riosalado	3	y	Clegap	91							

Sheet1

- Inconsistency between data collection events
  - Different site spellings, capitalization, spaces in site names—hard to filter
  - Codes used for site names for some data, but spelled out for others
  - Mean1 value is in Weight column
  - Text and numbers in same column – what is the mean of 12, “escaped < 15”, and 91?

Best Practices

data.xls

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Site	Date	Plot	Species	Weight	Acult		Rodent Trapping 3/15/2010						
2	DeepWell	2/13/2010	1	DIPO	12.1	j		Site	Plot	Adult	RodentSp	Weight		
3	Deep Well	Feb-10	2	Pero	13.22	j		DW	1	y	Pero	12		
4	rioSalado	2/13/2010	1a	pero	16	N		RS	2	j	PERO	escaped <15		
5	riuSladu	"	1*	CleGap	18.92	gut away		RS	3	n	Clegap	91		
6				Mean1	15.06									
7														
8														
9														
10														
11														
12	Rodent Trapping		MJK & ALN	10-Apr-10										
13	Site	Plot	Adult	Species	grams	Ccmments								
14	deep well	1	y	woodrat	13									
15	riosalado	2	y	PERO	24.5									
16	riosalado	3	y	Clegap	91									

Sheet1

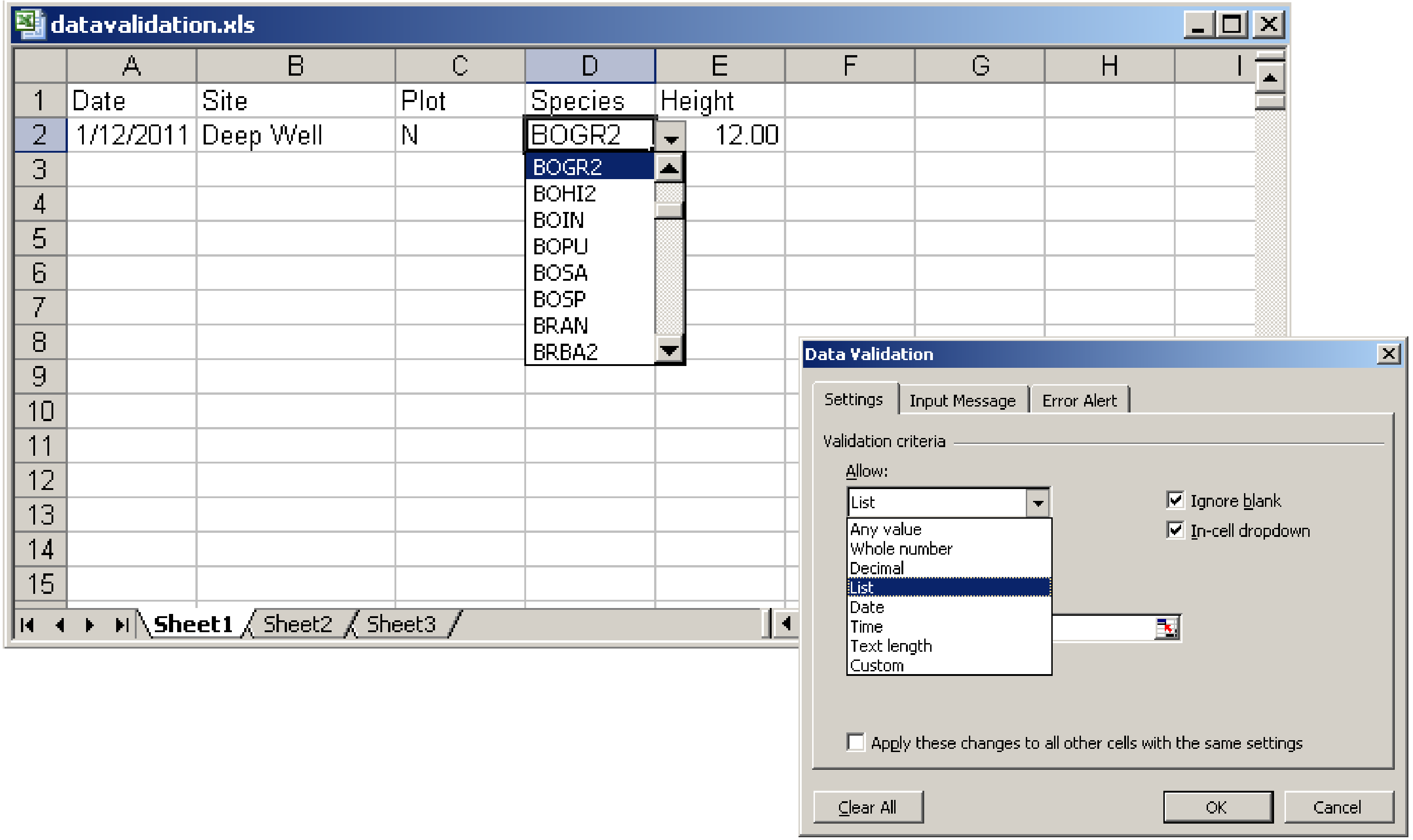
SEV_SmallMammalData_v.5.25.2010.xls

	A	B	C	D	E	F	G	H
1	Date	Site	Plot	Species	Weight	Adult	Comments	
2	2/5/2010	Deep Well	1	DIPO	13.2	y		
3	2/4/2010	Deep Well	1	CLEGAP	11.6	j		
4	2/5/2010	Rio Salado	1	DIPO	14.2	y		
5	2/5/2010	Rio Salado	2	PERO	10.1	y		
6	3/15/2010	Deep Well	1	DIPO	15.2	y	plot burned	
7	3/15/2010	Deep Well	2	DIPO	21.7	y	pregnant	
8	3/15/2010	Rio Salado	1	CLEGAP	16.2	j		
9								
10								
11								
12								

SmallMammalTrapping / Sheet3

- Columns of data are consistent: only numbers, dates, or text
- Consistent Names, Codes, Formats (date) used in each column
- Data are all in one table, which is much easier for a statistical program to work with than multiple small tables which each require human intervention

If you use Excel or similar



SIOS InfraNor kick-off meeting

Information about reporting and invoicing

30. mai 2018

Inger Jennings, Tromsø

SIOS
SVALBARD INTEGRATED ARCTIC
EARTH OBSERVING SYSTEM

Basic principles

- Each partner institution will sign a contract with SIOS Svalbard AS listing the instruments that are included in the project
- Each institution is responsible for reporting on their instruments
- Each instrument contact person is responsible for keeping up to date records for their instrument

- N.B.: We are still waiting to sign the contract with RCN and cannot sign the partnership agreement contracts until this has been done

Invoicing

- Invoices must follow the instructions provided
- Invoices must be accompanied by a financial reporting form (template provided)
- **One invoice and financial reporting form per instrument!**
- Invoicing should be quarterly, if additional invoicing is required please get in touch
- Invoices for person hours must be accompanied by timesheets
- Annual reporting deadline **31st December**
- Annual invoicing deadline **15th December**

Reporting to RCN

- Detailed milestone plan must be submitted by the end of year 1

- Annual progress report – requires input from all partners

- Revised budget for the operational phase – must be delivered by the end of year 3 (2020)

Requirements from SIOS

- Make data available in SIOS data portal
- Make infrastructure available and visible (Observation Facility Database)
- Outreach – use SIOS logo and inform us!
- Think about sharing logistics with others that are working in the same area

- PI is responsible for obtaining persmissions and following relevant legislation

Requirements from SIOS (cont.)

- Register in RiS
  - One project per instrument
  - Links to associated projects

- Marking of instruments
  - Owner – institution and contact person (telephone number?)
  - Date for installation and retrieval
  - RiS ID
  - SIOS InfraNor + instrument number

SIOS Call for Access 2018

- Call will be published 3rd or 4th July on the SIOS website
- Application deadline: 15th September
- Activities that are directly linked with existing SIOS coordinated initiatives, e.g. InfraNor, will be prioritised
- Keep an eye on our website and Twitter feed (@SIOS_KC) for more information!

Meeting plan

- Annual InfraNor partners meeting: during SIOS Polar Night Week
  - 14th – 18th January 2019

- Leader group should meet regularly
  - Next meeting soon?

Reports to RCN should include the following:

Progress and status:

- Data delivery to SDMS for each instrument, interoperability
- Quantification of data sets, data users etc.
- InfraNor is integration with the international contributions to the observing system
- COAT integration
- SIOS KC services supporting the implementation of SIOS InfraNor
- Progress and implementation of research infrastructure projects closely connected to and integrated into SIOS, e.g. the Grand Challenge Initiative
- Examples (highlights) of how SIOS supports Earth System Science research and generates data sets of relevance that are used for Earth System Modelling.
- How SIOS contributes to a pan-Arctic observing system
- Partners contributions to SIOS outside of the commitments of the InfraNor project

COAT
A core element of the terrestrial biosphere part of SIOS

Åshild Ønvik Pedersen, Norwegian Polar Institute

SIOS Kick-off meeting Tromsø 29 May 2018

Photo: C. Hübner, T. Nordstad, B.E. Sandbakk; K. Blom

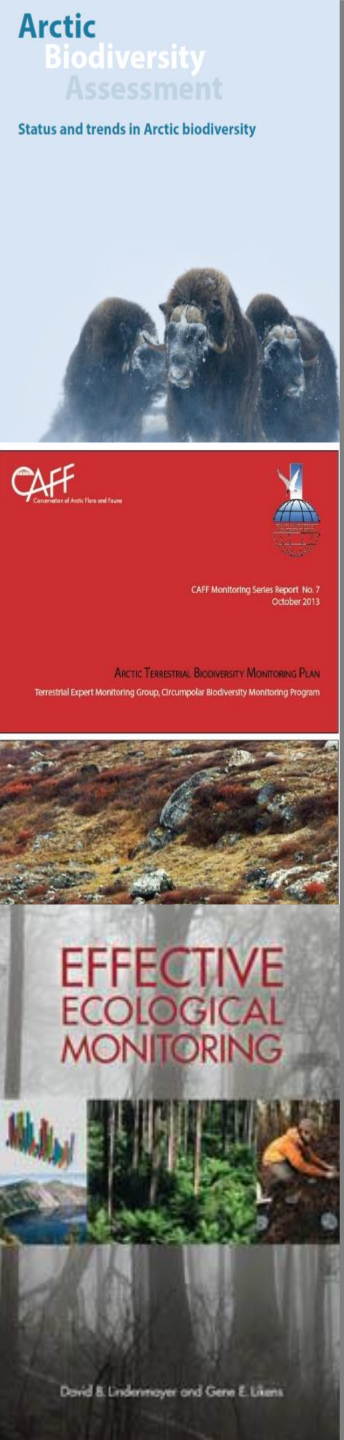
Norwegian Institute for Nature Research

Norwegian Meteorological Institute

AGENDA

- What is COAT?
- Ecosystem monitoring modules
- Climate impacts on terrestrial ecosystems
- Status

1. **COAT** is an apative system for long-term ecological research (LTER) and monitoring of arctic ecosystem.
2. **COAT** builds on and expands the ongoing research and long-term monitoring of the tundra ecosystem in Svalbard.



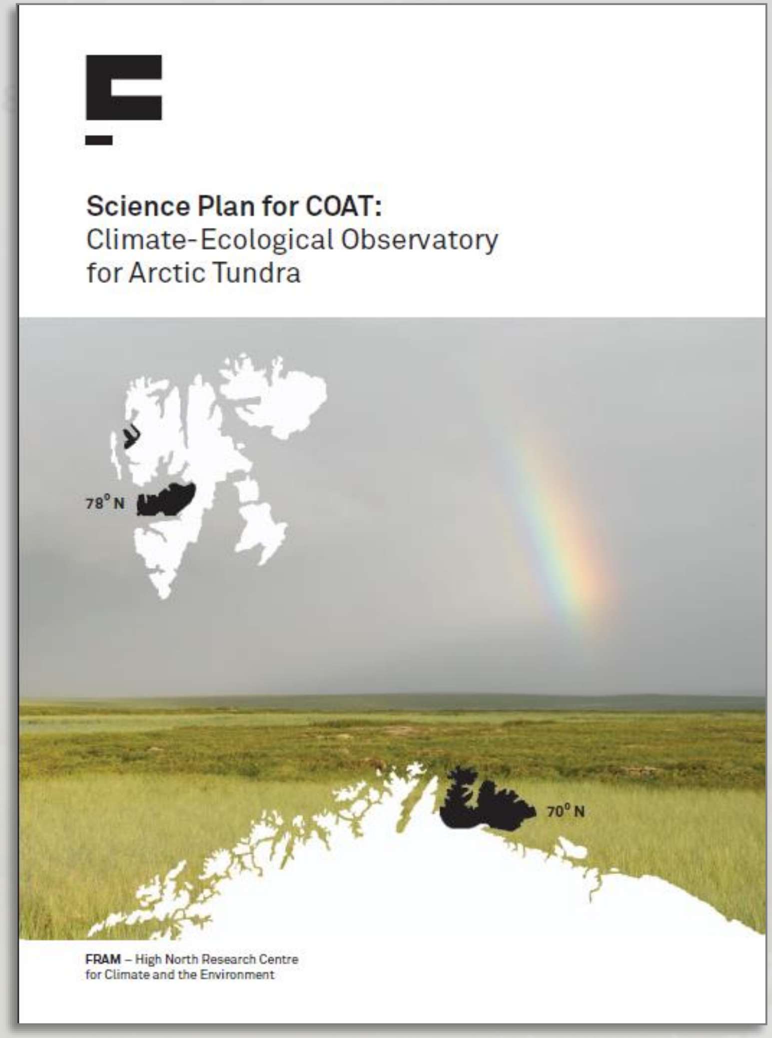
COAT is a response from 5 central FRAM Centre institutions to the urgent international calls for establishment of scientifically robust observation systems that enable real time detection, documentation and understanding of climate impacts on arctic tundra ecosystems.

UNIVERSITY OF TROMSØ
NINA
Meteorologisk institutt
met.no
UNIS
NORSK·POLARINSTITUTT

- Multi-diciplinary research «climate - ecology»
- **Climate =** is the statistical description of typical weather pattern over time that drives ecological processes
- **Ecology =** is dealing with the relations and interactions between organisms and their environment

COAT has ambitions to answer how climate change impact directly and indirectly the tundra ecosystem and the future consequences for the system through food-web monitoring

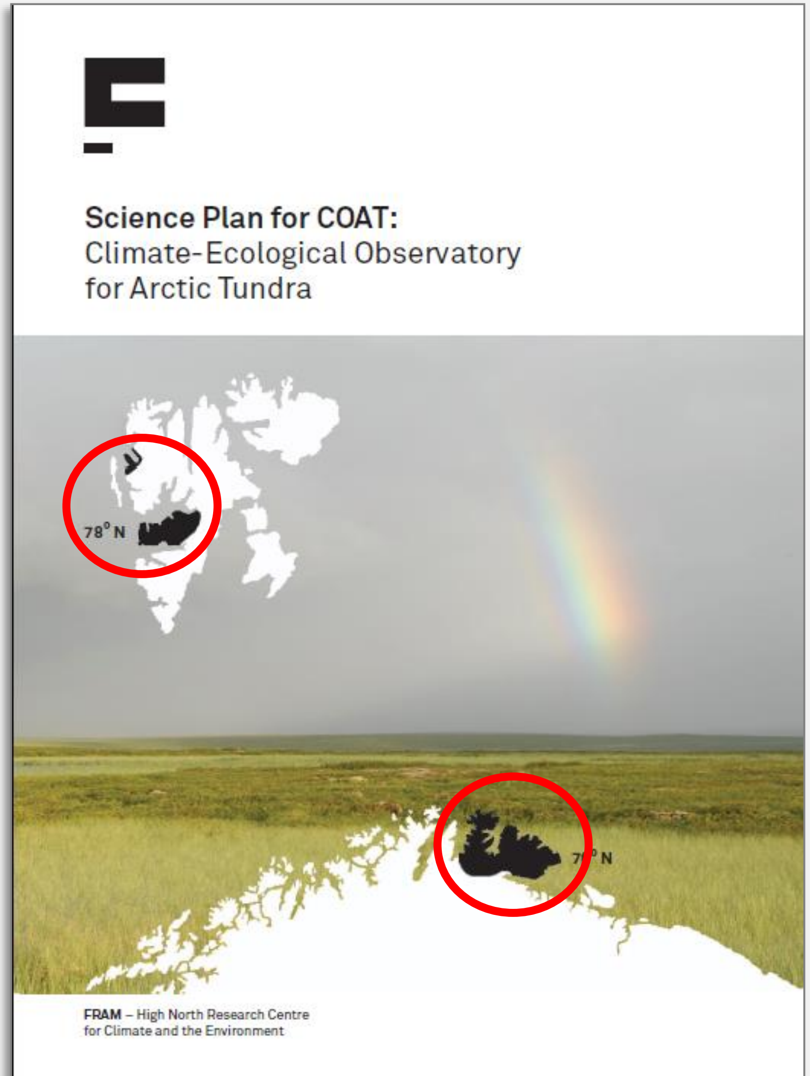
The COAT Science Plan



- Outlines implementation of the **adaptive monitoring system** that documents how focal components of Norwegian tundra ecosystems respond to climate change
- Developed by a COAT planning task force (23 ecologist & climatologists)
- Internationally quality assured with grade «excellent» by NFR referee panel

Fram Centre report series no.1, http://www.aminor.org/coat

2 COAT regions and focal ecosystems



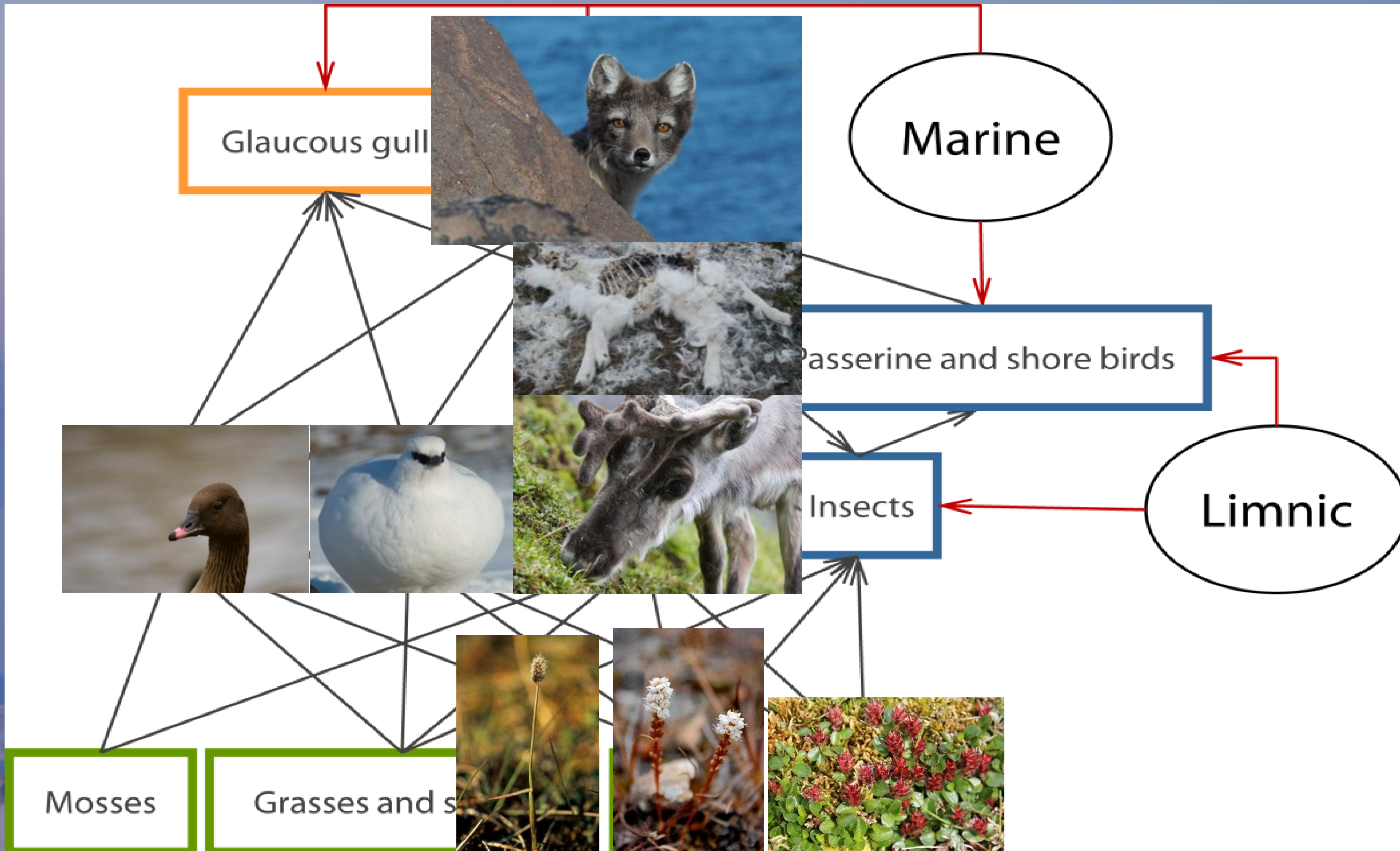
Varanger Peninsula

- Low arctic – bordering sub-arctic

Svalbard

- High Arctic - 2 bioclimatic zones (middle & northern Arctic bioclimatic zones)
- Climatic gradients – coastal to inner fjord

COAT applies a «**food-web approach**» that targets climate sensitive species and functional groups that are and/or can be locally managed



oto: N. Lecomte, T. Nordstad, J. Dybdahl, B. Frantzen, E. Fuglei

The terrestrial ecosystem in Svalbard

Lack
lemmings and
specialist predators

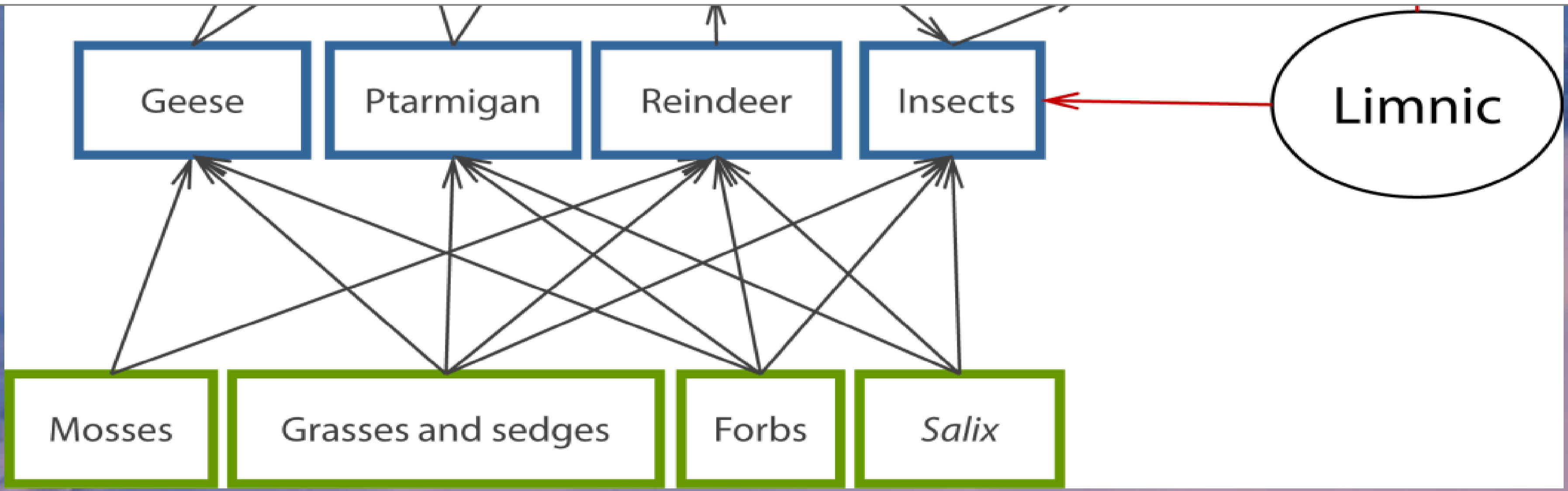


Photo: E. Fuglei

COAT focuses on 2 drivers of ecosystem changes

«climate change» and «local management»

1. The temperature increases

85. måned over normaltemperaturen

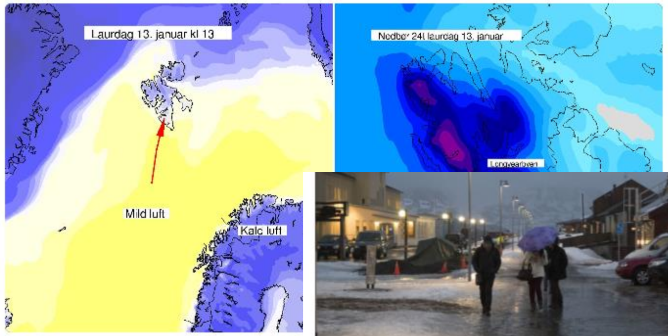
Varmerekorder og temperatur langt over det normale på Svalbard og Jan Mayen skremmer klimaforskerne. – Det vi ser er ekstremt, sier Reidun Gangstø Skaland.

UVANT MED IS: Biolog Åshild Ønvik Pedersen fra Norsk Polarinstitutt og feltassistent Larissa Beumer gransker tykkelsen på overflateis på Svalbard, is som kommer på grunn av at nedbør stadig oftere kommer som regn. De to kartlegger hvilken effekt klimaendringene på øygruppen har å si for villreinen som lever der.
FOTO: ODD-ARNE OLDERBAKK / NRK

Meteorologene
@Meteorologene

Følg

#Svalbard i helga: Mild luft og nedbør. Temperaturar rundt +4 grader og totalt 20-40 mm regn i løpet av laurdagen. Mildt og litt regn også på søndag.



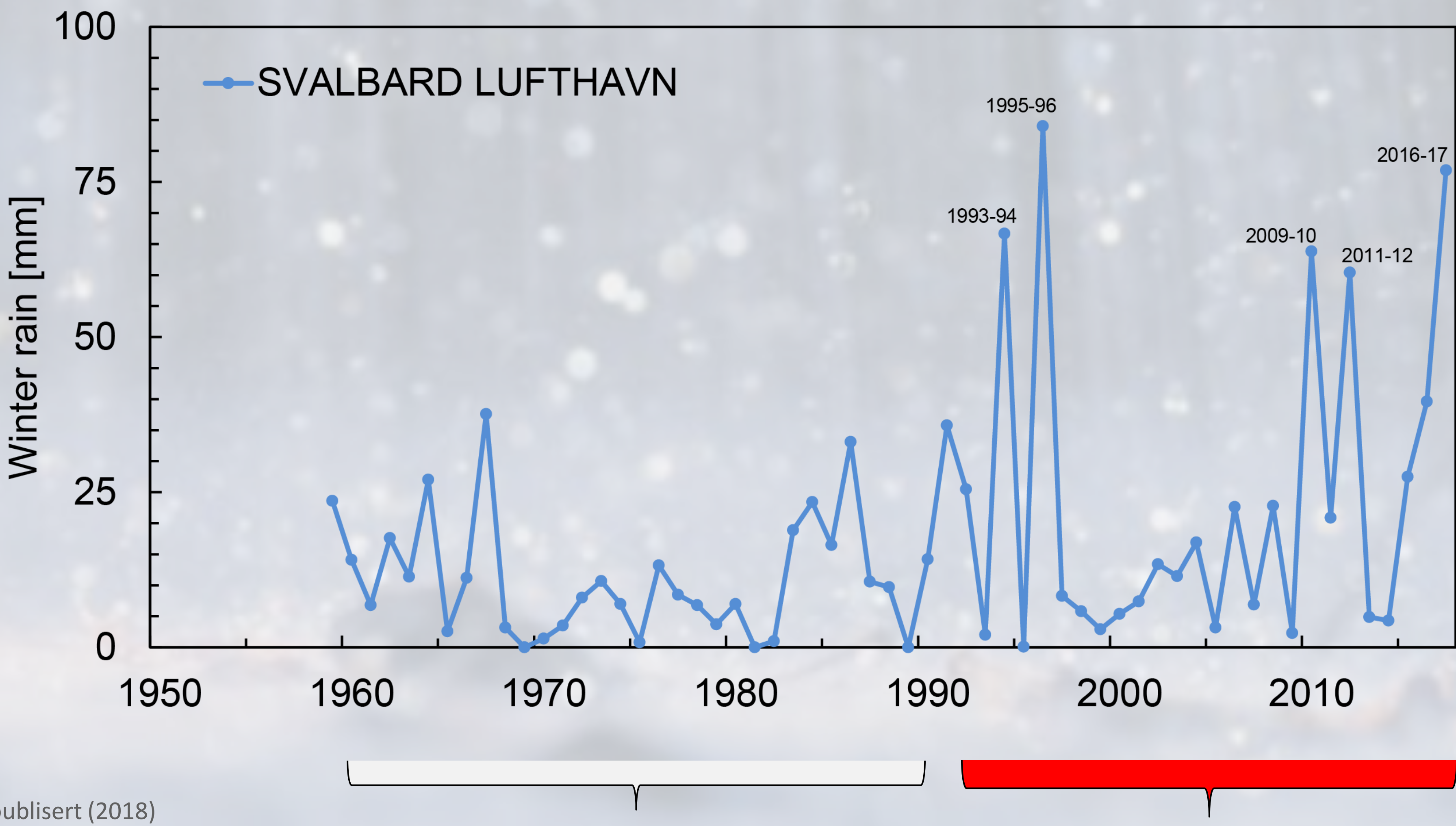
05.41 - 10. jan. 2018

Månedstemperaturen i Longyearbyen har vært over normalen i 85 måneder på rad. Bildet ble tatt i februar i fjor. FOTO: Line Nagell Ylvisåker (arkiv)

Denne utviklingen skremmer klimaforskeren

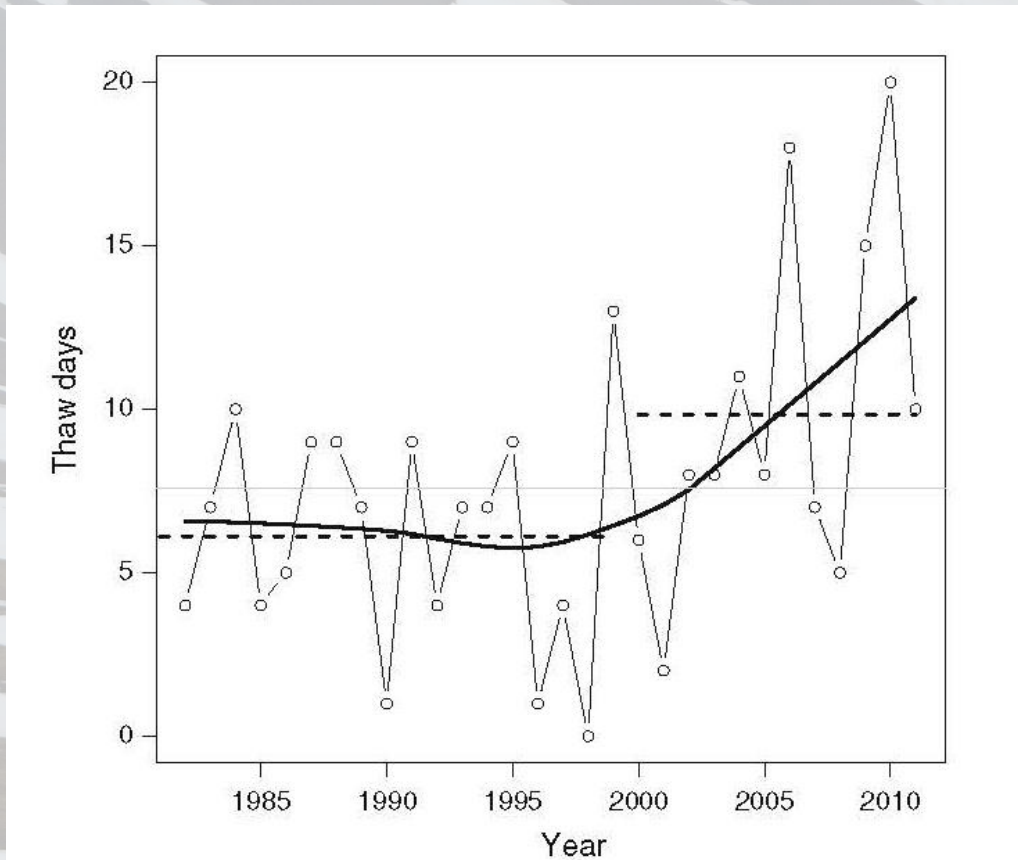
I 85 strake måneder har månedstemperaturen ved Svalbard lufthavn vært over normalen. Årsgjennomsnittet har nå vært høyere enn normaltemperaturen i 29 år på rad. – Det er ekstremt, sier Reidun Gangstø Skaland.

2. Winter rain is more frequent



Isaksen upublisert (2018)

3. Sping onset is earlier



No. days > 0°C in May

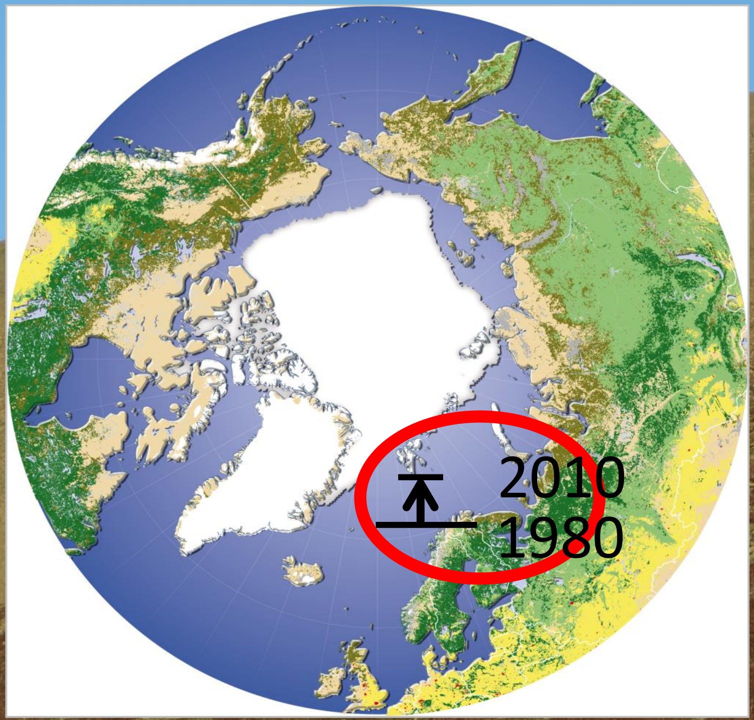
(gjennomsnitt over Ny-Ålesund og Svalbard Lufthavn; 1981-2011)

Jensen et al. (2014)

4. Winter onset is later

The growth season is changing

- Southern growth seasons (days with > 4°C) has moved on average 4-7 latitudes north during the last 30 years (Xu et al. 2013)



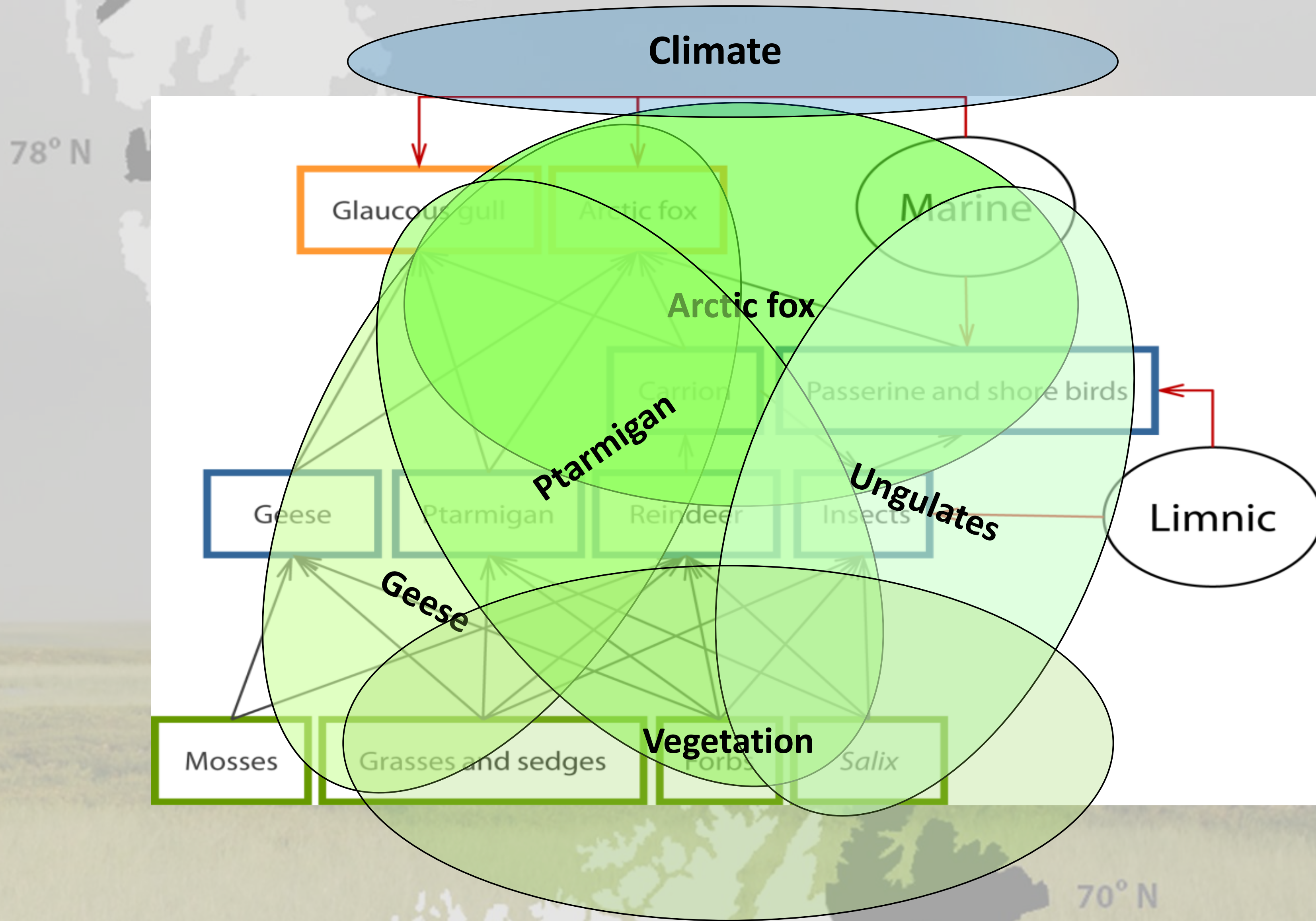
Sør-Spitsbergen i 2010 =
Finnmark i 1980

Foto: A. Tarroux

5. The sea is warmer and not covered with ice anymore

Foto: Asle Isaksen (1 May 2006), Internett, J. Roberts, L. Beumer

5 food-web monitoring modules cover overlapping compartments of the food web



Food-web modules


Foto: E. Fuglei, T. Nordstad, N. Lecomte, B. E. Sandbakk

- Contain compartments of the food web with strong links (interactions) with a *ecosystem service*, *ecosystem function* or *conservation target*
- Overlap and are linked by trophic and non-trophic interactions

Each monitoring module has a conceptual model describing the climate impact pathways and predictions

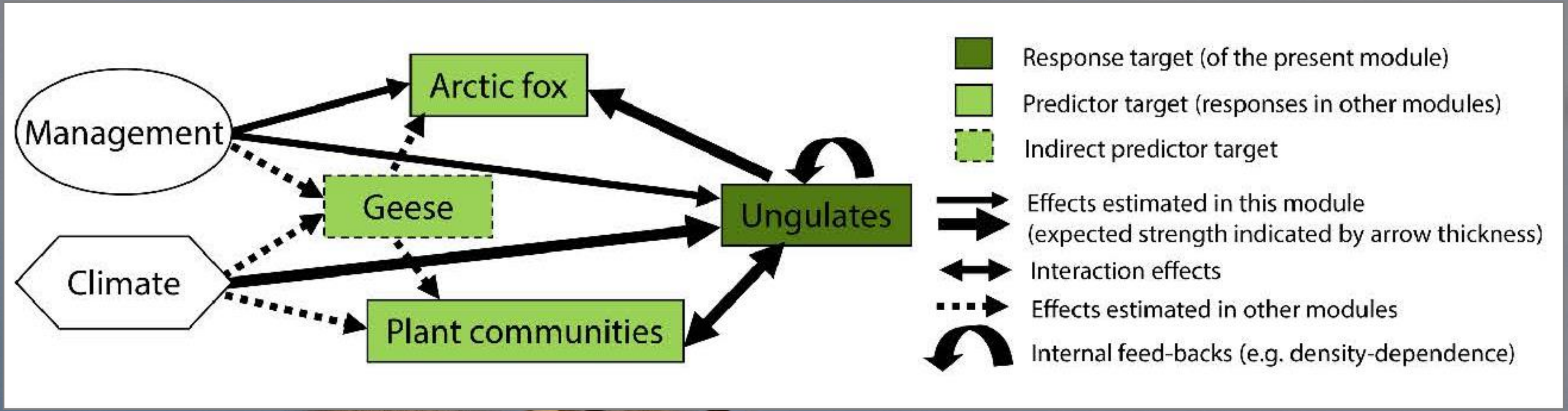


Photo: N. Lecomte

Where are we now?
COAT status 2018

36 RESEARCH NOTES FRAM FORUM 2016

Åshild Ø. Pedersen // Norwegian Polar Institute
Audun Stien // NINA – Norwegian Institute for Nature Research
Eeva Soininen and Rolf A. Ims // UiT The Arctic University of Norway

Climate-Ecological Observatory for Arctic Tundra—Status 2016

The arctic tundra is challenged by climate change — more so than most other ecosystems on Earth. The rapid shifts to new climate regimes may give rise to new ecosystems with unknown properties. These dramatic changes call for ecosystem-based monitoring of climate impacts on arctic food webs.

http://www.framsenteret.no/

Photo: J. Doest

«COAT Infrastructure» (2016-2020)

Research infrastructure to run the long-term monitoring

COAT Svalbard Infrastructure (10 mill. Tromsø Forskningsstiftelse)

COAT Svalbard infrastructure + (≈ 15 mill SIOS-InfraNor)

«COAT Infrastructure» 2016-2020

«COAT Science» 2016 for eternity!

«COAT Science» — the long-term research and monitoring program facilitated by the infrastructure


COAT Infrastructure will implement and operationalize physical and electronic infrastructure related to 77 state variables
ski-doo
ZN 9545
Photo: Å. Ø. Pedersen

Weather stations

- Extend network of automatic stations (6 NL + 3 west coast)
- Cover ecological gradients relevant to the food-web modules

Norsk Polarinstitutt

Søk... Meny

Forsiden › Om oss › Nyheter ›

Nye værstasjoner gir klimadata fra Svalbardtundraen

Av Elin Vinje Jenssen / Norsk Polarinstitutt – 15. september 2017

De nye værstasjonene skal hjelpe forskere å bedre forstå og forutsi konsekvensene som et stadig varmere Arktis får for arter og økosystemer på land.

I Arktis oppleves de globale klimaendringene spesielt sterkt. Vintrene er mildere og våtere, og det er vanskelig å forutsi konsekvensene dette får for arter og økosystemer på land.

Det langsiktige overvåkningsprogrammet COAT skal samle informasjon om landøkosystemene i norsk Arktis og studere hvordan nøkkelarter påvirkes av de raske klimaendringene, fra rovdyr til planteetere og viktige beiteplanter.

Klimadata fra nye geografiske områder

Nylig var en gruppe økologer og meteorologer på befaring på Nordenskiöld Land, som er det sentrale landområdet på Spitsbergen, for å finne passende steder å sette opp seks nye værstasjoner i regi av COAT.

Når værstasjonene blir operative skal de sende data direkte inn i Meteorologisk institutt sine datasystemer og dekke geografiske områder som i dag ikke inngår i det eksisterende nettverket. Fra før er det 17 slike

PÅ BEFARING De som deltok på befaringen for å finne egnede steder for de nye værstasjonene var forsker Åshild Ønvik Pedersen (f.v.) og ingeniør Stein Tore Pedersen fra Norsk Polarinstitutt og COAT, overingeniør Bernt Enge Larsen og forsker Ketil Isaksen fra

Examples

Temperatureloggers and snow/basal ice measurements

- Extend the climate monitoring network 2010 NL & Brøgger + (2000)

Photo: Å.Ø. Pedersen, B.B. Hansen

Examples

SnowModel (Liston et al.)

- Ecological relevant spatial and temporal scales (100 × 100 m)
- Supply snow/ice related predictors relevant to COAT modules

AGU PUBLICATIONS
JGR
Journal of Geophysical Research: Earth Surface
RESEARCH ARTICLE
10.1002/2016JF003999

Multidecadal climate and seasonal snow conditions in Svalbard

W. J. J. van Pelt[1,2], J. Kohler[2], G. E. Liston[3], J. O. Hagen[4], B. Luks[5], C. H. Reijmer[6], and V. A. Pohjola[1]

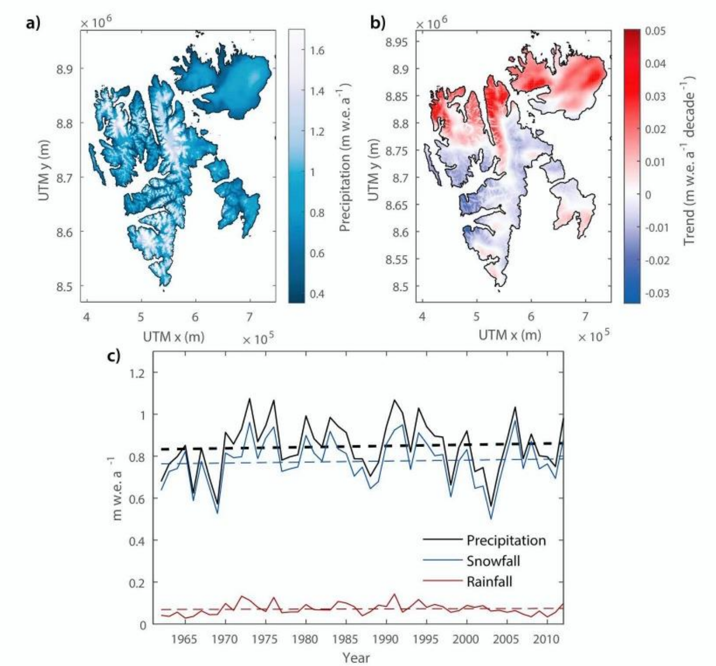


Figure 6. Precipitation in Svalbard between 1961 and 2012: (a) long-term mean spatial distribution and (b) trend, and (c) land area-averaged precipitation, snowfall, and rainfall time series with years defined between 1 September (preceding year) and 31 August.

Examples

Automatic cameras

- Monitoring of abundance
- Herbivory
- Plant phenology
- Snow-melt

78° N

70° N

Photo: E. Fuglei

Examples

78° N

Acoustic sensors

- Monitoring of ptarmigan abundance

Photo: E. Fuglei

Examples

Telemetry
– GPS and satellite transmitters

- Monitoring of spatial and temporal distribution of response targets (fox, ptarmigan, reindeer)

78° N

Photo: M. L. Moullec

Examples

Digital infrastructure = COAT Data Portal

- Based on GeoNode = an open source *Spatial Data Infrastructure*
- Web platform with multiple components (python/django, Geoserver, pycsw etc.)
- API engine created for data upload, download, querying
- Catalogue based on international standards
- In June 2018 the first staging version of the portal is ready for testing

Photo: M. L. Moullec

Thank you!

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Jesper Madsen

TROMSØ FORSKNINGSSTIFTELSE

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Forskningsrådet
The Research Council of Norway

Photo: B. Peeters

Remote sensing, autonomous unmanned vehicles, floats and oceanographic modelling in Arctic Seas

Relevant ongoing projects Akvaplan-niva

1. The Glider project: "Unmanned ocean vehicles, a flexible and cost-efficient offshore monitoring and data management approach" (Apn: RCN DEMO 2000 and ConocoPhillips). Infrastructure "waveglider", "seaglider", "sailbouy". Head Lionel Camus

2. The SEA PATCHES project. "Sustainable harvesting of a patchy resource: aggregation mechanisms and implications for stock size estimates. Objective: To determine the physical and biological mechanisms that are responsible for the formation of zooplankton patches, and how these influence stock size estimations of a commercially utilised key species". (UiT: RCN Marinforsk). Head Sünnje Linnéa Basedow (Ole Anders NøstApn)

3. Viasta project. "Unstructured-grid modeling of transport and dispersion in the Lofoten-Vesterålen region" (UiO: Vista programmet). Head Pål Erik Isachsen (Ole Anders Nøst, Eli Børve Apn).

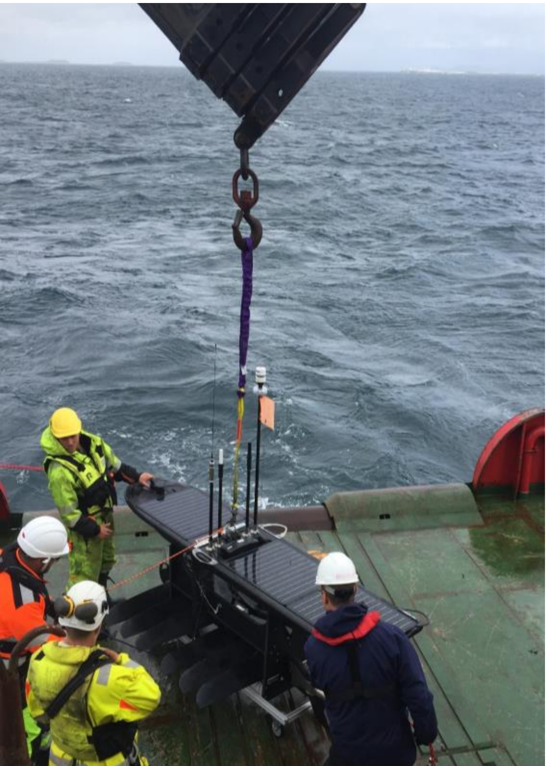
4. NorArgo2 "Norwegian Argo Infrastructure – a contribution to the European and global Argo infrastructure" . (IMR: RCN Infrastructure). Head Kjell Are Mork (Stig Falk-Petersen Apn)

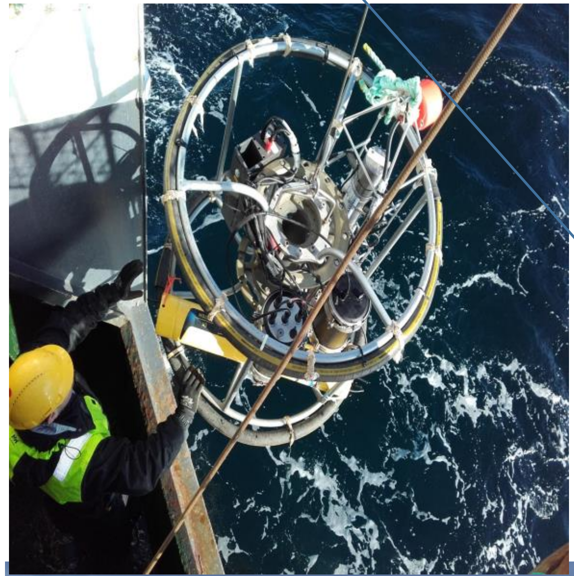
5. NorSOOP. "Norwegian Ships of Opportunity Program for marine and atmosferic research (NIVA RCN Infrastructure. Head Kai Sørensen (Stig Falk-Peresen Apn)

Stig Falk-Petersen, Akvaplan-niva and UiT, research scientist and professor

Remote sensing platforms:
Satellites, surface gliders, subsurface gliders, ships, argo floats and landers.

Instruments that can monitor:
Phytoplankton, krill, *Calanus,* fish larvae, fish, mammal vocalisation, salinity, temperature, currents, wind, surface temperature, oxygen, nutrients, hydrocarbons, Ph and more





Research Institutions:
Akvaplan-niva, U Tromsø, U Nord, U Oslo, U Bergen, DNMI, University of British Columbia, Institute of Marin Research, Marine and Freshwater Research Institute Island, University of Strathclyde, Shanghai Jiao Tong University, Institute of Oceanology Poland, AWI, Uni Research, NIVA.

Technology partners:
Kongsberg Maritime UPM, Christian Michelsen Research AS (CMR), Offshore Sensing, Maritime Robotics, Calanus as, Aanderaa.

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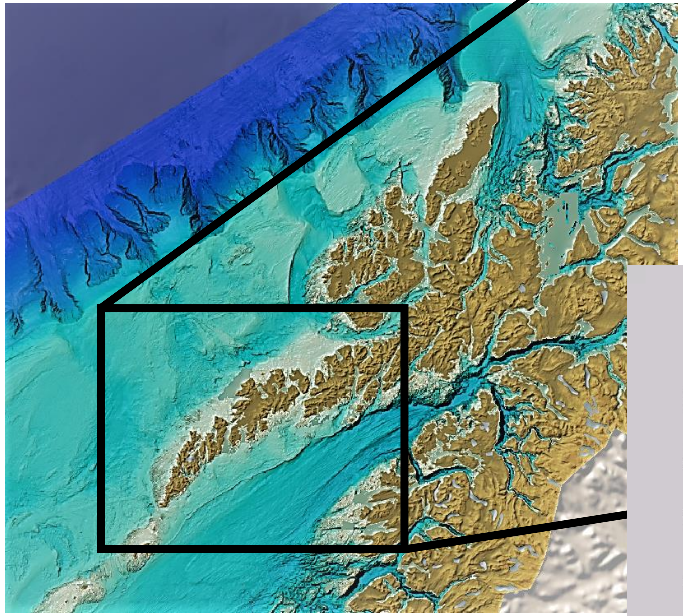
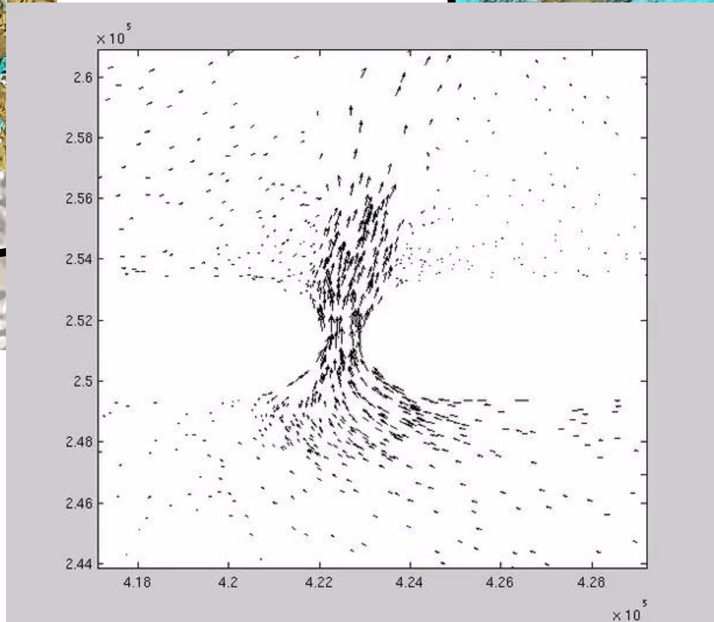
MARITIME ROBO
Joel Pederick

Vista prosjektet
Unstructured-grid modeling of transport and dispersion in the Lofoten-Vesterålen region
FVCOM





Eli Børve, Pål Erik Isachsen , Ole Anders Nøst

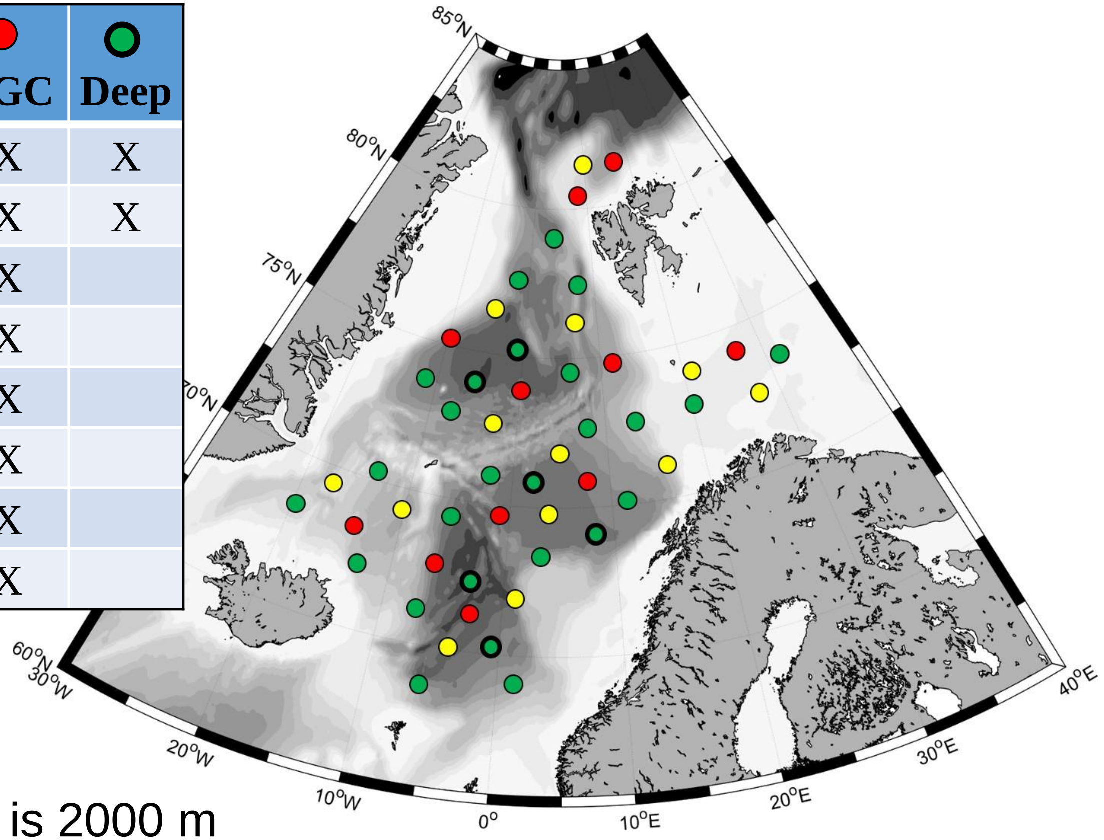
Does oscillating current mean oscillating transport?

Across shelf, canyons and sounds

NorArgo2 project

- NorArgo2 will operate and maintain an array of 40 Argo floats
- Four different types of Argo floats with different equipment / properties

Ocean Variable / Sensor	Core	Bio	BGC	Deep
Pressure, temp., salinity	X	X	X	X
Drift (at depth and surface)	X	X	X	X
Oxygen		X	X	
Chlorophyll		X	X	
Suspended particles, POC		X	X	
Irradiance, PAR		X	X	
pH			X	
Nitrate			X	



Core, Bio, BGC: max depth is 2000 m
Deep: 4000 m

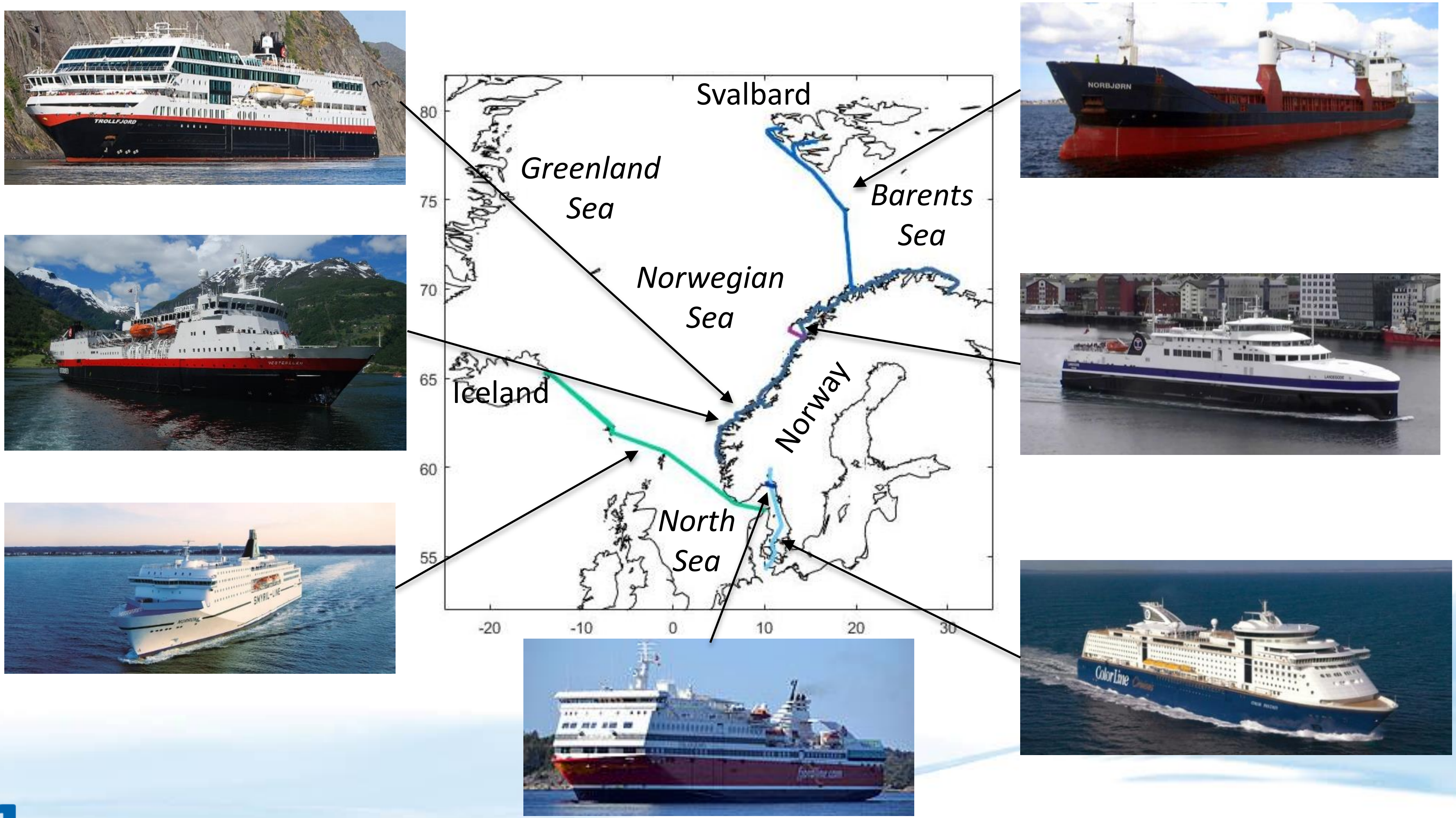
Ships of opportunity in SIOS

(Item 56 to upgrade the FerryBox with Atmospheric and satellite validation sensors was not funded)

Kai Sørensen, NIVA

NorSOOP: **Nor**wegian **S**hips **O**f **O**pportunity **P**rogram for marine and atmospheric research

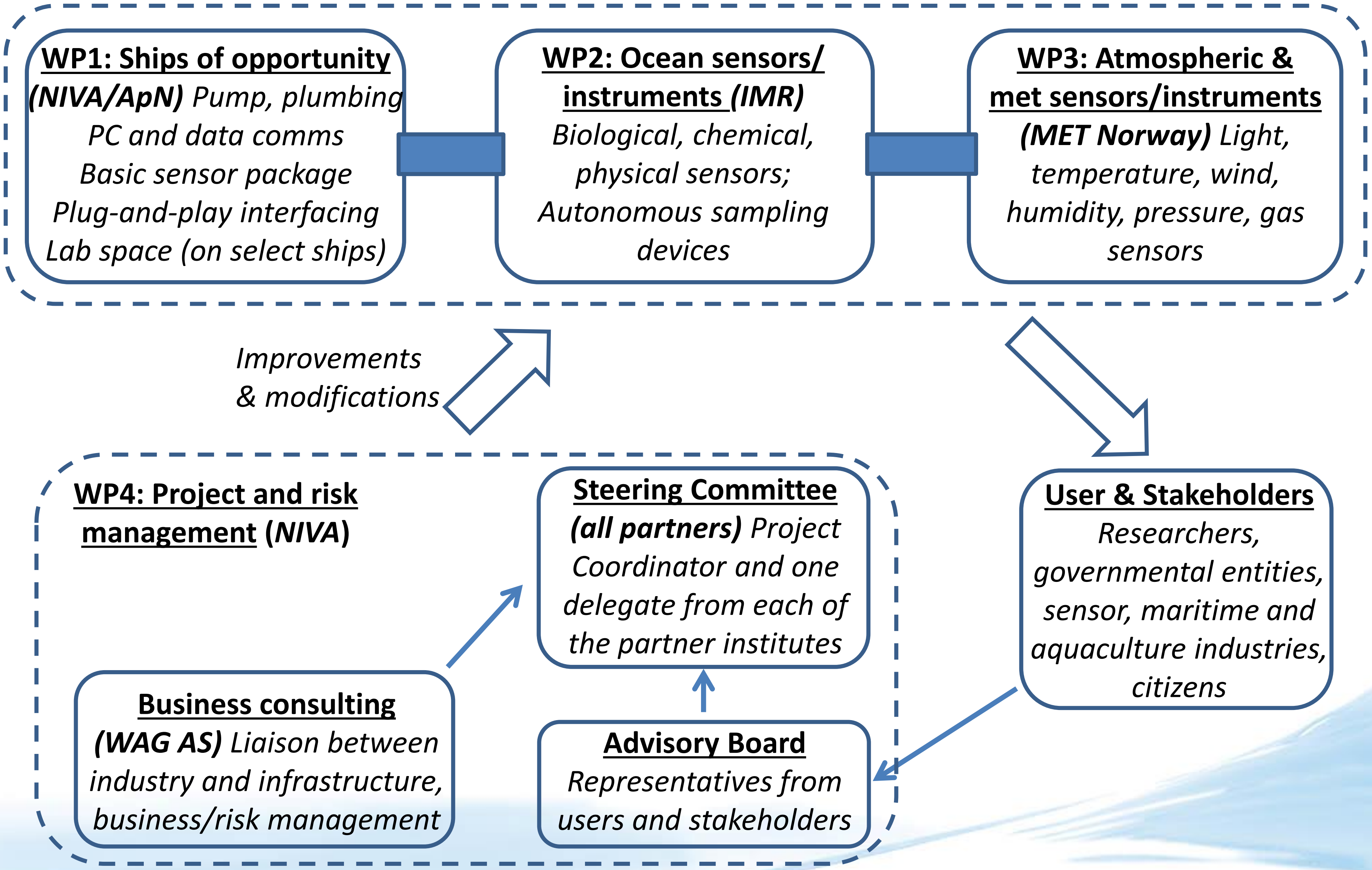
NIVA, IMR, Akvaplan-niva, MET Norway



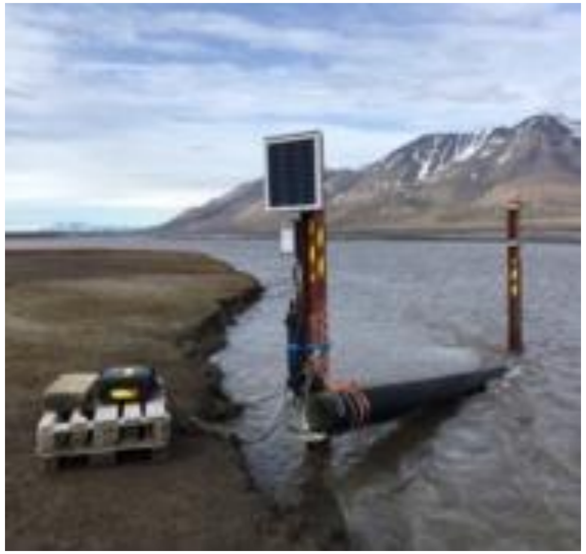
Project goals

- Provide and support high-quality, highly-resolved, cost-efficient, and environmentally-neutral basic and applied ocean and atmosphere research opportunities
- Coordinate and upgrade existing FerryBox ship of opportunities
- Add 3 new lines to important socioeconomic and research regions (Lofoten Islands, Norwegian Sea, Arctic)
- Foster innovation and growth for maritime, environmental sensor, and aquaculture industries

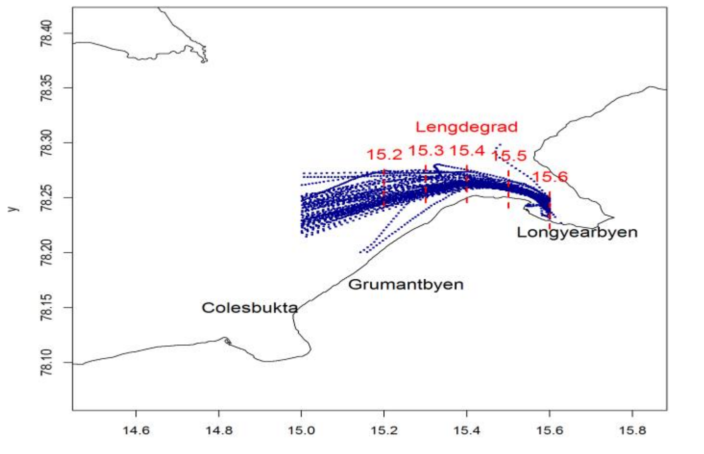
NorSOOP organization

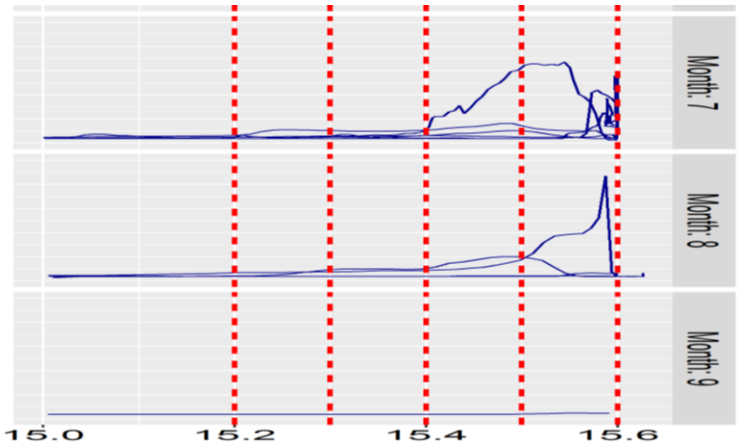


The Norbjørn (FB) are linked to SIOS-InfraNor (AdventFjord Bouy) and NIVA LOI (AdventRiver)



NIVAs Land Ocean Interaction (LOI) facilities





Norwegian Meteorological Institute

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Weather stations as part of an integrated, multidomain monitoring network

Ketil Isaksen, Lars-Anders Breivik, Øystein Godøy, Ole Einar Tveito, Cecilie Stenersen, Ragnar Brækkan, Bernt Enge Larsen

SIOS InfraNor Kick-off meeting
Tromsø - 29th May 2018

Coordination and co-location through SIOS

Multiple sensors and new measurement programs co-located with both existing and new stations.

This ensures:

- consistency and close cooperation between the major national and international initiatives in Svalbard,
- a minimization of the environmental footprint of installations
- the investments in new weather stations provide real new value beyond what already exists.

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Existing weather stations on Svalbard

- Stations operated by MET Norway
- Stations operated by cooperating institutions
- Stations operated by UNIS

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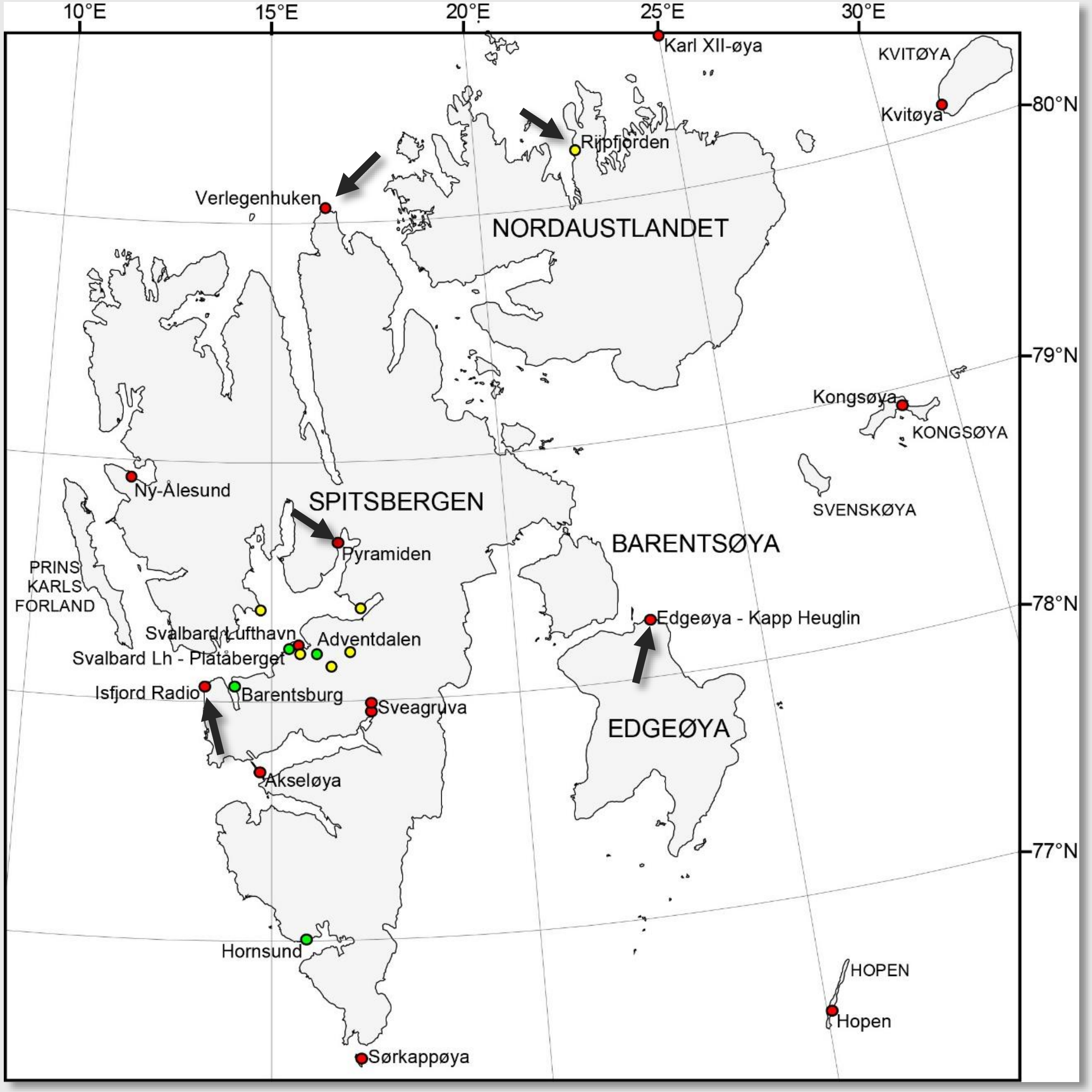
Co-location - Atmosphere and land module

Upgrade of AWS and establish new permafrost boreholes linked to existing AWS



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Verlegenhuken

Pyranometer & pyrgeometer

Infrared radiometer

Sonic Ranging Sensor

Digital thermal data acquisition nodes

Upgrade of AWS & establish permafrost monitoring

- Upward and downward short and long wave radiation (pyranometer, pyrgeometer)
- Infra Red Surface (skin) temperature
- Snow depth measurements
- New tower and energy supply (combined solar power and wind turbines)
- Permafrost temperature monitoring in 20 levels in a 30 m deep borehole

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New stations for long-term monitoring

- Provide new and more accurate knowledge of climate change and regional climate gradients towards the inner and higher regions of Spitsbergen, where we currently have a poor observational base

- In COAT the climate observational network is a core of the monitoring program

- Variability and long-term changes in weather and climate are the most important drivers controlling arctic species/populations and ecosystems and their interactions both in time and space

2019-2020 - COAT Svalbard Climate observation network

Climate monitoring design in COAT

- Automatic monitoring (1hr) AWS
- Automatic monitoring (1hr) AWS – additional sensors
- Automatic monitoring (1-6 hr) – module stations
- Manual monitoring (1 week – 1 yr) – module stations

Reference- / Base station

Automatic Weather Station (AWS)

Air temp. (4.0m)
Wind speed&dir.
Precipitation
Radiation
Humidity
Barometric pressure
Snow depth
Ground temp. (-0.05m)
Soil water cont. (-0.05m)
Permafrost temp. (0-30m)

Air temp. (2.0m, 0.2m)
Snow cover (Camera)
Ground temp. (-0.0m, -0.05m)
Soil water cont. (-0.05m)

Snow density
Snow hardness
Snow conductivity
Snow depth
Ground ice thickness

Module station – level 1

Air temp. (2.0m, 0.2m)
Snow cover (Camera)
Ground temp. (-0.0m, -0.05m)
Soil water cont. (-0.05m)
Snow density
Snow hardness
Snow conductivity
Snow depth
Ground ice thickness

Module station – level 2

Ground temp. (-0.0m, -0.05m)
Snow depth
Ground ice thickness

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2020 - COAT Svalbard Climate observation network / SIOS INFRANOR

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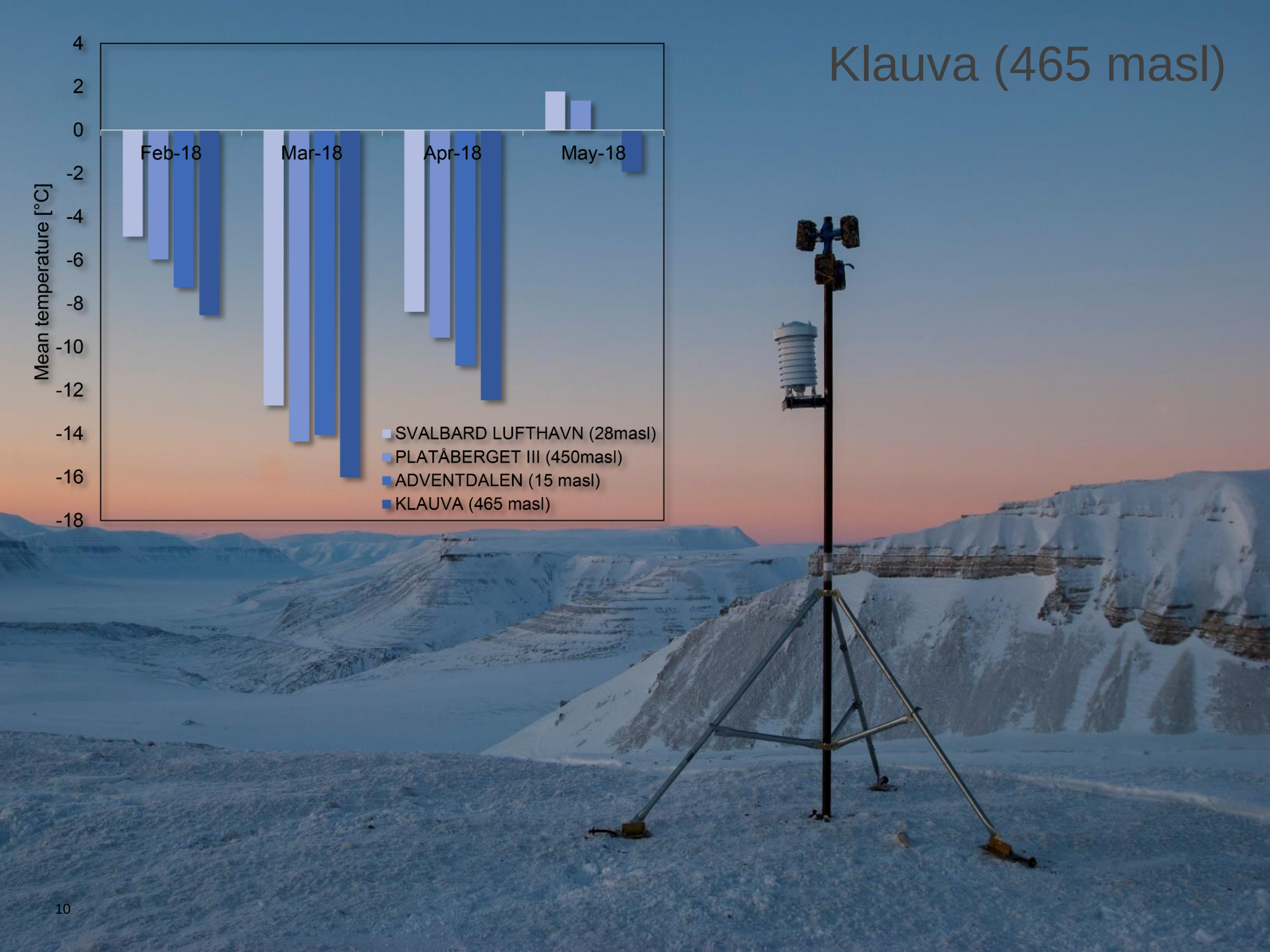
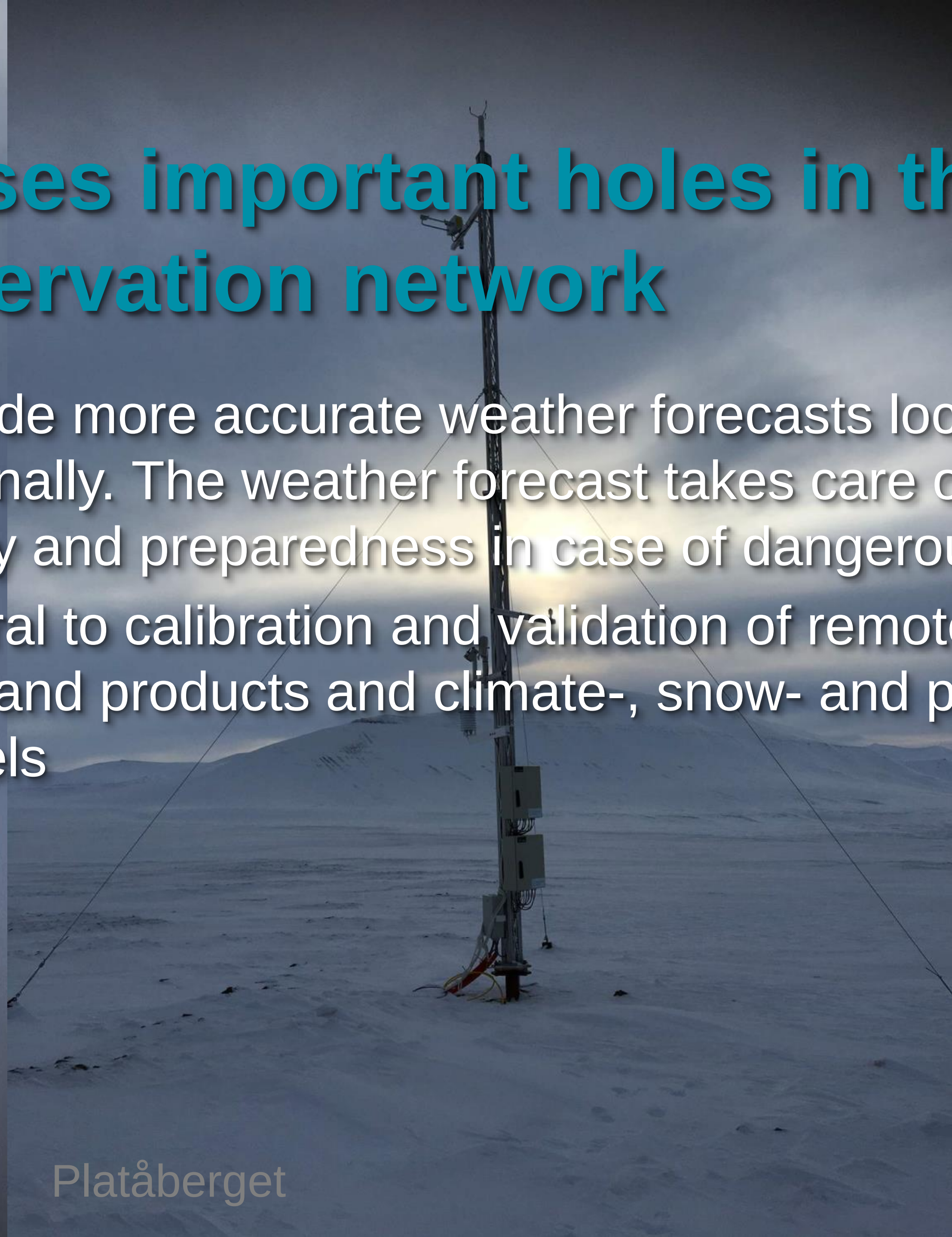
Klauva (465 masl)



Closes important holes in the observation network

- Provide more accurate weather forecasts locally and regionally. The weather forecast takes care of society's safety and preparedness in case of dangerous weather.
- Central to calibration and validation of remote sensing data and products and climate-, snow- and permafrost models



Platåberget

Real-time data and data transfer

The new stations will provide real-time data, and data transfer and storage takes place through MET Norway operational systems

Ensure fast data access for both

· researchers

· operational weather- and avalanche forecasting

· local rescue services

· tourism

· general public

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National Meteorological Infrastructure

- New stations will be part of the National Meteorological Infrastructure
- Long-term perspective that ensures long-term and stable operations and service
- Science as a service; bringing knowledge to action
- In line with the Norwegian Government's new strategy for research and higher education in Svalbard

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Norwegian
Meteorological
Institute

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InfraNor in the context of SIOS as a whole - bringing in an international perspective

Hanne H. Christiansen, Dr. Prof.
Head Arctic Geology Department
UNIS

InfraNor >< SIOS as an international research infrastructure

- The challenge: Developing a national infrastructure as part of an international research structure!
- How to handle this ?
- Discuss how InfraNor can be an advantage for SIOS !
- Develop advantages (where natural) for international activity in SIOS: SESS, access (should SIOS provide access to own national infrastructure?)).
- Aim for providing international access to all InfraNor infrastructure