WORLD METEOROLOGICAL ORGANIZATION

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (OF UNESCO)

JCOMM EXPERT TEAM ON SEA ICE (ETSI)

3rd Ice Analysts' Workshop

Copenhagen, Denmark
18-22 June 2011

FINAL REPORT

JCOMM Technical Report No. 56

N O T E

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APPENDICES

ANNEXES

GENERAL SUMMARY OF THE WORKSHOP

1. OPENING OF THE SESSION

1.1 Opening and Welcome

The 3rd Ice Analysts' Workshop (IAW-3) was opened by the Chairperson of the Expert Team on Sea Ice (ETSI), Dr. Vasily Smolyanitsky (Russian Federation), at 0900 hrs on Tuesday 18 June 2011 at the Danish Meteorological Institute, Copenhagen, Denmark. Dr. Smolyanitsky noted that the Ice Analysts' Workshops are endorsed by both JCOMM and the International Ice Charting Working Group (IICWG) as being a valuable forum to share knowledge and coordinate ice information services throughout the world. Recognizing the increasing navigation that is taking place in the Arctic, five new METAREAs were created 3 years ago to ensure that meteorological, including ice, Marine Safety Information (MSI) through the Global Global Maritime Distress and Safety System (GMDSS) would be available to mariners in the Arctic. After 2 years of development and testing, 2011 is the year in which GMDSS in these new METAREAs is to become operational. One of the objectives of this workshop is to give ice experts the opportunity to work out the details of coordination of ice information for GMDSS among the Issuing and Preparation Services.

Erik Buch, Director of the Centre for Ocean and Ice at the Danish Meteorological Institute (DMI), welcomed the workshop participants to DMI. He noted that the Centre is responsible for all activities related to ocean and ice, including the Greenland Ice Service, which was formed over 50 years ago following the tragic sinking of a passenger vessel off the Greenland coast. The ice service is important for the security of people who operate at sea as well as their ships and cargoes. Climate change and increased activity in Arctic waters have put more emphasis on ice services and increased demands on operational ice information services. Additionally, many services face the challenge of decreasing resources which emphasizes the importance of international cooperation, a focus on new technologies and products and new demands for data providers. He emphasized the importance of the JCOMM initiative to organize these ice analysts' workshops to further cooperation among the ice services and finished by saying that DMI is very proud to host IAW-3 and wished the group a fruitful workshop.

The participants (Appendix I) introduced themselves in round table fashion.

1.2 Adoption of the agenda

The chairman reviewed the agenda (Appendix II) and timetable (Appendix III) prepared by the Secretariat expanding on the objectives and background for the Case Studies (See Appendix IV for a description of the proposed case studies).

The group proposed that Agenda Item 6 be expanded in time and scope to also include a discussion of regulations and practices in greater detail. The participants agreed on the agenda with this change.

1.3 Workshop logistics and arrangements

The participants agreed on the hours of work. Nora Adamson (DMI) provided information on local facilities, including locaton of breakout rooms and details of wireless Internet connections that were provided to all participants.

2 Reports

2.1 Key facts about national ice information systems for 2010-2011 season

2.1.1 Canada – Darlene Langlois (Annex A)

Ms. Langlois informed the group about the Canadian Ice Service (CIS) noting that Canada wants to have joint ice and weather bulletins for the Arctic METAREAs rather than separate bulletins. The coordination with adjacent areas will have to be worked out. Canada will be establishing 5 new surface weather stations in the Canadian Arctic to support their METAREAs as well as developing better coupled ocean-ice-atmosphere models to be operational in 2-3 years. She noted that the CIS production system (ISIS) is now 10 years old and cannot support many GIS formats. A new system (Polaris) is under development that will be much more flexible in this regard.

2.1.2 Chile – Gonzalo Concha (Annex B)

Lt. Concha briefed the group on the Ice Forecast Service of the Chilean Naval Marine Meteorological Service. The service is provided for Chile's area of responsibility from the Punta Arenas Meteorological Centre using information from Antarctic land stations, ships and satellites and from the U.S. National Ice Centre. He noted that Chile does not use the egg code because their users find it difficult to read when transmitted by radiofax. Ice charts are transmitted by HF radiofax twice a day as well as being distributed by Internet.

The Chairman noted that there is no information about the Chilean ice service in the WMO Publication No. 574, "Sea-Ice Information Services in the World". He encouraged Chile to submit appropriate information.

2.1.3 Denmark (Greenland) – Keld Qvistgaard (Annex C)

Mr. Qvistgaard informed the workshop about the Greenland Ice Service operated by DMI. The main area of interest is the east coast and southern tip of Greenland where Multi-Year Ice (MYI) is present throughout the ice season which varies from a few weeks to 6-8 months. Icebergs are present all of the time. RADARSAT has been very important but in recent years almost unlimited access to Envisat data from the rolling archive has become more important – although the rolling archive is not completely reliable. DMI has a contract with KSAT to obtain Envisat Wide Swath imagery when it is critically important. The daily chart is generally a summary of all data received the previous day with a focus on areas where there is navigation. The Greenland ice patrol concentrates on near-shore ice conditions in navigation areas. Longer range outlooks and forecasts are produced for the offshore oil industry.

2.1.4 Finland – Tuomas Niskanen (Annex D)

Mr. Niskanen briefed the group on the organizational changes at the Finnish Meteorological Institute which placed the operational ice service into the oceanographic services group. Detailed ice charts for the Baltic Sea are produced daily from November - December to May and a simplified ice chart is produced every Monday. A new arrangement with Sodankyla Geophysical Observatory in Lapland allows FMI to receive MODIS images 3 hours earlier than from the NASA Rapid Fire website. Current development is concentrating on new warnings for water levels and rough seas and the development of new tools for ice charting.

2.1.5 Germany – Natalija Schmelzer (Annex E)

Ms. Schmelzer updated the workshop on changes in the German Ice Service. Starting in the winter of 2011/12, BSH will cease production of the twice weekly ice charts of the northern Baltic but will continue to produce daily charts of the southern and western Baltic. BSH also plans to produce a "reference" chart for the entire Baltic based on satellite images and information from other Baltic ice services once a week. This chart will include ridging, rafting and floe sizes in addition to ice concentration and thickness when possible. Ice charts are produced in ArcGIS using the coding of the Ice Objects Catalogue. The intention is to produce S-100 format files based on these.

2.1.6 Norway – Nick Hughes (Annex F)

Mr. Hughes presented the information on the Norwegian Ice Service (NIS) explaining how ice charts are produced on weekdays using ArcView. They are currently working on a new computer system to speed up the information flow to the chart production system. The main focus is on the Svalbard area although ice charts are produced for the whole Arctic area from the Greenland Sea to the Kara Sea.

Weddel Sea Antarctic ice charts are produced weekly to support Southern Ocean cruise and supply ships. Forecast ice charts are produced in a format similar to the analysis and verify quite favourably. The NIS uses about 2 RSAT-2 images per day mainly from MyOcean project. However, NIS can also share images with all Norwegian government agencies so they have the ability to get about 1500 images per year. Mr Hughes noted that ice information is available through several new web addresses.

2.1.7 Russia – Oleg Folomeev (Annex G)

Mr. Folomeev briefed the group on the ice services provided by the Arctic and Antarctic Research Institute (AARI), noting that operational activity is concentrated in the Center for Ice and Hydrometeorological information – the main AARI operational department. Total staff of operational department is 50 specialists including 16 ice analysts with 4 specialized for Antarctic. Operational ice analysis is carried out in ArcGIS 8.x – 9.x environment and is provided on weekly scale for the Arctic Ocean and seas from Greenland to Chukchi, Northern Pacific as well as for the Baltic, Caspian, Black and Azov Seas. Antarctic circumpolar analysis is done twice a month. More frequent ice analysis is provided within the customized support – up to twice a day analysis. Regional ice charts from 2001 covering the stated areas are now available publicly from AARI WDC Sea Ice file-server in SIGRID3 format. AARI has its own satellite station and is sending annotated georeferenced images to clients within 30 minutes of reception. Various ASAR and high-resolution visible information is usually achieved through the SCANEX data provider in Moscw. AARI is in the process of installing a receiving station on Svalbard that will cover the whole Arctic.

2.1.8 U.S.A. – Christopher Szorc (Annex H)

The presentation on the National Ice Center (NIC) was given by Mr. Szorc who informed the workshop that the NIC produces ice charts covering 36 regions in the Arctic and 24 regions in the Antarctic as well as the Great Lakes and Chesapeake Bay. Great Lakes ice charts are produced cooperatively with Canada under the banner of the North American Ice Service (NAIS). All products are available on their website. Over the next 3 years, military ice analysts will be replaced by civilian analysts to provide greater continuity of personnel. Mr. Szorc emphasized that the NIC very much wishes to work collaboratively with other ice services to improve services and reduce workload.

2.2 Report from JCOMM (Annex I)

The chairman of the Expert Team on Sea Ice (ETSI), Vasily Smolyanitsky, informed the workshop of the recent activities and priorities of JCOMM and the relevant Expert Team on Sea Ice (ETSI) and the Expert Team on Marine Safety Services (ETMSS) as well as the status of the implementation of Arctic METAREAs and the recent work on Ice Information for Electronic Navigation Charts. Dr. Smolyanitsky explained that the ETMSS formally adopts changes to marine safety standards related to ice based on the recommendations of ETSI and stressed the importance of this workshop in formulating such recommendations. He brought the attention of the participants to the JCOMM METAREA website http://weather.gmdss.org. The workshop approved the report of the Chairman.

3 CASE STUDIES

3.1 Workshop Logistics

Nora Adamson and Keld Qvistgaard outlined the logistics for the case studies. Participants were provided three breakout areas in addition to the plenary room. Each group had access to presentation facilities to allow collaboration. DMI provided ArcGIS software and several participants had GIS software available on their own laptop computers.

Dr. Smolyanitsky and Mr. Qvistgaard gave a brief presentation explaining how on-line resources were to be accessed for the workshop. This included http and ftp access to the IAW-3 file server at gmdss.aari.ru and a local file server at DMI. Much background material for use in the case studies had already been placed in various directories on these ftp sites and participants were shown how it was structured and could be used.

The workshop participants discussed how they would like the case studies to proceed and what each group will present to the plenary. For Case Study 1, it was agreed that each group would produce snapshots of their analysis process ending with .gif and SIGRID-3 format ice charts.

3.2 Case Study #1a - Online analysis and ice charting for the Greenland Sea

3.2.1 Objective

The objective of this case study was to share best practices in ice analysis and assess differences in analysis procedures, the magnitude and sources of error, and the impact on end-users by having a team of ice experts from different services work together to prepare an ice analysis for a defined date and region using data normally available to the ice services.

3.2.2 Logistics

The team members were:

- Oleg Folomeev (AARI)
- Nora Adamsen (DMI)
- Signe Alverstein (met.no)
- Annabelle Serritslev (DMI)

The team used the SIKU ArcGIS ice charting system in place at DMI. Input data was acquired from the IAW-3 ftp server at AARI.

3.2.3 Results

The team initially discussed who the chart was intended for – navigation, fishing or others – recognizing that this could have a major impact on the level of detail required. They determined that, for simplicity and in light of the time constraints, it should be a general overview. They decided to produce the ice chart for the area of northeast Greenland and Svalbard for June 13, 2011. The primary input data used was an Envisat ASAR mosaic of the previous 3 days, a NOAA AVHRR image and 2 MODIS images.

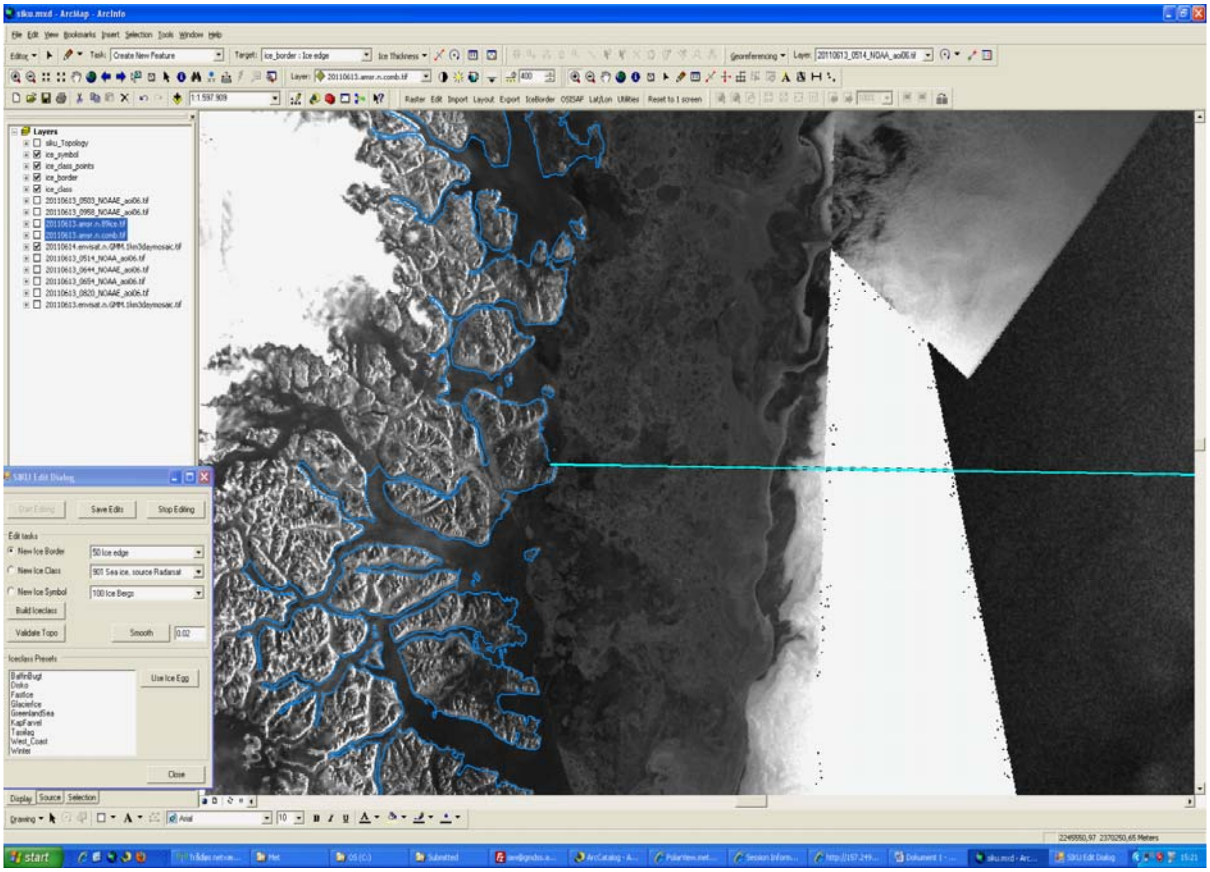

Figure 1 – Satellite image mosaic for Case Study 1a

The team started the analysis process by drawing the ice edge. This is the DMI method but is not the same as that employed by the other ice services. In discussion, they noted that the precise procedure of preparing an ice chart varies from analyst to analyst even within the same organization.

It was noted by the team that the formal definition of the "ice edge" is the boundary between ice free and any type of ice – even new ice. However, some services would not necessarily include thin strips of ice adjacent to the main pack and would place "strips and patches" symbols outside the main ice edge. The comment was made that, for fishing, this ice edge is very important – which leads back to the discussion of the end user.

They then completed drawing the boundaries between areas (polygons) based on floe sizes, ice type and ice concentration. It was noted that AARI and met.no normally use fixed intervals for ice concentration (e.g. 1-3, 4-6, 7-8, 9-10, 10) whereas DMI changes the intervals (e.g. 6-8) according to end users needs. There was little difference in how to classify the various ice types based on the imagery but there were some differences of opinion on exactly where to place the boundaries. In these discussions, the concept of the needs of different types of users was a factor. While AARI, DMI and met.no all support civilian and military ships and fishers, AARI users also include submarines and aviation, DMI users include dog sleds and met.no users include tourists.

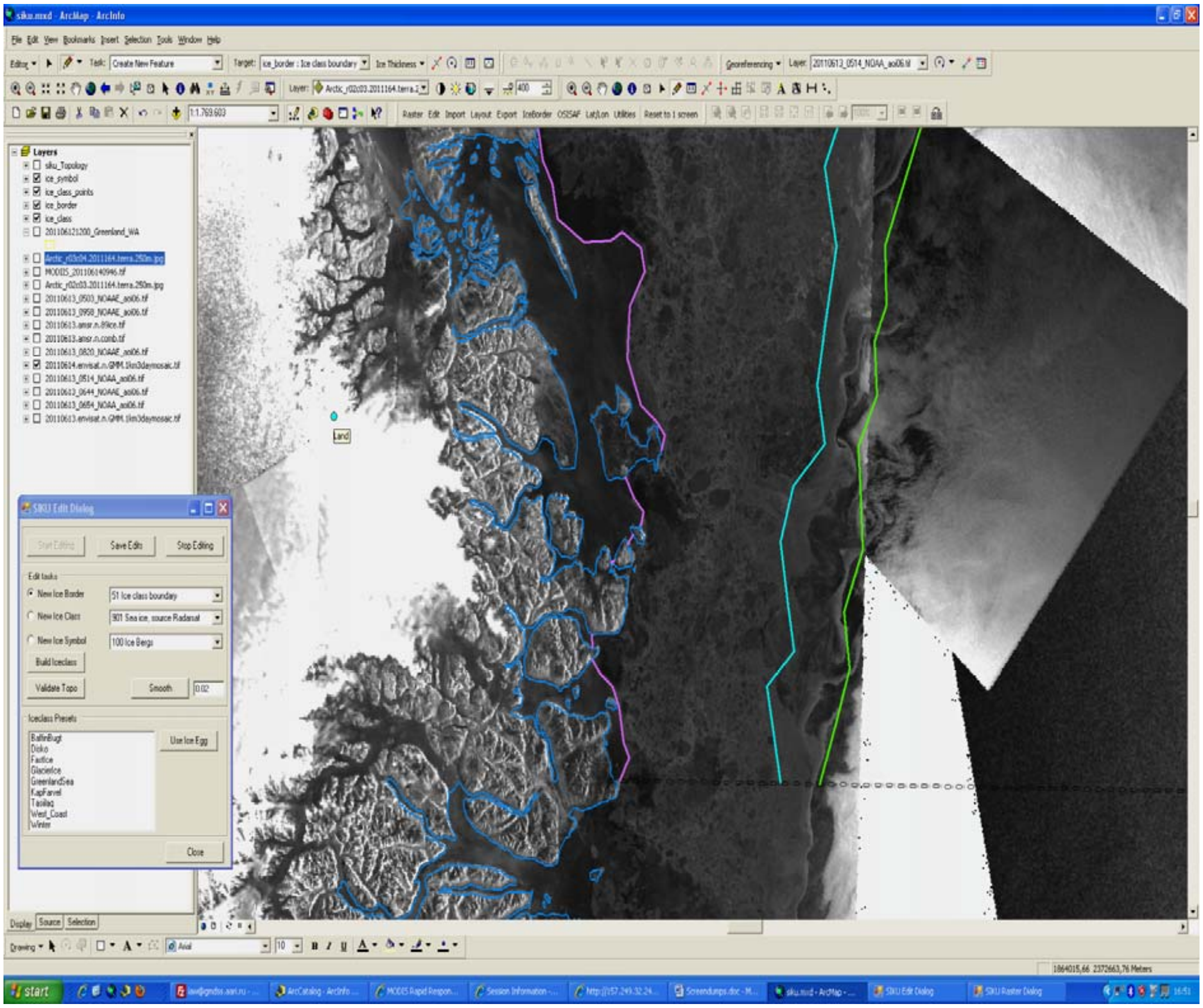

Figure 2 - Case Study 1a Analysis Partially Completed

The team used the standard DMI egg codes noting that, although the portrayal falls within the WMO International Symbology (egg code), it is different from that used in other services – and, in fact that all ice services do not follow identical practice in the use of the egg code. For example, the DMI practice used by the team does not indicate partial concentrations of different ice types present – the rationale being that differentiations between First Year Ice (FYI) and Multi-Year Ice (MYI) is based more on history than actually observation. DMI also indicates both floe sizes and strips in the "form of ice" portion of the egg. In operational practice, AARI includes several types of information to determine the ice edge (e.g. new ice/ nilas) whereas the other services determine the ice edge based on concentration alone.

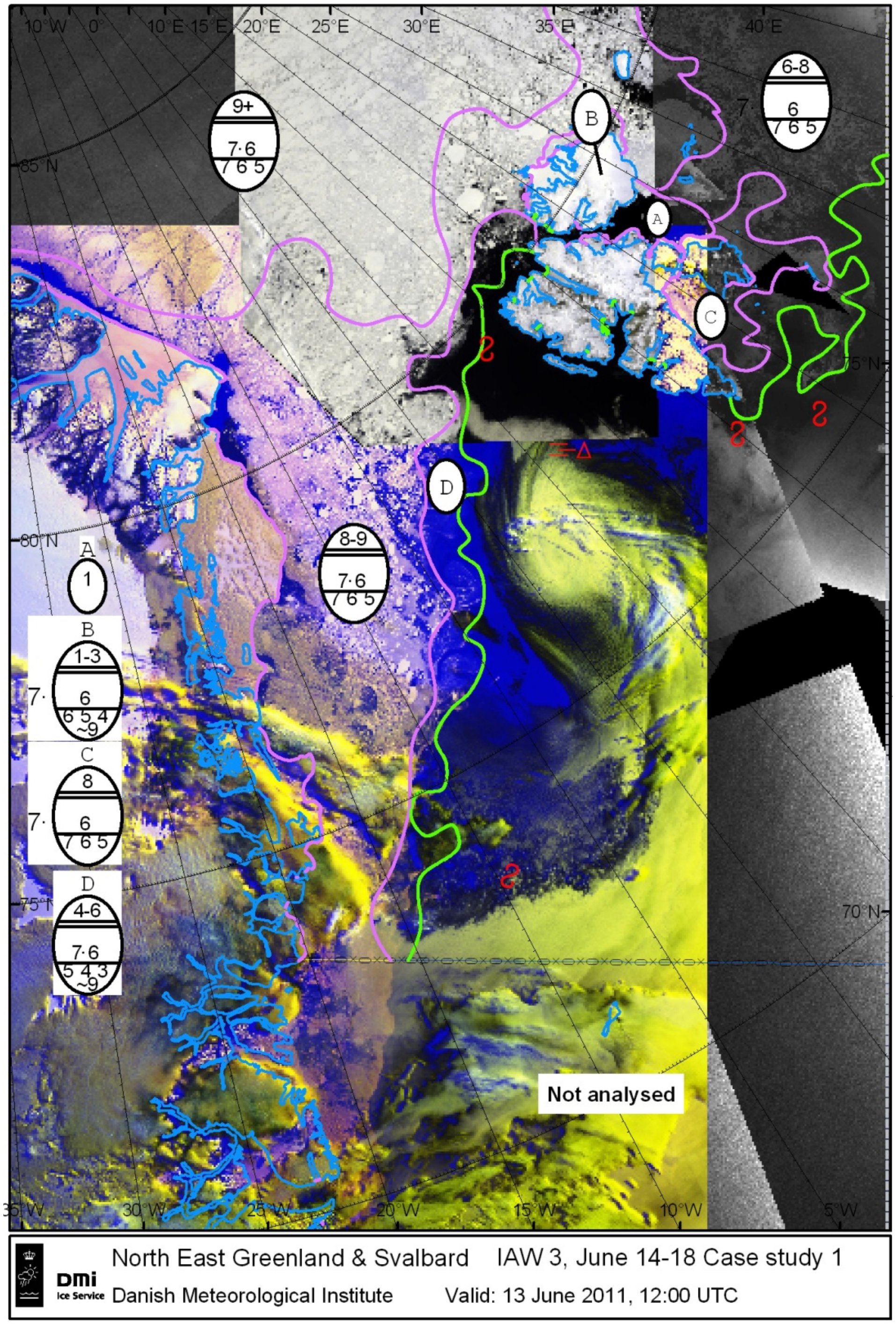

Figure 3 - Case Study 1a Analysis with Images Used

During the analysis process the team recognized the importance of using the latest information – a 3-day or daily mosaic should only be used if there is no better information. The problem of determining ice type from satellite radar data with the ice is wet was noted - MODIS and AVHRR images were used with better results for this analysis. Data from shore stations were used to estimate the thickness of the fast ice based on freezing degree-days and interpolate this to the floe ice. It was noted that this is a very dynamic area and 3-4 days long series of imagery are required to determine the drift of the ice to understand how the ice pack is changing.

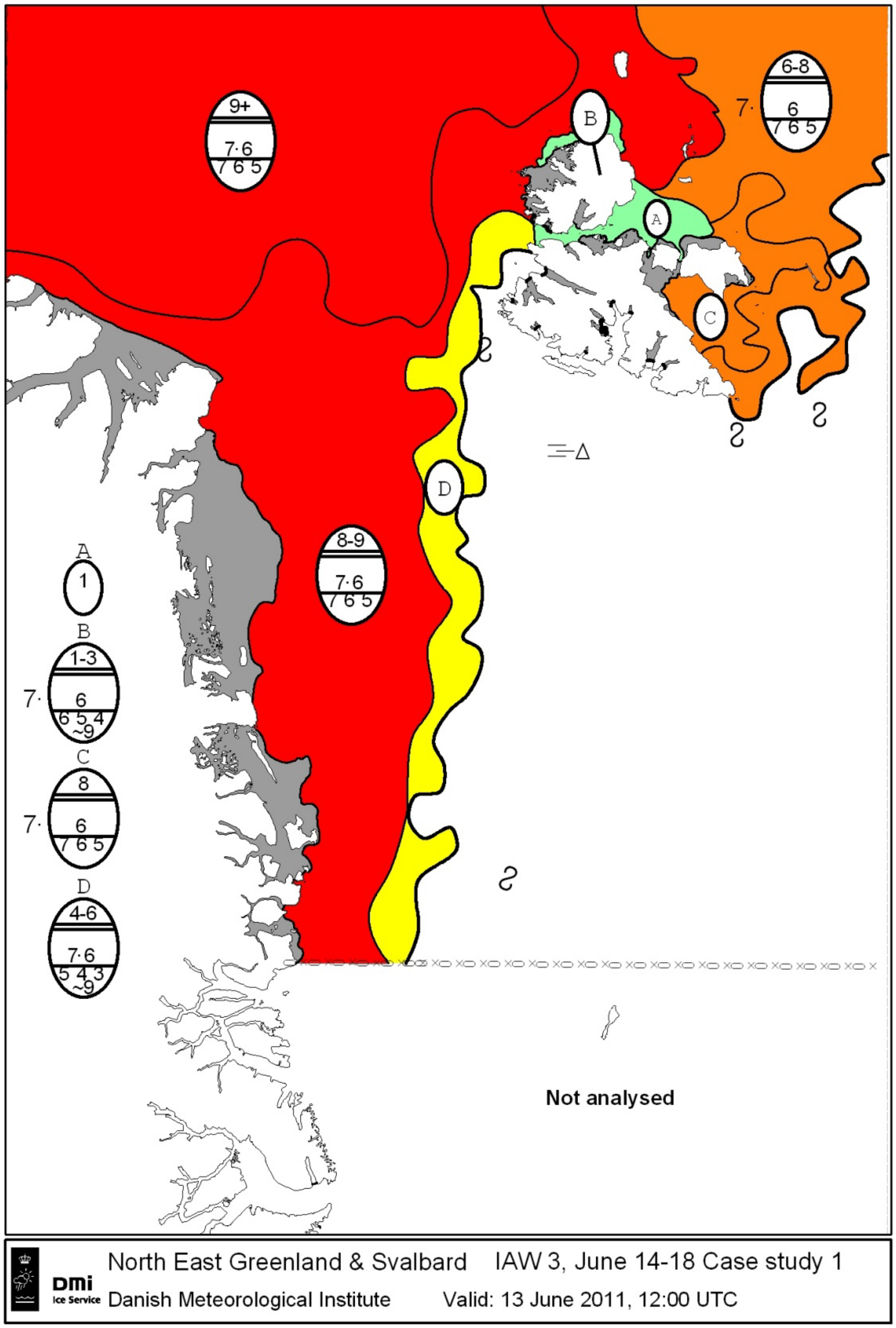

Figure 4 - Case Study 1a Completed Ice Chart

There were some comments about the notion of the "correctness" of an ice chart that is based on data spanning several days. Some ice services attempt to estimate the ice situation at a particular date and time (by modeling ice motion forward from the date and time of observation) while other services depict a "composite" of observed data from latest to oldest without adjusting the data for time.

In response to a question, most ice services indicated that, while the primary purpose of their ice charts is to support user in real time, they are also concerned with the uses of their charts for climatological purposes. This is a consideration that has impact on the application of the chart for general users as opposed to specialized users.

3.3 Case Study #1b – Online analysis and ice charting for the Baltic Sea

3.3.1 Objective

The objective of this case study was to share best practices in ice analysis and assess differences in analysis procedures, the magnitude and sources of error, and the impact on end-users by having a team of ice experts from different services work together to prepare an ice analysis for a defined date and region using data normally available to the ice services.

3.3.2 Logistics

The team members were:

- Natalija Schmelzer (BSH)
- Marika Marnela (FMI)
- Tuomas Niskanen (FMI)
- Polina Soloschuk (AARI)

The team used ArcGIS 9.3 software on a laptop to produce the analysis. Input data was acquired from the IAW-3 ftp server at AARI as well as an FMI memory stick and paper print-outs from BSH.

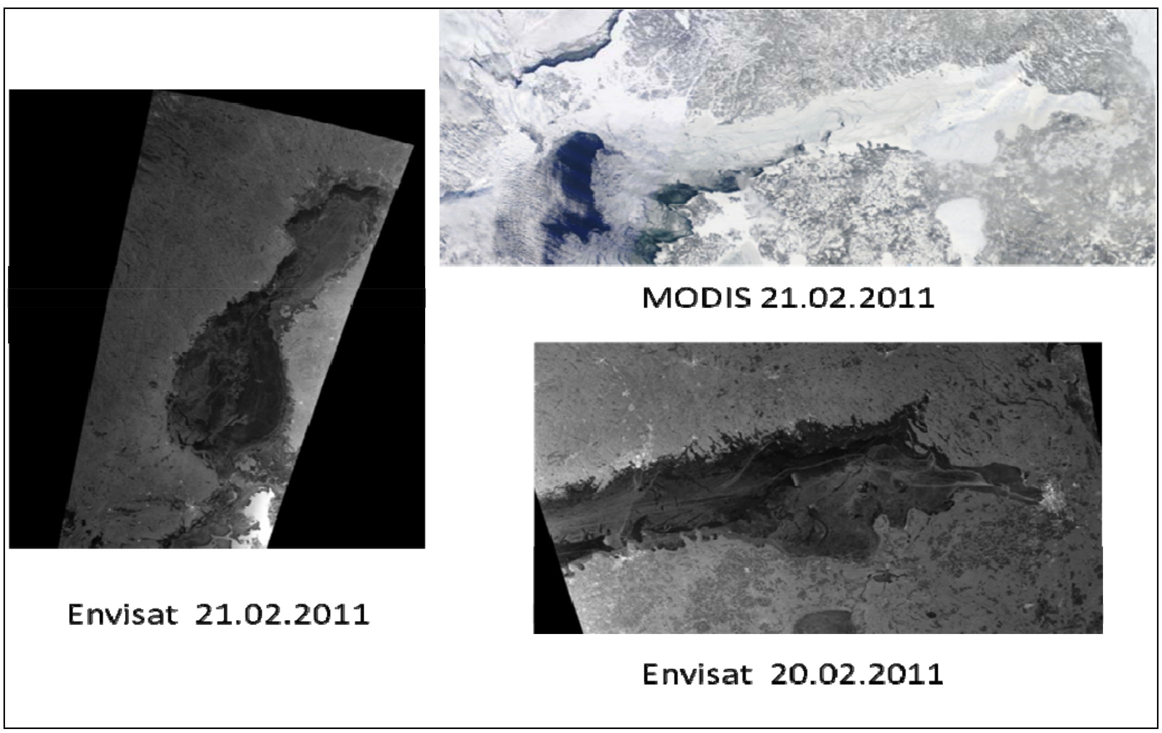

Figure 5 - Case Study 1b Satellite Images Used

3.3.3 Results

The team elected to produce the sea ice chart for the Baltic Sea on February 21, 2011using the following data:

- Envisat 21.02.2011 09:20 UTC (Gulf of Bothnia)

- Envisat 20.02.2011 19:42 UTC (Gulf of Finland)
- MODIS 21.02.2011 08:45 UTC (Gulf of Finland)
- Ice charts from previous days from AARI, BSH and FMI
- Temperature information

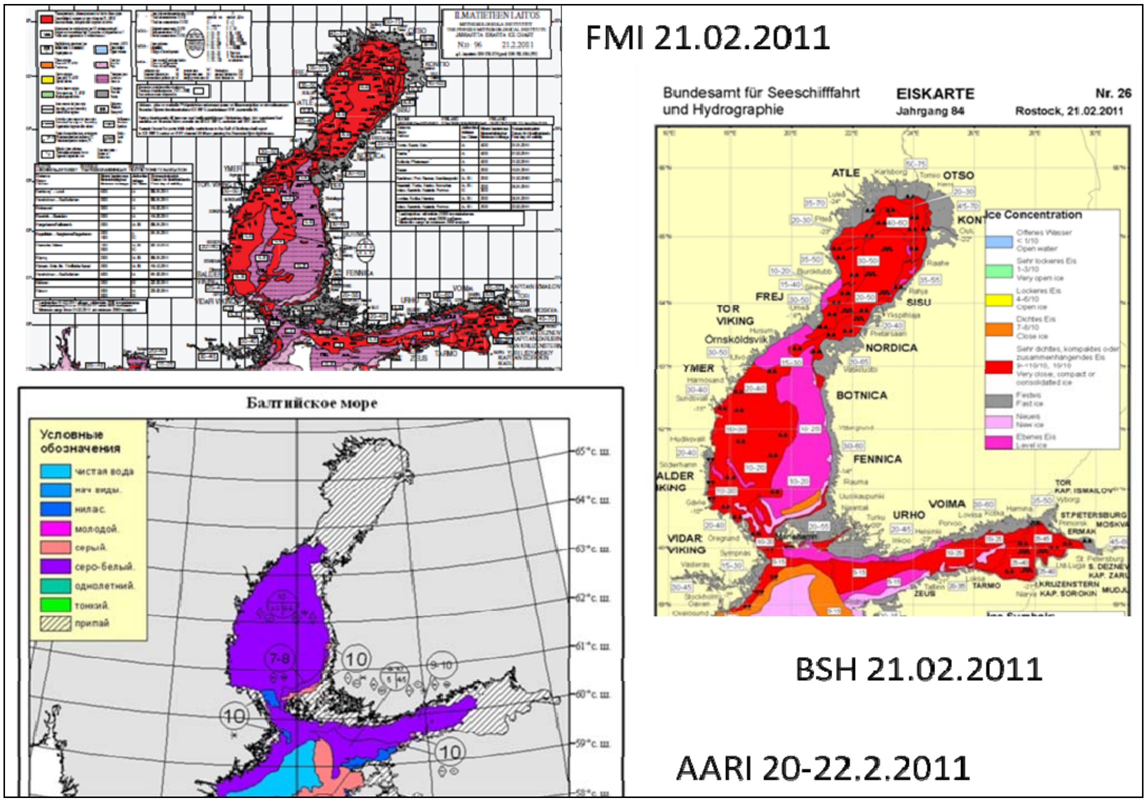

Figure 6 - Case Study 1b Preceding Ice Charts Used

It was noted that the AARI chart covered 3 days while the FMI and BSH charts were for were single day.

This team also discussed the purpose for the chart. Was it to be designed to support shipping and other maritime activity or should it be sufficiently detailed to be of scientific use?

There was question about order of steps to draw the chart. Finland and Germany alway starts with the previous day's chart and then incorporate information from satellite images. However, this process also varies among individual operators.

The team finished by marking leads, ridges and rafts taking the information from the images and from ship reports (especially for rafting). During this work, they discussed a feature that looked like a lead but determined from older charts and temperature data that it was actually level ice. They also decided that, since it was not in a shipping area, it was too small scale a feature to mark on final chart.

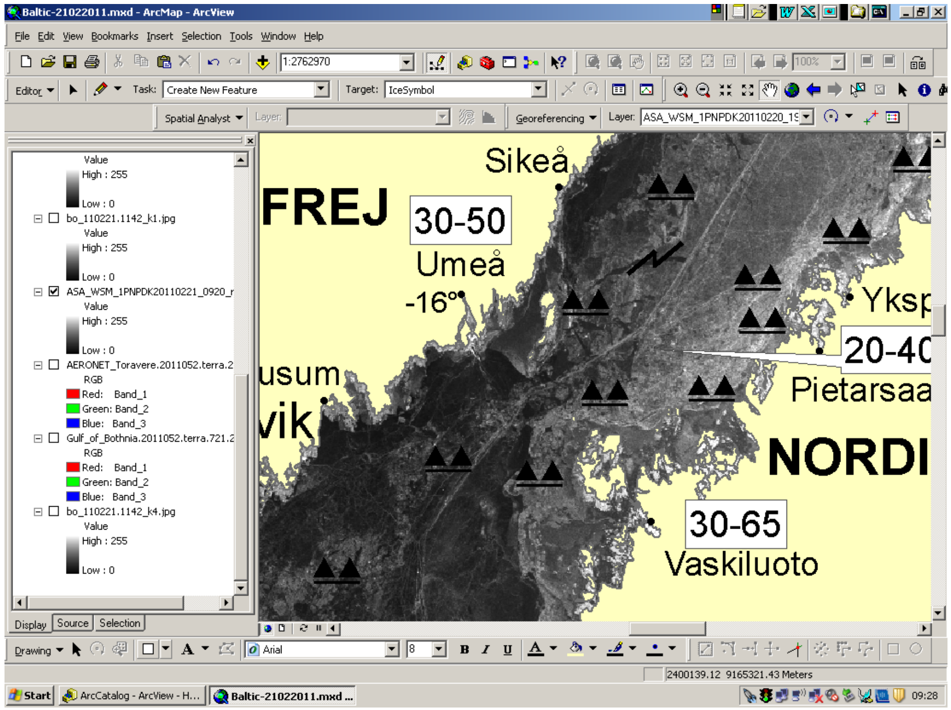

Figure 7 - Case Study 1b Detail of Analysis in Bay of Bothnia

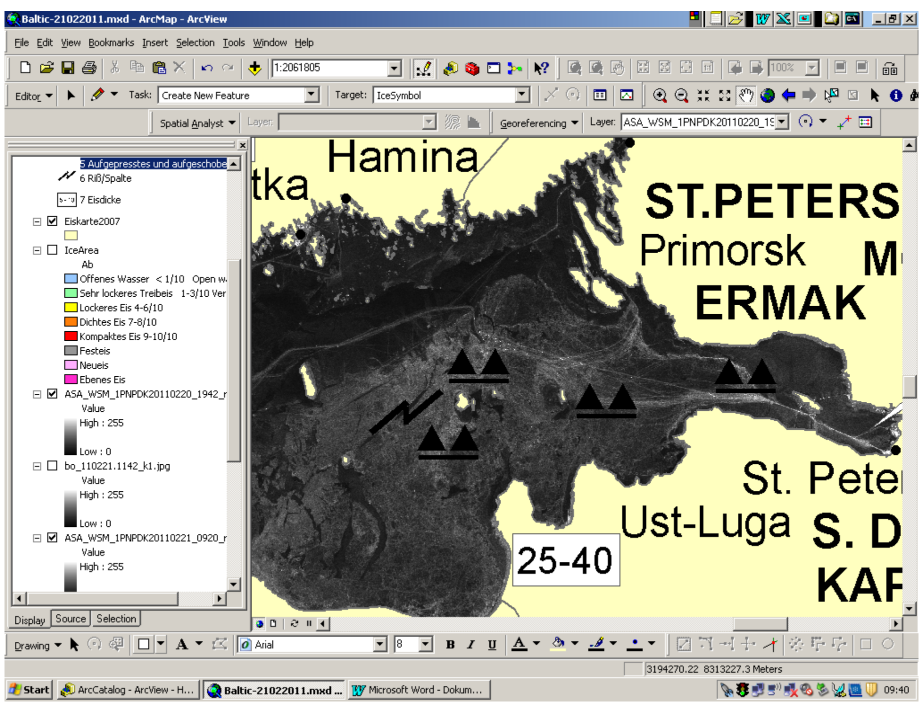

Figure 8 - Case Study 1b Detail of Analysis in Gulf of Finland

During the course of this work, the experts noted that there are different definitions used for "level ice". In some services, level ice is considered to have a maximum thickness of 20 cm. Other services considered no such maximum thickness.

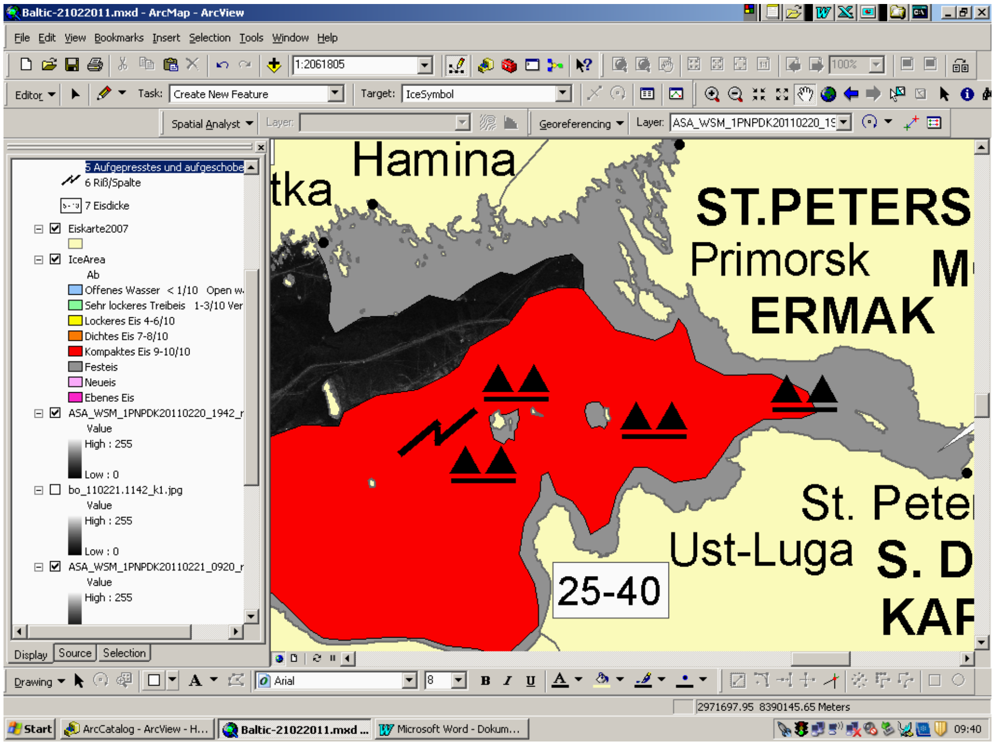

Figure 9 - Case Study 1b Detail of Final Ice Chart in Gulf of Finland

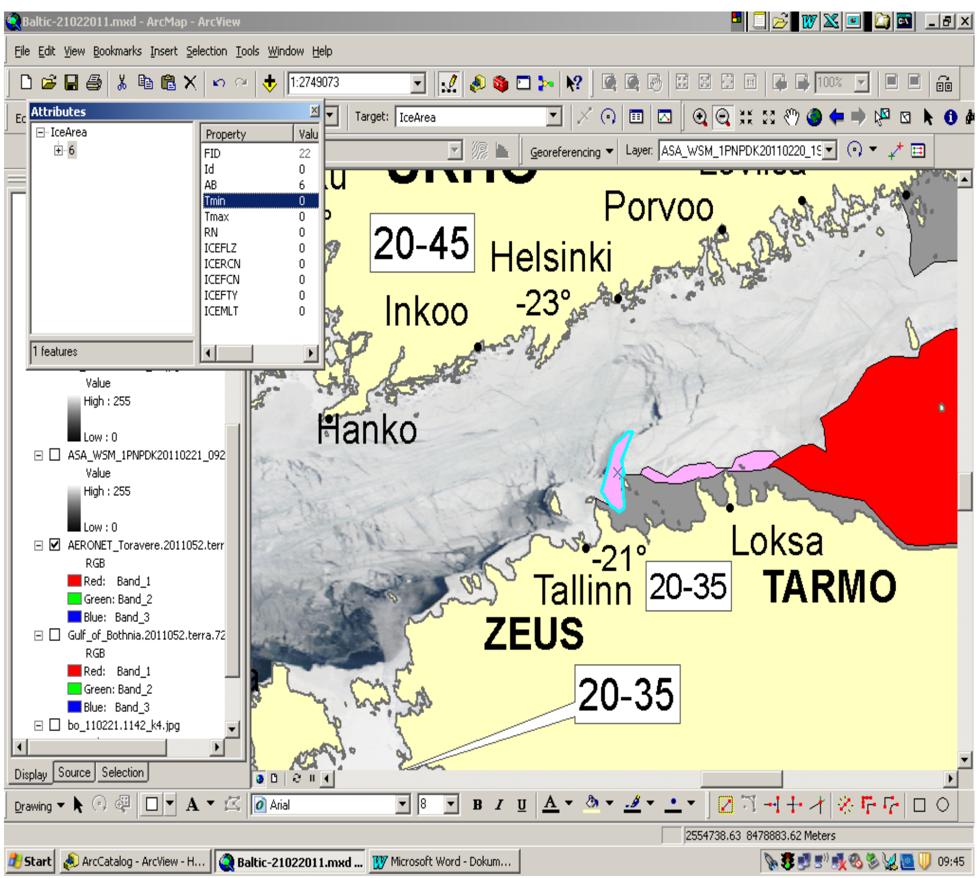

Figure 10 - Case Study 1b Detail of Ice Chart with Satellite Image Overlaid

The ice thickness related to rafted ice was also discussed. Some services consider the thickness of level ice to apply to non-rafted ice only. However, an ice area can include ice that is considerably thicker due to one or multiple rafts. Some ice services would indicate the total thickness while others would indicate the level ice thickness but would add a rafting symbol to indicate the situation.

It was noted that the Baltic ice services do not always use the International Ice Symbology (ice egg). It is used at the discretion of the analyst.

A difference of practice with respect to fast ice and consolidated ice was encountered by the team. AARI often indicates large areas of immobile ice as being "fast" but Germany and Finland never draw fast ice in an area of shipping or an area that was previously consolidated and that might still move in the near future. This initiated a discussion about the meaning of fast ice with agreement that, in general, fast ice does not produce pressure whereas pressure could be significant in areas of consolidated ice. This definition could be significant for not only ship navigation but also oil drilling operations.

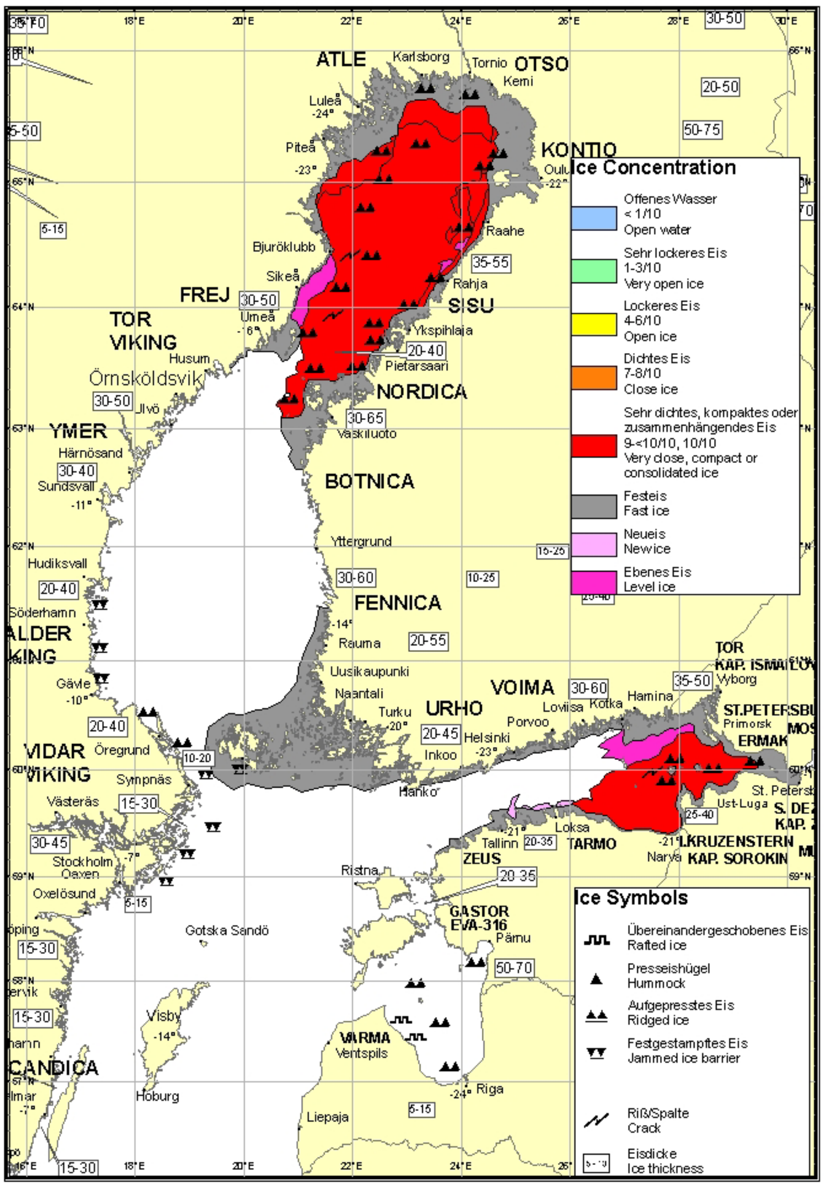

Figure 11 - Case Study 1b Completed Ice Chart

3.4 Case Study #1c – Online analysis and ice charting for the Antarctic

3.4.1 Objective

The objective of this case study was to share best practices in ice analysis and assess differences in analysis procedures, the magnitude and sources of error, and the impact on end-users by having a team of ice experts from different services work together to prepare an ice analysis for a defined date and region using data normally available to the ice services.

3.4.2 Logistics

The team members were:

- Christopher Szorc (NIC)
- Jürgen Holfort (BSH)
- Gonzalo Concha (CNWS)
- Håvard Larsen (met.no)
- Sean McDermott (Horizon / DMI)

The team used the NIC SIPAS software on a laptop to produce the analysis. Input data was acquired from the IAW-3 ftp server at AARI. The team used the SIPAS analysis tool for drawing lines which were later converted to polygons.

3.4.3 Results

The team elected to produce the sea ice chart for the Weddell Sea / Bellingshausen Sea for June 14, 2011, a time when the area was undergoing freeze-up. They simulated a scenario in which an icebreaker was in need of support which required a chart that would be more detailed than in normal practice.

The team inventoried all available images and investigated the climate data for this period. They looked at other information that was available including a surface analysis, temperature profiles and pictures of ice development taking place near the Chilean military base to help place the current ice regime in seasonal context. In the end they chose 2 Envisat images from 12 June and 14 June and an AMSR-E image from the 13th. Images were loaded into the SIPAS system and examined.

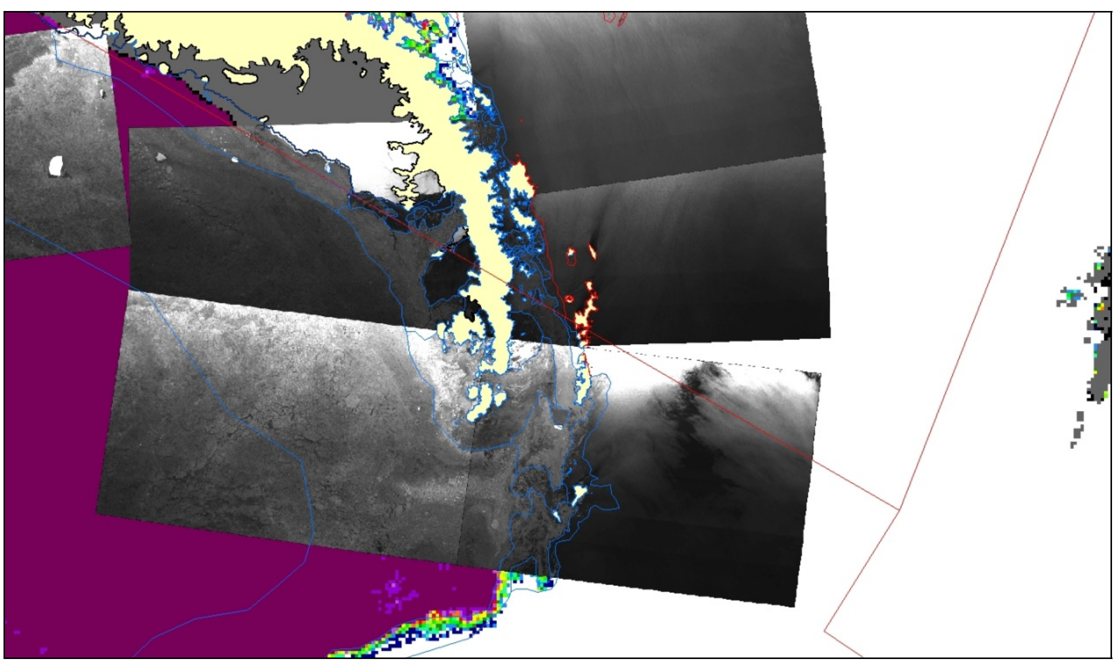

Figure 12 - Case Study 1c Mosaic of Envisat Images Used – June 12-14

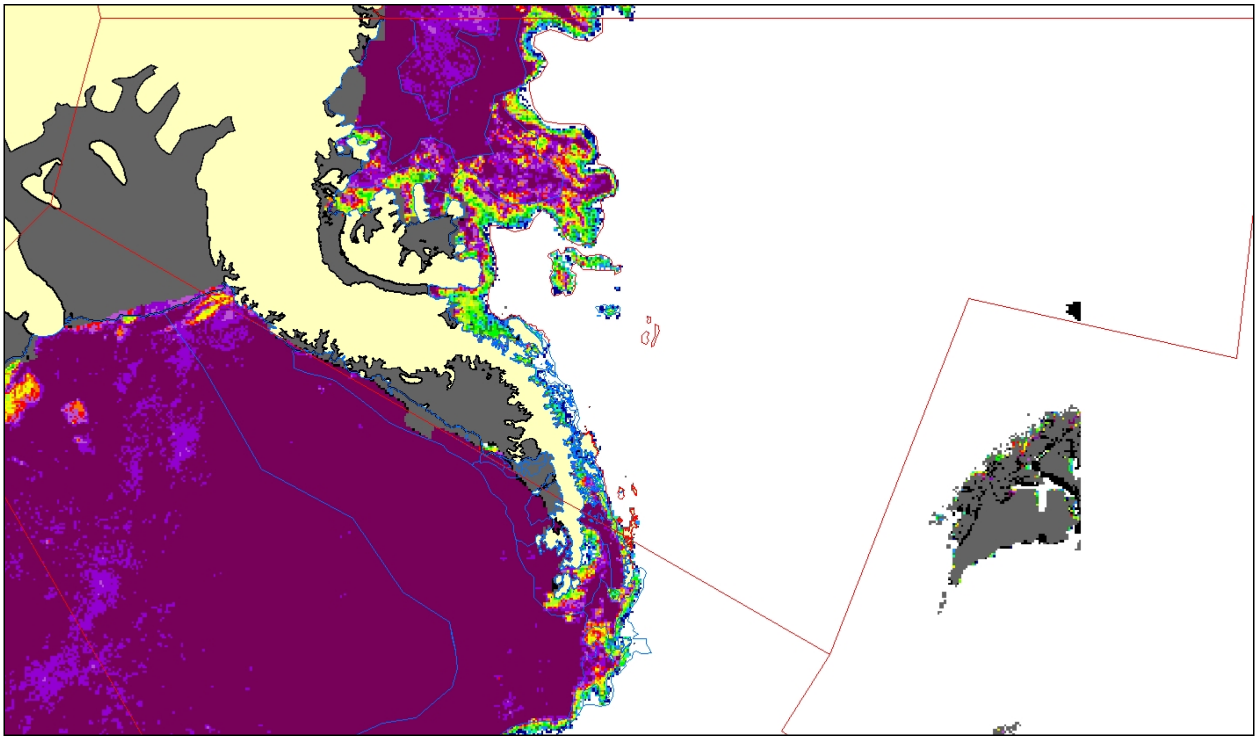

Figure 13 - Case Study 1c AMSR-E Image Used - June 13

The analysis began by defining major ice concentration boundaries. This worked well with all five participants adding to the discussion and consensus was never an issue. Freeze-up was in rapid development so ice was either 30cm or less or multi-year ice. Conditions were dynamic. The examination of the previous 2 weeks indicated that there was a period of ice loss from the 5th through the 11th. This loss was found to be caused by compression due to rafting and brash development and not temperature related, as the period had temperatures less than -5C throughout.

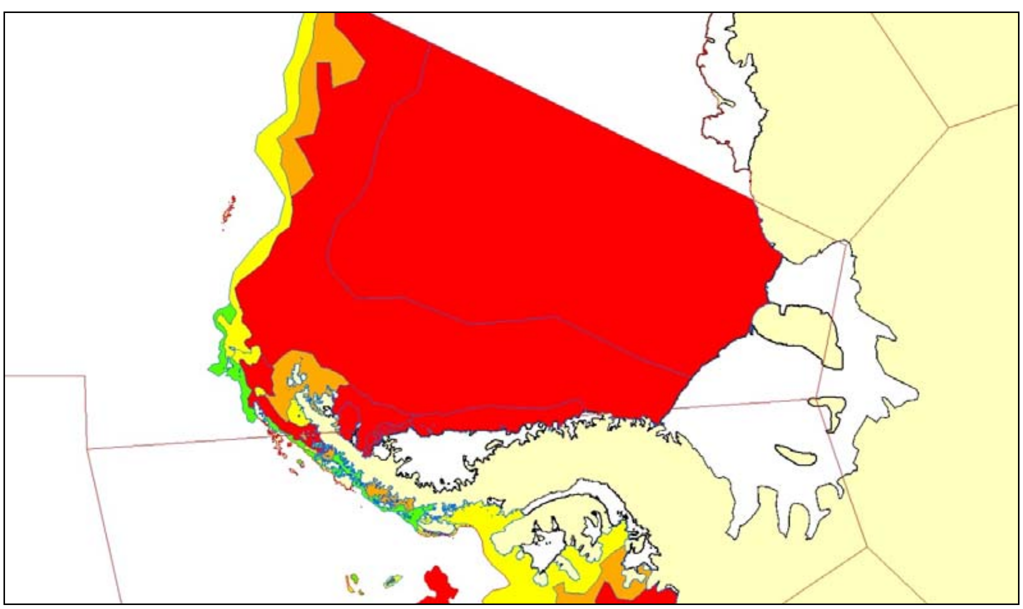

Figure 14 - Case Study 1c Completed Ice Chart Valid June 14

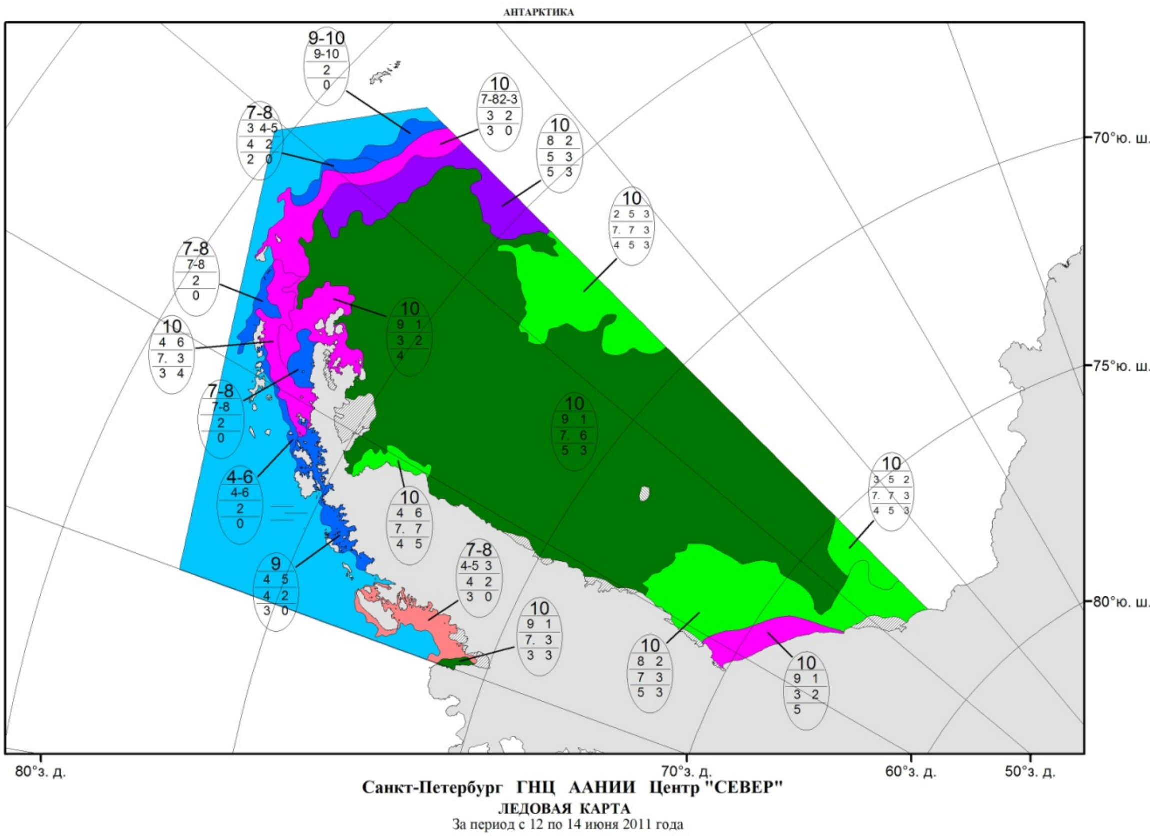

Figure 15 - Case Study 1c - AARI Ice Chart - June 14

The experience of the participants made the chart development process efficient and there was good agreement on interpretation.

The analysis chart produced was compared to an operational AARI chart produced for the same date of June 14th . There was very very strong correlation with only subtle differences in the subjective interpretation of some polygon contents. Ice boundaries were very similar.

It was noted that some of the ice shelf boundaries available in SIPAS are no longer correct. A question was raised about the colour for ice shelves. They just show as white on the chart but in accordance with the WMO colour code standard they should be light grey.

It was noted that all polygons on the team chart have bergs, following NIC practice. However, the AARI charts do not show icebergs except very large ones that are depicted as objects without an egg.

The AARI ice chart uses the stage of development colour code but the NIC charts use only the concentration colour code. AARI changes to the concentration code during the summer when all ice is about the same age.

3.5 Case Study #1d – Development of rules and procedures for ice bulletins

3.5.1 Objective

The objective of this case study was to draft the procedures to be used in producing GMDSS ice bulletins to a level of detail suitable for operational use by preparation and issuing services.

3.5.2 Logistics

The team members were:

- Darlene Langlois (CIS)
- Nick Hughes (met.no)
- Keld Qvistgaard (DMI)
- Vasily Smolyanitsky (AARI)

This team included the managers of the issuing services for the Arctic METAREAs.

3.5.3 Results

The team produced a draft document (Appendix V) that includes proposals for:

- Rules for exchange of information between the Services and issuing bulletins based on previous issues for adjacent METAREAs
- Naming conventions for sub-regions within the METAREAs
- Rules for defining ice edges

The team prepared a summary document for use by other teams in Case Study 3. Following the workshop, the document will be distributed to WMO and IICWG and proposed as a new supplement for relevant WMO Publications No. 471 and 558 (Guide to /Manual on for Marine Meteteorological Services).

The team did raise a question concerning the practice for provision of ice information in previously established METAREAs that are further south, such as the sub-Arctic Pacific and Atlantic (e.g. Bering Sea and Labrador Seas) or the Southern Oceasn. It was agreed to propose that the Arctic METAREAs guidelines be applied to these METREAs as well. It was acknowledge that this will have to be discussed with the issuing services for these other METAREAs.

3.6 Case Study #2

3.6.1 Objective

The objective of this case study was to demonstrate how ice charts originating from different services in a standard SIGRID-3 format could be exchanged, combined and presented in the host ice chart production system. In doing so, challenges to be overcome were to be identified and practices and procedures to reconcile potential differences in ice edges and polygons at the boundaries between adjacent preparation services were to be explored.

3.6.2 Logistics

Three teams were formed based on particular METAREA Preparation Service principle:

- METAREAs XVII-XVIII
  - Darlene Langlois (CIS)
  - Christopher Szorc (NIC)
  - Gonzalo Concha (CNWS)
  - Marika Marnela (FMI)
  - Signe Alvarstein (met.no)
- METAREA XIX
  - Nick Hughes (met.no)
  - Nora Adamsen (DMI)
  - Annabelle Serritslev (DMI)
  - Sean McDermott (Horizon / DMI)
  - Natalija Schmelzer (BSH)
- METAREA XX-XXI
  - Vasily Smolyanitsky (AARI)
  - Oleg Folomeev (AARI)

- o Polina Soloschuk (AARI)
- o Jürgen Holfort (BSH)
- o Håvard Larsen (met.no)
- o Tuomas Niskanen (FMI)

The leader for each team was selected from the Preparation Service for the METAREA.

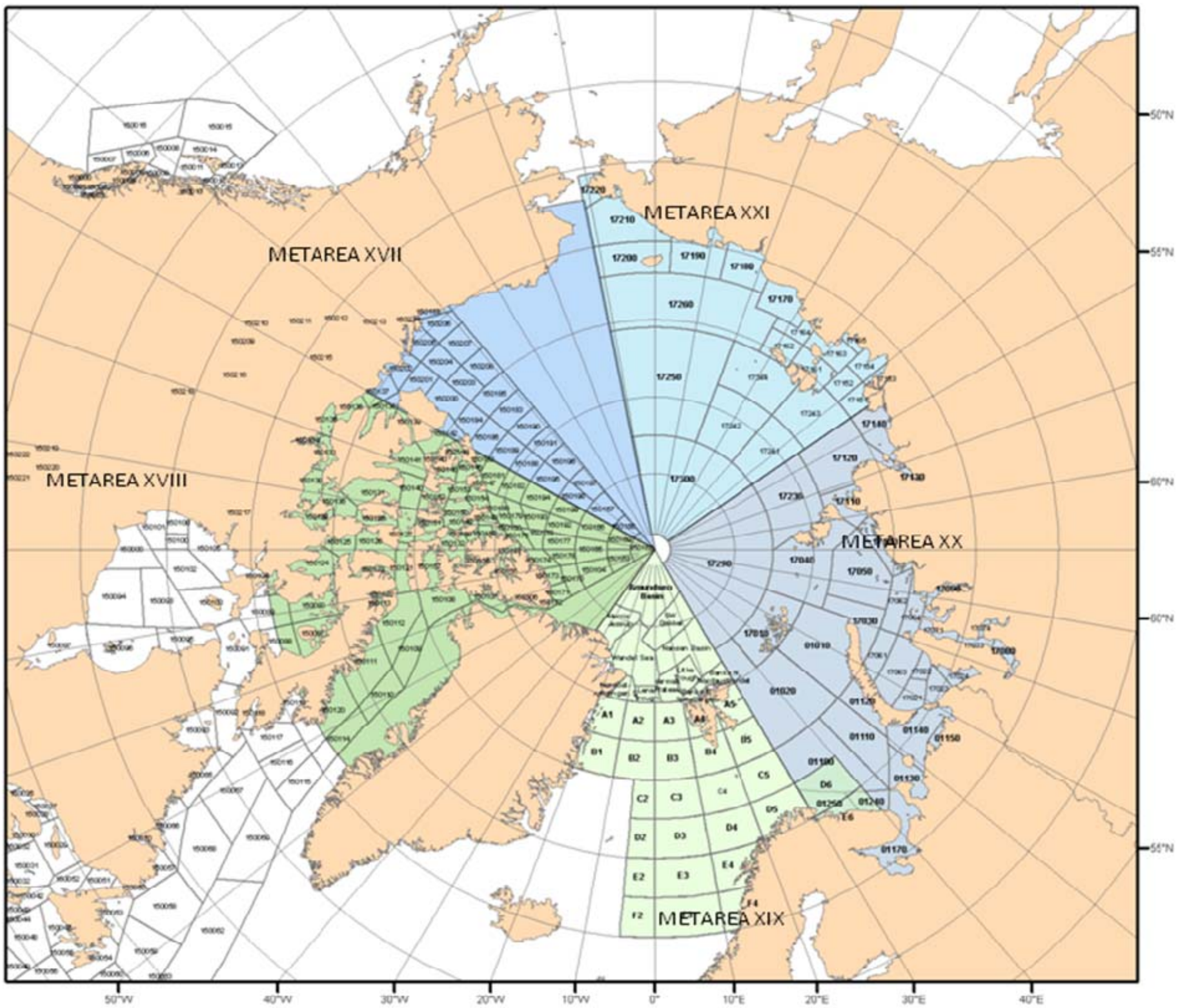

Figure 16 – Draft schema of sub-areas for preparation of GMDSS bulletins within the Arctic METAREAs XVII-XXI, June 2011.

3.6.3 Results

In general, no major differences were noted between ice charts except along the marginal ice zone. Plots show that analysis of ice concentration and ice edge are compatible and easy to merge with slight editing. These differences were largely attributable to differences in the data sources used as well as the time difference of the observation data and the time differences in ice chart production. In a dynamic ice area, even a difference of 12 hours can make a big difference in the ice situation, especially along the ice edge. The teams also reported that there were differences in the level of detail in the ice charts, mostly due to the time available to produce the charts. It was noted that these differences could cause problems when describing the ice edge for the GMDSS bulletin.

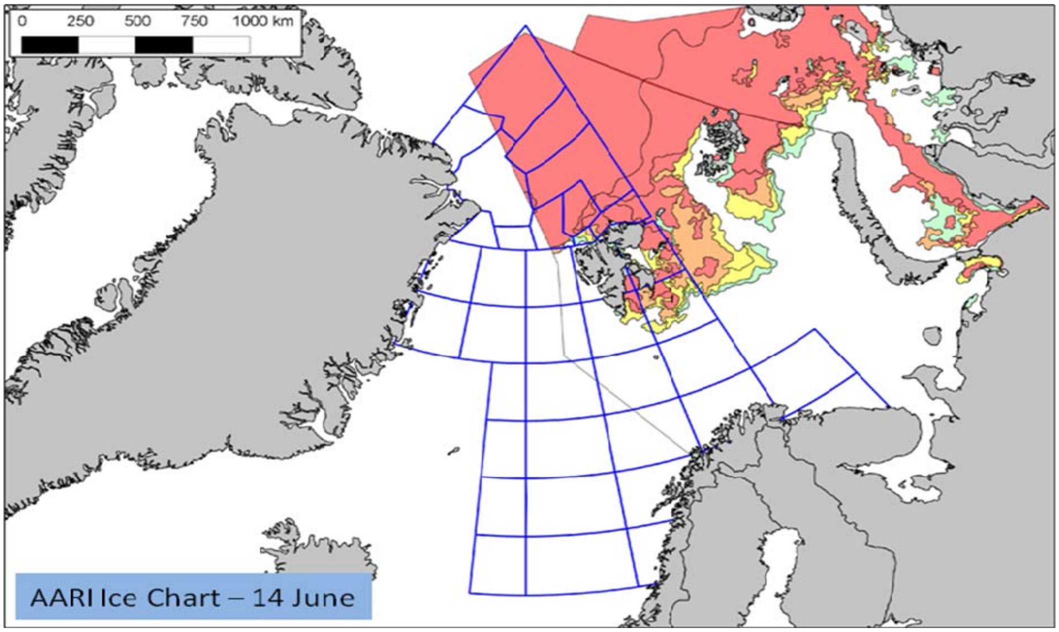

Figure 17 - Case Study 2 - AARI Ice Chart - June 14

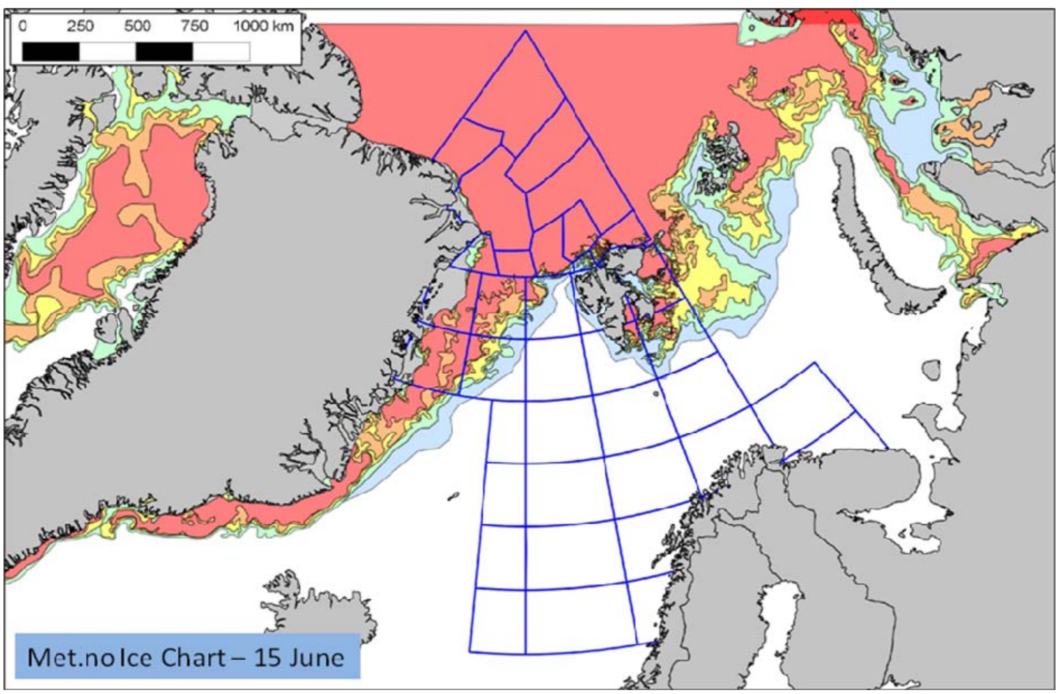

Figure 18 - Case Study 2 met.no Ice Chart June 15

Another challenge that was encountered in exchanging ice charts in an operational setting is the differing production schedules of the ice services. For example, resently AARI produces their chart in the adjacent METAREA XIX once a week on Tuesdays using data received over the preceding 2.3 days. There could be a significant difference in the ice edge depending on which chart is chosen in a dynamic area like the Barents Sea where there can be major drift. On the other hand, met.no produces the ice chart for METAREA XIX on weekdays (Mon-Fri) based on data from the preceding 24 hours. To overcome this difficulty, AARI intends to use internal daily image analyses to obtain the ice edge on a daily basis.

It was noted that some ice services use a "buffer zone" of open water adjacent to the main ice edge while other services carry Ice Free right up to the ice pack. This could also cause difficulties in describing the ice edge and there were significant discussions on philosophy of the ice edge throughout the workshop. The solution depends not only on the availability of data and resources for production but also on the intended use of the chart. Although safety of navigation is the primary consideration, the workshop did recognize the danger of being so overly cautious as to be useless to mariners. It was noted that the Polar Code guidelines may require SOLAS vessels operating inside the ice edge to be ice strengthened. If the ice edge is defined to include vast areas of ocean where there is little chance of encountering ice, the produce would become irrelevant. One proposal was to define the ice edge as the edge of the "main" ice pack with a note that "outside the ice edge there could be additional strips and patches of ice. However, after much discussion, the workshop agreed to stick with the definition of *ice edge* as being *the boundary between Ice Free and any amount of ice*.

The above discussion also included situations in which narrow openings in the ice could create hazardous situations if ships went into area and then ice drift cut them off. CIS uses a rule that any openings of less than 30 nm width are ignored when drawing the ice edge. The workshop agreed to adopt this standard.

Differences in use of the egg code that were noted in Case Study 1 were also apparent in this Case Study. However, it was not deemed to have a significant impact for the production of GMDSS ice edges.

RECOMMENDATION 1. **When describing the ice edge for a GMDSS bulletin in areas where there are overlapping ice charts from different preparation services, the most conservative ice edge should be adopted in the interest of marine safety.**

One team used the NIC SIPAS ice chart production system on a laptop. It was able to easily import the SIGRID-3 files from the CIS and AARI. The exception was the met.no charts. Met.no does not produce ice charts in SIGRID-3 format at the present time (attribute table for the polygons contains concentration intervals descriptions rather than SIGRID3 codes) , although it is planning to implement SIGRID-3 input/output on a new database server during July/August 2011.

RECOMMENDATION 2. **Met.no should maintain their plan to implement SIGRID-3 import/export capability in 2011.**

However, it was noted that the SIGRID-3 format does not require projection files (.prj) at this time though most of the Services are including .prj files by dfault. The inclusion of projection files makes the import of files much more seamless and should be considered mandatory. A recommendation to this effect was made to the last ETSI meeting but has not been acted upon yet.

RECOMMENDATION 3. **Expert Team on Sea Ice should follow up on the recommendation to make projection files a mandatory component of SIGRID-3.**

The Canadian Ice Service produces SIGRID-3 format ice charts but is incapable of ingesting SIGRID-3. This technical difficulty is expected to be overcome with their new Polaris system that is under development. This should be implemented as soon as possible to allow interoperability.

RECOMMENDATION 4. **The Canadian Ice Service should implement the capability to import SIGRID-3 ice chart data as soon as possible to allow interoperability with the other Arctic preparation services.**

Some differences were noted between the coastlines used by the different services – mainly with smaller islands. This is not a major difficulty since the ice polygons can be hidden behind the coastline.

However, it may become a problem when exporting ice chart data to Electronic Navigation Chart Systems.

The major ice locations where ice edges must be matched between neighbouring issuing services are between METAREA-XIX and METAREA-XX in the Barents Sea and between METAREA XXI and METAREA XVII in the Chukchi Sea. It is unlikely to have an ice edge between METAREA-XIX and METAREA-XVIII. Met.no currently provides the ice edge to METAREA-I (UK) covering east coast of Greenland so there is no coordination issue there. METAREA-XIX does border METAREA-IV (U.S.) in the southern Greenland waters where no iceinformation is being provided. This also raised the issue that there are other METAREAs that regularly have ice but for which no ice information for GMDSS is available though ice charts are routinely produced. The Bering Sea, Sea of Okhotsk and the Southern Ocean are all implicated. The workshop agreed that ice information should be available for all METAREAs that have ice-affected seas and that the standards being developed for the Arctic METAREAs should also apply outside the Arctic.

RECOMMENDATION 5. **JCOMM should address issue of non-Arctic METAREAs that have ice providing ice information in conformance with the standards being developed for the Arctic METAREAs. This affects the Preparation Services of the UK, USA, Russian Federation, Japan, Chile, Argentina, Australia, New Zealand and South Africa.**

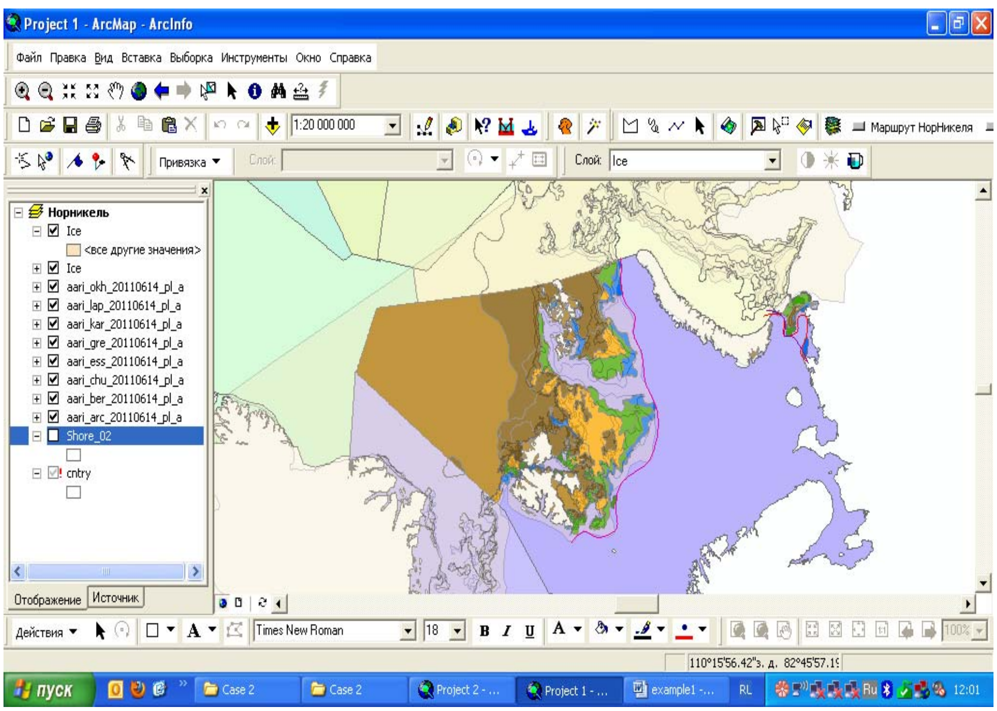

Figure 19 - Case Study 2 June 14 Ice Chart Covering METAREA XIX-XX Boundary

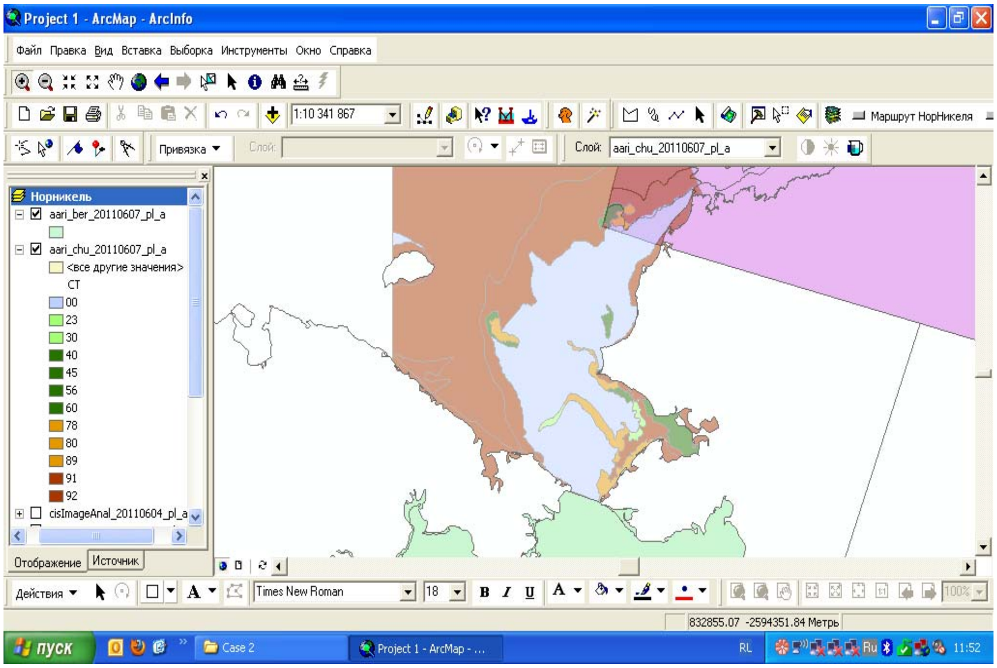

Figure 20 - Case Study 2 June 6 Ice Chart Covering METAREA XXI-XVII Boundary

3.7 Case Study #3 - Online composition of sea ice MSI for GMDSS and NAVTEX

3.7.1 Objective

The objective of this case study was to demonstrate how sea ice Marine Safety Information and NAVTEX bulletins originating from different services can be produced in a coordinated manner to test the existing formats and identify changes to standards for sea ice and icebergs MSI and NAVTEX bulletins.

3.7.2 Logistics

The same three teams that were formed for Case Study #2 were maintained for this case study. The teams were asked to simulate operational communication by accessing information only from the IAW-3 ftp site and placing their products on the site. The bulletins for Tuesday June 14 were to be produced. Teams concentrated on the ice information content of the bulletins and did not pay attention to the format of headers and trailers for the bulletins noting that this is still under development within ETMSS.

3.7.3 Results for GMDSS Ice Bulletins

The AARI GMDSS ftp site generally worked very well at allowing coordination among the preparation services and providing a convenient place to store and access the products and relevant files.

RECOMMENDATION 6. AARI should maintain the GMDSS ftp site for future operational coordination between the preparation services for the ice bulletins.

The GMDSS ice edge bulletin for METAREA XIX was produced and placed in the IAW-3 ftp directory correctly along with the associated shape files. The various shape files components (.shp, .shx, .dbf, .prj) were all stored separately and it was agreed that it they should be packaged into one .zip file as standard practice. The bulletin text file should be kept separate.

RECOMMENDATION 7. Files relating to the same shape file should be packaged together in one .zip file when being placed on the AARI GMDSS ftp site

However, the METAREA XVII-XVIII team had difficulty uploading to the ftp site because of software compatibility issues. It was recognized that there a different methods for communicating with ftp site and each service must adopt a method that is best for them.
The bulletins for METAREAs XX and XXI were produced based on an analysis of satellite images and again easily placed in the IAW-3 ftp server.. The team could not produce shapefiles due to local computer limitations that will not be an issue in real operations.

3.7.3.1 METAREA XVII-XVIII

Observational material was not available for these METAREAs. To improvise, the team used the operational NIC Ice Edge product from June 14.

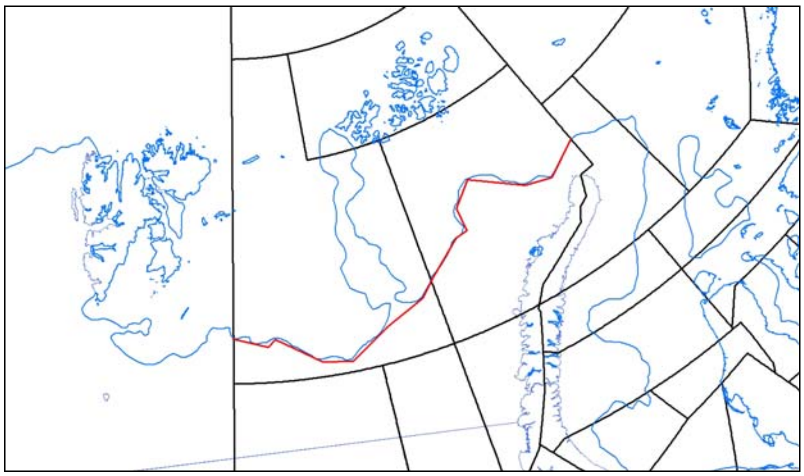

Figure 21 - Case Study 3 Ice Edge for METAREA XX

ICE BULLETIN FOR METAREA XX
ISSUED BY NIC at 15UTC 14 Jun 2011

01020
ICE N OF 7601N 02957E, 7548N 03317E, 7558N 03358E, 7520N 03805E, 7513N 04051E, 7549N 04434E, 7613N 04836E, 7633N 05008E.

01010
ICE N OF 7633N 05004E, 7713N 05400E, 7716N 05518E, 7750N 05517E, 7818N 05753E, 7731N 06301E, 7719N 06550E, 7744N 07000E.

3.7.3.2 METAREA XIX

The team used the June 15 chart from Case Study 2. The ice edge was drawn manually on the previously produced ice chart to be just outside the areas of Open Water (0/10 to 1/10) on the chart. A shape file containing the generated ice edge as a line was produced to extend across the METAREA and 150 nm into the adjacent METAREA XX.

Met.no has the capability to generate an ice edge bulletin automatically based on the ice chart shape file. However, the software must be revised slightly in accordance with the standards (e.g. currently no 150 nm buffer into adjacent METAREA).

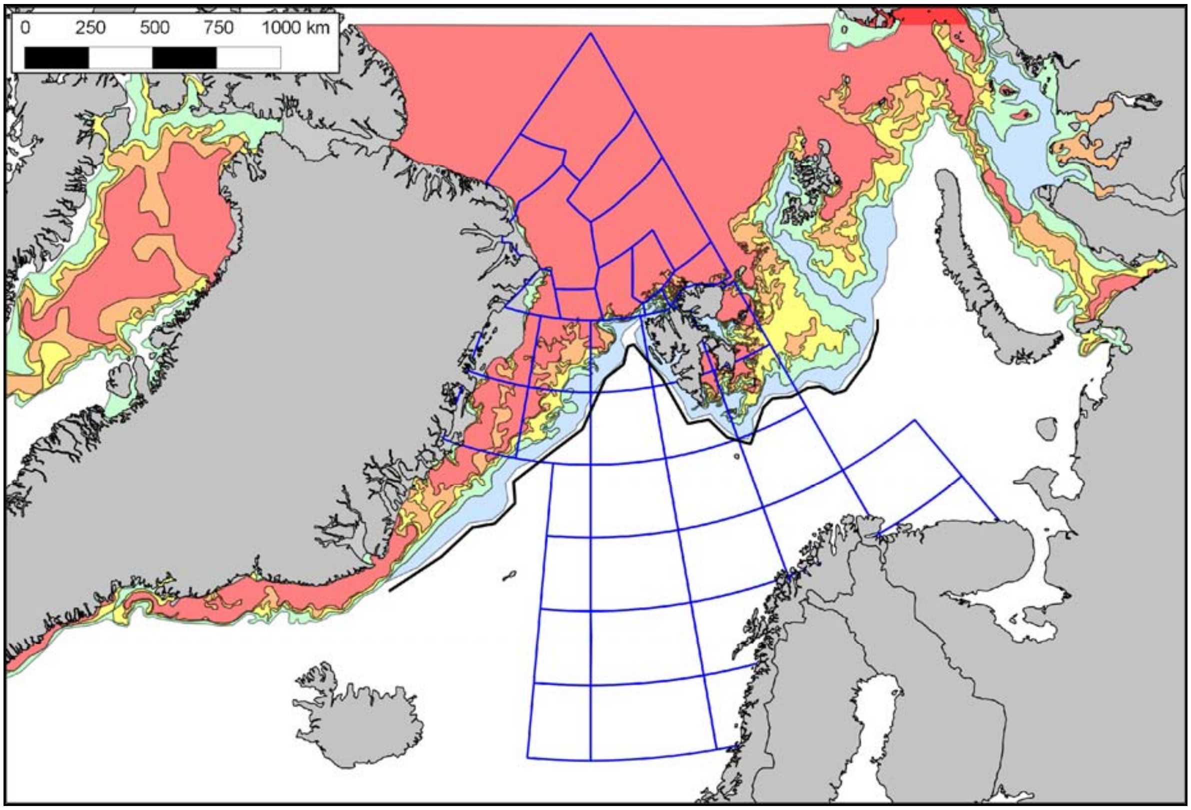

Figure 22 - Case Study 3 Ice Edge for METAREA XIX

Several differences between the sample bulletins that were produced and the standard guidelines were noted. The FULL EXTENT section is not included in the agreed format and could create a problem with length. Similarly the contact information in the sub-header and the disclaimer at the end are not included in the specification. It was agreed that there appears to be no problem including these as optional sections at the discretion of issuing service.

FQNT21 ENMI 152300
SECURITE

HIGH SEAS BULLETIN FOR METAREA 19
Issued at 23:00 UTC on Wednesday 15 June 2011
BY TROMSO METEO, NORWAY

... Weather report here ...

ICE BULLETIN FOR METAREA 19 ISSUED BY THE NORWEGIAN ICE SERVICE (ISTJENESTEN@MET.NO) AT 23 UTC 15 JUN 2011.

FULL EXTENT
ICE N OF 7500N 00640W, 7528N 00449W, 7613N 00110W, 7758N 00227E, 7824N 00542E, 7900N 00645E, 7902N 00753E, 7743N 01142E, 7600N 01359E, 7556N 01700E, 7510N 01839E, 7457N 01952E, 7441N 02117E, 7539N 02448E, 7548N 02626E, 7533N 02858E, 7533N 02858E, 7532N 02959E.

B2
ICE N OF 7500N 00640W, 7528N 00449W, 7613N 00110W, 7613N 00110W, 7647N 00000E.

A3
ICE N OF 7730N 00128E, 7758N 00227E, 7824N 00542E, 7900N 00645E, 7902N 00753E, 7902N 00753E, 7819N 01000E.

...

METAREA 1 BOUNDARY
ICE N OF ...

METAREA 20 BOUNDARY
ICE N OF ...

ICE EDGE NOT FOR NAVIGATIONAL PURPOSES.

3.7.3.3 METAREA XX-XXI

The team used the June 14 chart that was available together with MODIS visible imagery for the same date and produced ice edge bulletins for ice edges in the Barents – Kara Seas (adjacent to METAREA XIX) and the Chukchi Sea (adjacent to METAREA XVII).

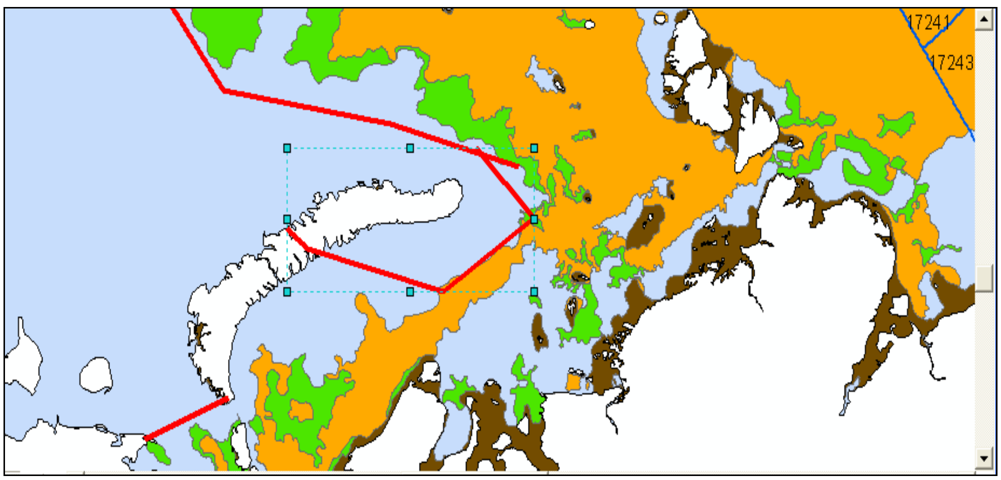

Figure 23 - Case Study 3 Detail of Ice Edge in METAREA XX

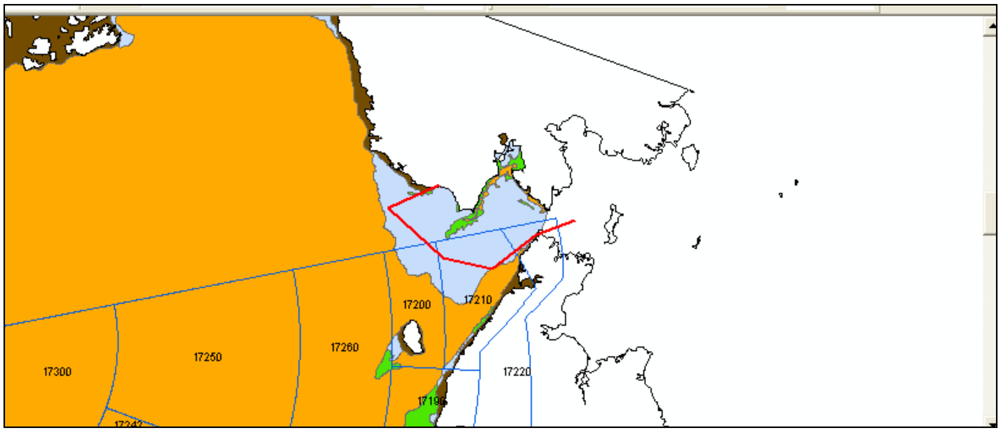

Figure 24 - Case Study 3 Ice Edge across Boundary of METAREAs XXI and XVII

```
ICE BULLETIN FOR METAREA  XX
ISSUED BY AARI
at 14 JUNE 2011 AT 1200UTC

ICE

SUBAREA A3-A4-B4-B5
ICE N OF 79460N 00843E, 79470N 01027E, 76070N 01459E, 75120N 02152E, 75240N 03008E.

SUBAREA 01020-01010
ICE N OF 75240N 03008E, 75170N 03837E, 77320N 06020E, 77440N 06924E, 77460N 07013E.

SUBAREA 17030-17060
ICE E OF 77440N 07000E, 77420N 07027E, 77400N 07000E.

SUBAREA 01140
ICE E OF 70410N 05715E, 68530N 05348E.

ICE BULLETIN FOR METAREA  XXI
ISSUED BY AARI
at 14 JUNE 2011 AT 1200UTC

SUBAREA 17200-17210-17220
ICE NW OF 70205N 19109W, 69495N 18910W, 68025N 18721W, 66165N 18954W, 65255N 19019W.

SUBAREA xVII-ch
ICE N OF 69205N 19654E, 71265N 19603E, 70185N 19101E.
```

Again, several differences between this example and the standard guidelines were noted. The use of the word "SUBAREA" in the header for each subarea is not standard. For sub-areas that are named, this does not present a problem. However, for sub-areas that are numbered, the number alone may be mistaken for a date or time. After some discussion, the workshop agreed that the sub-area header should contain only the name of the sub-area(s) and nothing additional (such as SUBAREA).

RECOMMENDATION 8. **In the GMDSS bulletin, the sub-area header should contain only the name(s) of the sub-area(s) – i.e. the inclusion of the word "SUBAREA" is discouraged. User feedback should be monitored to determine if there is any confusion caused by this practice. Sub-areas may be prefaced by the METAREA number in intersection zones.**

It was noted that longitudes greater than 180 degrees are used and it was confirmed that this has been accepted practice in Russia. (e.g. 190E is equivalent to 170W) Other participants objected to this usage since it is not commonly used in North America and may cause problems with GIS systems.

RECOMMENDATION 9. **Check with other IMO standards to determine if longitudes greater than 180 degrees are accepted international marine practice. Adjust the GMDSS guidelines to be in accordance.**

The example produced by the team also used latitudes to the nearest 0.5 minute requiring 5 figures in the latitude group – different from 4 figures in the guidelines. The workshop re-confirmed that only 4 figures should be used for latitude, corresponding to degrees and whole minutes.

The group also discussed the use of place names in bulletins in addition to latitude/longitude coordinates. It was agreed that in some places, especially in narrow channels and straits, the use of coastal place names could make the bulletin easier to understand. However, the use of place names must be restricted to names that are well known globally.

RECOMMENDATION 10. **Reference maps with acceptable place names for use in GMDSS bulletins should be developed, exchanged and provided to ETMSS with further publication on the GMDSS website (weather.gmdss.org)**

It was noted that the ice edge in the Chukchi Sea in METAREA XXI did not appear to consider the loose ice along the Alaskan coast in METAREA XVII. For the workshop, an ice edge bulletin was not produced for METAREA XVII and so this was not coordinated. However, it did highlight the importance of coordination between adjacent METAREAs.

It was noted that the all of the sub-areas in METAREAs XVII and XVIII have not yet been named.

RECOMMENDATION 11. **Canada should complete the naming of the sub-areas in METAREAs XVII and XVIII as soon as possible to allow other issuing services to prepare their systems appropriately.**

It was noted that the headers and sub-headers of the sample bulletins produced by the three teams were all slightly different in format and content. The guidelines produced to date do not include templates for these.

RECOMMENDATION 12. **The GMDSS ice bulletin standard should specify the content, terminology and format of the bulletin header and sub-headers in accordance with WMO practice for other Marine Safety Information bulletins.**

3.7.4 Results for NAVTEX Bulletins

Only the team for METAREA XX-XXI had sufficient time to produce a sample NAVTEX bulletin. This was done for the Kara Sea based on the ice chart available.

The sample NAVTEX bulletin was produced using the latest ETSI draft for sea ice abbreviations (based essentially on BSH and CIS practices and proposals) and circulated to the group earlier.

The workshop did not have time to consider carefully the draft NAVTEX abbreviations but there were no significant negative comments. It is considered that this draft is near-final.

RECOMMENDATION 13. **All ice experts should provide additional comments and suggestions for additional NAVTEX abbreviations terms to Jürgen Holfort (BSH) by the end of August. The intention is to provide the final draft to ETMSS by end of September 2011.**

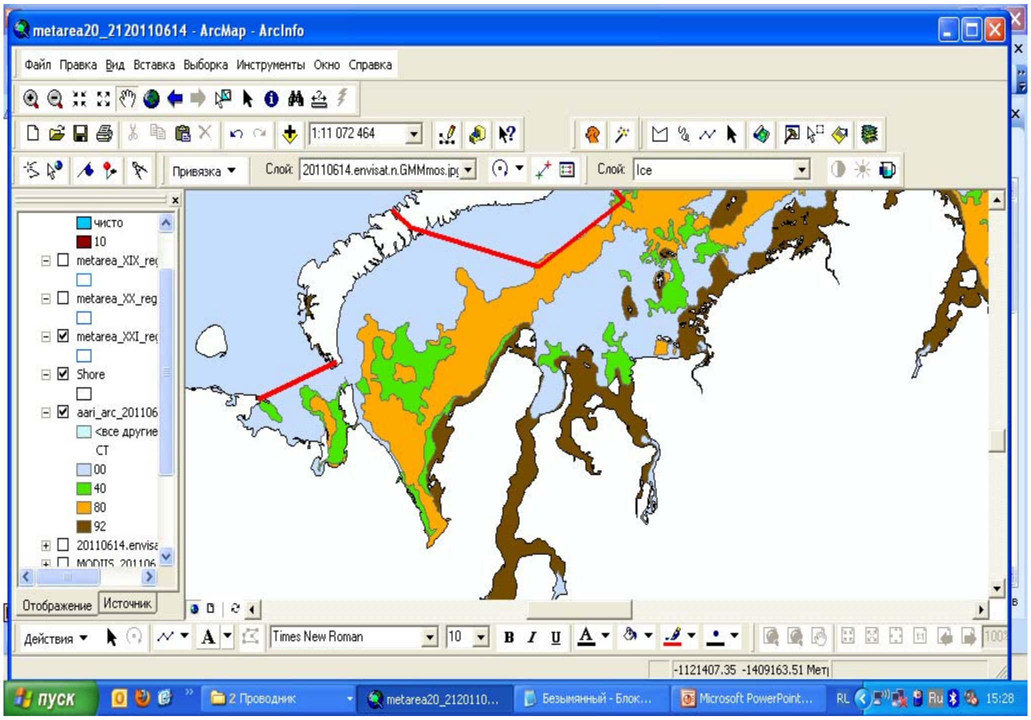

Figure 25 - Case Study 3 Detailed Ice Edge in METAREA XX for NAVTEX Bulletin

```
Southern Kara Sea

western part VCL by shore, VOP-CL at sea
eastern part VCL in bays, OW with VCL at sea


17063 W-PART OW, E-PART CL
17022 CL-VCL:ROTN
17021 VOP-CL:ROTN
17024 VCL-CL:ROTN
```

4 Presentations

4.1 Coastal Radar for Ice Analysis in the Baltic Sea – Tuomas Niskanen (Annex J)

Mr. Niskanen gave an interesting presentation (Annex J) on the use of coastal vessel traffic monitoring radar for ice analysis of the Bay of Bothnia by the Finnish Marine Institute. He noted that the reception of the data from the radar is done within 2 minutes allowing almost real-time monitoring of the ice situation. The post processing device costs only about 25,000 Euro (not counting the cost of the radar). In response to a question he noted that there is a reduction in signal with distance from the radar but there are some post-processing techniques to minimize this. The presentation included three interesting animations of the time series of coast radar images that generated much interest among the participants. In response to a question, Mr. Niskanen agreed that in summer, this technique could be used to monitor currents and waves.

The chairman noted that a further presentation of this work will be given at the International Ice Charting Working Group

4.2 Exchange practices for satellite imagery relay and exchange

Dr. Smolyanitsky showed the participants the locations and organization of the AARI GMDSS ftp site directories where satellite images are placed automatically by scripts written at AARI. MODIS images are downloaded from the NASA RapidFire server and written to the ftp site in GeoTIFF and JPEG2000 formats. The same images are also written to the ftp site in JPEG2000 which uses image compression to significantly reduce the size of the files. The ftp site is now scheduled to automatically update twice per day. While it is recognized that this is a duplication of several other servicesk, it is very convenient and could serve as an easy source of data as well as a backup to other services. The ftp server is only intended for use by METAREA preparation services – not the general public (the url was provided to participants but is not presented here). Dr. Smolyanitsky noted that the free Geoviewer available from Lizardtech can read the JPEG2000 format and convert it to Geoiff.

Mr. Qvistgaard presented a public website maintained by DMI (http://Ocean.dmi.dk) that contains rectified MODIS, NOAA and Envisat satellite images around the entire coast of Greenland available in near-real-time. The value of this website was noted by the workshop participants who were all supportive of its continuation. It was suggested that it would be nice if the images were compressed.

5 Summary of operational analysis differences and interoperability

Based on the reports and discussions from the case studies, the Secretariat prepared a draft summary of differences practices and procedures. The summary of differences is presented at Appendix VI.

6 Guidelines for harmonization of practices and services

With reference to the summary of operational analysis differences, the workshop adopted a number of recommendations aimed at improving interoperability, harmonization and the provision of ice information to users. These recommendations follow:

RECOMMENDATION 14. **NIC should revise the colour of ice shelves and update the boundaries of shelves on their Antarctic ice charts.**

RECOMMENDATION 15. **Ice services should provide a better description of the philosophy of their ice services for WMO Publication No. 574 (Sea Ice Information Services in the World).**

RECOMMENDATION 16. **Ice Services should implement the practice for GMDSS bulletins as agreed at IAW-3 i.e. the ice edge is the boundary between Ice Free and any sea ice - excludes bergy waters.**

RECOMMENDATION 17. **ETSI should discuss the issue of which concentration value to use to determine the colour of a polygon – average or extreme.**

RECOMMENDATION 18. **ETSI should verify that the egg symbology standard permits the indication of strips in the form of ice section of the egg and also check the possibilities of extending the symbology standard.**

RECOMMENDATION 19. **The sources of data used in preparing an ice chart be indicated in the SIGRID-3 metadata.**

RECOMMENDATION 20. **Ice thickness estimates or observations should be shown for level ice.**

RECOMMENDATION 21. **The issue of how to indicate the thickness of ice in the presence of rafting should be raised for further discussion towards a resolution at ETSI and the Baltic Sea Ice Meeting (BSIM).**

RECOMMENDATION 22. **Ice services should re-examine the practice of indicating icebergs on charts and in the egg code for further discussion at ETSI.**

RECOMMENDATION 23. **Publication of ice charts with both WMO colour codes (concentration and stage of development) is recommended and Ice services should re-examine their practices to determine if improvement is warranted.**

RECOMMENDATION 24. **In preparing ice chart shape files, ice polygons should extend over coastline so they will be masked by the coastline – resolve differences with other coastline. Other coastline problems should be examined on a case by case basis.**

RECOMMENDATION 25. **ETSI should amend the SIGRID-3 standard to include projection files as mandatory.**

RECOMMENDATION 26. **Ice Services should populate the SIGRID-3 XML file according to standard.**

RECOMMENDATION 27. **Ice Services should exchange scripts and software for processing SIGRID-3 attribute tables.**

RECOMMENDATION 28. **The METAREA Bulletin format standard should allow inclusion of optional sections to cover national practice (e.g. FULL EXTENT, Contact Information, Disclaimer).**

RECOMMENDATION 29. **GMDSS bulletins should be all uppercase**

7 Workshop recommendations and actions

In the wrap-up discussion, one further recommendation concerning GMDSS ice bulletins was adopted by the workshop to improve the availability of information concerning the bulletins and further educate mariners.

RECOMMENDATION 30. **Standards for preparation of the ice bulletins should be advertised on the GMDSS website and in Notice to Mariners and Mariners Handbooks along with a general caution note about ice being encountered outside the ice edge.**

All of the workshop recommendations are summarized in Appendix VII.

A round table discussion was held to gather opinions on how the workshop was viewed and how it could be improved. All of the participants expressed satisfaction with the work done and progress made during the workshop. It was noted that the Ice Services have come a long way in terms of interoperability in a few years. All agreed that it was a worthwhile workshop that achieved a lot of important decisions toward implementation of GMDSS bulletins for Arctic METAREAs. A number of recommendations for a future workshop were made:

- Invitation information to participants should be sent at least 2 months in advance of the workshop;
- Case studies should also consider the spring/fall melt/freeze-up seasons – they would probably show more differences between ice analyses;
- All products should be available for distribution on flash drives instead of relying on the local network (which could occasionally be slow);
- More detailed presentations on "best practices" for the ice chart production process from selected presenters would be useful ;
- More breakout sessions with more mixing of the groups would be good to allow everyone to be exposed to the practices of all others; and,
- Ice information in non-Arctic METAREAs should be addressed by inviting experts from other issuing services.

It was also suggested that ESRI should be approached to provide additional ArcGIS licenses for the workshop use so that everyone could use the same system. On the other hand, having different systems available is instructive to see how the production process is done in different systems. A balance between the two approaches is needed and no firm consensus was reached.

Similarly, the workshop discussed whether participants should prepare more information in advance and only compare results at the workshop. Alternatively, it was also recognized that it is instructive to observe the whole analysis process.

8 Close of workshop

On behalf of all of the participants, the Chairman expressed appreciation for the hospitality and support from DMI which made the workshop run very smoothly and was instrumental in advancing the implementation of Arctic METAREAs and harmonization of ice services. He thanked, in particular, Klaus Harnvig, Keld Qvistgaard, Nora Adamsen and Lisbeth Palle. The chairman also noted a perfect Secretariat work provided by Mr John Falkingham. In addition, he expressed appreciation for the hospitality and support provided by InformiGIS Denmark.

The chairman declared the workshop closed at 12:00 noon on Saturday June 18, 2011.

Appendix I - List of Registrants

#	Name	Affiliation	Country	
1.	SMOLYANITSKY, Vasily	AARI	Russia	Chair
2.	FALKINGHAM, John	IICWG/WMO	Canada	Secretariat
3.	PALLE, Lisbeth Bergqvist	DMI	Denmark	Administrator
4.	MCDERMOTT, Sean	Consultant	Canada	DMI Ice Advisor
5.	LANGLOIS, Darlene	CIS	Canada	
6.	CONCHA, Gonzalo	CNWS	Chile	
7.	QVISTGAARD, Keld	DMI	Denmark	
8.	ADAMSEN, Nora	DMI	Denmark	
9.	HARNVIG, Klaus	DMI	Denmark	
10.	SERRITSLEV, Annabelle	DMI	Denmark	
11.	NISKANEN, Tuomas	FMI	Finland	
12.	MARNELA, Marika	FMI	Finland	
13.	HOLFORT, Juergen	BSH	Germany	
14.	SCHMELZER, Natalija	BSH	Germany	
15.	ALVARSTEIN, Signe	Met.no	Norway	
16.	LARSEN, Håvard	Met.no	Norway	
17.	HUGHES, Nick	Met.no	Norway	
18.	FOLOMEEV, Oleg	AARI	Russia	
19.	SOLOSHCHUK, Polina	AARI	Russia	
20.	SZORC, Chris	NIC	USA	

Appendix II - Agenda

1. Opening of the workshop

1.1. Opening and welcome
1.2. Adoption of the agenda
1.3. Workshop logistics and arrangements

2. Reports

2.1. Key facts of national ice information systems for the last season 2010/2011" (template to be provided by Organizing Committee) (10-15 minutes each).
2.2. Reports/presentations from JCOMM, Secretariat, ice groups and data providers

3. Case studies

3.1. Workshop logistics
3.1.1. Presentation of online resources to be used during case-studies
3.1.2. Identification of a strategy for comparing practices and ice products
3.1.3. Identification of 3-4 break-out groups:
3.2. Case study #1: Train ice experts in ice analysis through online analysis of routine dataset and ice charting for a test region by two teams of ice analysts
3.2.1. Case study #1a: Train ice experts in ice analysis through online analysis of routine dataset and ice chart production for two test regions by two teams of ice analysts in break-out sessions
3.3. Case study #2: Train ice experts in ice analysis through assimilation of ice charts in SIGRID-3 format; interoperability of format implementation across the services; reconciliation of ice edge and adjacent polygons
3.4. Case study #3: Train ice experts in the preparation of ice Marine Safety Information (MSI) through online composition of sea ice MSI for GMDSS and NAVTEX bulletins

4. Plenary discussions

4.1. Discussion of Case Studies #1 and 1a - Investigating philosophies for ice analysis and requirements from individual clients
4.2. Discussion of Case Study #2: Assimilation of ice charts in SIGRID-3 format; interoperability of format implementation across the services; reconciliation of ice edges and polygons in adjacent METAREAs
4.3. Discussion of Case Study #3: Online composition of sea ice Marine Safety Information for GMDSS and bulletins for NAVTEX
4.4. Exchange of practices for satellite imagery relay: georeference and annotation standards, validity times, means for provision to customers, imagery display

5. Presentations

5.1. Use of Coastal Radar for Ice Analysis in the Baltic Sea – Tuomas Kiskanen

6. Review of existing sea ice regulatory publications

7. Workshop proceedings

7.1. Development of a summary of operational ice analysis differences and ice charts interoperability

7.2. Development of guidelines for harmonization of ice practices, delivery of the products and training in ice analysis including preparation of MSI

7.3. Workshop actions and report

8. Close of the workshop

Appendix III – Timetable

Time	Tuesday 14 June	Wednesday 15 June	Thursday 16 June	Friday 17 June	Saturday 18 June
09.00	1.1 Opening and welcome 1.2 Adoption of Agenda 1.3 Workshop Logistics	3.2 continues	3.3 continues	6. Review of Existing Sea Ice Regulatory Publications	7.2 Guidelines for harmonization of practices and services
09:30	2.1 Reports on ice information systems			3.4 Case Study #3	
10:30		5.1 Use of Coastal Radar for Ice Analysis in the Baltic Sea – Niskanen			7.3 Workshop recommendations and actions
11.00	**Health Break**				
11.15	2.2 Reports from JCOMM, Secretariat, ice groups, data providers	4.1 Discussion of Case Studies #1 and #1a	4.2 Discussion of Case Study #2	3.4 continues	Secretariat and Chairperson finalize the Report
12:00	3.1 Workshop Logistics		Social event		
12.30	**Lunch Break**			**Lunch Break**	
13:30	3.2 Case Studies #1 and #1a	Tour of DMI Weather and Ice Services		4.3 Discussion of Case Study #3	Secretariat and Chairperson finalize the Report
14.30		3.3 Case Study #2		4.4 Discussion of exchange practices for satellite imagery	
15.30	**Health Break**			**Health Break**	

15.45	3.2 continues	3.3 continues		7.1 Summary of operational analysis differences and interoperability	
17.00	***Icebreaker at DMI***			***End of Day***	***End of Day***
17:30		***End of Day***			

Appendix IV – Proposed Case Studies

Facilities Setup

Plenary Room

The large conference room will be used for plenary presentations and discussions as well as for one case study team. This room is equipped with a projector and computer dedicated for presentations (this computer is not powerful enough to run GIS software). In addition, DMI will provide one portable computer with ArcGIS for the purpose of case study analysis work. This computer can be connected to the projector for group analysis. It will have Internet access and be able to download/upload files to the IAW-3 http/ftp file server.

Breakout Rooms

There will be three smaller breakout rooms available for case study work. Each of these rooms is equipped with a projector and computer for presentations. These computers are not powerful enough to run GIS software. Internet access will be available in the room. Selected team members will provide GIS analysis software on their own laptop computers. These laptops should be able to download/upload files to the IAW-3 http/ftp file server and be connected to the room's projector.

Participants identified to provide laptops with analysis software are:

- CIS – Darlene Langlois
- NIC – Chris Szorc
- AARI – Vasily Smolyanitsky
- Met.no – Nick Hughes

Others are welcome to bring their own laptops with software as available (participants should be familiar with their own software to avoid wasting time with technical issues)

IAW-3 http/ftp File Server

An Internet site with both http and ftp access has been set up at (http:// gmdss.aari.ru and

ftp:// gmdss.aari.ru) for operational coordination of the Arctic METAREAs. It is proposed to test this file server during the IAW-3.

Credentials for ftp-access to the directory are "xxx" / "xxxxxx". Currently all catalogues and their content are visible but this may change in future.

The structure includes directories:

/docs for Marine Safety Information documents

/archive for archival SafetyNET bulletins

/ice rolling set of ice bulletins and ice edge projects for 5 METAREAs for ice analysts only

/meteo rolling set of meteo bulletins for 5 METAREAs for meteo analysts only

/work working area with sub-directories containing background and intermediate material for ice & meteo analysts e.g.

/metarea17 – working area for METAREA-XVII only

...

/metarea21 – working area METAREA-XXI only

The sub-directory /docs/iaw3 will be used during the workshop for depositing input data as well as workshop outcomes.

Case Study #1

On-line analysis of routine datasets and ice chart production for a test region by two teams of ice analysts in break-out sessions.

Objective

Compare ice charts produced by several teams of analysts using identical input data to assess differences in analysis procedures, magnitude and sources of error, and impact on end-users.

Procedure

The group will be divided into two teams of 5 analysts. Each team will be given the same set of input data and asked to produce an ice chart for the same region. In the following plenary, the group will then discuss the similarities and differences in the resulting ice chart products, identifying the sources of the differences and the impact these differences might have on end-users.

Input Data

The test region will be the Greenland Sea. DMI will prepare the datasets for analysis. The test period is defined as a 2-week period preceding workshop i.e. 1-14 June 2011. The target date for the ice chart to be produced is June 14, 2011.

For the test region and period:

- Several daily and weekly ice charts in SIGRID3 and graphical formats (GIF, PDF) immediately preceding the target date
- Georeferenced satellite images - optical/IR (NOAA, EOA), passive microwave (SSMIS, AMSR) and synthetic aperture radar (ENVISAT/RADARSAT. Images should be close to but preceding the target date/time
- Weather maps and bulletins close to but preceding the target date/time
- Ship/shore ice and weather reports close to but preceding the target date/time
- Ocean current information for the test region

DMI will deposit the input data on the IAW-3 file server prior to the workshop. Met.no will submit their Arctic European sector weekday ice chart in shapefile format, background imagery and ArcView project for 14 June 2011. Other participants may also deposit relevant data on the IAW-3 file server prior to the workshop.

Product Format

The ice chart should be produced using WMO International Sea Ice Symbology (egg code) using the analysis systems available at DMI or on participants laptops. It should be saved preferably in the WMO SIGRID3 format and/or ESRI .mxd project or shapefile format. Hard-copies of the ice charts and intermediate steps of analysis process should be produced for use in plenary and proceedings.

Proposed Teams

These may be adjusted at the workshop.

Team 1	Team 2
Soloschuk (AARI)	Folomeev (AARI)
Langlois (CIS)	Buus-Hinkler (DMI)
Harnvig (DMI)	Adamsen (DMI)
Jonsdottir (IMO)	Larsen (met.no)

Case Study #1a (*in parallel with #1*)

On-line analysis of routine datasets and ice chart production for two test regions by teams of ice analysts in break-out sessions.

Objective

Share analysis techniques and procedures among the ice analysts within each team. Document best practices.

Procedure

The group will be divided into two teams of 5 analysts. Each team will be assigned a different region and, based on a set of input data, asked to produce an ice chart for that region.

In the following plenary discussion, each group will discuss the similarities and differences in analysis techniques and procedures of the individual members of the group and identify the best practices adopted to produce their ice chart.

Input Data

It is proposed to have 2 regions:

- Baltic Sea – test period is defined as a 2-week period 7-21 February 2011. The target date for the ice chart to be produced is February 21, 2011.
- Antarctic TBD (propose Bellingshausen / Weddell Seas) – test period is defined as a 2-week period preceding workshop - 1-14 June 2011. The target date for the ice chart to be produced is June 14, 2011.

For each region, the following is needed:

For the test region and period:

- Several daily and weekly ice charts in SIGRID3 and graphical formats (GIF, PDF) immediately preceding the target date
- Georeferenced satellite images - optical/IR (NOAA, EOA), passive microwave (SSMIS, AMSR) and synthetic aperture radar (ENVISAT/RADARSAT. Images should be close to but preceding the target date/time
- Weather maps and bulletins close to but preceding the target date/time
- Ship/shore ice and weather reports close to but preceding the target date/time
- Ocean current information for the test region

NIC, AARI, met.no, BSH and CNWS should deposit their data for the Antarctic on the IAW ftp file server before the workshop. Met.no will submit their weekly Antarctic Atlantic sector ice chart, background imagery and ArcView project for 18 April 2011 (last day of production for the 2010-2011 season).

FMI, BSH, NIC, and AARI should deposit their data for the Baltic on the IAW ftp file server before the workshop.

Product Format

The ice chart should be produced using WMO International Sea Ice Symbology (egg code) using the analysis systems available at DMI or on participants laptops and saved preferably in the WMO SIGRID3 format and/or ESRI .mxd project or shapefile format. Hard-copies of the ice charts and intermediate steps of analysis process should be produced for use in plenary and proceedings.

Proposed Teams

These may be adjusted at the workshop

Team Baltic	Team Antarctic
Holfort (BSH)	Szorc (NIC)
Marnela (FMI)	Schmelzer (BSH)
Alvarstein (met.no)	Concha (CNWS)
Niskanen (FMI)	Hughes (met.no)
Qvistgaard (DMI)	Sarkisov (AARI) – remote

Case Study #2

Assimilation of ice charts in SIGRID-3 format; interoperability of format implementation across the services; reconciliation of ice edges and polygons in adjacent METAREAs.

Objective

Demonstrate how ice charts originating from different services in a standard SIGRID-3 format can be combined and presented in the host ice chart production system. Identify challenges to be overcome in doing so. Explore practices and procedures to reconcile potential differences in ice edges and polygons at the boundaries between adjacent preparation services. Develop a process to make changes to the analysis that borders another METAREA. The aim is to come to agreement of the ice analysis over the Arctic METAREAs for the first week of June as a model. Test and assess communication means and rules.

Procedure

The group will be divided into 3 teams with leaders from corresponding preparation services.

- Team 1 – METAREA XVII - XVIII (lead CIS)
- Team 2 – METAREA XIX (lead met.no)
- Team 3 – METAREA XX – XXI (lead AARI)

The test period is defined as a 2-week period preceding workshop – May 30 - 09 June 2011. The target date for the ice chart to be produced is June 9, 2011.

Each team will use the ice charts produced by their lead service during the test period, together with georeferenced satellite imagery and any ancillary data for 1-3 days preceding the target date. All input data should be representative of data actually available to each service. Their task will be to prepare an updated ice chart for the target date for:

1) their METAREA and the adjacent 300 mile wide intersection zones; and optionally,
2) the circumpolar Arctic Ocean.

At the first step of the assimilation process, each team will focus on interoperability of SIGRID-3 format and identify challenges to be overcome in doing so.

At the second step, the teams will estimate congruence of the ice edge and ice zone polygons in the adjacent and overlaying zones and explore the practices leading to differences (like satellite imagery used, issue times, collection periods, philosophies).

At the third stage, each team will aim to come to agreement of the ice analysis over particular Arctic METAREAs and adjacent zones for the target dates. In doing that the teams will develop a process to make such changes to the analysis that ensures continuity of at least the ice edge across the METAREAs and document necessary operational decisions (at the level of preparation service).

Throughout the above stages, each team must communicate with the team in adjacent areas in order to produce ice charts that are compatible at the boundaries of the METAREAs.

In the following plenary discussion, the groups will discuss the challenges they faced in communicating with their neighbours and how they addressed those challenges. The group will identify best practices in coordinating between adjacent METAREAs. Finally the plenary group will aim to come to agreement of the ice analysis over the whole Arctic METAREAs for the first weeks of June as a model.

Input Data

For each METAREA:

- Daily, weekly or bi-weekly ice charts in SIGRID3 format produced during the test period
- A few satellite images close to but preceding the target date/time
- Weather maps and bulletins close to but preceding the target date/time
- Ship/shore ice and weather reports close to but preceding the target date/time
- Ocean current information for the test region

NIC and CIS should deposit the data for METAREAs XVII-XVIII on the IAW ftp file server before the workshop.

Met.no should deposit the data for METAREA XIX.

AARI should deposit the data for METAREAs XX-XXI.

Note that all of the above data should be somewhat simpler in magnitude and complexity than what was provided for Case Study #1 (the objective here is to focus on coordination between METAREAs and interoperability issues, not on the analysis procedures). The same data should not necessarily be available to every team but, rather, should be representative of the data routinely available to the responsible preparation service.

The inter-team communication can be made more or less real by restricting the means by which teams can communicate. For example, the simulation could be made more real if only ftp and http exchange through the gmdss.aari.ru file server and/or e-mail telephone communication is allowed.

Product Format

Ice charts should be produced using WMO International Sea Ice Symbology (egg code) using the analysis systems available at DMI or on participants laptops and preferably in the WMO SIGRID3 format as well as ArcGIS project files. These products should be posted at the appropriate directory (/ice) on the IAW-3 file server. Proposed naming is metareaXX_2011MMDD.mxd (.shp, .dbf , etc). Hard-copies of the ice charts and intermediate steps of the assimilation process should be also produced for use in plenary and proceedings.

Proposed Teams

These may be adjusted at the workshop

Team XVII-XVIII	Team XIX	Team XX-XXI
Langlois (CIS)	Qvistgaard (DMI)	Soloschuk (AARI)
Marnela (FMI)	Adamsen (DMI)	Folomeev (AARI)
Alvarstein (met.no)	Harnvig (DMI)	Holfort (BSH)
Concha (CNWS)	Buus-Hinkler (DMI)	Larsen (met.no)
Jonsdottir (IMO)	Schmelzer (BSH)	Niskanen (FMI)
Szorc (NIC)	Hughes (met.no)	

Case Study #3

Online composition of sea ice Marine Safety Information for GMDSS and bulletins for NAVTEX.

Objective

Demonstrate how sea ice MSI and NAVTEX bulletins originating from different services can be produced in a coordinated manner to maximize the useful information content for mariners and minimize potential confusion. Test existing formats and identify changes to standards for sea ice and icebergs MSI and NAVTEX bulletins. Test and assess communication means and rules.

JCOMM ETSI, during its 4th session, agreed on a set of rules for the description of ice conditions in a SafetyNET bulletin as well as usage of NAVTEX abbreviations. These will be used by the participants as a starting point.

Procedure

The same 3 teams as for Case Study #2 will be used.

- Team 1 – METAREA XVII - XVIII
- Team 2 – METAREA XIX
- Team 3 – METAREA XX - XXI

Using the ice charts produced in Case Study #2, each team must firstly delineate ice edge and secondly produce its description along with other appropriate ice information a GMDSS marine safety notice and a NAVTEX bulletin for its METAREA.

The teams should firstly follow rules set by JCOMM ETSI for description of sea ice and icebergs in SafetyNET and NAVTEX bulletins (ice edge description with at most 10 points is the only must, plain text for NAVTEX is preferable, additional information is at the competence of preparation service).

Secondly, each team must communicate with the team in adjacent areas in order to produce products that are compatible at the boundaries of the METAREAs and try to simulate and/or assess circumpolar circular (westward CIS 03/15UTC→ AARI 06/18UTC→ met.no 11/23UTC….) exchange of information. The inter-team communication can be made more or less real by restricting the means by which teams can communicate. For example, the simulation could be made more real if only ftp and http exchange through the gmdss.aari.ru file server and/or e-mail and/or telephone communication is allowed. The teams should identify challenges arising in ensuring continuity of ice edge description and other additional information in the bulletins.

During or after the process of compilation each team should assess the following challenges for SafetyNET and NAVTEX bulletins: descriptions and size of described areas; synoptic vs region descriptions; ice descriptions (average vs shipping lane details); number of ice edge points; use of local place names; use of abbreviations vs plain language; merging with weather descriptions; format for ice forecasts; iceberg details in bulletins; and, any other issues that may arise.

In the following plenary discussion, the group will discuss the challenges they faced in compiling the bulletins and in communicating with their neighbours and how they addressed those challenges to ensure timeliness and continuity of the bulletins. As a follow-up, the group will identify best practices in coordinating between adjacent METAREAs. Further, the group will identify and recommended changes to the compilation rules for the SafetyNET and NAVTEX bulletins (i.e. descriptions and size of described areas, etc) based on their experience.

Input Data

For each METAREA:

- The ice chart produced in Case Study #2
- ArcGIS / shapefile format layer, depicting regions and sub-regions of appropriate METAREA
- SafetyNET and NAVTEX (if appropriate) ice bulletins for the previous date. Met.No will submit their GMDSS bulletin in proposed format for METAREAs I and XIX and background ice charts.
- WMO rules for producing GMDSS marine safety information and NAVTEX bulletins

All other data except the stated ice chart (ArcGIS projects with ice edge) should be considered as supplementary, as information to support the analysts' decisions.

Product Format

Products should conform to the accepted formats for GMDSS and NAVTEX and posted at appropriate directory (/ice) at the IAW-3 file server. Proposed naming convention is metareaXX_2011MMDD.txt. Hard-copies of the ice edge delimitation and intermediate steps of bulletin compilation process should be produced for use in plenary and proceedings.

Appendix V – Draft METAREA Agreements

BROADCAST TIMES

XXVII – 03 UTC, **15 UTC**

XXVIII – 03 UTC, **15 UTC**

XIX 11 UTC, **23 UTC**

XX – **12 UTC**, 18 UTC

XXI - **12 UTC**, 18 UTC

03 UTC – XXVII and XXVIII (automatic)

11 UTC – XIX (automatic)

12 UTC – XX and XXI (manual update)

15 UTC – XXVII and XXVIII (manual update)

18 UTC – XX and XXI (automatic)

23 UTC – XIX (manual update)

And back to top

Sub-area names

- should not duplicate sub-area names in other MetAreas
- Russian areas use numbers based on WMO rules (Clarification required)
- Norway areas and names are based on oceanographic features
- Canadian areas are based on dominant wind direction

Ice Edge

- All uppercase
- no more than 10 lat/long points in a sub-area
- latitude 4 digits; longitude 5 digits (add preceding 0 if needed)
- N/W/E must be added for areas bordering the E/W divide
- lat/long pairs separated by comma
- period at the end of the lat/long string to define end of info
- no local names used (exception – reference chart is to be prepared with acceptable well-known place names)
- location of sea ice relative to ice edge given before lat/long string
- additional information may be added – diffuse, compact, movement, growth
- can cut across small islands as if they weren't there
- extend into neighbouring MetArea by 150 NM (use issuing office ice boundaries as reference recognizing that, with different issue times, the boundaries may have moved)
- when describing neighbouring MetArea ice, use names from that METAREA
- cannot create ice free "holes" in the ice pack unless they are significant as noted below; ice-free "inlets" in the ice pack will be ignored if the entrance is less than 30 nm wide

    - o Significant open water within the main ice edge may be described with an ice edge if shipping is active within that area (significant means that an entire marine sub-area is open water)
- Include all sea ice within the ice edge – fast ice, strips and patches; ice edge is boundary between any sea ice and sea ice free (icebergs may be outside of the ice edge provided there is no sea ice)
- idea is to be conservative and not endanger shipping

<u>No ice edge present in MetArea (including overlap area)</u>

- in winter, when ice edge is outside of Sub-area due to complete ice cover, bulletin to say "Ice covered"
- in summer, when ice edge is outside of region due to lack of sea ice, bulletin to say "ice free" or "bergy water".

<u>Example Bulletin</u>

FICNXX CWIS 251455

SECURITE

ICE BULLETIN FOR METAREA *XX* ISSUED BY *ISSUING OFFICE* AT 15 UTC 23 JUN 2011.

REGION NAME.

ICE N OF 6610N 05635W, 6620N 06500W, 7256N 07621W, 8015N 10022W. (*6/10 FIRST YEAR and OLD ICE. DIFFUSE ICE EDGE MOVING S.)*

<u>Sharing information</u>

- text and shape file polygons in SIGRID3 format will be deposited into AARI server (ftp://gmdss.aari.ru) organized by MetArea and date/time:
    - o /bull/NN/YYYYMMDD/ where NN is METAREA number 17…21
- following naming conventions (masks) should be followed for the bulletins and supporting information:
    - o @@@NN_YYYYMMDD_HH.xxx where:
        - @@@ is met for meteorological, ice for ice and metice for combined meteorological and ice bulletin
        - NN is METAREA number
        - YYYYMMDD_HH is date and time (in hours)
        - xxx is .txt for text, .zip for zipped shapefiles (SIGRID3), .mxd for ArcGIS project files
- If either service changes the ice edge, also deposit screen captures of new imagery.
- MetArea issuing or preparation services will refer to that data when preparing the overlap areas

<u>Additional</u>

- well known place names are allowed, especially in narrows.

Example:

SUBAREA 17110

ICE N OF 7635N 01239E, 7534N 01951E, 7540N 02841E, 7610N 03003E. OPEN OLD ICE MOVING SWD IN VILKITSKY STRAIT.

Appendix VI – Summary of Operational Analysis Differences and Interoperability

Difference	Impact	Proposed Resolution / Recommendation
NIC Antarctic charts do not depict ice shelves in the correct colour according to the international colour code	Minimal	NIC should revise the colour of ice shelves and update the boundaries of shelves on their Antarctic ice charts
Difference in analysis procedures between services and between individual experts	Minimal	Ice services should provide a better description of the philosophy of their ice services for WMO Publication No. 574 (Sea Ice Information Services in the World)
Definition of the "ice edge" varies among services. • For some, it is the boundary between ice free and any ice. • Others do not always include small or narrow strips of ice adjacent to the main pack - would place "strips and patches" symbols outside the ice edge. • Some services consider other criteria to define the ice edge (e.g. new ice / nilas may be outside the ice edge)	Significant for many users	Ice Services should implement the practice for GMDSS bulletins as agreed at IAW-3 i.e. the ice edge is the boundary between Ice Free and any sea ice - excludes bergy waters
Use of concentration intervals in egg code • Some services use fixed intervals (1-3, 4-6, 7-8, 9-10) • Others use variable intervals (e.g. 1-2 or 6-8) Some services use the average value of concentration to determine the colour for the polygon while others use the extreme value	Moderate - Both uses fall within the international symbology standard for the egg code but not for the colour code	ETSI should discuss the issue of which concentration value to use to determine the colour of a polygon – average or extreme
Use of partial concentration in egg code • Not all services indicate the partial concentrations of the ice types in an egg code	Minimal	None required. Both uses fall within international symbology standard
Indication of strips in the form of ice section of the egg code • Some services use this practice – others do not	Minimal -	ETSI should verify that the egg symbology standard permits the indication of strips in the form of ice section of the egg and also check the possibilities of extending the egg symbology standard

Precise date/time of ice chart and ice edge • Some ice services attempt to estimate the ice situation at a particular date and time by modeling ice motion forward from the date and time of observations • Other services use a "composite" of observed data from latest to oldest without adjusting the data for time	Could be significant	This is not an easy difference to resolve since it involves differences in philosophies of ice chart production and purpose. Ice services should indicate their philosophy of operation in WMO No.574. It is further recommended that the sources of data used in preparing an ice chart be indicated in the SIGRID-3 metadata
Purpose of ice chart and ice edge / philosophy – who are the users? • Some services produce ice charts with particular users in mind • Others produce more general charts	Could be significant when trying to integrate charts	Ice services should indicate their philosophy of operation in WMO No.574
Different definitions for "level ice" • Some services consider level ice to have a maximum thickness of 20 cm • Other services have no such maximum thickness	Minor impact if actual thickness is also indicated	Ice thickness estimates or observations should be shown for level ice
Indication of thickness of ice in the presence of rafting • Some services indicate the total thickness of the ice • Others show the thickness (stage of development) of the single layer of level ice only and indicate rafting by means of a rafting symbol	Significant impact	The issue of how to indicate the thickness of ice in the presence of rafting should be raised for further discussion towards a resolution at ETSI and the Baltic Sea Ice Meeting (BSIM)
Baltic ice services do not always use International Symbology (egg code)	May have minor impact	None - As a small, tightly controlled area with a very large number of ships operating in the ice season, this regional practice is well accepted and well documented for users
Icebergs on ice charts • Some services indicate icebergs in all areas • Others only indicate very large bergs and assume that mariners know the icebergs can be everywhere	Minor impact on navigation; significant impact on climatology	Ice services should re-examine the practice of indicating icebergs on charts and in the egg code for further discussion at ETSI
Use of colour codes on ice charts • Some services use only the ice concentration code • Some services use both concentration and stage of development codes	Some impact because of lack of information to users – individual charts do not	Publication of ice charts with both WMO colour codes (concentration and stage of development) is recommended and Ice services should re-examine their practices to determine if improvement is

simultaneously • Some services switch between code depending on the season	cause confusion	warranted
Ice information in non-Arctic METAREAs (e.g. Bering Sea, North Atlantic) • Practice in previously established METAREAs is non-standard • Met.no provides ice edge to UK Met Office for inclusion in METAREA 1 bulletins • No ice information is available in METAREA bulletins in many other areas	Significant impact on mariners and issuing services	JCOMM should address issue of non-Arctic METAREAs that have ice providing ice information in conformance with the standards being developed for the Arctic METAREAs. This affects the issuing services of the UK, USA, Russian Federation, Japan, Chile, Argentina, Australia, New Zealand and South Africa.
Differences in coastlines	Probably not significant impact; could cause gaps between ice polygons and coastline – also difficulties in blending ice charts	In preparing ice chart shape files, ice polygons should extend over coastline so they will be masked by the coastline – resolve other coastline. Other coastline problems should be examined on a case by case basis
Differences in SIGRID-3 formats • Services have not all implemented SIGRID-3 • CIS cannot import SIGRID-3	Significant impact on interoperability	ETSI should amend the SIGRID-3 standard to include projection files as mandatory Ice Services should populate the SIGRID-3 XML file according to standard Ice Services should exchange scripts and software for processing SIGRID-3 attribute tables The Canadian Ice Service should implement the capability to import SIGRID-3 as soon as possible
Differences in METAREA bulletin format • Met.no adds FULL EXTENT section, contact information and disclaimer • Other services do not necessarily add these sections • Use of uppercase not consistent	Minimal impact	The METAREA Bulletin format standard should include optional sections to allow for national practice (e.g. FULL EXTENT, Contact Information, Disclaimer) GMDSS bulletins should be all uppercase

Appendix VII – Workshop Recommendations

RECOMMENDATION 1. When describing the ice edge for a GMDSS bulletin in areas where there are overlapping ice charts from different preparation services, the most conservative ice edge should be adopted in the interest of marine safety.

RECOMMENDATION 2. Met.no should maintain their plan to implement SIGRID-3 import/export capability in 2011.

RECOMMENDATION 3. JCOMM Expert Team on Sea Ice (ETSI) should follow up on the recommendation to make projection files a mandatory component of SIGRID-3.

RECOMMENDATION 4. The Canadian Ice Service should implement the capability to import SIGRID-3 ice chart data as soon as possible to allow interoperability with the other Arctic Preparation Services.

RECOMMENDATION 5. JCOMM should address issue of non-Arctic METAREAs that have ice providing ice information in conformance with the standards being developed for the Arctic METAREAs. This affects the issuing services of the UK, USA, Russian Federation, Japan, Chile, Argentina, Australia, New Zealand and South Africa.

RECOMMENDATION 6. AARI should maintain the GMDSS ftp site for future operational coordination between the preparation services for the ice bulletins.

RECOMMENDATION 7. Files relating to the same shape file should be packaged together in one .zip file when being placed on the AARI GMDSS ftp site

RECOMMENDATION 8. In the GMDSS bulletin, the sub-area header should contain only the name(s) of the sub-area(s) – i.e. the inclusion of the word "SUBAREA" is discouraged. . User feedback should be monitored to determine if there is any confusion caused by this practice. Sub-areas may be prefaced by the METAREA number in intersection zones.

RECOMMENDATION 9. Check with other IMO standards to determine if longitudes greater than 180 degrees are accepted international marine practice. Adjust the GMDSS guidelines to be in accordance.

RECOMMENDATION 10. Reference maps with acceptable place names for use in GMDSS bulletins should be developed, exchanged and provided to ETMSS with further publication on the GMDSS website (weather.gmdss.org)

RECOMMENDATION 11. Canada should complete the naming of the sub-areas in METAREAs XVII and XVIII as soon as possible to allow other issuing services to prepare their systems appropriately.

RECOMMENDATION 12. The GMDSS ice bulletin standard should specify the content, terminology and format of the bulletin header and sub-headers in accordance with WMO practice for other Marine Safety Information bulletins.

RECOMMENDATION 13. All ice experts should provide additional comments and suggestions for additional NAVTEX abbreviations terms to Jürgen Holfort (BSH) by the end of August. The intention is to provide the final draft to ETMSS by end of September 2011.

RECOMMENDATION 14. NIC should revise the colour of ice shelves and update the boundaries of shelves on their Antarctic ice charts.

RECOMMENDATION 15. Ice services should provide a better description of the philosophy of their ice services for WMO Publication No. 574 (Sea Ice Information Services in the World).

RECOMMENDATION 16. Ice Services should implement the practice for GMDSS bulletins as agreed at IAW-3 i.e. the ice edge is the boundary between Ice Free and any sea ice - excludes bergy waters.

RECOMMENDATION 17. ETSI should discuss the issue of which concentration value to use to determine the colour of a polygon – average or extreme.

RECOMMENDATION 18. ETSI should verify that the egg symbology standard permits the indication of strips in the form of ice section of the egg and also check the possibilities of extending the symbology standard.

RECOMMENDATION 19. The sources of data used in preparing an ice chart be indicated in the SIGRID-3 metadata.

RECOMMENDATION 20. Ice thickness estimates or observations should be shown for level ice.

RECOMMENDATION 21. The issue of how to indicate the thickness of ice in the presence of rafting should be raised for further discussion towards a resolution at ETSI and the Baltic Sea Ice Meeting (BSIM).

RECOMMENDATION 22. Ice services should re-examine the practice of indicating icebergs on charts and in the egg code for further discussion at ETSI.

RECOMMENDATION 23. Publication of ice charts with both WMO colour codes (concentration and stage of development) is recommended and Ice services should re-examine their practices to determine if improvement is warranted.

RECOMMENDATION 24. In preparing ice chart shape files, ice polygons should extend over coastline so they will be masked by the coastline – resolve other coastline. Other coastline problems should be examined on a case by case basis.

RECOMMENDATION 25. ETSI should amend the SIGRID-3 standard to include projection files as mandatory.

RECOMMENDATION 26. Ice Services should populate the SIGRID-3 XML file according to standard.

RECOMMENDATION 27. Ice Services should exchange scripts and software for processing SIGRID-3 attribute tables.

RECOMMENDATION 28. The METAREA Bulletin format standard should include optional sections to allow for national practice (e.g. FULL EXTENT, Contact Information, Disclaimer).

RECOMMENDATION 29. GMDSS bulletins should be all uppercase

RECOMMENDATION 30. Standards for preparation of the ice bulletins should be advertised on the GMDSS website and in Notice to Mariners and Mariners Handbooks along with a general caution note about ice being encountered outside the ice edge.

Appendix VIII - ACRONYMS AND OTHER ABBREVIATIONS

AARI	Arctic and Antarctic Research Institute
AMSR	Advanced Microwave Scanning Radiometer (EOS)
BAS	British Antarctic Survey
BSH	Bundesamt für Seeschiffahrt und Hydrographie (Germany)
BSIM	Baltic Sea Ice Meeting
CB	Capacity Building
CBS	Commission for Basic Systems (WMO)
CCI	Commission for Climatology
CIS	Canadian Ice Service
COMSAR	Sub-Committee on Radio-communications, Search, and Rescue (IMO)
CPRNW	Commission on the Promulgation of Radio Navigational Warnings (IHO)
C&SMWG	Colours and Symbols Maintenance Working Group (IHO)
DMI	Danish Meteorological Institute
DSMP	Defense Meteorological Satellite Program (USA)
EC	WMO Executive Council
ECDIS	Electronic Chart Display Information System
ECIMO	Russian Unified System of Information on World Ocean Conditions
ECS	Electronic Navigation System
ENC	Electronic Navigational Charts
ENCIO	Electronic Navigational Chart Ice Objects
ENVISAT	Environmental Satellite
EOS	Earth Observing System (NASA)
ESA	European Space Agency
ESRI	Environmental Systems Research Institute
ET	Expert Team
ETMSS	Expert Team on Maritime Safety Services (JCOMM)
ETSI	Expert Team on Sea Ice (JCOMM)
EU	European Union
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
EWG	Environmental Working Group
FMI	Finnish Meteorological Institute
GCMP	GCOS Climate Monitoring Principles
GDSIDB	Global Digital Sea Ice Data Bank
GIS	Geographic Information System
GMDSS	Global Maritime Distress and Safety System
GMES	Global Monitoring of Environment and Security Programme
GML	Geography Markup Language
HF	High Frequency
HGMIO	Harmonization Group on Marine Information Objects
HMC	Hydrometeorological Centre in Moscow
IABP	International Arctic Buoy Programme
IALA	International Association of Lighthouse Authorities
IAOOS	Integrated Arctic Ocean Observing System
IASOA	International Arctic System for Observing the Atmosphere
ICEMON	Sea Ice Monitoring in the Polar Regions
ICS	International Chamber of Shipping
ICSU	International Council for Science
IEC	International Electro-technical Commission

IHB	International Hydrographic Bureau
IHO	International Hydrographic Organization
IICWG	International Ice Charting Working Group
IIP	International Ice Patrol
IMB	Ice Mass Balance
IMO	International Maritime Organization
IMO	Icelandic Meteorological Office
IMMA	International Maritime Meteorological Archive
IMMSC	International Maritime Met-Ocean Services Conference
IMSO	International Mobile Satellite Organization
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
IPAB	International Programme for Antarctic Buoys
IPO	IPY International Programme Office
IPY	International Polar Year
ISO	International Standards Organization
IWICOS	Integrated Weather, Sea Ice and Ocean Service System
JC	WMO/ICSU Joint Committee (IPY)
JCOMM	Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology
JEWL	Cross-JCOMM Pilot Project on Extreme Water Level
JMA	Japan Meteorological Agency
KSAT	Kongsberg Satellite Services
MACICE	Manual of Standards Procedures for Observing and Reporting Ice Conditions (Canada)
MDA	Macdonald, Dettwiler and Associates
MIO	Marine Information Object
MIZ	Marginal Ice Zone
MMSM	Marine Meteorological Services Monitoring
MOCS	Marine and Oceanographic Climatological Summaries
MODIS	Moderate Resolution Imaging Spectrometer
MoU	Memorandum of Understanding
MSC	MCSS Summaries
MSI	Maritime safety Information
MSS	Maritime Safety Services
NAIS	North American Ice Service
NASA	National Aeronautics and Space Administration (USA)
NATO	North Atlantic Treaty Organization
NAVO	US Naval Oceanographic Office
NCOM	Navy Coastal Ocean Model
NEARGOOS	North-East Asian Regional GOOS
NIC	National Ice Center (USA)
NMEFC	National Marine Environment Forecast Centre (China)
NMS	National Meteorological Service
NOAA	National Oceanographic and Atmospheric Administration (USA)
NODC	National Oceanographic Data Center
NOGAPS	Navy's Operational Global Atmospheric Prediction System (USA)
NSIDC	National Snow and Ice Data Center (USA)
NSF	National Science Foundation
NSR	Northern Sea Route
NWP	Numerical Weather Prediction
OFS	Ocean Forecasting System

OI	Optimal Interpolation
OOPC	Ocean Observation Panel on Climate
PAME	Arctic Council's Protection of the Arctic Marine Environment
PANC	Naval Combined Antarctic Patrol (Argentina)
PIPS	Polar Ice Prediction System
PMSI	Polar Maritime Safety Information
POC	Point of Contact
QC	Quality Control
RADARSAT	Satellite from Canada
RAE	Russian Antarctic Expedition
RECLAIM	ICOADS-related Recovery of Logbooks and International Marine Data
RMC	Regional Meteorological Center (WMO)
SAF	Satellite Application Facility
SAO	Senior Arctic Officials
SAR	Synthetic Aperture Radar
SCAR	Scientific Committee on Antarctic Research
SENC	System ENC
SG	Steering Group
SI	Sea Ice
SIGRID	Format for the archival and exchange of sea-ice data in digital form
SIR	Sea Ice Requirements
SIMS	Sea Ice Mapping System
SMARA	Argentine Navy Meteorological Service
SMHI	Swedish Meteorological and Hydrological Institute
SOG	Statement of Guidance
SOLAS	International Convention for the Safety of Life at Sea
SPA	Services Programme Area (JCOMM)
SSM/I	Special Sensor microwave Imager
SST	Sea Surface Temperature
STG	Space Task Group
TC	Technical Committee
TD	Technical Document
TG	Task Group
THORPEX	Observing System Research and Predictability Experiment (WMO)
TLO	Top Level Objectives
ToR	Terms of Reference
TSMAD	Transfer Standard Maintenance and Application Development (IHO)
TT	Task Team
ULS	Upward Looking Sonar
UNESCO	United Nations Educational, Scientific and Cultural Organization
URD	User Requirement Document
WG	Working Group
WIS	WMO Information System
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experimentation
WWNWS	Worldwide Navigational Warning Service (IHO/IMO)
WWW	World Weather Watch (WMO)
XML	Extensible Markup Language