



# **19<sup>th</sup> MEETING OF THE INTERNATIONAL ICE CHARTING WORKING GROUP**

**SEPTEMBER 24-28, 2018**

**HELSINKI, FINLAND**



## **Meeting Report**

Prepared by John Falkingham



# IICWG-XIX

## September 24-28, 2018

### *“Ice Information for Navigating the Sub-Polar Seas”*

#### Table of Contents

|  |           |
|--|-----------|
| <b>INTRODUCTION .....</b>  | <b>1</b>  |
| <b>MEETING OPENING.....</b>  | <b>2</b>  |
| WELCOME FROM THE CO-CHAIRS .....   | 2         |
| WELCOME FROM THE FINNISH METEOROLOGICAL INSTITUTE .....  | 2         |
| PARTICIPANT INTRODUCTIONS.....   | 3         |
| ADOPTION OF AGENDA.....  | 3         |
| STANDING COMMITTEE REPORTS.....  | 3         |
| <i>Applied Science and Research Standing Committee (ASRSC).....</i>  | <i>3</i>  |
| <i>Data, Information and Customer Support Standing Committee (DICSSC) .....</i>                                      | <i>3</i>  |
| <i>Iceberg Standing Committee.....</i>   | <i>4</i>  |
| REPORT FROM THE SECRETARIAT.....   | 4         |
| REPORTS FROM OTHER ICE WORKING GROUPS .....  | 4         |
| ARCTIC REGIONAL CLIMATE CENTRE (ARCC) / PARCOF REPORT.....   | 5         |
| REPORT ON PLENARY ACTION ITEMS.....  | 6         |
| <b>PLENARY SESSIONS .....</b>  | <b>7</b>  |
| PLENARY SESSION 1: IDENTIFYING THE PROBLEM – “SO MUCH DATA – SO LITTLE INFORMATION? THE ICE NAVIGATION DILEMMA”..... | 7         |
| PLENARY SESSION 2: SOLUTIONS - “BIG DATA, ARTIFICIAL INTELLIGENCE, AND THE ROLE OF THE ICE ANALYST” .....            | 8         |
| <i>Break-Out Discussion: Big Data and Machine Learning.....</i>  | <i>9</i>  |
| PLENARY SESSION 3: TRANSITIONING TO FUTURE SATELLITE/SENSOR CONCEPTIONS.....   | 9         |
| <i>Panel Discussion: How Can Science Achievements be Transitioned into Operations?.....</i>                          | <i>10</i> |
| PLENARY SESSION 4: MARITIME TRAINING CENTRES AS USERS OF ICE INFORMATION .....                                       | 12        |
| <i>Panel Discussion: How Can Ice Services Work with the Training Centres to Produce Better Ice Mariners? ...</i>     | <i>12</i> |
| PLENARY SESSION 5: FEEDBACK - PERSPECTIVES FROM BALTIC/ARCTIC ICE INFORMATION USERS .....                            | 13        |
| PLENARY SESSION 6: NEW CONCEPTS FOR ICE CHART PORTRAYAL AND VISUALIZATION .....                                      | 14        |
| <b>WORKSHOPS.....</b>  | <b>16</b> |
| OPERATIONS WORKSHOP .....  | 16        |
| <i>Session 1: Ice Information for Navigating the Sub-Polar Seas .....</i>  | <i>16</i> |
| <i>Session 2: Ice information Products for a New Breed of Ice Navigators Armed with New Technology .....</i>         | <i>17</i> |
| <i>Panel Discussion: How Ice Services are Evolving in Response to User Demands and New Technologies .....</i>        | <i>19</i> |
| SCIENCE WORKSHOP .....   | 21        |
| <i>Session 1.....</i>  | <i>21</i> |



# IICWG-XIX

## September 24-28, 2018

### *“Ice Information for Navigating the Sub-Polar Seas”*

|   |           |
|---|-----------|
| <i>Session 2</i> .....  | 22        |
| <b>AD-HOC SOUTHERN OCEAN GATHERING</b> .....  | <b>23</b> |
| <b>POSTERS</b> .....  | <b>24</b> |
| <b>OPEN MEETING SUMMARY AND CLOSE</b> .....   | <b>25</b> |
| APPROVAL OF PRESS RELEASE .....   | 25        |
| IICWG VISION .....  | 25        |
| IICWG ORGANIZATIONAL STRUCTURE .....  | 25        |
| REVIEW OF POTENTIAL ACTION ITEMS .....  | 26        |
| NEXT MEETING .....  | 26        |
| FINAL WORDS.....  | 26        |
| <b>IICWG BUSINESS MEETING</b> .....   | <b>27</b> |
| OPENING REMARKS.....  | 27        |
| NEW BUSINESS.....   | 27        |
| <i>Mission and Vision of the IICWG</i> .....  | 27        |
| <i>Recommendation for CIMR Mission</i> .....  | 27        |
| <i>Engaging with the Arctic Council Senior Arctic Officials</i> .....                         | 28        |
| <i>Interaction with the Arctic Shipping Best Practices Information Forum Web Portal</i> ..... | 28        |
| REVIEW OF ACTION ITEMS .....  | 29        |
| NEXT MEETING .....  | 29        |
| MEETING CLOSE .....   | 29        |
| <b>ACRONYMS</b> .....   | <b>30</b> |



# IICWG-XIX

## September 24-28, 2018

*“Ice Information for Navigating the Sub-Polar Seas”*

### APPENDICES

- A** LIST OF PARTICIPANTS
- B** AGENDA AS PRESENTED
- C** ASRSC ACTION ITEM REPORT
- D** DICSSC ACTION ITEM REPORT
- E** ICEBERG SC REPORT
- F** REPORT FROM THE SECRETARIAT
- G** REPORTS FROM OTHER ICE WORKING GROUPS
- H** REPORT ON PLENARY ACTION ITEMS
- I** PLENARIES 1-2-3 BACKGROUND PAPER
- J** RANKING EXERCISE RESULTS
- K** BIG DATA BREAKOUT GROUP DISCUSSION SUMMARY
- L** IICWG-XIX PRESS RELEASE
- M** TASK TEAM DRAFT TERMS OF REFERENCE
- N** IICW-XIX PROPOSED ACTION ITEMS
- O** IICWG MISSION, VISION, STRATEGIC GOALS AND ORGANIZATIONAL STRUCTURE
- P** DICSSC ACTION ITEM DISPOSITION
- Q** ASRSC ACTION ITEM DISPOSITION
- R** ICEBERG SC ACTION ITEMS DISPOSITION
- S** IICWG-XIX ACTION ITEMS
- T** IDEA PARKING LOT
- U** LOCATIONS OF IICWG MEETINGS



## IICWG-XIX September 24-28, 2018

*“Ice Information for Navigating the Sub-Polar Seas”*

### MEETING REPORT

*(Secretariat note: All of the documents, presentations, and posters referenced in this report are available on the IICWG website <http://nsidc.org/noaa/iicwg/>. Presentations and posters are in alphabetic order by presenter.*

*Throughout this report, potential action items are indicated in line with the text to provide context. These potential actions are compiled at Appendix N where their disposition is indicated. Accepted actions have been assembled at Appendix S where they are numbered for reference and assigned to individuals responsible.)*

### Introduction

The 19<sup>th</sup> meeting of the International Ice Charting Working Group (IICWG) was held in Helsinki, Finland during September 24-28, 2018. The meeting was hosted by the Finnish Meteorological Institute (FMI). Seventy-eight attendees representing 43 organizations from 14 countries participated. The theme for the meeting was “*Ice Information for Navigating the Sub-Polar Seas*”.

The organizing committee for the meeting was chaired by John Falkingham and included:

- Antti Kangas (FMI - host)
- Satu Keki (FMI)
- Patrick Eriksson (FMI)
- Dave Jackson (Canadian Ice Service)
- Mike Hicks (International Ice Patrol)
- Keld Qvistgaard (Danish Meteorological Institute)
- Penny Wagner, (Norwegian Ice Service)
- Chris Readinger (U.S. National Ice Center)
- Jan Lieser (University of Tasmania)
- Shanna Pitter-Combley (U.S. National Oceanographic and Atmospheric Administration)
- Klaus Strübing (IICWG Emeritus Member).

The meeting took place from Monday September 24 to Friday September 28, 2018 at the Finnish Meteorological Institute in Helsinki. The Open meeting, including the Operations and Science Workshops was held Monday through Friday morning. The Business meeting, which involved only Charter signatories, national ice services and invited guests, was held Friday afternoon.

A technical tour of the Arctech Helsinki Shipyard, where an icebreaking tanker was under construction, was held on Tuesday.

On Monday evening, an icebreaker reception was hosted at FMI and, on Wednesday evening, FMI hosted a dinner at the Restaurant Meripaviljonki for all participants.



## IICWG-XIX September 24-28, 2018

*“Ice Information for Navigating the Sub-Polar Seas”*

### **Meeting Opening**

#### ***Welcome from the Co-Chairs***

Marianne Thyrring, the co-chair for Eurasia, opened the meeting and introduced Tom Cuff as co-chair for the Americas. Tom has succeeded Diane Campbell.

Tom expressed his honor at being asked to serve as the co-chair. He is the Director of the Ocean Prediction Center of the U.S. National Oceanographic and Atmospheric Administration (NOAA). He chairs the JCOMM Services Programme and is very concerned with hazards in the marine environment, especially sea ice. He explained that the US National Ice Center is being transitioned from the NOAA Satellite Service to the National Weather Service.

He spoke to the work of the IICWG in supporting the implementation of the Polar Code as well as the interaction with the Arctic Shipping Best Practices Information Forum (ASBPIF). He congratulated the organizing committee on the agenda and reminded everyone that much of the meeting will be webcast – a first for the IICWG.

Marianne spoke of the theme of the meeting and its relationship to big-data, a topic recurrent from last year’s session. She noted that the large majority of mariners who need ice information actually operate outside of the Polar Regions and giving them timely, accurate, and relevant ice information is a big challenge for the ice services – even more so as they face a flood of data.

Marianne thanked the Finnish Meteorological Institute for hosting the meeting and introduced Juhani Damksi.

#### ***Welcome from the Finnish Meteorological Institute***

Juhani Damksi, Director-General of the FMI, expressed his delight at the progress the IICWG has made. He noted that, under the current Finnish chairmanship, one of the Arctic Council priorities is meteorological cooperation. The WMO received observer status in the Arctic Council and the Executive Committee has approved a resolution supporting meteorological collaboration. They would like to see it sustained in the Arctic Council and there is work going on to incorporate it into the various working groups of the Arctic Council. This opens a door for the ice community to speak to the highest levels of government.

Finland organized two major events during its chairmanship: an Arctic science workshop where scientists came together and an Arctic Meteorology Summit where the messages from the scientists were conveyed to senior officials. Those messages included the need for a satellite mission in a highly elliptical orbit to provide high bandwidth communications, accurate positioning, and geographic information over the entire Arctic. They also raised the importance of crowdsourcing to introduce new datasets and the need to integrate indigenous knowledge with scientific knowledge. The indigenous people are masters of adaptation and we can learn from each other. There will be a side event at the May 2019 Arctic Council chairmanship handover in Lapland that will advance the discussions with indigenous communities.



## IICWG-XIX September 24-28, 2018

### *“Ice Information for Navigating the Sub-Polar Seas”*

In closing, Juhani noted the need to sustain cooperation between the Arctic Council and the WMO, give more consideration to the cryosphere and consider a whole system approach in everything we do. He is speaking with Iceland and Russia about carrying on the meteorological theme in the future Arctic Council chairmanship.

### ***Participant Introductions***

The participants introduced themselves to the meeting. The list of participants is attached as Appendix A.

### ***Adoption of Agenda***

The agenda was initially adopted as published with some minor changes to presentation titles and authors. However, during the course of the meeting, a discussion on the IICWG vision resulted in a significant re-structuring of the Working Group and a change to the Committee meeting sessions. The new vision and structure are discussed later in this report. The final version of the agenda as presented is attached as Appendix B.

### ***Standing Committee Reports***

#### **Applied Science and Research Standing Committee (ASRSC)**

Wolfgang Dierking reported on the status of the action items of the ASRSC, attached as Appendix C. Significant actions that were completed are:

- SC15-9: Argentine navy ships are in the process of incorporation into the Voluntary Observing Ship program. AARI and NSIDC are receiving regular reports from the Argentine meteorological coastal stations.
- SC16-2: the Spanish version of the Argentine ice observation manual is completed and is available in digital format. The English version is being prepared.
- SC18-1: A revised white paper on “New Ice Chart Parameters” was prepared and distributed broadly.
- SC18-4: A letter was sent to the IICWG distribution list seeking suggestions for projects suited for closer collaboration between researchers in the Northern and Southern Hemispheres.

Three action items remained open that were dealt with later in the meeting.

#### **Data, Information and Customer Support Standing Committee (DICSSC)**

Chris Readinger spoke to the status of the action items of the DICSSC, attached as Appendix D. Significant actions where progress was made are:

- DC17-5 / DC18-4: Uncertainty / confidence measures for ice charts



## IICWG-XIX September 24-28, 2018

### *“Ice Information for Navigating the Sub-Polar Seas”*

DC18-3: Ice Analyst/Forecaster Competency Requirements

Additionally, a number of initiatives to further the availability of ice information in the Southern Ocean were undertaken. A number of open action items remain that were dealt with later in the meeting.

### **Iceberg Standing Committee**

Mike Hicks gave the presentation in Appendix E describing the accomplishments of the Iceberg Sub-Committee. Significant actions where progress was made are:

IC17-7: The new iceberg model has been implemented in NAIS, DMI and Argentina although there are coastline problems in Argentina. They group is looking at different current formulations and have adopted a standard versioning system for the code.

IC18-1 and -2: Harmonizing iceberg terminology and symbology.

In response to questions, Mike answered that growler detection remains a significant challenge. Interferometric wide swath SAR data misses these tiny targets, which is why the IIP still does aerial reconnaissance in critical shipping lanes. Mike also responded to a question saying that they are concerned about how to report the risk of a large iceberg breaking up and becoming small icebergs.

### ***Report from the Secretariat***

John Falkingham presented the report attached as Appendix F noting, in particular, the proposed action item to consider lending support to the Copernicus Imaging Microwave Radiometer (CIMR) mission. This prompted considerable discussion about whether this is the appropriate mission to be supporting. Discussion was tabled to the Business Meeting later in the week.

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| <b>ACTION?</b> The IICWG should consider writing to the EC, ESA and the Polar Space Task Group (PSTG) expressing support for the CIMR mission in time for the 2nd Arctic Science Ministerial on 25-26 October 2018. |
|---|

### ***Reports from Other Ice Working Groups***

Written submissions are attached at Appendix G. Abbreviated oral reports were presented by the following groups:

- Baltic Sea Ice Meeting – Jürgen Holfort (BSH)
  - Ice services from Denmark, Germany, Poland, Latvia, Finland, Sweden, and Norway attended the meeting held just two weeks previously.
  - Discussion about brash ice barrier – will be submitting a change proposal to ETSI.
  - Every service was encouraged to produce a report on the previous winter for the public.
  - There is a desire to have an open database for measured ice data along the fairways.



## IICWG-XIX September 24-28, 2018

### *“Ice Information for Navigating the Sub-Polar Seas”*

- European Ice Services (EIS) – Nick Hughes (NIS)
  - The Finnish Meteorological Institute (FMI) and the Swedish Meteorological and Hydrological Institute (SMHI) implemented their GIS charting program “Vanadis” on a trial basis last winter.
  - The Norwegian Ice Service (NIS) continues development of the open source program “Bifrost”.
  - EIS has received some funding from the EC to lead plans for the future of Copernicus. The Kepler program will run for 2 years – they are soliciting user feedback.
- North American Ice Service (NAIS) – Kristen Serumgard (IIP)
  - 16th annual meeting was held two weeks before IICWG
  - Russ White of ECCC has assumed a co-chair role.
  - DMI has been an observer since 2016 and NWS Alaska Region was brought on as a participant in 2018.
  - There was discussion about the role of ice services in validation and verification of ice models, also on big data and satellite data utilization.
  - There was talk about collaborating on joint products in areas such as the Bering Sea and the Grand Banks where there is synergy to make better products.
- International Arctic Buoy Program (IABP) / International Program for Antarctic Buoy (IPAB) – John Wood (NIC)
  - There is good coverage of buoys in the Arctic thanks to efforts by a number of organizations although there is a bit of a gap on the Eurasian side.
  - There are 55 buoys in the Antarctic which is about as many as we can hope for; it is a challenge to keep buoys alive on Antarctic sea ice.
- Expert Team on Sea Ice (ETSI) – Vasily Smolyanitsky (AARI)
  - Vasily showed the new JCOMM organization chart noting that ETSI remains intact; there are challenges to find a place for sea ice under the new WMO structure.
  - A scoping workshop is planned for the new Antarctic Regional Climate Center.
  - The next ETSI meeting is planned for the spring of 2019.

### ***Arctic Regional Climate Centre (ARCC) / PARCOF Report***

***John Parker (ECCC)***

John spoke of the gap in climate services at the regional level – we are missing a seasonal and sub-seasonal pan-Arctic view. There are 20 RCCs globally but the Polar Regions are underserved. He explained the multi-geographical node structure of the RCC (it is the first to span multiple WMO regions) and the various responsibilities under the mandatory functions. He explained the consensus that is needed to develop the outlooks from the ArcRCC. Each node member still has their own domestic responsibilities, but will accept circumpolar and regional views to downscale to their own services. Initial products include seasonal summaries, seasonal



## IICWG-XIX September 24-28, 2018

### *“Ice Information for Navigating the Sub-Polar Seas”*

outlooks, and the Arctic Consensus statement. The main foci are the intermediate users of climate information, the meteorological and ice services. The most recent meeting of the climate outlook forum was held in Ottawa. FMI will host the next in- person meeting in Helsinki. He showed the breakdown of the users that were represented at the meeting, including naming the 6 end users that were able to participate. He shared the lessons learned from the users, regarding how they use these climate products, as well as where we need to train in product interpretation.

**ACTION?** Form task group to provide input for the ArcRCC sea ice outlook semi-annually.

As a discussion topic this week, John asked if we should formalize the IICWG role in the ArcRCC. There are several tasks that the IICWG can help with, such as climate model verification. We could identify contacts on a more sustained engagement.

**ACTION?** Formalize the IICWG-ArcticRCC relationship.

In response to a question, John noted that the Climate Outlook Forum is the main venue to receive client feedback. However, Norway is developing a virtual forum on the website.

### ***Report on Plenary Action Items***

The co-chairs reviewed the status of the plenary action items from the previous meeting, attached at Appendix H. Of 30 action items accepted at last year’s meeting, 16 were closed. Fourteen action items remain open.

**ACTION?** Form a task group to provide input to Iceland’s Arctic Council chairmanship related to sea ice and icebergs and emerging issues.



## IICWG-XIX September 24-28, 2018

*“Ice Information for Navigating the Sub-Polar Seas”*

### Plenary Sessions

#### ***Plenary Session 1: Identifying the Problem – “So much data – So little information? The Ice Navigation Dilemma”***

- Richard Hall (Equinor): *Data Availability Evolution*
  - See presentation and Webcast recording.
  - Take-away messages: This is not an exercise to replace people; studies have shown that while artificial intelligence can take away 20% of the jobs, it can also create 20% more jobs; data must have a purpose – to work smarter and more efficiently, leading to better decisions; it is not just about tools and technology but about new ways of thinking, working and learning; it requires a change in mindset and competencies; decision makers should focus on the quality of the information not the source.
  
- Penny Wagner (NIS): Open Discussion: *Results of the On-Line Issue Ranking Exercise*
  - See presentation and Webcast recording.
  - Questions and results of the on-line ranking exercise are attached at Appendix J
  - Discussion:
    - There were 58 responses, with the ice services providing more than 50% of the responses.
    - The subjectivity of answers is obvious in the ranking. The sample size is extremely small and care must be taken in interpreting the results. IICWG should rank user responses higher priority than others.
    - Standardized formats are ranked low by ice services but very high by users.
    - Access to climate data is ranked high by users but only middle for ice services.
    - A key element is uncertainty – does the product represent the norm or the extremes?
    - Blending data sources: Source of data is important to blender but not to end-users. It is logical to say that end users are looking for ease of use and confidence – once people get confidence with a product they will use it and won't care what is behind it.
    - Mariner training is well beyond the scope of IICWG but it is clear that not all maritime training institutes instruct users on ice information. Ice Services need to take some responsibility. Ice Services should understand how their users get their education.
    - The research sector doesn't find image analysis to be very important. Perhaps because researchers work with the data early in the process (before QC), they might not care about the image analysis operationally.



## IICWG-XIX September 24-28, 2018

### *“Ice Information for Navigating the Sub-Polar Seas”*

- It was a surprise that understanding where data can be found wasn't ranked higher.
- It was a surprise that Authoritative Source was ranked so low. Perhaps it is assumed that ice information is part of a national service mandated by governments.
- A comment was made that it is the job of the ice services to produce ice information, but not to disseminate it. That is someone else's concern. Some users don't want ice information; they just want to know where the ice edge is. Some users don't even know what information they need.
- Users don't need layers of information, just the relevant items. However, a picture is worth a thousand words any ice-pilot/captain would want a picture or image of the ice situation. Even a low resolution image is much more useful than an ice chart.
- The discussion keeps focusing on “this” user and “that” user. We need to consider one product going to all users. However, each user is unique – different users have different needs.
- Despite the differences, we all want a basic thing - to shape the minds of mariners to conduct safe marine operations. Better interaction with a range of user communities is key in prioritizing the feedback.
- The ranking exercise was useful for getting the discussion going. We must listen to users even though a lot of the problems identified are not within the purview of the ice services.
- This is a natural place for cooperation between individual users - support by commercial agencies and common good for overall marine safety.

### ***Plenary Session 2: Solutions - “Big Data, Artificial Intelligence, and the Role of the Ice Analyst”***

Following the 1<sup>st</sup> plenary session which considered the problem of dealing with large data volumes, this session was designed to begin exploring some solutions. The session was opened with four introductory presentations:

- Matilde Brandt Kreiner (DMI): *Capabilities of Artificial Intelligence in Ice Charting*
  - See presentation and Webcast recording.
  - Take-away messages: manual ice charting is too time-consuming if we want to incorporate all of the data available; a multi-sensor and multi-data approach is necessary - currently using Sentinel-1, AMSR-2 and AVHRR; use supervised machine learning with neural networking which requires calibrated and de-noised data; the model is very good at picking out the ice edge and has promise for ice types; the next generation could include CIMR as well as L-band SAR.
- Sean Helfrich (NOAA): *NOAA STAR Research on AI in Ice Charting*
  - See presentation and Webcast recording.



## IICWG-XIX September 24-28, 2018

### *“Ice Information for Navigating the Sub-Polar Seas”*

- Take-away messages: machine learning uses a human trainer while deep learning allows the machine to figure out the features in its own way; NOAA has invested in deep learning algorithms that show the feasibility of this approach for ice classification; an automated SAR ice extent product – ice/no ice from Radarsat and Sentinel-1 data is currently being put into the Ice Mapping System product.
- Mike Hicks (IIP): *Where can machine learning take us? IIP’s work with the NASA Jet Propulsion Laboratory*
  - See presentation and Webcast recording.
  - Take-away messages: an incident on August 5, 2018, where a ship spotted an iceberg almost coincident with a Sentinel-1 pass, prompted an investigation into the use of Machine Learning techniques to see if an automated process could detect icebergs in SAR imagery with confidence; IIP concluded from this instance that there is not sufficient confidence in satellite monitoring to rely on it routinely; a better Machine Learning Process in which they will have confidence is needed.
- Andreas Czifersky (BAS): *Cloud-based Handling and Operational Use of Big Data – Opportunity, Risk, Necessity*
  - See presentation and Webcast recording.
  - Take-away messages: cloud-based systems are now common - they are fast, easy to use, cheap, convenient and have a social component; the largest risks are trust (entrusting the service provider with your data), cost, integration with legacy systems, and security; there is now a website for the Polar TEP user interface with the capability to run code in the cloud in addition to a data catalogue.

### **Break-Out Discussion: Big Data and Machine Learning**

Following these presentations, the participants broke off into 8 smaller groups to discuss the issues surrounding big data and machine learning in the ice service context. A summary of the group reports is attached at Appendix K.

### ***Plenary Session 3: Transitioning to Future Satellite/Sensor Conceptions***

The 3<sup>rd</sup> plenary session was organized by Mick Hicks and Patrick Eriksson. Following 3 introductory presentations, there was an expert panel discussion.

- Rune Storvold (NORUT): *Use of Satellite Information to Optimize Drone Coverage, Navigation and Data Collection*
  - See presentation and webcast recording.
  - Take away messages: Integrated surveillance system using drones, satellites and ship’s radar can be put into model to get intelligent routing; drones can fly alone and get radar images in poor weather – have flown in winds up to 15 m/s; landing on ship is challenge – takes 2 people to operate.



## IICWG-XIX September 24-28, 2018

### *“Ice Information for Navigating the Sub-Polar Seas”*

- Richard Hall (Equinor): *Ice Surveillance and the Common Operating Picture for Newfoundland*
  - See presentation and webcast recording.
  - Take-away messages: Integrating drone, aircraft and satellite data is the way of the future – a single sensor cannot detect all targets but a system of sensors will eventually do it.
- Pekka Laurila (IceEye Ltd.): *ICEYE Satellite Constellation for Ice Monitoring*
  - See presentation and webcast recording.
  - Take-away messages: ICEYE is part of the new wave of small satellites weighing less than 100 kgs; SAR constellation will deliver fast response times and frequent revisit with resolution of 5m; SAR on-time per orbit is measured in 100s of seconds; potential Antarctic coverage is same as Arctic – can shift between left and right looking in seconds; amount of data from space is exploding and will require machine learning and AI to make use of it all.
- Ola Gråbak (ESA); *ESA – The Future Sentinels*
  - See presentation and webcast recording.
  - Take-away messages: the IICWG should get more involved in the Service Component of Copernicus to promote Arctic services; IICWG could have some input on how Sentinel-1 c/d are operated in 2022 if S-1 a/b are still healthy; of the 6 Copernicus High Priority Candidate Missions, 3 have Polar components (CIMR, ROSE-L, TOPO) – IICWG could make cases for the importance of these missions.

**ACTION?** IICWG to get more involved in the Service Component of Copernicus to promote Arctic services.

**ACTION?** Provide advice on what to do with the Sentinel-1 C/D – increased coverage for Southern Ocean.

**ACTION?** IICWG to provide endorsement for Copernicus Polar High Priority Candidate Missions.

### **Panel Discussion: How Can Science Achievements be Transitioned into Operations?**

- Moderator: Mike Hicks
- Panelists:
  - Ruth Lane (NIC)
  - Kristen Serumgard (IIP)
  - Ola Gråbak (ESA)
  - Suman Singha (DLR)
  - Wolfgang Dierking (AWI)



## IICWG-XIX September 24-28, 2018

### *“Ice Information for Navigating the Sub-Polar Seas”*

- Messages from panelists:
  - Airborne SAR data for high resolution sea-ice thickness is already being transitioned into operations by private companies.
  - ESA has always done a lot of science projects; recently they are more focused on making data access easier through data portals and establishing processing platforms, etc.
  - We need to ensure a close tie between R&D and operations.
  - R&D projects need to include estimates for on-going needs and costs. Development is one thing – maintenance in an operational environment is not cheap.
  - Some users don’t want raw data, but need tailored products; or small amounts of data in a special spectrum.
  - We need to be closer to stakeholders to ask what they would like to receive. We have found ourselves increasingly working with China and Japan and sometimes we hear that our products are not useful to them. Some users don’t want satellite data, but instead small datasets or satellite data in a special spectrum. Some users have said they don’t need information about polygons, but instead point data
  - We confirmed that the role of the ice analyst will need to change. We will be using automated methods for ice analysis. We need to connect operations with the science community to ensure science is looking at the right things.
  - Data assimilation into models to predict routes is step forward.
  - We need to develop forecast products and undertake verification and validation of the products.
  - IICWG should be more closely involved with the groups developing optimum ship routing products.
  - Researchers can produce useful products but it is usually not on a sustainable basis that operational centres could emulate.
  - What is the relationship between the national space agencies and the private sector? Are they in competition? Do we need to sort this out or just wait for the natural outcome?
  - Machine learning needs training data. Someone needs to collect that training data, especially for smaller ice services. A common dataset for training and validation would be very useful. ESA will be making a wide variety of training data available to scientist.
  - IICWG needs a common set of data and observation requirements so we can have a unified voice.
  - Make the space agencies aware that it is better to have combined missions.

|                |  |
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| <b>ACTION?</b> | Develop a common set of data and observation requirements for communicating Ice Service needs to space agencies. |
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## IICWG-XIX September 24-28, 2018

*“Ice Information for Navigating the Sub-Polar Seas”*

### ***Plenary Session 4: Maritime Training Centres as Users of Ice Information***

This session was organized by Dave Jackson and Keld Qvistgaard and featured three presentations.

- Igor Zlodeev (Admiral Makarov State University of Maritime and Inland Shipping): *Implementation of New Requirements of STCW and the Polar Code*
  - See presentation and WebEx recording.
  - Take-away messages: Makarov Centre has 44 training simulators, >150 expert instructors, >100 training programs, and trains about 14000 students per year; students are more frequently coming from ice-free countries; training is done according to Polar Code requirements; specialized training for practical ice navigation takes 4-6 students at a time for 5 days and includes simulator time, sailing on board icebreakers, and training in a specialized ice model basin; use of ice charts and ice forecasts is part of their training.
- Bjørn Kay (Marstal Maritime Education Centre)
  - See presentation and WebEx recording.
  - Take-away messages: Marstal has online courses and simulators for basic training; they need ice advisors in real-time for their on-board decision loop; would like one standard ice definition, one ice information display, and one graphical standard (there are too many egg codes, color schemes, etc.), real-time updates for Search-and-Rescue, satellite data on ships, ice radar on ships, SONAR with plug and play ECDIS capability, lat/long grids on ECDIS charts for implementation together with digital weather, currents and ice information, and no gaps in coverage; IICWG could assist in the basic training.
- Jarmo Teränen (Satakunta University of Applied Sciences (SAMK))
  - See WebEx recording.
  - Take-away messages: All of their training material comes from Internet sources; finds that ice charts vary quite a lot from service to service; training materials are updated every 3 years; remote sensing training on imagery analysis is part of their curriculum.

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| <b>ACTION?</b> Investigate why ice charts “vary quite a lot different from service to service” – are we not following the common standard? |
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### **Panel Discussion: How Can Ice Services Work with the Training Centres to Produce Better Ice Mariners?**

- Moderator: Keld Qvistgaard
- Panelists:
  - Igor Zlodeev



## IICWG-XIX September 24-28, 2018

### *“Ice Information for Navigating the Sub-Polar Seas”*

- Bjørn Kay
- Jarmo Teränen
- Comments from the panel:
  - Actual ice information should be used for training, not filtered or partial information because you think they can't learn it. No limitation is needed on content of ice information.
  - There is a difference between a mariner with only the Advanced Polar Course and an experienced ice navigator. Navigators are smart and can learn quickly – don't withhold imagery or any other information from them.
  - Norwegian Ice Services has used different types of remote sensing data in Polar Code training programs at the University in Tromsø.
  - DMI offers excellent training for ice navigators using all of the ice charts and satellite imagery.
  - The international model of basic training has just 5 hours for ice education (the whole course is only 40 hours).
  - Users still ask for paper charts even though ECDIS is mature and supposedly becoming mandatory in 2020. Ship owners will only invest in mandatory requirements for IMO compliance. A good master or training center needs to invest in the electronic systems.
  - There are only a couple of ECDIS systems that can import ice charts.
  - The most intelligent solution is to give annotated imagery to the masters - not the raw images.
  - There is no published list of ice information sources – schools just use what they find.
  - Danish mariners have a Facebook group that allows for ice chart discussion.
  - Training centres would love to see more interaction with ice services to keep updated with newest materials. Navigators should renew knowledge every 5 years, so the centres need updated information to keep it fresh and interesting.

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| ACTION? | Explore ways to work with the Nautical Institute and Marine Training Institutes to improve the training of ice navigators with respect to ice. |
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| ACTION? | Develop strategy and actions to address the lists of items presented by Duke Snider, Bjørn Kay and Jarmo Teränen at IICWG-XIX, needed to improve mariner training. |
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### ***Plenary Session 5: Feedback - Perspectives from Baltic/Arctic Ice Information Users***

This session was organized by Antti Kangas and featured five presentations:



## IICWG-XIX September 24-28, 2018

### *“Ice Information for Navigating the Sub-Polar Seas”*

- Tuomas Taivi (Finnish Transport Agency): *Finnish-Swedish Winter Navigation Information System*
  - See presentation and WebEx recording.
  - Take-away messages: IBNet is an information hub that collects and distributes weather and ice information, including satellite images, among the icebreaker fleet on the Baltic; would like to have ice movement forecasts.
- Teemu Vanninen (KNL Networks): *National Geographic Explorer 2018 Arctic Connectivity Trial - A Case Study*
  - See presentation and WebEx recording.
  - Take-away messages: global HF/VHF communication system to complement other systems on ships at much lower cost than Iridium; bandwidth and quality vary a lot because of ionosphere fluctuations; typical speed is about 100 MB/day.
- Lauri Seitsonen (VTT): *Travel Time Estimations in Icy Waters*
  - See presentation and WebEx recording.
  - Take-away messages: System to visualize AIS data to determine travel times; could be improved by incorporating ice forecasts and machine learning algorithms; the system will not work if the track is controlled by icebreakers and it would not likely work in the Arctic because there are too few ships.
- Antonio Reppucci (CMEMS): *CMEMS Arctic Service Portfolio*
  - See presentation and WebEx recording.
  - Take-away messages: Copernicus Marine Environment Monitoring Service is a pan-European distributed platform with more than 50 contributing entities; there are 4 production centers for sea-ice observations and model reanalysis/forecasts; provides free and open access to many analysis and forecast products of ocean physics, including ice; web portal is aimed at intermediate users (e.g. service providers) – can provide information to help an ice service improve its services.
- Lisa Lind (SMHI): *FMI-SMHI Common Ice Chart Production*
  - See presentation and WebEx recording.
  - Take-away messages: SMHI and FMI take turns producing the Baltic ice chart on a weekly rotation basis; Finnish Transportation Agency was the main user consulted – they like the product: the ice chart is available to both the icebreakers and the public.

### ***Plenary Session 6: New Concepts for Ice Chart Portrayal and Visualization***

This session was organized by Jürgen Holfort and featured four presentations:

- Klaus Strübing (BSH Ret): *High Resolution Ice Charts – Fiction or Challenge?*
  - See presentation and WebEx recording.



## IICWG-XIX September 24-28, 2018

### *“Ice Information for Navigating the Sub-Polar Seas”*

- Take-away messages: most current ice charts have a scale of 1:1 Million or coarser; we really need charts at a scale of 1:250,000 or better based on SAR imagery.
- Jürgen Holfort (BSH): *Vector Ice Charts: Are we there and where to go?*
  - See presentation and WebEx recording.
  - Take-away messages: Ice charts on an ECDIS must co-exist with other ENC displays and not violate IMO regulations for displays; navigation chart displays are very often at much finer scale than ice charts so displaying the ice information as an overlay does not work too well; need to investigate the need for dusk and night portrayals, the possibility to generalize symbols as the scale changes, explore interaction with weather portrayals (S-412), and include ice egg portrayal.

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| <b>ACTION?</b> | Investigate how to prevent the accidental use of old information (in the context of ECDIS charts and imagery). |
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- Lasse Rabenstein (Drift & Noise Polar Services GmbH): *Needs of Global Ice Navigators in a Digitized World*
  - See presentation and WebEx recording.
  - Take-away messages: a lot of data is available to ice navigators but often not in convenient formats; navigators need “actionable information” – in future, that could be just a route in which they have confidence; need integrated view of information; need automated delivery of information.
- Christina Ulrich (SevenCs): *Ice Charts in the ECDIS World*
  - See presentation and WebEx recording.
  - Take-away messages: to determine the best portrayal for ice information on an ECDIS, we really need to determine how ice information is used on the bridge and what is most appropriate to meet that need; traditional ice charts may not be the answer – a new type of product is needed.



## IICWG-XIX September 24-28, 2018

*“Ice Information for Navigating the Sub-Polar Seas”*

### Workshops

#### *Operations Workshop*

The Operations Workshop was organized by the IICWG Data, Information, and Customer Support Standing Committee (DICSSC) under co-chairs Penny Wagner, Chris Readinger, and Alvaro Scardilli. Alvaro was unable to attend the meeting.

#### **Session 1: Ice Information for Navigating the Sub-Polar Seas**

The first session of the workshop featured three presentations:

- Klaus Strübing (BSH Ret): *Ice Navigation and Shipping Tracks in the Baltic Sea – A Review*
  - See presentation and Webcast recording.
  - Take-away messages: there has been a dramatic change in winter navigation in the Baltic Sea since it first began many decades ago; the impacts of shorter ice seasons can be seen in the long record; increased shipping breaks up the ice cover making it more dynamic and more greatly affected by wind and current.
- Chris Readinger (NIC): *Ice on the US East Coast*
  - See presentation and Webcast recording.
  - Take-away messages: NIC produces ice hazard products for the Atlantic coast of the U.S. when necessary; generally, ice is a nuisance in this region; NIC produces a beta product called ICECON that shows a discreet numerical scale of ice hazards in the Great Lakes; looping of GOES images provides valuable information for the analysis.
- Mike Hicks (IIP): *IIP/NAIS Iceberg Limit Product*
  - See presentation and Webcast recording.
  - Take-away messages: Iceberg Limit product is a collaboration under the NAIS; inputs include Canadian models and predictions, the US Navy’s FNMOC model and IIP’s historical currents info, and other products; the models don’t consider iceberg shape; dotted line on the chart product indicates a climatological limit produced by DMI based on Radarsat data over a 15 year period; future DMI work will try to estimate the actual number of icebergs in the region; the term “iceberg risk” was incorporated into the WMO terminology. Sea ice limit is also defined now but we need to define what the iceberg limit is; ship-iceberg discrimination is a major challenge – mainly for fishing vessels that do not have AIS.

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| <b>ACTION?</b> | Establish a formal definition for Iceberg Limit and get incorporated into WMO Nomenclature. |
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- Jan Lieser (on behalf of Pip Bricher -UTAS): *Due South*
  - See presentation and Webcast recording.



## IICWG-XIX September 24-28, 2018

### *“Ice Information for Navigating the Sub-Polar Seas”*

- Take-away messages: Due South is a web-based platform for ship operators to share their plans to help with joint operations and resupply, etc.; the Due South community consists of the Australian Antarctic Division, SOOS scientists, ASPeCT, and COMNAP; information comes from JCOMMOPS and individual scientists and voyage coordinators; soon COMNAP and IAATO will be included; feedback can be sent to [data@soos.aq](mailto:data@soos.aq).
- Open Discussion
  - The question of volunteer observers was discussed noting that this is well established for weather observing. FMI has an app for citizens to report ice observations and the Baltic Code defines what they should observe; Germany and Poland have volunteer observers who are required to give daily reports and are paid about 125€ per year; there is a format for the reports; people living around Chesapeake Bay provide reports informally to the NIC.

### **Session 2: Ice information Products for a New Breed of Ice Navigators Armed with New Technology**

The second session of the workshop featured two presentation followed by a panel discussion.

- Captain David (Duke) Snider: *The Foundation of At-Sea Operations: What Mariners Need*
  - See presentation and Webcast recording.
  - Take-away messages: there is a wide breadth of experience among mariners on vessels with no icebreaking capabilities through to heavy icebreakers; their needs are varied so their information requirements are varied – polar to non-polar, ice avoidance to ice encounter; ice navigators are different from mariners that meet only Polar Code training requirements; the latter don’t necessarily have competence in safely navigating ice; ice navigators are certified by the Nautical Institute; ice navigators need information that is simple, accurate, timely, free, and accessible; POLARIS information is vital on the ship to make instant go/no-go decisions; broadband connectivity capabilities are varied - low bandwidth is more normal; in general, mariners would like better access to high resolution imagery for prompt on-board analysis and quick decision making/action – 10m resolution is desired but can get away with 500m; daily charts need to be scheduled better with user needs in mind; mariners would like daily charts earlier in the ice season and a better response to requests for coverage with closer to real-time dissemination; standardization of charts is very important; mariners need a clear representation of the coding for ice concentration and stage of development that is simple; the egg code is easy to use but they need standard colours; DMI and CIS use similar colours, but Alaska Region charts are completely different; some mariners would like georeferenced ice charts, such as the shapefiles that NWS Alaska Region provides, to use for voyage planning; they would like multi-layered GIS charts that are scalable for zooming and have more safety contours



## IICWG-XIX September 24-28, 2018

### *“Ice Information for Navigating the Sub-Polar Seas”*

according to ship class; mariners would like more predictions and they don't have to be perfect; mariners can live with uncertainty; there should be improved single or combined portals; Mariners can't find the information they need and it is hard to track multiple sites, especially when websites change; the Ice Logistics Portal would be useful if it is kept updated and well populated.

**ACTION?** Ensure that the Ice Logistics Portal is kept up to date and investigate the possibility of providing more content.

- Duke believes that the ice services are being overly conservative when producing their charts. When challenged that “the less experienced mariners benefit from that conservatism”, Duke replied that there are other pressures on navigators. Less experienced navigators are concerned with the economics of going around an ice field that may not be there, delaying a voyage. Charter managers could be pushing them to go a certain speed when the ice chart would be cautioning them. He suggested that ice services should not necessarily reduce the conservatism but should keep the mariners' pressures in mind.
- In response to a question about whether ice navigators will be replaced by ship pilots guided by charts and systems, Duke answered that it was not likely in his lifetime or generation. The variety in the space is so wide, it is unlikely the model will change. The Baltic Sea is becoming more like the aviation model. In Finland and Norway, there is a vessel tracking center that gives guidance to vessels. However, Duke noted that the ship captain still makes the decisions – they are not required to follow the guidance.

**ACTION?** See if the NWS Alaska Region could produce ice charts with standard coding and colours.

- Catalin Tita: *Ice Information Production: Ice Analyst Roles Past and Present*
  - See presentation and Webcast recording.
  - Take-away messages: all products are georeferenced and incorporate the most recent information possible; products include long-range outlooks for the Arctic region and Southern Canada; CIS is a partner in the NAIS and co-produces the iceberg chart; as the sources of data have evolved, the roles of the analysts have also evolved.
  - In response to a question, Catalin responded that the CIS does not provide tailored products to anyone who asks. They support specific users with whom they have agreements. If CIS is advised of a ship entering their region, they will produce ice charts starting 5 days before arrival. (Note: Catalin was challenged on this point by a user who could cite instances when this has not happened.) Catalin noted that the request should come through the Canadian Coast Guard.



## IICWG-XIX September 24-28, 2018

*“Ice Information for Navigating the Sub-Polar Seas”*

### **Panel Discussion: How Ice Services are Evolving in Response to User Demands and New Technologies**

- Panelists:
  - John Parker (CIS)
  - Marianne Thyrring (DMI)
  - Kevin Berberich (NIC)
  - Antti Kangas (FMI)
  - Nick Hughes (NIS)
  - Lisa Lind (SMHI).
- Question – What do you think are the roles and responsibilities for ice services?
  - Lisa: In the Baltic, our users are different. Mariners are not allowed to make their own way through the ice. We support the icebreaking management organizations. Ice charts aren't provided to icebreakers - satellite imagery is given instead. Ice charts are only used for planning.
  - Antti: We have a really good connection with these icebreaker management units and get good feedback from them, including well-articulated requirements for services. They have a lot of experience with the types of ships that operate in the Baltic, so they have a better understanding of their needs. Lessons learned in the Baltic could be applied in the Arctic and Antarctic as they get more and more developed.
  - Kevin: There are lots of new technologies available so they need to pivot on IT services. With the changes in sensing technologies, we need to understand what is available and what is coming. Very large datasets must be handled. There is currently lots of realignment within NOAA. The move to the Ocean Prediction Center should allow for expanded services for prediction of ice movement and better integration with the weather side. Changes in production flow and product coordination are being done and they are looking closely at their processes to improve communication channels and provide what users request.
  - Marianne: Improving service demands collaboration between providers and users. Collaboration between science and operations flows from the large quantities of data and technology available. There is a gap between the expectation of users and what national ice services can produce. We must be honest about the fact that there are many things we could do but it takes time to get the budget needed to work with all of the new data sources. We could use the impetus from the climate change agenda to help but we must be quite clear on the role of the national ice services. What is do-able? We should invite the private sector into room along with other key stakeholders. Let them make the case to politicians that national ice services need adequate budget support. The basic construction of the DMI ice service started in 1959 and has not changed since. Currently, we are modernizing the setup because users' needs have changed dramatically. We want to make ice services similar to weather services but that requires more money.



## IICWG-XIX

### September 24-28, 2018

#### *“Ice Information for Navigating the Sub-Polar Seas”*

- Nick: In Norway, we have a continuous series of user feedback and evaluation to drive research and development. We are resource-limited. We collaborate with research and science to develop new products to reach new user groups. This approach was started 10 year ago and is now starting to bear fruit. The big challenges include the ever increasing amount of satellite data and ways to exploit them. We are exploring automated processing to remove the burden from our analysts.
- John Parker: In considering the future of ice analysts and forecasters, automation can help, but will not solve all the problems. We still need to produce low bandwidth products as well as highly technical information. Technology has its strengths, but people also have strengths. Technology is best suited for routine and repetitive tasks, while people are adaptive. People should get away from producing the products and move to dynamic adaptation of information. CIS experts will act in the impact-based forecasting space. Consultation and decision support are the big new things. AI and machine learning will be used for situational awareness and intervention, to identify anomalies or special situations requiring human intervention. However, it takes time to make these changes and we need investment to keep legacy systems functioning until new ones are available.
- Question: Regarding the evolving services and technology, who do you collaborate with when all of the ice services are evolving differently to meet their own user needs?
  - John: Regardless of software or hardware platforms, as long as the end products are compatible from a user perspective and are shared, we can work together. Experts can work on common data formats and standards that will allow for co-production between the services. Standards must be tied to data and not infrastructure.
  - Nick: Collaboration and communication are key. Everything NIS is doing is as open-sourced as possible. The cooperation between us is becoming more relevant. There still needs to be a transition to this data driven model. That is driven by targeted goals that we jointly hold. Drawing a parallel with the weather world, different states haven't needed to change their systems, only to focus on the goals.
  - Lisa: Sweden has the challenge of maintaining expertise within a small service that has a short season. Our collaboration to develop an ice charting system with Finland was successful because we concentrated on sharing data rather than having the same hardware for co-production.
- Comment from Vasily (AARI): Russia provides icebreaker support only. Ship operations on the Northern Sea Route are escorted by icebreakers. Their challenges include more winter operation, new ice classes and certification of new vessel classes, as well as dealing with a lot of coastal areas and non-SOLAS vessels with no ice class.
- Comment from John: We are not doing things differently, but doing different things.



## IICWG-XIX September 24-28, 2018

*“Ice Information for Navigating the Sub-Polar Seas”*

### ***Science Workshop***

The science workshop was organized by the IICWG Applied Science and Research Standing Committee (ASRSC) under co-chairs Wolfgang Dierking, Dean Flett, and Philip Reid. Philip was unable to attend the meeting.

#### **Session 1**

The first session of the workshop featured three presentations:

- John Yackel (University of Calgary): *Ice Monitoring: Melting Stage*
  - See presentation and webcast recording.
  - Take-away messages: We should be able to use the fact that Ku-, C- and L-band SAR have the *same* signal pattern through melt for FYI but *opposite* signal patterns for MYI to understand the melt process on FYI and MYI, to know what the temperature and salinity profiles look like and how the strength of the ice changes affecting ship trafficability; the detection of melt onset and the notion of ice strength are the missing link in sea ice stage of development reporting.
- Amandine Guillot (CNES): *Possibilities of Altimetry in Ice Charting*
  - See presentation and webcast recording.
  - Take-away messages: Sentinel-3 is an altimetry mission that can be a valuable data source for estimating ice thickness to accompany SAR data; its main limitation is the very narrow track requiring many orbits to cover an area; S-3 Level-2 products include an ice-type product generated from the altimeter waveform; there is also an automated Polar Code Risk Index Outcome (RIO) product available that is computed from Sentinel-3 data.
- Wolfgang Dierking (AWI): *Multi Frequency SAR Classification of Sea Ice*
  - See presentation (this presentation was re-scheduled and did not get web-cast)
  - Need to have different frequencies due to different sensitivities to sea ice properties, the complementarity of the sensor data that we want to use, the separability between the different ice classes, and the dynamic range.
  - At the present time, having different SAR frequencies means using different satellites; the implied time differential must be less than 1 hour.
  - ROSE-L (Radar Observing System for Europe in L-band) is an ESA SAR project and a Copernicus High Priority Candidate Mission.
    - Mission requirements document is due to be published in mid-2019
    - The space requirements group is soliciting requirements for dynamic range, resolution, incidence angle, dual-pol vs full polarimetry, atmospheric/ionospheric corrections, the interferometric accuracy, and the inclusion of wave modes. The constellation combo (C and L band combo) is under discussion.



## IICWG-XIX September 24-28, 2018

### *“Ice Information for Navigating the Sub-Polar Seas”*

- Wolfgang would like to conduct a demonstration of ice charting based on C- and L- band image - He is seeking a list of ice services that are interested in participating in doing the analyses.
- Q: Can the combo of C and L band be used for better discrimination of icebergs?  
A: I have seen a study (Lawrence Gray in Canada) that says so, but I haven't done any work for this study.
- Q: Everyone is excited about the possibility of 4 L-band satellites. Is there the ability to process all that data?  
A: I need to bring this up with the advisory group. My question is if the ice services can actually handle all the data as well.
- Comment: If there were 4 or even 3 Sentinels, we could get more capacity to image the Southern Ocean. Ships need the info on the quality of the ice that they are breaking through.
- Q: What is the best SAR frequency for seasonal ice areas with only first year ice?  
○ A: Adding L- to C-band is a plus. For smooth ice, it is still hard to discern.
- Comment: Issues still to be addressed include the communication channel capacity to download the data, and temporal coverage during the day.

### Session 2

The second session of the workshop also featured three presentations:

- Leif Eriksson (Chalmers University): *Earth Observation Data for Maritime Navigation*
  - See presentation and webcast recording.
  - Take-away messages: ship routing services use weather, wind and current information to reduce fuel consumption and increase passenger comfort; routing options should incorporate ice conditions as well.
- Anton Korosov (NERSC): *Retrieval of Sea Ice Drift and Deformation and Assimilation into a Lagrangian Sea Ice Model*
  - See presentation and webcast recording.
  - Take away messages: Lagrangian sea ice model with elasto-brittle rheology runs very efficiently on laptop computer; assimilates SAR data and ECMWF forecasts; working to improve the model and make it available to operations.
- Philippe Lamontagne (NRCC): *Leveraging Historical, Current and Forecast Information to Support Safe Navigation in Ice-Infested Waters*
  - See presentation and webcast recording
  - Take away messages: NRCC maintains an operational iceberg model and has a variety of applications using ice charts; can stitch ice charts together along a route, compute risk assessment reports compatible with Polar Code but need to incorporate ice melt information.

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| <b>ACTION?</b> | Ice Services need to provide stage of development as well as ice concentration to support detection of melt onset period and for Polar Code Risk Assessment |
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## IICWG-XIX September 24-28, 2018

*“Ice Information for Navigating the Sub-Polar Seas”*

### **Ad-hoc Southern Ocean Gathering**

This ad-hoc meeting was called by Jan Lieser of the University of Tasmania to give participants with an interest in Southern Ocean matters a chance to talk about mutual interests. Following is Jan’s report on the meeting.

“We met on Tuesday (25 Sept. 2018, after the End of Day 2 of the 19th IICWG annual meeting) for half an hour and had a great turnout of more than 20 participants. The main aim of the meeting was to gauge the appetite within the International Ice Charting Working Group to get together as a focussed group and discuss Southern Ocean specific issues. This appears to be an under-investigated subject matter for a long time, as the IICWG hears regularly from many specialised subgroups (incl. North American, European and Baltic ice services meetings) during their annual gatherings, but nothing centred around the vast Southern Ocean. Creating such a group appears timely as the community recognises more and more the differing challenges of the southern hemisphere cryosphere.

“Judging from the lively discussion in the room, there seems to be strong support for such a specialised meeting - keeping in mind that Southern Ocean science questions are regularly discussed and addressed at other international meetings (for example biennial SCAR meeting and similar). Therefore, the focus and strength of an IICWG Southern Ocean meeting should be about the transfer of scientific progress into operational products and the requirements of Ice Services responsible for Southern Ocean METAREAs and NAVAREAs (including marine safety services centred around hazard warnings to mariners) in terms of research and development needed to sufficiently address their obligations.

“Like the Arctic, Southern Ocean ship operations can be grouped largely into three types:

- Vessels that want to stay completely away from floating ice. This issue revolves around the capabilities of iceberg detection, which is to a large degree limited by the availability of remote sensing data for the region. There is no ‘Southern Ocean iceberg limit (or limit of all ice)’ published by any ice service, which is a big gap in the operational products list;
- Navigation in bergy waters; that is, ships that want to avoid all sea ice but are willing to operate within a region of the Southern Ocean which can reasonably be expected to hold a rather large number of icebergs. A consistent, daily updated sea-ice edge for GMDSS to fulfil the responsibility of high seas hazard warning is not available to support these operations;
- Sea-ice transit navigation in support of science and resupply operations at the Antarctic coast and on the continent. Tailored support is available for these operations but they are limited and depend largely on personal relationships rather than an institutionalized, sustainable system.

“Without trying to rank these issues, each of these identified needs would probably justify a day each of presentations and discussions. We understand that there is sufficient interest within the IICWG community that would warrant a focussed gathering in the not too distant future. We shall be in touch with the IICWG co-chairs and secretariat to develop this further.”



## IICWG-XIX September 24-28, 2018

*“Ice Information for Navigating the Sub-Polar Seas”*

### Posters

Most health breaks were 45 minutes in length to allow time for participants to view the posters and speak with the presenters. In addition, presenters were given 5 minutes each at various times during the meeting to introduce their poster to the plenary.

- Suman Singha (DLR): *Potential of Compact Polarimetry for Operational Sea Ice Monitoring over Arctic and Antarctic Regions*
- Louise Ireland, Andrew Fleming, Andreas Cziferszky, David Herbert (BAS): *POLARIS Calculations Based on NIC Ice Charts*
- Lasse Rabenstein (Drift & Noise Polar Service): *PRedictive Ice IMAgEs (PRIIMA)*
- Gabrielle McGrath (RPS Ocean Science): *Data Integration to Support Decision-Making for Mission Critical Operations*
- Marko Mäkynen, Juha Karvonen, Mwaba Hiltunen, Bin Cheng, Patrick Eriksson, Antti Kangas, Eero Rinne (FMI): *Coastal Downstream Service for the Baltic Sea Landfast Ice Extent and Thickness*
- Mallik Mahmud, John Yackel: *Incidence Angle Dependency of Multi-Frequency SAR Backscatter*
- Oleg Folomeev, Alexey Godvod, Mikhail Lyamzin, Ekaterina Afanasieva (AARI): *New Challenges During Ice Support of the LNG Tankers 'Vladimir Rusanov' and 'Eduard Tolle' on Their Voyage on the Eastern Section of the NSR in June - July 2018*
- Hugo Isaksen, Andreas Hay Kaljord (KSAT); *Near Real-Time Multi-mission SAR*



## IICWG-XIX September 24-28, 2018

*“Ice Information for Navigating the Sub-Polar Seas”*

### **Open Meeting Summary and Close**

#### ***Approval of Press Release***

Further to its introduction on Monday, followed by off-line discussions and written comments from the participants, a revised version of the IICWG-XIX Press Release was presented to the participants. It was approved as written. The final version is attached at Appendix L.

#### ***IICWG Vision***

A task team had been nominated at IICWG-XVII to work on updating the mission and strategic vision of the IICWG with a particular focus on the next 5-10 years. A draft was discussed at IICWG-XVIII with many comments and suggestions offered by the participants. At this year’s meeting, at the direction of the Co-Chairs, a small group met to develop a strategic vision statement that would be succinct, relevant, meaningful, and consider the comments on earlier drafts. The group developed a one page draft of a mission, vision and five strategic goals that was presented to the plenary. The draft was discussed and minor revisions proposed. A final draft was tabled to the Business Meeting for approval.

#### ***IICWG Organizational Structure***

Earlier in the meeting, the co-chairs had challenged the Group to consider evolving to a more effective structure. They noted that:

- Actions are often assigned to committees with little time for discussion with the result that committees are often over-tasked with actions that are not necessarily impactful, that lack a champion to drive them, or, in some cases, are not even achievable;
- Many of these actions are vague and lack focus, making them difficult to interpret after the IICWG meetings;
- Having separate Data and Science Committees seems to be an outdated and artificial construction;
- Committee membership and active participation seems to be on the decrease;
- There doesn't seem to be a home for many important operational issues, including those regarding the relationship between scientific research and operations; and,
- There doesn't seem to be a consistent relationship between the Terms of Reference for the committees and the IICWG itself.

After lengthy discussions in the committees, jointly and separately, it was proposed that the standing committees be abolished. Rather than having standing committees with lots of disparate actions, it was decided to establish Task Teams to address specific problems as needed. The Task Teams should have clear deliverables and be disbanded once the issue is fully addressed. This arrangement will also ensure every new action item has a champion willing to lead a team that would work the problem. A Co-Chairs’ Coordinating Group, comprised of the two IICWG Co-Chairs and the Task Team Leads, was formed to track progress.



## IICWG-XIX September 24-28, 2018

### *“Ice Information for Navigating the Sub-Polar Seas”*

Following this decision, a generic Terms of Reference for the Task Teams was adopted and eight Task Teams were established and team leads identified:

- |                                    |                   |
|------------------------------------|-------------------|
| 1. ROSE-L                          | Wolfgang Dierking |
| 2. ICEBERG MODELING                | Mike Hicks        |
| 3. E-NAVIGATION                    | Jürgen Holfort    |
| 4. UNCERTAINTY                     | Sean Helfrich     |
| 5. ANALYST FORECASTER COMPETENCIES | Catalin Tita      |
| 6. RCC CONTRIBUTIONS               | John Parker       |
| 7. ARCTIC COUNCIL INTERACTION      | Marianne Thyrring |
| 8. MARINER TRAINING NEEDS          | Keld Qvistgaard   |

The draft Task Team Terms of Reference are attached as Appendix M.

The meeting participants expressed their appreciation for the work of the standing committees and committee co-chairs over the past 19 years noting that this decision was no reflection on their performance.

### ***Review of Potential Action Items***

The plenary reviewed the old action items that remained open as well as potential new action items proposed during this meeting. Action items were either closed, cancelled, moved to the Parking Lot, adopted by a Task Team or discarded. The results are summarized in Appendix N.

### ***Next Meeting***

Marianne Thyrring invited the IICWG to hold its 20<sup>th</sup> meeting in Copenhagen, Denmark during September 23-27, 2019. The meeting thanked Denmark for the invitation and noted that a 20<sup>th</sup> anniversary celebration should be planned.

Tentatively, we are planning for Buenos Aires in 2020 and St. Petersburg in 2021.

### ***Final Words***

The co-chairs expressed their thanks to the organizing committee and to the hosts – particularly to Antti Kangas and Patrick Eriksson for their constant attention to the meeting logistics and WebEx broadcasting. This was a very successful meeting and the organizational changes should help breathe new enthusiasm into the initiatives of the IICWG.

The IICWG charter signatories and the heads of the national ice services were invited to attend the Business Meeting together with their invited guests.

### ***End of Open Meeting***



## IICWG-XIX September 24-28, 2018

*“Ice Information for Navigating the Sub-Polar Seas”*

### **IICWG Business Meeting**

#### ***Opening Remarks***

The Co-Chairs welcomed the ice services and their guests back from lunch, noting that the meeting had been very productive up to that point but that there was still some important business to complete. A revised agenda was adopted as presented.

#### ***New Business***

##### **Mission and Vision of the IICWG**

The draft mission, vision, and strategic goals document previously discussed in the open plenary was tabled for review. After some considerable discussion, mainly around the strategic goals, the version attached as Appendix O was approved.

It was also recommended that the new organization structure comprising the newly created Co-Chairs’ Coordinating Group and the Task Team Leads be described in the same document. The Co-Chairs committed to holding quarterly teleconferences of the Coordinating Group. As well, a recommendation for the structure of the annual meeting was proposed for inclusion.

|                |  |
|----------------|--|
| <b>ACTION?</b> | Secretariat to schedule quarterly teleconferences of the Co-Chairs Coordinating Group – mid November, February, May, August. |
|----------------|--|

|                |  |
|----------------|--|
| <b>ACTION?</b> | Task Teams Leads to draft work plans prior to first Coordinating Group teleconference. |
|----------------|--|

##### **Recommendation for CIMR Mission**

John Falkingham had prepared a briefing note on the issue of the possible loss of AMSR-2. The Northern Hemisphere primarily utilizes SAR for ice monitoring but the Southern Hemisphere needs passive microwave radiometer data to obtain reasonable geographic coverage. The best candidate to replace AMSR-2 for this purpose is the proposed ESA Copernicus Microwave Imaging Radiometer (CMIR). The meeting participants raised the point that the ROSE-L mission, an L-band SAR planned to be operated in tandem with the C-band Sentinel-1s, is also of great interest to the IICWG community. Both missions are High Priority Candidate Missions in the Copernicus Expansion Program but neither has yet been approved. They may be in competition for funding.

The ensuing lively discussion elicited a number of points:

- The IICWG has previously told ESA that multi-frequency SAR is our highest priority;
- Although we want to support global coverage of the Southern Hemisphere, we don’t want to jeopardize multi-frequency SAR;



## IICWG-XIX September 24-28, 2018

### *“Ice Information for Navigating the Sub-Polar Seas”*

- The need for Passive Microwave Radiometer coverage may be reduced if Sentinel 1-a/b are still healthy when S-1 c/d, are launched and the four satellites can be operated together;
- The greatest density of maritime activity is in the Arctic so the greatest impact on maritime safety will come from multi-frequency SAR, rather than passive microwave;
- While there is documented evidence of the positive potential benefits of C+L Band SAR for sea ice classification, combining SAR with Passive Microwave data is less well developed.

It was agreed that the IICWG should lend support to both the ROSE-L and CIMR missions with a priority for ROSE-L should that become necessary. It was noted that the altimeter TOPO mission, another Polar High Priority Candidate Mission, could also be supported but as a third priority.

|   |
|---|
| <b>ACTION?</b> IICWG to send letter to European Commission Copernicus program conveying our support to both the ROSE-L and CIMR missions with a priority for ROSE-L should a choice become necessary. |
|---|

### **Engaging with the Arctic Council Senior Arctic Officials**

The chair of the Arctic Council moves from Finland to Iceland in 2019. Iceland has already indicated that they will continue to pursue the meteorological cooperation theme initiated by Finland. The Arctic Council Interaction Task Team will develop a workplan to engage the Icelandic planning committee.

### **Interaction with the Arctic Shipping Best Practices Information Forum Web Portal**

Marianne gave a presentation on the IICWG at the 2<sup>nd</sup> meeting of the ASBPIF and we have been invited to participate in future meetings. The IICWG Ice Logistics Portal is featured prominently on the ASBPIF portal and so is now in front of a larger audience. It has been noted that the Ice Logistics Portal is often missing information which will now be more widely noticed – we need to ensure that it is up-to-date.

BSH operates the Ice Logistics Portal. Missing data is usually a technical problem that is exacerbated when ice services change urls for their charts. All ice services should check regularly to ensure that their charts are making it to the Portal.

Mariners have asked for historical ice charts to be made available. At the least, we should be able to provide links to websites with historical data.

|   |
|---|
| <b>ACTION?</b> John Falkingham to provide Jürgen Holfort with a list of links to web sites containing historical ice information suitable for mariners. Jürgen to add them to the Ice Logistics Portal. |
|---|



## IICWG-XIX September 24-28, 2018

*“Ice Information for Navigating the Sub-Polar Seas”*

### ***Review of Action Items***

The plenary and committee action items were reviewed. Since the Standing Committees were abolished, all of their outstanding actions were addressed. Some of these were adopted by one of the Task Teams. Several were closed as having no immediate further work to do. Some of the actions were placed on the Parking Lot for future consideration. The disposition of the Standing Committee actions is presented in Appendices P (DICSSC), Q (ASRSC) and R (Iceberg).

The plenary action items were reviewed. Of the 14 actions that remained open at the start of the meeting, 12 were closed, cancelled, moved to the Parking Lot, or adopted by a Task Team. Two old actions remain open. New actions proposed at this meeting were adopted by a Task Team, moved to the Parking Lot for future consideration, accepted by individuals or discarded. The resulting list of open plenary action items is attached at Appendix S. The Parking Lot is attached at Appendix T.

### ***Next Meeting***

The next meeting was confirmed for Copenhagen, Denmark during September 23-27, 2019.

The organizing committee for IICWG-XX will be the Co-Chairs Coordinating Group consisting of the Co-Chairs and Task Team Leads, a local logistics group led by Keld Qvistgaard and Marianne Thyrring, and the secretariat.

### ***Meeting Close***

The co-chairs thanked everyone for their participation and efforts in making this a very successful meeting. They noted that some very productive work was done to re-organize and rejuvenate the Working Group – but noted that we must not forget what we have agreed to do.

They again thanked the Finnish Meteorological Institute for being a superb host in in providing excellent facilities, superb logistical support, and wonderful social activities.

IICWG-XIX was closed with wishes to all for safe travels home.

***End of IICWG-XIX***



# IICWG-XIX

## September 24-28, 2018

*“Ice Information for Navigating the Sub-Polar Seas”*

### ACRONYMS

|          |   |        |   |
|----------|---|--------|---|
| AAD      | Australian Antarctic Division   | IABP   | International Arctic Buoy Program                     |
| AARI     | Arctic and Antarctic Research Institute   | IIP    | International Ice Patrol                              |
| ACECRC   | Antarctic Climate and Ecosystems Cooperative Research Centre  | IMetO  | Icelandic Meteorological Office                       |
| ASF      | Alaska Satellite Facility   | IMO    | International Maritime Organization                   |
| ASRSC    | Applied Science and Research Standing Committee   | IPAB   | International Programme for Antarctic Buoys           |
| AWI      | Alfred Wegener Institute for Polar and Marine Research  | ITOPF  | International Tanker Owners Pollution Federation Ltd. |
| BAS      | British Antarctic Survey  | JPL    | Jet Propulsion Laboratory                             |
| BSIM     | Baltic Sea Ice Meeting  | KSAT   | Kongsberg Satellite Services                          |
| BSH      | Bundesamt für Seeschifffahrt und Hydrographie   | met.no | Norwegian Meteorological Institute                    |
| BOM      | Australian Bureau of Meteorology  | MSC    | Meteorological Service of Canada                      |
| CCG      | Canadian Coast Guard  | NAIS   | North American Ice Service                            |
| CDPF     | Canadian Data Processing Facility   | NERSC  | Nansen Environmental and Remote Sensing Center        |
| CIS      | Canadian Ice Service  | NIC    | National Ice Center                                   |
| CLS      | Collecte localisation satellites  | NIS    | Norwegian Ice Service                                 |
| CMEMS    | Copernicus – Marine Environment Monitoring Service  | NMI    | Norwegian Meteorological Institute                    |
| CNES     | Centre national d'études spatiales, France  | NOAA   | National Oceanic and Atmospheric Administration       |
| COMNAP   | Council of Managers of National Antarctic Programs  | NRCC   | National Research Council Canada                      |
| CPOM     | Centre for Polar Observation and Modelling  | NRL    | Naval Research Laboratory                             |
| CSA      | Canadian Space Agency   | NSIDC  | National Snow and Ice Data Center                     |
| DICSSC   | Data, Information and Customer Support Standing Committee   | NSOC   | NOAA Satellite Operations Center                      |
| DLR      | Deutsches Zentrum für Luft- und Raumfahrt (German Aerospace Center)                                   | NWS    | National Weather Service                              |
| DMI      | Danish Meteorological Institute   | OSRL   | Oil Spill Response Ltd.                               |
| ECCC     | Environment and Climate Change Canada   | SMHI   | Swedish Meteorological and Hydrological Institute     |
| EC-PHORS | WMO Executive Council Panel of Experts on Polar and High Altitude Observations, Research and Services | SHNA   | Servicio de Hidrografia Naval de Argentina            |
| EIS      | European Ice Services   | SPRI   | Scott Polar Research Institute                        |
| EMSA     | European Maritime Safety Agency   | UCL    | University College London                             |
| ESA      | European Space Agency   | UAF    | University of Alaska Fairbanks                        |
| ETSI     | Expert Team on Sea Ice  | UTAS   | University of Tasmania                                |
| FMI      | Finnish Meteorological Institute  | WMO    | World Meteorological Organization                     |
| IAATO    | International Association of Antarctic Tour Operators   |        |   |



**IICWG-XIX**  
**September 24-28, 2018**

*“Ice Information for Navigating the Sub-Polar Seas”*