

2nd Arctic ABC and ABCD meeting

Tromsø, 14-15 April 2016



Technology team deploying POPEs 1,2 and 5 in Storvatnet at Kvaløya. Photo: A Crabb

Agenda for the meeting:

Thursday 14 April: UiT (room C205)

- 9.00-9.15 Opening of meeting and meeting logistics (Jørgen Berge)
- 9.15-9.30 Brief round of introductions (if needed)
- 9.30-10.30 This week's field activities and technology development (Geir Johnsen coordinate with input from the tech group)
- 10.30-11.00 *Coffee break*
- 11.00-11.30 Importance of phytoplankton advection in WSC (Ingrid Ellingsen)
- 11.30-12.00 Human dimension (Njord Wegge)
- 12.00-13.00 *Lunch (Cafeteria)*
- 13.00-13.30 Circadian rhythm in visual sensitivity in krill during the Polar Night (Kim Last)
- 13.30-14.00 Bioacoustics (Maxime Geoffroy)
- 14.00-14.30 *Coffee break*
- 14.30-15.00 Ice biology plans (Bodil Bluhm)
- 15.00-15.30 End user forum (Finlo Cottier)
- 15.30-16.30 Open discussions and Andy Crabb on filming / plans for filming

Dinner at 18.00 in Håkøyvegen 348B

Friday 15 April: UiT (room C205)

- 9.00-9.15 Info and meeting logistics (Jørgen Berge)

9.15-9.45 Data harvesting (Asgeir Sørensen)
 10.00-15.00 Group discussions

Meeting summary

This was the second annual Arctic ABC meeting, this year held in conjunction with the sister project Arctic ABC Development. The main purpose of the meeting was to secure that we are on track regarding infrastructure development and to inform each other about the current status. In parallel with the project meeting, the technology-group of Arctic ABC had a trial week in Tromsø, testing POPEs 1,2 and 5.

The development of POPEs is well on its way. A main ambition for this meeting was to develop an overview of each POPE regarding instrumentation, function, cost and progress:

Item	Pope 1: Simba	Pope 2:	Pope 3: AZFP+Eco-triplet,Ld,T,S,D, 3-4	Pope 4: UHI, Video+Ecotriplet
Order of magnitude				
#	Up to 10?	Up to 10?		2-3
Duration & capacity: normal operation	All year Consumables	All year Consumables	All year To be retrieved	6 months (ambient light). To be retrieved
Data storage	≈0 (iridium)	≈0	≈GB	≈TB
Cost KNOK	90	200	1200	2000
Power	tbd	tbd	tbd	tbd
Variables	Ice growth and thickness (T)	Downwelling Radiance (Ld) S, T, D (tilt?)	AZFP (2x, up/down) Ecotriplet (Chla, cDOM, TSM), depth?	Hyperspectral images, spectral radiance, video, Chla, cDOM, TSM
Depth	5	5	35	1-5
Sampling rate	10 min?	10 min?	1 h?	12 h?
Communication	Iridium	Iridium	Iridium + data harvesting	Iridium + data harvesting
Autonomy level	Unsupervised/full	Unsupervised/partly/ biofouling	Unsupervised/partly due to EcoTriplet	Supervised/partly/ biofouling/risk/ power/data
Location	Fast ice /drift ice	Fast ice /drift ice	Fast ice /drift ice	Fast ice /drift ice when close to vessel

The technology group will update this table during the next few weeks. Any input on need for sensors / data that is not embedded in the table need to be reported ASAP to Geir Johnsen / Jørgen Berge / Finlo Cottier.

All POPEs should be operational by January 2017, when they will be deployed in Kongsfjorden during the *Underwater robotics and polar night biology* course. The deployment in Kongsfjorden will be an opportunity to deploy, test and modify the POPEs before they are to be deployed in vanMijenfjorden in Feb/March 2017 in connection with the FAABolous project.

We have agreed on the following main milestones for the project:

1. January 2017. All POPEs to be deployed on artificial ice in Kongsfjorden, AB334
2. First "data-deployment" in vMf feb/Mar 2017 (date to be decided together with the FAABolous project)
3. Summer / autumn deployments with cruises 2017
4. Fjord deployments regularly from 2018
5. AO deployments from 2018

Other issues / decisions made during the meeting:

A: Next project meeting (2017) to be held in Trondheim and NTNU. Timing of the meeting will most likely be after the POPEs have been recovered from vanMijenfjorden.

B: Since 2015, the tech group of ABC has had weekly Skype meetings each Tuesday. Until now, this has been very important in order to secure that the development of POPEs is moving forward. As of May 2016, the **first Tuesday each month** will be an open all-ABC meeting. It is not compulsory to join, but each partner institution will be invited to join in. Please make sure to inform Daniel and Jørgen in advance if your institution wants to participate. We will aim at sending out an agenda for these monthly meetings on the previous Friday.

C: During Friday we discussed the need for ground-truthing of data / measurements. For both fjord and Arctic Ocean deployments we need to look into possibilities of parallel sampling of biological material.

Report from Arctic ABC tech group

Storvatnet, Kvaløya 11-15 April 2016



Trial runs of Pope 1-2 and weather station, 11-15 April 2016. Photo: Andy Crabb

Arctic ABC Technology development

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Weather station

- Wind speed/direction
- Temperature
- Pressure
- Temperature
- Irradiance/total radiation?

Pope 1 - SIMBA

- 0- 5 m: 5 cm spacing between T sensors
- Measurements of ice growth rate and thickness

Pope 2 – light meters, temperature, salinity and depth

- 0-2.5 m under ice: 0.5 m between sensors
- 2.5-5.5 m under ice: 1 m between sensors
- Ld (Lu): all depths
- Temperature: all depths
- Salinity: all depths
- Depth: at 5.5 m only

Pope 3 – AZFP & Ecotriplet

- 2 AZFP at 35 m depth (up/downlooking)
- Ecotriplet: at 3 m? or 35 m?
- Downwelling light intensity, temperature & salinity (with depth in the end of line)
- Depth/tilt sensor?

Pope 4: Underwater hyperspectral Imager (UHI), video and Ecotriplet

- Science objective: Characterize spectral light climate, phytoplankton and ice algae. One spectrum per image pixel.
 - Imaging range: 0.2-5 m
 - Spatial resolution: 1500-190 pixels (binning 1-8)
 - Spectral resolution 0.5-4 nm (binning 1-8)
 - Dynamic range: 12 bit (signal per wavelength – 4096 intensities)
 - Power: 30 W, 2.3 A, 12 V
 - Size (length x diameter): 40 x 11 cm
 - Weight (air/water): 9/5 kg
 - Interface: Camera control & communication: Ethernet
 - Depth rating: 100 m (Titanium house)
 - Gb data per min: Depending on spatial & spectral resolution, frame rate (Hz: 1-68), exposure time (ms) and sampling rate.
 - Operating system: Linux
 - Language: Independent (Ethernet protocol)
 - Metadata (time stamp, power, eventual selected spectra): Iridium/black pope
 - UHI data I: In UHI flask and black pope
 - UHI data II: Raw data (digital counts) – post processed to radiance, $W m^{-2}$ per image pixel
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- HD video/camera?
 - Ecotriplet: [Chl a], [cDOM] & [TSM]

Black pope (black box/ferdskriver)

- Storage of data from Pope 3 & 4
- Data harvesting to other sources (eg. Drones)
- Back up system

Deployments

- Jan 2017: Test deployment in Kongsfjorden, Svalbard, January 2017:
All 4 POPEs and Automatic Weather Station (AWS) and the data storage hub (BlackPOPE) to be deployed in connection with the UNIS underwater robotics course. Kongsfjorden will w/o ice, thus deployment from “artificial ice”, i.e. some floating pontoon.
- Feb-Apr 2017: Van Mijenfjorden, Spitsbergen.
Pope 1-4 in ice covered (hopefully) waters. Sheltered fjord with landfast ice. Accessible by snowscooter.
- May-Jun 2017: Possible deployments in Arctic Ocean ice from R/V Polarstern or Norwegian coast guard vessel (date tbc). Pope 1-4.
- All deployments use the same POPEs, which implies they need to be recovered, serviced and recharged between the deployments. It was suggested to operate with one set of POPEs until 2018.
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- In 2019 possible long-term deployment of full set with R/V Polarstern freeze-in (“MOSAIC” cruise). Advantage: Personnel from Polarstern can follow up on instruments for the entire drift.

Timeline

- All POPEs need to be operational by the end of 2016, including the blackPOPE.
- To be discussed: How to ship the POPE components to and from Ny-Ålesund/Kongsfjorden. If we use R/V Helmer Hanssen as platform, everything can be shipped with HH.
- If not, most of the gear, in particular the batteries, need to be shipped with cargo ship. Need to check when last cargo ship of the season is heading for Ny-Ålesund, might be as early as beginning of December. There might also be a problem to ship items from Ny-Ålesund to Van Mijenfjorden by February. One might consider to send a separate set of battery packs by cargo ship to Svea (van Mijenfjorden) earlier.

Immediate task: data table

- By Friday there should be a preliminary table available for discussion regarding data and power consumption.
- Responsible:
 - POPE 1, 2, AWS,
 - Black-POPE: Phil and Bernard.
 - POPE 3: Max.
 - POPE 4: Geir and Asgeir.
- Table items:
 - Variables/parameters (sensors)
 - Type of data
 - Sampling
 - Data storage
 - Power

Topics to be solved/discussed

Buoy design

Mooring attachments in open waters, fast ice and sea ice?

Communication/data transfer to Black pope (black box/ferdsskriver).

Bio-fouling optical sensors: Light meters, Ecotriplet, Video and UHI

Power requirements

Data storage (sensors/black pope/transfer)

How to download data from Pope 3-4?

Additional “pope” for weather images, EPAR, pyrometer and snow thickness
(camera-ruler)