

The Synoptic Arctic Survey (SAS) - Update

Community Meeting Report

March 31, 2022

1. Introduction

The Synoptic Arctic Survey (SAS) is an international, researcher-driven program designed to establish the present states of the Arctic Ocean ecosystem and carbon system and of the foundational physical system that drives them. The ultimate goal of the far-seeing SAS effort is to detect environmental change by establishing decadal benchmarks to provide period comparisons. The vision is that cooperating national programs of vessel-based oceanic research together assess the key variables during the same season and same year over a broad region of the Arctic, providing a Pan-Arctic snapshot of system status. The first SAS is ongoing, with cruises taking place in 2020 and 2021 and planned for 2022.

The international SAS is coordinated by an international Science Steering Committee (SSC) that includes two representatives from each of the participating countries. The program is based in the coordination office at the Bjerknes Center in Bergen Norway, lead by Drs. Øyvind Paasche and Are Olsen who also are the chair and vice-chair of the SSC.

A community meeting was held on March 31, 2022 in conjunction with the Arctic Science Summit Week, in Tromsø Norway. The meeting was hybrid, with some participating in-person at the University of Tromsø and others joining on-line via Zoom. Approximately 40 scientists, program managers, and early career/student investigators joined the meeting. Two early career scientists, Annika Margevich and Savannah Sandy, assisted and served as rapporteurs – this report is in great part based on their efforts. The goals of the meeting were to provide an update on the program, especially on the recent and planned cruises, to further plans for coordination between 2022 field programs and for syntheses of findings from across the effort, and to identify concrete action items to accomplish these syntheses, maintain forward momentum for the program, and look ahead to planning for the next decadal survey.

The meeting was very successful, with a broad review of recent and upcoming cruises and opportunities for synergies and coordination identified based on that review. Introductory talks were followed by national reports. This information then was discussed during the last hour of the workshop. A list of action items was identified to help move the program forward.

2. Synopses of Individual Reports

a. Carin Ashjian, Øyvind Paasche, Jackie Grebmeier – Introduction

The premise, goals, and organizational structure (coordination office in Bergen, international SSC lead by Øyvind Paasche and Are Olsen) of the SAS were reviewed. Italy has recently joined the effort and SSC, leading a cruise in 2021. The goals of the workshop were reviewed and the need to turn attention to next steps and achieving synthesis was identified.

b. Øyvind Paasche – Next steps

The status of the international secretariat in Bergen was reviewed. The “assistant” position presently is vacant but interviews have been conducted and an appointment should be possible within the next 6 weeks. This person would assist with organization of workshops, coordinate meetings, maintain the website, and represent the SAS in a range of forums. The need to identify means for data coordination and sharing was introduced. In 2019, a paper in EOS described the SAS; it was proposed that the time is appropriate for a follow up paper. Looking forward, it is not too soon to start thinking about special issues to showcase the program. Also looking forward, it is not too soon to think about the steps needed to continue the SAS in 2030 (handing it off to the next generation of researchers?). It was noted also that SAS is taking place during the UN Ocean Decade and coincides with MOSAiC, and the Nansen Legacy program as well as other programs. The next SAS might coincide with the next IPY. Individual nations are urged to pursue funding to follow up SAS-related efforts, such as those focusing on integration and synthesis, modeling, or education (in addition to thinking ahead to 2030). Russian scientists have been part of the SAS but, due to present circumstances, communication and collaboration with them is uncertain. It was pointed out that effective collaborations and interpersonal relationships can take time to develop and that it would be unfortunate to lose those connections. There is no clear path forward on this issue.

c. Agneta Fransson – Update on the Nansen Legacy activities (Norway/2021)

The Nansen Legacy conducted a cruise in 2021. The cruise was conducted on the new *R/V Kronprins Haakon* with a cruise track that partly overlapped that of the Oden for the same year. The purpose of the cruise was to provide integrated scientific knowledge on the rapidly changing marine climate and ecosystem of the northern Barents sea and adjacent Arctic basin that will facilitate sustainable management. The research focused on physical, chemical, and biological processes in a climate perspective. The science areas were far ranging and included water column, benthic, and sea ice sampling. The team plans to publish data in 2023 and are happy to collaborate; please contact Marit Reigstad, Agneta Fransson, or Bodil Bluhm to discuss sharing. Preliminary results showed more fresh, cold water in the upper water column of the Amundsen Basin than in the Nansen Basin, reflecting the Atlantic influence on the Nansen Basin. This difference will have impacts on the ecosystem and carbon system. The team also discovered an unknown deepwater organism.

d. Pauline Snoeijs Leijonmalm – Update on 2021 Oden cruise/Sweden (2021)

A cruise on the Oden in 2021 to the Central Arctic Ocean north of Greenland concentrated on ecosystem mapping of the western Eurasian Basin, the Lomonosov Ridge, and the Atlantic inflow. Sixty sampling sites were occupied, 36 by ship and 24 by helicopter. Water column, benthic, and sea ice sampling was conducted for a range of variables. Fish were of particular interest and, although fish were observed on the acoustics, very few fish were caught. The cruise report and metadata should be available by the end of April.

- e. Heidiemarie Kassens – Update on German/Russian/Swiss cruise “Arctic Century” (2021)

This was a multi-disciplinary research cruise studying the atmosphere, ice sheets, sea ice, ocean, terrestrial and marine ecosystems, seafloor, and climate archives on board the Akademik Tryoshnikov. The cruise was conducted in the Barents, Kara, and Laptev Seas. Two hundred and fifty stations were conducted as well as work on land. A wide range of physical, chemical, and biological variables were sampled from the different environments. In addition, sampling for microplastics was conducted.

- f. Are Olsen – SAS Cruise to the Greenland Sea (2022)

This cruise will take place May 24th to June 10th this year. This is a collaborative cruise, and will include participants from IMR, UiB, and NORCE. Three hydrographic sections will be occupied: Fugløya-Bjørnøya (across the Barents Sea Opening), Bjørnøya-Vest (Across the Greenland Sea, corresponds to GO-SHIP section A29), and Gimsøy (from the central Greenland Sea to Lofoten Islands). Measurements of temperature, salinity, oxygen, nutrients, dissolved inorganic carbon, total alkalinity, CFC-12 and SF₆ will be conducted. Wp2- and multinet hauls will also be done

- g. Shigeto Nishino – Results from SAS collaborative cruises in 2020 and topics on the *R/V Mirai* cruises in 2021-2022

Japan conducted a cruise on the R/V Mirai in 2021 to the Western Arctic Ocean. This cruise was part of a Canadian/US/Japan/Korea collaboration since all countries mounted cruises in the western Arctic that year. Initial results from the collaborative effort found low dissolved oxygen water on the Chukchi Plateau that may have resulted from a shrinking Beaufort Gyre permitting low DO water to spread from the East Siberian Shelf-Slope towards the Canada Basin.

A cruise on the R/V Mirai is planned for 2022. The cruise track will extend into Canadian waters. One of the foci of the cruise will be to study the variations of Bering Strait throughflow and Mackenzie River outflow using piston core and multi core samples from the Chukchi and Beaufort Seas.

ISAR-7 (7th International Symposium on Arctic Research) is scheduled for March 2023 in Tokyo. The SAS should propose a special session to highlight the program.

- h. Mary-Louise Timmermans – Update on the Canadian JOIS /US AON/BGEO activities and SAS (2021/2022)

The Beaufort Gyre program has been working since 2003. During the 14 years of the program, they have observed intensification of the Beaufort Gyre, with increased freshwater and heat content and a deepening of the isopycnals. The program conducted an expedition in August-September 2021, sampling hydrography, a range of chemical parameters, and zooplankton. Four ice-tethered profilers, three TOPs buoys, one AOFB, and some SIMBs also were deployed. Underway and moored pCO₂ and pH was sampled.

A 2022 cruise is planned, occurring likely from mid-September through mid-October. Activities will include mooring turn-arounds, hydrography, chemistry, net tows, and underway pCO₂ and pH at locations similar to those sampled in 2021. Buoy deployments also will be conducted.

i. Kyoung-Ho Cho – Korea's contribution to SAS: Aaron 2020 and 2021 cruises

Korea conducted cruises on the Aaron in the Pacific Arctic in both 2020 and 2021, sampling a wide range of SAS variables including hydrography, chemistry, and ecosystem parameters. Over 90 stations were sampled and four sets of moorings that had been operating since 2017 serviced. Observations from those cruises were shared with the group. In addition, there are a number of research papers published recently focusing on results from these cruises.

In 2022, Korea is planning another cruise on the Aaron focusing on ocean-sea ice-atmosphere integrated observations. The goal is to establish a monitoring system for analyzing variations in the Arctic marine environment caused by Arctic warming and to project future changes using numerical models coupled to observations. A wide range of variables will be sampled. They also will deploy a new moored sediment trap and maintain their ongoing moorings.

Data from the cruises are available at the KAOS web site (<http://kaos.kopri.re.kr>)

j. Karen Edelvang – DTU Aqua Danish participation in SASA activities in 2022

Although Denmark will not be mounting a SAS expedition in 2022, scientists will participate in three other SAS related cruises: 1) R/V Kronprins Haakon (Nansen and Amundsen basins), 2) R/V Merian (East Greenland Shelf), 3) R/V Neil Armstrong (Davis Strait).

k. Carin Ashjian and Jackie Grebmeier – The US contribution to the SAS

There will be a 50-56 day cruise on the USCGC Healy in September-October 2022 in the Western Arctic. Planning is ongoing. The cruise track extends from the northern Chukchi Sea across the Chukchi Plateau into the Central Arctic, potentially as far north as the North Pole. A suite of physical, chemical, and biological measurements are planned. The Chukchi Ecosystem Observatory moorings will be turned over at the start of the cruise. There is some overlap with the locations of the Korean, Japanese, and Canadian cruises. Expressions of interest for additional projects that are complementary and collaborative to the planned work that are consistent with SAS objectives, and that can be accommodated within the planned cruise activities are welcome but requests need to come very soon. There are a number of research areas open for community contributions. The availability of berths is limited and, as it is late in the planning process, the opportunity will not be open much longer.

There is a website focusing on the US SAS: <https://www2.whoi.edu/site/ussas/>

l. Maurizio Azzaro – The Italian contribution to SAS: the CASSANDRA project

Italy conducted in 2021 a cruise (the CASSANDRA project) as part of the SAS. The cruise sampled along an east-west transect in the Greenland Sea at 75°N. Physical, biological, and biogeochemical variables were measured. The influence of Atlantic Water was prominent, with higher salinity, dissolved oxygen, and fluorescence in the upper water column along the eastern end of the transect. Ice melt water was seen on the western end of the transect. TCO₂ drawdown in the photic zone by phytoplankton was linked to higher pH. Next steps include completing sample analysis and validation, storing data sets in data centers, investigating hydrographic structures that are of importance to biological and biogeochemical distributions, investigating biological diversity and function, and responding to the goals of the SAS. The need to decide on a common policy on how to share data within the SAS was discussed.

m. Mats Granskog – ARICE: Survey – access to research icebreakers in the Arctic

There is an ongoing survey to identify experiences and challenges in transnational access to icebreaker cruises and to proposed solutions for these challenges. The group was urged to complete the survey.

3. Next steps and looking forward

The remainder of the meeting was devoted to identifying immediate next steps, discussing data sharing, and planning for synthesis activities and SAS in 2030. During the talks, it was obvious that there are a number of collaborative efforts that can be accomplished immediately to increase coordination and to foster synthesis. This includes sharing the positions of cruise tracks and stations and of cruise reports. The international SAS secretariat will be the repository for this information and will serve it on the international SAS website.

The coordinator position at the international SAS secretariat is presently being filled; Are and Øyvind hope to have someone in place very soon.

The discussion about data management was wide ranging, with everyone recognizing the need and being willing to share within the SAS program. A number of options for centralized data or metadata archiving were discussed. The basic SAS model is that data are archived on national data archives according to the schedule and requirements of each nation but that access and information on how to access the data are shared within the SAS, making this essentially a virtual data center. It was agreed that the SAS secretariat should 1. Gather information on where data reside (both interim and long-term), 2. Make the information interactive and 3. Establish and share linkages to data centers. Metadata should at the very least include contact information and information on the expected publication dates and locations. Several established information centers were offered up as examples or potential bases for the SAS data:

- <https://www.marinefacilitiesplanning.com/>
- <https://isaaffik.org/>
- <https://www.marinefacilitiesplanning.com/>

Plans for a journal issue dedicated to the SAS results were discussed. JGR was proposed as a potential journal. Mary-Louise Timmermans and Are Olsen were provisionally volunteered as two of the editors. Everyone agreed that at least one special issue is important.

Identifying a list of synthesis papers also is a near-term goal. A good starting point is to focus on the nine SAS questions (see science/implantation plan). Upcoming SAS meetings should start working on this.

Opportunities to further collaboration and to showcase the findings of the SAS at other established events were discussed. Upcoming events include ASSW 2023 in Vienna and ISAR-7 in Japan.

A dedicated SAS workshop, at which investigators can review data and work on synthesis projects, was discussed. Jackie Grebmeier and Carin Ashjian offered to host such a meeting in Maryland, US in fall of 2022 or, alternatively, in spring 2023.

The need for a second community paper to be published in EOS that would provide an update to the international science community on the progress of the SAS was recognized. There was some discussion on how to include a large group of authors. Øyvind Paasche will follow up on this idea.

Follow-up proposals were discussed briefly. If people have ideas for follow-up proposals, they should follow through because this is how to keep the SAS alive over the decade. Early career scientists were particularly urged to become involved as the future of the SAS is in their hands.

This workshop report and versions of the individual presentations will be posted on the International SAS website.

4. Action Items

- Identify administrative/web page help for the International SAS Secretariat in Bergen Norway.
- Write an update paper to be published in EOS – Øyvind to lead
- Start planning for first special issue focusing on the SAS. Suggestion: JGR (Mary-Louise, Are guest editors?)
- Start thinking about follow-up proposals. Examples include:
 - Syntheses
 - Modeling
 - Education
- Set up a template for listing of all data collected on the cruises and ask the International SSC to distribute to the appropriate people to collect information for all past, ongoing, and future cruises. Serve the information on the international SAS web page.

- Collect information on positions of moorings for the 2022 field season. This is most important in the Pacific Arctic. Bob Pickart (WHOI) may have a good start on this.
- Collect planned or executed station locations from all SAS cruises. Use a standardized form (Are volunteered to set up the template). Plot them on common maps, by year and in summary. Serve the information on the International SAS web site. (Are volunteered to do the plotting).
- Start pulling together metadata for the cruises. Compile information on where the data are archived (e.g., national archive, individual PI). Compile information on when they will be publicly available (note, data still to be shared within SAS for synthesis before this).
- Start list of synthesis papers and self-identify which papers people want to join. Focus synthesis questions on the nine original research questions of the SAS.
- Start planning for international synthesis working meeting to be held in US in Maryland (tentatively) in late Fall 2022 (or spring 2023?).
- Identify forums for special sessions focusing on the SAS.
 - 2023 ASSW in Vienna
 - 2023 ISAR-7 in Tokyo
- Develop a SAS listserver of investigators to distribute information

APPENDIX I – List of participants

Kyoung-Ho Cho, Korea Polar Research Institute
Mary-Louise Timmermans, Yale University
Jackie Grebmeier, Univ. Maryland Center Enviro Science, Solomons, Maryland
Greg Anderson, Program Officer with the Arctic Sciences Section of the US National Science Foundation's Office of Polar Programs
Michiyo Yamamoto-Kawai, Tokyo University of Marine Science and Technology
Marit Reigstad, UiT the Arctic University of Norway
Hyoung Chul Shin, Korea Polar Research Institute
Bodil Bluhm, UiT The Arctic University of Norway
Shigeto Nishino, JAMSTEC
Anna Nikolopoulos, Norwegian Polar Institute
Roberto Delgado, U.S. National Science Foundation, Office of Polar Programs
Annika Margevich, Yale University
Savannah Sandy, University of Alaska Fairbanks
Lee Cooper, University of Maryland Center for Environmental Sciences
Manuel Bensi, National Institute of Oceanography and Applied Geophysics, OGS, Italy
Agneta Fransson, Norwegian Polar Institute
Pauline Soneijs Leijonmalm, Stockholm University
Cindy Pilskaln, School of Marine Science&Technol., Univ. of MA Dartmouth
Beverly Walker, U.S. National Science Foundation, Office of Polar Programs
Karen Edelvang, Section from Oceans and Arctic at DTU Aqua, Denmark.
Heidimarie Kassens, GEOMAR, Germany
Carin Ashjian, Woods Hole Oceanographic Institution
Are Olsen, University of Bergen
Øyvind Paasche, Bjerknes Center, University of Bergen
Marc Meloche
Mats Granskog, Norwegian Polar Institute
Verónica Willmott (ARICE), AWI, Germany
Maurizio Azzaro, Italy
Vito Vitale, Italy
Bodil Bluhm, University of Tromsø
Marit Reigstad, University of Tromsø
Christina Goethel
Jorgen Berge
Vincent Le Fouest
Marina Moonti
Clare Gaffey, Clark University
Adam Ulfsbo, University of Gothenburg

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Thursday, March 31, 2022

Time: 14:00 - 18:00 GMT+2 (local time Tromsø)

Agenda:

1400-1530

1. Introduction to workshop: Carin Ashjian/WHOI, USA
2. International SAS Office Overview: Øyvind Paasche/UiB, Norway, SAS Project Office
3. Overview of SAS projects: Topics - Science accomplished in 2021 and plans for 2022 (10 minutes each); also how to access SAS data for comparative purposes (see topics section of agenda)
 - Agneta Fransson—Update on SAS Nansen Legacy activities/Norway (2021)-in person
 - Pauline Snoeijs Leijonmalm—Update on 2021 Oden cruise/Sweden (2021)-online
 - Heidiemarie Kassens—Update on German/Russian/Swiss cruise “ArcticCentury” (2021)-in person
 - Are Olsen—Update on 2022 SAS cruise, Norway (2022)-in person
 - Shigeto Nishino—Results from SAS collaborative cruises in 2020 and topics on the R/V Mirai cruises in 2021/2022—online
 - Mary-Louise Timmermans (2021-2022)—Update on the Canadian JOIS / US AON/BGEO activities and SAS (2021/2022)-online
 - Kyoung-Ho Cho—Korea's contribution to SAS: Araon 2020 and 2021 cruises-online
 - Lise Lotte Sørensen or Karen Edelvang/Denmark—Update on SAS activities-online
 - Carin Ashjian, Jackie Grebmeier (US SAS) –Update on the 2022 US SAS cruise
 - Maurizio Azzaro—The Italian contribution to SAS: the CASSANDRA project (Greenland Sea Gyre; 75 ° N transect)-online
 - ARICE: online survey presentation- Mats Granskog, Norwegian Polar Institute

1530-1600: Coffee break

1600: Continue country reports SAS cruises/results

1630: Topics

- Spatial and temporal overlap of cruises, synergies for 2022
- Overlap of measurements from all cruises
- Shared data plan; where are the data? e.g., T, S, other data (now and future)
- Opportunities for additional SAS science activities on SAS 2022 cruises

1730: Future plans

- 2023 workshop

1900: Dinner for attendees

Session 1 (1400-1530):

- Introductions
 - Carin Ashjian, Jackie Grebmeier, Øyvind Paasche
 - What is it?
 - International collaboration to collect physical, biological, and carbon data from across Arctic ocean over late summer 2020-2022
 - Bottom-up effort
 - Data will be used to detect ongoing and future climate change and it's impacts
 - Chair: Øyvind Paasche
 - Vice-Chair: Are Olsen
 - Italy has recently joined the SAS effort
 - Main Research Goal: What are the present state and major ongoing transformations of the Arctic marine system?
 - Vision:
 - Coordinated effort to take snapshot of the state of the Arctic Ocean
 - Goal is to repeat this kind of effort every decade
 - Next Steps:
 - Synthesis
 - Planning for next cruises
- Øyvind Paasche: Future Steps for SAS
 - Status on the international secretariate in Bergen
 - Position announced last year; interviews carried out; pending decision for University
 - Expect to have someone in place soon to help organize meetings, coordinate activities, represent SAS, maintain webpage, etc....
 - Data—Making Data available beyond national portals
 - A ton of data collected through SAS
 - Some data has already been made available or is in the process of being made available through national portals
 - Making all SAS data accessible is CRUCIAL
 - Discussion point for later today
 - Perspective paper on SAS and SAS→2030
 - EOS paper from 2019 was well received and outlined ambitions, goals, etc....
 - Have provided empirical fundament for new scientific insight about Arctic
 - Now we must summarize our experience and look forward to SAS→2030
 - Ideas:
 - Plot points cumulatively to show all stations associated with SAS
 - Special Issue—Share science and showcase SAS
 - There is an opportunity for a special issue
 - We need editors, any volunteers? (Potentially Are and another co-editor?)
 - SAS→2030 and synergies with other initiatives and organizations
 - Momentum in Arctic research (experiences + observations + understanding)
 - How do we plan for the road ahead?
 - Moving into a new phase. Need to work closely with others

- Ocean decade, IPY-2033, YOPP, Mosaic, Nansen-Legacy, etc....
- Follow-Up proposals:
 - Critical time to secure funding
 - SAS-team from Norway, US, Canada, Japan, South Korea have submitted proposal for 5-year funding frame
 - SSC is happy to support and write endorsement letters, etc.... (The more doing this, the better)
- Questions/Additional Comments
 - Worked closely with Russian participants, but that has since changed; SAS has no mandate on how to handle this; Øyvind isn't convinced that the complete embargo of Russian researcher and scientists is the right way going forward
 - Heidi thinks we should maintain contact because it is easy to destroy something, but we must protect the things we have worked so long to build
 - 5000 scientists have signed petitions against the war...something to keep in mind
- Agneta Fransson—Update on SAS Nansen Legacy activities/Norway (2021)
 - International cruise plan
 - Partly overlaps Oden cruise—a few cross over stations
 - Purpose: provide integrated scientific knowledge on rapidly changing marine climate and ecosystem of northern Barents Sea and adjacent Arctic basin to facilitate sustainable management through the 21st century
 - Physical, chemical, biological components
 - Five scientific teams:
 - PO and sea ice physics
 - Ocean, sea ice chemistry
 - Lower trophic
 - Zooplankton and pelagic fish
 - Benthic organisms and sediments
 - Cruise Stations and Tracks
 - Crossed Gakkel Ridge
 - First station was the only station with open water
 - 236 logged process stations and activities
 - Sea ice and lead work; sampling of sea ice and water for physics, chemistry, and biology; trawling; lots of activities going on...
 - Comment from Carin: “Perhaps we could all produce tables of the data types collected on each cruise and post them on note SAS web site.”
 - Data and Collaboration
 - Data planned for publication in 2023
 - For collaboration, data sharing within the project, please contact Marit Reigstad/Agneta Fransson/Bodil Bluhm and PIs of dataset
 - Salinity/Temperature might already be published
 - Results:
 - More FW and colder water in upper 100m in Amundsen Basin than in Nansen Basin

- High CO₂ in AmB giving more corrosive water at 0-300m than Nansen Basin
 - Plankton, unknown deep-water polar organisms
- Pauline Snoeijs Leijonmalm—Update on 2021 Oden cruise/Sweden (2021)
 - 60 sampling stations (36 ship, 24 helicopter)
 - 260 successful device operations
 - Ice was very dynamic, up to 3.2m thick ice at north pole; much thinner ice/open water closer to Greenland
 - Thinner ice was more susceptible to winds which made picking routes more difficult
 - Had to get to get close to Greenland; closest a ship has ever been to the Greenland coast
 - Open water north of Greenland—large area with no ice; portion of ice moving up and down with winds
 - Optical observations zooplankton
 - Underwater vision profiler (UVP)
 - LOKI
 - Under ice traps—difficult; only got three fish
 - Beam net (0-800m): deployed 45 times and caught one fish
 - MIK net (0-800m): microzooplankton; caught a good deal
 - Echo-sounder showed the fish were there, but they avoided all the nets (indirect confirmation of fish)
 - Box cores got otoliths so indirect confirmation of fish in the region
 - Polar bears!! (also didn't get any fish)
- Heidiemarie Kassens—Update on German/Russian/Swiss cruise “Arctic Century” (2021)
 - Multidisciplinary research program aiming to study the atmosphere, ice sheets, sea ice ocean, terrestrial and marine ecosystems, seafloor, and climate archives
 - 250 stations
 - Distribution of Atlantic water masses and biogeochemical
 - First cross-section across St. Anna Trough
 - High Arctic Islands—biodiversity and ecosystem functions at the margins of life
 - Looks like Mars!
 - Coastal erosion and sea-level history
 - Survey of floating debris—macro and micro plastics (found lots of plastic 😞)
 - Coming from Netherlands, Norway, etc....
 - Ice drillings on ice domes
 - She is a paleo-oceanographer; took sediment cores
 - ML asks “did you do any water-column sampling for microplastics?” Answer: “yes”
- Are Olsen—Update on 2022 SAS cruise, Norway (2022)
 - SAS et al Project (lots of projects going on)
 - IMR Repeat Sections
 - Komsomolets monitoring
 - NorArgo 2
 - NorEMSO
 - GO SHIP A29 Section

- SAS
 - May 24-June 9
 - Central Greenland Sea from 2000 (time series)
 - Water is becoming more acidic with time
 - Add to time series to better understand variability
- Shigeto Nishino—Results from SAS collaborative cruises in 2020 and topics on the R/V Mirai cruises in 2021/2022
 - SAS collaborative cruises 2020: Canada, US, Japan, Korea
 - Low DO and highly acidified water on Chukchi Plateau
 - Possible origin of the low DO and highly acidified water decomposition of organic matter and long-time contact with shelf flow sediments
 - BG extent and Atlantification determine DO distribution
 - 2008-2016: BG extended west over Chukchi Plateau but this was not the case in 2020
 - Consistent with water masses and frontal sections seen in 2020 transect (and lack thereof in 2008-2016)
 - Shrink of BG in Pacific Arctic and Atlantification opens the door of low DO water spreading from ESS shelf slope to Canadian Basin
 - R/V Mirai Cruise in 2021
 - Trails of in-water drone COMAI
 - Prelim Result: spread of anomalously fresh water
 - R/V Mirai Cruise plan for 2022
 - Extend into Canadian waters
 - Piston core and multiple core samplings in Chukchi and Beaufort seas to study the variations of BS throughflow and Mackenzie River outflow
 - ISAR-7 March 6-10, 2023
 - Special Session Proposal for SAS

Session 2: 1600: Continue country reports SAS cruises/results

- Mary-Louise Timmermans (2021-2022)—Update on the Canadian JOIS / US AON/BGEO activities and SAS (2021/2022)
 - BG intensification, increased FW content and heat content over 2003-2021
 - Manifestation in deepening of isopycnals
 - Heat content of surface water is seasonally reset; deep water shows rather sustained increase in heat content
 - 2021 Expedition: Aug 19 to Sept 16 (25 science days)
 - 3 moorings (A, B, D) —mooring C ended in 2008
 - 4 ITPs
 - 2022 Expedition: Sept 15-Oct 11 (likely)
 - Sampling similar to 2021
 - Host of chemistry sampling
 - 3 TOPs (ITPs but only 200m tethers)
 - Vertical net tows
 - Comments:
 - Carin: We also need to make sure we have up to date mooring locations.

- ML: a SAS repository of cruise reports would be good
- Kyoung-Ho Cho–Korea's contribution to SAS: Araon 2020 and 2021 cruises
 - What are the present state and major ongoing transformations of the Arctic marine system?
 - 2020/2021 ARAON Arctic Ocean Cruises
 - Over 90 stations
 - 4 sets of ocean moorings operating since 2017
 - Biological Oceanographic Study
 - Korea Activity Plan 2022
 - Ocean-Sea Ice-Atmosphere Integrated Observations
 - Korea Arctic Mooring System
 - New Sediment trap
 - Data available via KAOS (Korea Arctic Ocean-data system)
 - Questions:
 - Lee Cooper: “Trends in chlorophyll...are they integrated or surface?”
 - They are surface
 - Vito: “Atmospheric measurement in conjunction with marine?”
 - No idea about that
- Lise Lotte Sørensen or Karen Edelvang/Denmark–Update on SAS activities
 - Norwegian Polar Institute
 - Helmholtz-Zentrum Hereon
 - University of Washington
- Carin Ashjian, Jackie Grebmeier (US SAS) –Update on the 2022 US SAS cruise
 - To/from Dutch Harbor; ~50-56 days
 - Start sampling in northern part of the Chukchi
 - Planning discussions are ONGOING
 - Track fills in western side of the Central Arctic
 - Planned measurements (will be posted on WHOI-based SAS website)
 - * indicates measurements in CORE SAS measurements
 - All of the ships’ underway sensors will be operating, but we will not be analyzing them
 - We welcome expressions of interest for additional projects that:
 - Are complementary and collaborative to our planned work
 - Are consistent with SAS objectives and core parameters
 - Can be accommodated within the planned cruise activities
 - We don’t know berths yet so need to know SOON about potential additional involvements
 - Get in touch with Carin if you want fish saved in a certain way (we are doing DOC)
 - Bob Pickart maintains mooring information—get in touch with him about organizing that information
- Maurizio Azzaro–The Italian contribution to SAS: the CASSANDRA project (Greenland Sea Gyre; 75 ° N transect)
 - 29 August to 14 September 2021 along 75 N
 - 20 stations
 - September recorded annual minimum of sea ice in the Arctic

- ARICE: online survey presentation- Mats Granskog, Norwegian Polar Institute
 - Survey—access to research icebreakers in the Arctic
 - Objectives:
 - Map experiences and practices in implementing transnational research cruises
 - Identify major challenges/barriers for transnational access
 - Propose solutions to improve transnational access

1630: Topics

- Spatial and temporal overlap of cruises, synergies for 2022
 - Identify Action Items:
 - Get station locations for each year from each of the participating ships
 - Where could we have a repository for this information?
 - International SAS website
 - **Have standardized form for information with standard format**
 - Get SAS coordinator sorted out; website person on leave; ask temporary person
 - Work something out about sharing data—conversation with Michael
 - Portal for metadata
 - Issaffik? ARICE map viewer?
 - Polardex? Not for the data. Ongoing, planned, and past
 - Arctic PASSION? Trigger some resources?
 - ARICE data management: <https://arice-h2020.eu/data-tools/>
 - NSP Arctic Data center has a way to make portals so all the data searched for under a certain portal comes up—so think of a SAS portal
 - Have repository for metadata and data can be wherever but linked in
 - At the Atlantic DBO WS, the portals we mentioned (for metadata) were:
 - <https://www.marinefacilitiesplanning.com/>
 - <https://isaaffik.org/>
 - <https://www.marinefacilitiesplanning.com/>
 - Have reference person for the different data—easy first step
 - At some point, not only point to the data but collect the data like data products—will need person capacity but should be the goal (good data products for the Arctic!!)
 - **General Plan:**
 - **Gather info and put online (Standardized form)**
 - **Make it interactive via some website or portal**
 - **Establish links to data centers who have the data**
 - **Eventually making some Arctic product**
 - To start, the data will be sent through personal contact (Carin) because data won't make it into an official data archive for a while, so we need to find a short term means to communicate the data
 - **Make lists of synthesis papers we want to produce from SAS and get people to sign up for what they want to contribute**
 - SAS Oden: In the cruise report, it is stated by each variable who owns that data. i.e. the PI so they can be contacted about collaboration with the data

- Goal of SAS isn't to supplant each countries data reporting policies. It's to pull together data towards synthesis
- Overlap of measurements from all cruises
- Shared data plan; where are the data? e.g., T, S, other data (now and future)
- Opportunities for additional SAS science activities on SAS 2022 cruises

1730: Future plans? (2023 workshop)

- ASSW 2023 is science based (In February in Vienna); ICER in March in Tokyo
- Dedicated SAS Synthesis Workshop built into proposal
 - Optimal timing?
 - 9 research questions so taking a look at those and generating paper ideas
 - Seen some examples already (Korean-Japanese-Canadian)
 - Have meetings at ICER in March to try to hone these in?
 - Several sessions? Merge some of the questions? Challenge back to the community of how far are we in answering this question?
 - Make sessions attainable to where you can come out with something digestible and something to go forward with
 - Breeding ground for special issues?
 - ML on special issues: "I think I'm chiming in late on a special issue: a special issue (JGR?) would be wonderful. It brings attention to papers that are enhanced in context with other papers and is a great legacy. Plus now papers can be collected over years and still be part of the special issue."—nominated to be a co-editor.
 - Contact persons for the different meetings/conferences? Volunteer basis?
 - Shigeto Nishino—Proposing an SAS session to tackle some questions
 - ASSW session
 - In the US, have a workshop to talk about all the questions (Fall in Maryland)
 - Idea would be for people to be in contact before to come with working ideas and propositions
 - Community paper? Referred to as a SAS community with all of the authors listed at the end? Talk to editors on details
 - Form for people to fill out to be added to the list of contributors
 - **Need a SAS list (really need a coordinator—hopefully by the end of May)**
 - **Re-emphasize: If there is any opportunity for follow-up proposals, that's what we need. Maybe we can facilitate people you want to include in the proposal and review proposals. We need to find funding to keep this going**
 - Sub-team of early-career so they can discuss among themselves and come forward to the larger group?
 - **Post recording of meeting and (edited) presentations on website with form to know more**

Synoptic Arctic Survey Update

- Carin Ashjian hosting
- **What is the SAS?**
 - o Bottom-up international collaborative effort to collect physical, biological, and carbon data from across the Arctic Ocean in late summer of 2020-2022 using research vessels
 - o These data can be used to detect ongoing and future climate change and its impact
 - o Italy has recently joined
- Overarching question:
 - o What are the present state and major ongoing transformations of the Arctic marine system? (specifically, ecosystem and carbon system)
- 9 topical research question with overlap
- Vision:
 - o Coordinate national funded Arctic Ocean cruises in time and space into a set of intersecting sections
 - o To retrieve the full three-dimensional structure of the Arctic
 - o Standard sampling depths and core standards
- Next steps:
 - o Synthesis
 - o Looking ahead to next SAS in ~2030
- **Øyvind Paasche: Future steps for the SAS**
 - o 1. Status on the international secretariate in Bergen
 - Position announced last year and interviews carried out – currently pending decision from the university
 - We expect to have someone in place soon
 - When in place, this coordinator can help coordinate activities, regular updates on our webpage, organize meetings, represent SAS when necessary, etc.
 - Webpage updates. A little slow, also a resource question, but will improve soon.
 - o 2. Data – making data available beyond national portals?
 - Tons of data, wonderful data has been collected through SAS cruises
 - Some data has already been made available or are in the process of being made available through national portals
 - Making all SAS data accessible is critically important for us
 - Show value of SAS
 - Discussion point for later today
 - o 3. Perspective paper on SAS and SAS→2030
 - Our EOS paper (*Addressing Arctic Challenges Requires a Synoptic Arctic Survey*) from 2019 was well-received and outlined our ambitions and targets

- Now we have provided the empirical fundament for new scientific insights about the Arctic Ocean
 - The Time has come to summarize our experience and look forward to SAS 2030
 - Ideas welcome
 - 4. Special issue: share science and showcase accomplishments
 - Given the new data collected and analyzed
 - There is an opportunity for a special issue – the alternative outlets are many
 - We need editors, volunteers?
 - Are? Yes.
 - 5. SAS 2030 and synergies with other initiatives and organizations
 - There is a momentum in polar research (experiences + observations + understanding). We wish to keep that momentum going.
 - SAS 2030, next steps. How do we plan for the road ahead?
 - Moving into a new phase. Need to work closely with others
 - Ocean Decade, IPY-2033, YOPP, MOSAiC, Nansen Legacy, etc.
 - 6. Follow-up proposals
 - Now is a critical time for us to secure funding
 - A SAS team from Norway, US, Canada, Japan, and South Korea have submitted a proposal with a 5-year funding frame
 - Encourage others to follow and take advantage of relevant calls
 - The Scientific Steering Committee (SSC) is happy to support and write endorsement letters, etc.
- **Agneta Fransson (Norwegian Polar Institute): Presentation: Into the deep central Arctic Basin – the Nansen Legacy Arctic Basin expedition 2021**
- Norwegian contribution to SAS
 - International cruise plan
 - Partly overlaps Oden cruise, which occurred at the same time
 - *R/V Kronprins Haakon* and Nansen Legacy
 - Purpose: to provide integrated scientific knowledge on the rapidly changing marine climate and ecosystem of the northern Barents sea and adjacent arctic basin – facilitate sustainable management
 - Research focus on physical, chem, and bio processes in a climate perspective
 - Research
 - Five scientific teams:
 - Physical oceanography and sea ice physics
 - Ocean and sea ice chemistry
 - Lower trophic levels
 - Zooplankton and pelagic fish
 - Benthic organisms and sediments
 - Sampling to depths of >4000 m!
 - Arctic Basin 2021 stations:

- 1 process stn (48 hrs, bottom 2600m)
 - 4 process stns (72 hrs, bottom 3000->4000m)
 - 11 NLEG stns (3hrs, CTD+ water 1500m)
- Process stations and activities (236 logged)
- CTD/ADCP on KPH in moonpool water sampling
- Lead sampling in open lead
- Under-ice sensors
- Trace metal sampling
- Zooplankton
- Sediment/benthos work and filtrations
- Bacteria/virus sampling
- Trawling
- Helicopter flights for ice and snow thickness
- Sea ice and lead work and sampling of sea ice and water for physics, chemistry, and biology
- CDOM
- Oxygen isotopes
- Primary production
- Pelagic fish
- And others
- Data and collaboration
 - Data planned for publication in 2023
 - For collaboration, data sharing within the project, please contact Marit Reigstad/Agneta Fransson/Bodil Bluhm and PIs of dataset
- Results:
 - *Transport of freshwater, organic material, carbon and changes in the chemistry of the Arctic Basins from the Siberian shelf*, Charette et al. (2020)
 - More freshwater and colder water in the upper 100m in Amundsen Basin than in Nansen Basin
 - Nansen more influenced by water from Atlantic side
 - Carbonate chemistry and ocean acidification state
 - Unknown deepwater polar organisms discovered
- **Pauline Snoeijs Leijonmalm: SAS-Oden Expedition**
 - Ecosystem mapping the Central Arctic Ocean during the Swedish SAS-Oden 2021 expedition
 - Western Eurasian Basin
 - Lomonosov Ridge
 - Atlantic inflow
 - 60 sampling stations (36 ship, 24 helicopter)
 - 260 successful device operations
 - CTD
 - Multinet

- Bongonet
 - Beam net
 - MIK net
 - LOKI (optics)
 - Box corer
 - The ice was very dynamic, which is an effect of climate change: thinner ice is more susceptible to winds
 - ~3.2m thick ice at North Pole
 - (60% of the summer ice volume has disappeared during the last 20-30 years)
 - Were able to get very close to the coast of Greenland
 - SAS physical, biogeochemical, and biological data collected
 - 112 CTDs
 - Multinets
 - Bongo net
 - Optical observations zooplankton:
 - Underwater Vision Profiler
 - Lightframe On-sight Key species investigation system (LOKI)
 - Under-ice traps
 - 17 tube traps
 - 6 umbrella net traps
 - 3 fish
 - Beam net: 0-800m depth
 - 1 fish
 - MIK net: 0-800m depth
 - Macrozooplankton
 - Fish avoided the nets
 - Giant box corer
 - Well-preserved otoliths discovered immediately
 - Polar cod
 - Ice cod
 - Plan to do some genetic work with these
 - Ice cores
 - eDNA samples
 - Cruise report and metadata available within the month
- **Heidemarie Kassens: The Arctic in a Changing Climate – First Results of the Russian-Swiss-German Expedition “Arctic Century”**
- August-September 2021
 - 58 scientists, 69 crew, 14 different nations, 15 institutes
 - Multidisciplinary research program aiming to study the atmosphere – ice sheets – sea ice and ocean – terrestrial and marine ecosystem – seafloor and climate archives (system approach)
 - Barents, Kara, Laptev Seas

- 250 stations
- 5 weeks
- 4410 nautical miles
- Focus:
 - Distribution of Atlantic water masses and biogeochemical cycles
 - Intensive biological program
 - High Arctic Islands – biodiversity and ecosystem functions at the margins of life
 - Coastal erosion and sea-level history
 - Surveys of floating debris, microplastics
 - Ice domes
- **Are Olsen: Synoptic Arctic Survey et al., cruise to the Greenland Sea**
 - SAS cruise and other projects involved
 - IMR Repeat Sections
 - Komsomolets monitoring
 - NorArgo 2
 - NorEMSO
 - GO SHIP A29 Section
 - Synoptic Arctic Survey
 - Dates: May 24-June 9, 2022 (leg 1)
 - Measurements:
 - Temperature
 - Salinity
 - Nutrients
 - Chlorophyll
 - CTD and Winkler Oxygen
 - DIC
 - Total Alkalinity
 - CFC-12 and SF6
 - Zooplankton
 - Add to current time series
- **Shigeto Nishino (JAMSTEC): Results from SAS collaborative cruises in 2020 and topics on the *R/V Mirai* cruises in 2021-2022**
 - SAS collaborative cruises in 2020 by Canada/US, Japan, and Korea
 - Western Arctic Ocean
 - Found low dissolved oxygen and highly acidified water on the Chukchi Plateau
 - Possible origin: shelf in east Siberian Sea
 - Beaufort Gyre extent and Atlantification determine DO distribution
 - Shrink of a gyre in the Pacific Arctic and Atlantification open a door of low DO water spreading from the ESS shelf slope to the Canada Basin

- The low DO and acidified water may impact the marine ecosystem in the fishable area
 - Data stored in each country's data center, but SAS quality control may be needed
 - *R/V Mirai* cruise
 - Ice edge observation
 - Investigation of plastic pollution
 - Trials of in-water drone "COMAI"
 - Mooring deployment/recovery
 - Preliminary result: spread of anomalously fresh water
 - 1. How did this change in water property occur? Ice melt? River discharge?
 - 2. How does this less saline water impact ocean circulation and ecosystem?
 - *R/V Mirai* cruise 2022
 - Piston core and multiple core samplings in the Chukchi and Beaufort seas to study the variations of the Bering Strait throughflow
 - Paleoenvironment
 - Hydrography
 - Biogeochemistry
 - Plastics
 - Others
 - Announced ISAR-7 – 7th International Symposium on Arctic Research
 - March 6-10, 2023, Tokyo, Japan
- **Mary-Louise Timmermans: Beaufort Gyre Observing System/Joint Ocean Ice Study (BGOS/JOIS)**
 - Since 2003; funded through 2024
 - Annual expeditions aboard the CCGS Louis S. St-Laurent
 - Observed:
 - Beaufort Gyre intensification
 - Increased freshwater and heat content over 2003-2021
 - Steepening of isopycnals
 - 2021 expedition: Aug. 19 – Sep. 16 (25 science days)
 - 3 moorings
 - 4 ice-tethered profilers
 - 2022 activities:
 - Likely Sep. 15 - Oct. 11
 - Moorings
 - Hydrographic survey
 - Barrow and Mackenzie River lines
 - Chemistry sampling
 - Buoy deployments
 - Underway and moored pCO₂ and pH
 - Vertical net tows

- **Kyoung-Ho Cho (KOPRI): Korea's contribution to SAS: Araon 2020 and 2021 cruises**
 - Single overarching question: What are the present state and major ongoing transformations of the Arctic marine system?
 - Three focal areas:
 - Physical drivers
 - Ecosystem response
 - ...
 - Korea Arctic Mooring System
 - Spatial patterns of watermasses and circulations
 - Changes in heat and freshwater contents
 - Long-term variations of T S and current
 - Variations of T S structures
 - Long-term trend of Chl-a
 - Phytoplankton community
 - Phyto physiology
 - Mesozooplankton community
 - Zooplankton acoustics
 - Spatial and temporal variations of pCO₂
 - Characteristics of DIC
 - Characteristics of total alkalinity and aragonite saturations
 - Distribution of nutrients
 - Cruise plan for 2022
 - Ocean-Sea Ice-Atm Integration Observations (Bering Strait, Chukchi Sea/East Siberian Sea of Pacific CAO)
 - Mooring deployments
 - Phytoplankton and zooplankton communities and distribution
 - Zooplankton acoustics
 - Observations of pCO₂, DIC, nutrients
 - Data available via the Korea Arctic Ocean data System (KAOS)
- **Karen Edelvang: DTU Aqua Danish participation in SAS activities in 2022**
 - Joining in 3 different cruises
 - *R/V Kronprins Haakon* Norwegian Polar Institute
 - *R/V Merian*
 - *R/V Neil Armstrong*
- **Carin Ashjian and Jackie Grebmeier: The US contribution to the SAS**
 - Taking the Pulse of the Arctic Ocean System, from the Shelves to the Pole
 - Cruise on *USCGC Healy* in 2022
 - Planning discussions ongoing
 - Early September 2022
 - To/from Dutch Harbor
 - ~50-56 days in length

- Starting work on northern part of the Chukchi
 - Turn over Chukchi Ecosystem Observatory moorings
 - Some overlap with Korean, Japanese cruises
 - How to get involved?
 - We welcome expressions of interest for additional projects that:
 - Are complimentary and collaborative to our planned work
 - Are consistent with SAS objectives and core parameters
 - Can be accommodated within the planned cruise activities
 - Expressions of interest need to come within a week
 - Examples of research areas open for community contributions:
 - Ice characteristics
 - Phyto abundance/composition
 - Primary production
 - CDOM fluorescence
 - DOC
 - Fish
 - Microplastics
 - Ecosystem effects of ocean acidification
 - Etc.
- **Maurizio Azzaro: The Italian contribution to SAS: the CASSANDRA project**
- Greenland Sea; 75 degrees N transect
 - From 29 Aug. to 14 Sep. 2021
 - Physical, biological, biogeochemical stations
 - Atlantic water influence
 - Larger salinity, dissolved oxygen, and fluorescence values were found in the upper layer of the easternmost part of the section, occupied by Atlantic water
 - Signals of ice melting water on the westernmost part of the section
 - TCO₂ drawdown by phytoplankton in the photic zone linked to higher pH
 - Data analysis ongoing
 - Next steps:
 - Finish analysis of samples and validation of biological and biogeochemical datasets
 - Store all datasets in the CNR and OGS data centers
 - Define mixed layer depth along transect
 - Investigate mesoscale structures (eddies) and implications with biological and biogeochemical data spatial distribution during the cruise
 - Define bio data framework in terms of diversity and functioning
 - Respond to goals of SAS
 - Decide on a common policy on how to share data within the SAS
- **Mats Granskog: ARICE: Survey – access to research icebreakers in the Arctic**

- Whether a scientist, research funder, or ship operator, this survey is for mapping experiences with transnational access to research icebreakers
- Objectives:
 - Map experiences and practices in implementing transnational research cruises
 - Identify the major challenges/barriers for transnational access
 - Propose solutions for these challenges
- Carin: SAS cruise coordination of overlap
 - Where to compile this information?
 - SAS website for
 - Cruise reports
 - Station locations
 - **Action item:** Create standardized template for entering information (e.g., lat/long)
 - Are has agreed to create this
 - Are mentioned sorting out SAS coordinator position
 - Discussion about data management:
 - Vito Vitale: ARICE project may have tools for data management that can be used for this effort
 - Verónica Willmott (ARICE) provided link: <https://arice-h2020.eu/data-tools/>
 - Carin notes that we should have a contact person included in any forms
 - Mary-Louise: The NSF Arctic Data Center has a way to make portals that may be useful
 - Are proposes a procedure:
 - 1: Gather information
 - 2: Make the information interactive
 - 3: Establish linkages to data centers
 - Vito: Make sure the metadata contains a reference/link to where the data is located, to increase visibility
 - Include contact information
 - Include information about expected publishing dates and locations (information about where/when/how to find the data)
 - Anna Nikolopoulos: “At the Atlantic DBO WS, the portals we mentioned (for metadata) were: <https://www.marinefacilitiesplanning.com/>, <https://isaaffik.org/>, <https://www.marinefacilitiesplanning.com/>”
 - Are: Make a list of synthesis papers coming out of the SAS
 - Obtain a list of people that wish to contribute to these papers
 - Pauline: In cruise report for Oden expedition, each dataset is accompanied by:
 - A point of contact (data owner)

- Metadata
- Datasets are the responsibility of the people publishing the papers; those interested in collaboration contact those owners directly for data access
- Mats: “@Pauline - MOSAiC had a data policy that all participants signed, you included, that clearly states you need to respect the Data Owner (PIs).. Please, have some respect to those who use a lot of effort producing the data you use. CTD data also requires work. And the (data) ownerships vary from ship-to-ship, cruise-to-cruise.”
- Carin: The goal is not to form a massive dataset, but to work within the frameworks of each nation’s data requirements for true synthesis.
- Carin notes that we also need to begin thinking about SAS 2030
 - Possible opportunities to meet and hold workshops, e.g.:
 - ASSW 2023
 - ISAR-7
 - Øyvind: Good “breeding ground” for special issues
 - Mary-Louise: “I think I'm chiming in late on a special issue: a special issue (JGR?) would be wonderful. It brings attention to papers that are enhanced in context with other papers and is a great legacy. Plus now papers can be collected over years and still be part of the special issue.”
 - Workshops with a small number of concrete questions to answer, clearly-identified outcomes
 - Vito: we should promote the SAS’s capacity to provide standardized operating models
 - Jackie: Do we want a SAS meeting in fall 2023 or early winter 2024?
 - Øyvind: Is there interest in doing a community paper?
 - **Action item:** Develop a SAS listserv to make sure anyone who is interested in being involved is able to be (SAS coordinator)
 - Looking ahead to keep the project going:
 - New proposals
 - Post-docs
 - Involvement of early-career scientists
 - Are is looking for decisions to be made by May