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STEERING GROUP FOR THE GLOBAL DIGITAL SEA ICE DATA BANK (GDSIDB)
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FINAL REPORT

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N O T E

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ANNEXED DOCUMENTS

GENERAL SUMMARY OF THE WORK OF THE SESSION

1. OPENING OF THE SESSION

1.1. Opening

1.1.1. The fourth session of the JCOMM Expert Team on Sea Ice (ETSI) and the twelfth session of the Steering Group for the Global Digital Sea Ice Data Bank (GDSIDB) was opened by the Chairperson of the Expert Team on Sea Ice (ETSI), Dr. Vasily Smolyanitsky (Russian Federation), at 1000 hrs on Monday, 1 March 2010 at the Arctic and Antarctic Research Institute (AARI), St Petersburg, Russian Federation.

1.1.2. Prof. Frolov, Director of AARI, welcomed the Expert Team (ET) to AARI noting that, for many decades, AARI has participated in the ETSI and in its predecessor, the WMO CMM Sub-group on Sea Ice. He mentioned that this activity was beneficial for all ice services in its work to create a common language for ice services and common standards. He views the activity of the ETSI as one of the most important activities in JCOMM. On March 4, AARI will celebrate its 90th anniversary and Dr. Frolov expressed his hope that ETSI would continue its successful activities for the next decade of AARI. He expressed hope and confidence that this would be a successful meeting and that the participants would have a pleasant stay in St. Petersburg.

1.1.3. Mr. Valeri Martyschenko welcomed the ET on behalf of Roshydromet. He remarked that the Russian Federation traditionally pays high attention to marine meteorological activities in the Polar Regions including support and development of sustained and standardized systems and services for efficiency and safety of navigation and offshore activities. The work of JCOMM and in particular its SFSPA constituents is of a high priority for Roshydromet. Mr. Martyschenko wished the members a fruitful meeting and good time in St. Petersburg

1.1.4. On behalf of the Secretary-General of WMO, Mr. Edgard Cabrera welcomed the participants to the 4th Session of the ETSI. He remarked that the JCOMM-III noted that the work of the Expert Team is important for both WMO and IOC and in support of mariners at sea. The work of the ETSI and the ETMSS is one of the priorities for JCOMM. Mr. Cabrera thanked AARI and Roshydromet for their welcome to St. Petersburg and wished the Team great success in the meeting.

1.1.5. The ETSI chairperson, Dr. Vasily Smolyanitsky, welcomed the participants to these sessions and reviewed the agenda. He noted that the agenda was developed by himself and the Secretariat noting the importance of the development of new standards for sea ice products and services and new requirements for sea ice services in relation to the opening of the Arctic METAREAs and the considerations given at JCOMM-III. The ETSI is to support the opening of the METAREAs which are to become operational this year. This meeting was scheduled to be held early in the year in order to be able to help ETMSS and other expert teams in this critical development.

1.1.6. The ET congratulated AARI on the remarkable achievement of 90 years of prolific and successful activities in furthering humankind's knowledge of the polar regions.

1.2. Adoption of the agenda

1.2.1. The Team adopted its agenda for the session based on the provisional agenda. This agenda is given in Appendix I.

1.3. Working arrangements

1.3.1. The Team agreed on its hours of work and other practical arrangements for the session. The documentation was introduced by the Secretariat, and the participants introduced themselves, to facilitate future interactions. The list of Participants is attached at Appendix II.

2. REPORTS

2.1. Report of the Coordinator of the Service and Forecast Systems Programme Area (SFSPA)

2.1.1. Dr. Ming Ji, the SFSPA Coordinator, presented his report noting that the expected results of the WMO, as given at JCOMM-III, for SFSPA are: improving prediction, information and services; reducing risks of environmental hazards; supporting climate service; strengthening capacity building (CB); and, enhancing partnerships and cooperation. He informed the ET that the IOC high level outcomes, as given at JCOMM-III, relate to: natural hazards; adaptation to climate change; and, management procedures and policies.

2.1.2. Dr. Ming presented the SFSPA programmatic thrusts:

- Ensuring marine weather safety including Emergency Response to maritime distress;
- Reducing risks of natural disasters on coastal communities; and,
- Establishing operational ocean forecasting services

Dr. Ming noted that Climate Service is a major driver for priorities and Marine Weather and Sea Ice services for the Arctic Ocean are a priority in consideration of the expected increase in marine transportation in the Arctic Ocean. Dr. Ming's presentation is at Annex A.

2.1.3. Based on these thrusts and cross-cutting priorities, and in consideration of the JCOMM-III direction to move toward a project-oriented approach to its work instead of activity-based, the Programme Area coordinator met with the chairpersons of ETSI, ETWS and ETMSS to develop a workplan identifying 29 projects (Appendix III).

2.1.4. Dr. Ming informed the meeting of the priority activities of the ET-OOFS, ETWS, ETMSS and ETSI that serve to achieve the results identified in the workplan.

2.1.5. The ET was informed that the JCOMM Services Website will be merged into the SFSPA website on the main JCOMM website (www.jcomm.info) to be more sustainable. IOC will maintain two levels of the website: the top level will be for the SFSPA and the second level will be for expert teams. The ET Chairs and their teams must maintain the content on their own Team section. Cross-cutting information such as calendars, people and general news, and the ability to search and organize documents, will be maintained centrally.

2.1.6. Dr. Ming challenged the ET to adjust and agree on the priority for the projects assigned to ETSI and to complete information about key activities and timelines. A template should be completed for each project identifying Expected Outcomes, Key activities, Timeline, Major milestones, ETs and Other contributing organizations to allow the SFSPA coordinator to report effectively to JCOMM on project status. The ETSI Chairperson noted that the ET would discuss these priorities during agenda item 2.11.

2.1.7. In closing, Dr. Ming informed the ET about several meetings that are planned to move the work of the SFSPA forward. In May 2010, a GMDSS/MPERSS workshop is planned to be held in Melbourne, Australia to develop the workplan for ETMSS. The Services Coordination Group will also meet in May 2010 in Melbourne to finalize the SFSPA work plan. An ETWS meeting is planned for May 2010 in Toronto to establish the work plan for the ETWS. An ETOOFS meeting is planned for October 2010 in Tokyo.

2.2. Report of the Chairperson of the ETSI

2.2.1. Dr. Vasily Smolyanitsky presented his report (Appendix IV) noting that the Expert Team on Sea Ice (ETSI) was formally constituted at the First Session of JCOMM (JCOMM-I, Akureyri, Iceland, June 2001) and re-established at the Second Session, (JCOMM-II, Halifax, Nova Scotia, Canada, September 2005) as a part of the JCOMM Services Programme Area (SPA) as well as at the Third Session, (JCOMM-III, Marrakesh, Morocco, November 2009) as a part of the JCOMM Services and Forecasting Systems Programme Area (SFSPA).

2.2.2. During the intersessional period Dr. Vasily Smolyanitsky (Russian Federation) served as Chairperson of the ETSI. The Members of the ETSI included the Chairperson and eleven experts representing the national services related to sea ice and the ice-covered regions from Argentina, Canada, China, Denmark, Finland, Iceland, Japan, Norway, Sweden, United Kingdom and USA, and invited representatives of regional and international sea ice bodies, in particular, the Global Digital Sea Ice Data Bank (GDSIDB) Project, the Baltic Sea Ice Meeting (BSIM) and the International Ice Charting Working Group (IICWG).

2.2.3. Dr. Smolyanitsky noted that as, of JCOMM-III, the Terms of Reference of the ETSI (Appendix V) were revised to change the membership to have only eight core members but also to include representatives from other regional and international bodies. Dr. Smolyanitsky (Russian Federation) was re-elected as chairperson with the following experts to serve as core members of the Expert Team on Sea Ice: Ari Seina (Finland), Baohui Li (China), Beatriz Enriqueta Lorenzo (Argentina), Jonathan Shanklin (United Kingdom), Jürgen Holfort (Germany), Marie-France Gauthier (Canada) and Nick Hughes (Norway) with representatives of regional and international sea ice bodies, in particular the Baltic Sea Ice Meeting, European Ice Services, International Ice Charting Working Group and North American Ice Service, as invited experts. According to other ToRs, the ETSI chair or his representative serves as a core-member of ETMSS and ETMC. Jonathan Shanklin is also a member of Ship Observation Team (SOT). Dr. Smolyanitsky underlined that the only differences between core members and others is that WMO will support travel expenses for core members when necessary. Others must participate at their own expense. Marie-France Gauthier noted that some wondered whether those core members who are self-funded might be taking places away from other experts who could benefit from WMO funding. Mr. Cabrera noted that there is no expectation that all ET members would have their expenses paid for by WMO.

2.2.4. The past work plan for the ETSI was developed at ETSI-III (March 2007) on the basis, and following priorities, of the JCOMM intersessional work programme for 2005-2009 (JCOMM-II, September 2005), decisions of the 3rd Session of the Services Coordination Group (SCG-III, Exeter, United Kingdom, November 2006) and recommendations from the 2nd Session of the Expert Team on Maritime Safety Services and the 1st Session of the Expert Team on Marine Accident and Emergency Support (ETMSS-II and ETMAES-I, January 2007).

2.2.5. Key issues of the Team's intersessional activity included response to a new level of requirements for sea ice products and services for the safety and efficiency of ice navigation as

well as support for IPY 2007/2008 and the new Arctic METAREAS.

2.2.6. The work plan for 2007-2009 encompassed coordination and advice of the Members' ice services to support navigation and sea ice monitoring, interaction with the Expert Team on Marine Safety Services (ETMSS) on sea ice Marine Safety Information (MSI), development and revision of sea ice technical guidance material and standards, support for CB, interaction with the Expert Team on Marine Climatology (ETMC), guidance of the Global Digital Sea Ice Data Bank, tailored support for the IPY 2007/2008 and linkages with other relevant bodies, in particular GCOS, IHO TSMAD and regional and international sea ice projects and alliances including IICWG, BSIM and CliC. ETSI completed most of the parts of its past work plan, included as Appendix 3 and containing notes for achieved tasks.

2.2.7. Among the highlights of the achievements is the establishment and maintenance of the Ice Logistics Portal during and beyond the IPY 2007/2008. The "Ice Logistics Portal" (http://ipy-ice-portal.com/) is a joint JCOMM-IPY-Polarview project providing a single web-gate to operational sea-ice information from the national ice services both in low- (customers in field) and high-speed (customers in office) connection versions for the regions of the Northern and Southern hemispheres by means of clickable maps. The portal became operative in May 2007 and was endorsed by the WMO EC-LX in June 2008. The portal utilizes a provider-flexible operating schema resembling E2EDM, is estimated as one of the IPY observing system legacies and is planned to be integrated in the future with the WMO WIS, GCW and EC MyOcean.

2.2.8. Important interaction aimed at enhancement of ice services has been carried out between ETSI and ETMSS to respond to issues related to establishment of the new Arctic METAREAs. This includes ETSI input to WMO (No. 471, 558) and joint WMO/IHO/IMO Guides and Manuals on Marine Safety Services (MSS) to ensure completeness related to marine safety in ice infested waters as well as ETSI coordination of the provision of sea ice MSS in the Arctic and subpolar METAREAs for GMDSS by national ice services. The Team (at the ETSI-III session) agreed on its approach to sea ice NAVTEX abbreviations (recommended to use plain text) and on extension of the MMSM Questionnaire to cover ice products. It should be noted that present ice services do include but are not restricted to MSI by containing a variety of MMO products intended to ensure both efficiency and safety of navigation inside and outside of the ice edge.

2.2.9. Another important interaction is the maintenance of successful cooperation and joint meetings between ETSI and the national ice services' regional and international alliances, in particular the IICWG (8th – 10th sessions, October 2007 - 2009) and BSIM (23rd session, September 2008) with merged action items in work plans. Among others, practical results of cooperation include interaction with the IICWG on user requirements and update of the "Ice Information Services: Socio-Economic Benefits and Earth Observation Requirements" document used as a template for JCOMM sea ice requirements (http://nsidc.org/noaa/iicwg/pdf/).

2.2.10. A significant achievement is the development of the "Ice Objects Catalogue" which is a first standard for providing sea ice information in Electronic Navigational Charts (ENC). The standard was developed on the basis of a CIS Catalogue Ver. 4.0, adopted by ETSI-III in March and submitted to the IHO Registry of Marine Information Objects by May 2008. (http://195.217.61.120/iho_registry/). The Catalogue provides the basis for ice services to deliver ice charts information to customers at sea directly in S-57 format (in a future in S-100). The important vision of the relationships between the Sea Ice Nomenclature and the Ice Objects

Catalogue elaborated by the Team is that the Ice Objects catalogue represents a subset of the WMO Sea Ice Nomenclature being at the same time a driving force for amending the Sea Ice Nomenclature with an intention of including the navigators' feedback in the future.

2.2.11. According to agreement with IHO TSMAD, JCOMM ETSI is the formal body responsible for "Ice Objects Catalogue" as of November 2005 and the WMO Secretariat is the manager of the catalogue together with ETSI Electronic Navigational Chart Ice Objects Task Group (TG ENCIO). The terms of reference for the TG ENCIO (chair – Mr. John Falkingham) are attached as Appendix VI. This provides a unique position for the Team in JCOMM, which can and should be used by other ETs to achieve efficiency in developing S-57(S-100) extensions for other MMO information. As one of the priority activities for the 2010-2012 for the whole SFSPA is to create an initial catalogue of marine and oceanographic parameters for ENC, the Team is invited to check the necessity for explicit reference of this activity and the TG ENCIO in its new ToRs as was proposed by ETSI-III (...including management of an ice objects register within ECDIS…) **(Action: TG ENCIO)**.

2.2.12. During the winters 2008-2009, the Catalogue underwent testing by the Canadian Ice Service (CIS) (Gulf of St.Lawrence) and the Arctic and Antarctic Research Institute (AARI) (Baltic Sea, EU Arctic, Kara Sea). The development of sea ice product transmit and display specifications was undertaken with a target date of the end of 2009 with further proposals for discussion at the ETSI-IV session.

2.2.13. Other achievements related to development of the sea ice technical documentation, terminology, coding and mapping standards include update of a multi-language (EN/FR/RU/SP) electronic version of the WMO No. 259 "Sea Ice Nomenclature" (Volume I – terminology and codes and Volume II - Illustrated Glossary), annual update of the WMO No.574 "Sea Ice Information Services in the World", updates to WMO/TD. No.1214 "SIGRID-3: a vector archive format for sea ice charts" with electronic versions maintained at the JCOMM Services web-site documents section (http://www.jcomm-services.org/documents.htm?parent=39). In 2008-2009, activities to extend the "Sea Ice Nomenclature" with Baltic Sea Ice Services linguistic terms (in cooperation with BSIM) were initiated and a "4th annual update of the "Sea Ice Information Services in the World" was completed. This latter publication provides a 2009 snapshot and full description of sea ice services and products available and extends WMO No.9, vol. D, with special sections describing numerical modelling and ice charts data assimilation.

2.2.14. Development of sea ice climatology based on ice charts included maintenance of the Global Digital Sea Ice Data Bank. By 2009, ice charts for the period 1933-2008 from a number of national ice services are available in standard SIGRID family formats with continuing annual updates. GDSIDB data was used to provide information for the Arctic Marine Shipping Assessment (AMSA) in 2007-2008 and assessment of extreme 2007 and 2008 conditions in terms of sea ice climatology. The ETSI interacts with GCOS SST&SI WG and WCRP on the development of requirements for sea ice information as an Essential Climate Variable (ECV) within GCOS.

2.2.15. Highlights of achievements in sea ice capacity building support include provision of the 1st (June 2008) and the 2nd (June 2009) joint ETSI/IICWG/GCOS "Ice Analysts Workshops". The workshops encompassed case studies and discussions, including online exercises on analysis of the multi-sensor satellite imagery and compilation of ice charts, providing a platform for ice analysts to exchange views, techniques, expertise and share best practices. The Proceedings of the 1st workshop are available as WMO TD. No. 1441 (ftp://ftp.wmo.int/Documents/PublicWeb/amp/mmop/documents/JCOMM-TR/J-TR-43-IAW-

2008/index.htm). The proceedings of the 2nd workshop are available as WMO TD. No. 1517 (ftp://ftp.wmo.int/Documents/PublicWeb/amp/mmop/documents/JCOMM-TR/J-TR-49-2nd_IAW/index.htm). The scientific results of the 1st workshop included identification of uncertainties on current and historical ice charts. A valuable conclusion of the more practically-oriented 2nd workshop related to harmonization of ice charts from different Ice Services is that, potentially, Arctic ice charts are interchangeable for MSS within new Arctic METAREAs, provided that the timeliness, accepted accuracy of the boundaries and amount of additional information (leads, cracks, compactness) is sufficient for operative purposes.

2.2.16. The JCOMM at its third session in November 2009 analyzed the progress achieved by its bodies including the ETSI and endorsed among others, the Team's work. The JCOMM-III re-established the Team, though, it should be noted here, the last JCOMM Management Committee in December 2008, in seeking the best structure for the Commission, discussed other structural options.

2.2.17. The JCOMM-III endorsed the priority activities for the next intersessional period for the individual Expert Teams and requested tighter collaboration across the Programme Areas and individual Teams. For ETSI, the following priority activities were outlined (agenda item 8.4):

- Update sea ice standards;
- Continue to develop and manage technical documentation for ENC and sea ice services and information;
- Develop sea ice climatology based on ice charts and maintenance of the Global Digital Sea Ice Data Bank (GDSIDB);
- Contribute to the development and implementation numerical forecasting systems; and,
- Enhance the efficiency and safety of navigation in ice infested waters by harmonizing sea ice products.

2.2.18. The Chairman noted that the workplan report (Appendix VII) was quite successful in that most of the items were completed. A few items must be carried over to the new workplan, passed to other ETs or dropped.

2.3. Report of the Secretariat

2.3.1. Mr. Edgard Cabrera introduced the report of the Secretariat noting that ETSI is one of the most important ETs in JCOMM having a heritage that predates JCOMM itself. He noted the establishment of the ETOOFS as a new team at JCOMM-III.

Outcomes of the Third JCOMM Session, and recommendations to ETSI

2.3.2. Mr. Cabrera recalled that the Third JCOMM Session (JCOMM-III) was held in Marrakech, Morocco from 4 to 11 November 2009 with more than 110 participants from 40 countries. He referred to the summary by Dr. Peter Dexter, the co-president for meteorology of JCOMM (Annex B). The full JCOMM-III Final Report is at Annex C. Mr. Cabrera summarized the JCOMM-III decisions and recommendations regarding the Services and Forecast Systems Programme Area (SFSPA) and ETSI.

2.3.3. The Commission endorsed future priority activities for the next intersessional period for the SFSPA's four Expert Teams:

- Expert Team on Operational Ocean Forecasting (ETOOF);
- Expert Team on Wind Waves and Storm Surges (ETWS);

- Expert Team on Marine Safety Services (ETMSS); and,
- Expert Team on Sea Ice (ETSI).

Outcomes of Specific Interest to the ETSI

2.3.4. JCOMM-III adopted Recommendation 5 "that a JCOMM Guide to Operational Ocean Forecasting Systems be prepared". The recommendation includes an annex that outlines the proposed Table of Contents for this guide.

2.3.5. JCOMM-III adopted Recommendation 7 to establish an IMO/WMO Worldwide Met-Ocean Information and Warning Service. This recommendation included the adoption of a well-developed guidance document for this Service annexed to the recommendation. The recommendation urges WMO Members with GMDSS Marine Broadcast System responsibilities to continue to implement their responsibilities, to keep WMO informed of changes, to liaise closely with the users and to serve as METAREA coordinator within their area of responsibility. This recommendation requests the Expert Team on Maritime Safety Services to keep the implementation of, and user response to, the IMO/WMO Worldwide Met-ocean Information and Warning Service under review and to develop proposals for amendments as necessary. Recommendation 7 also specified that the Manual on Marine Meteorological Services, Volume I, Part I, be amended accordingly.

2.3.6. JCOMM-III adopted Recommendation 9 to modify the International Maritime Meteorological Tape (IMMT) format and Minimum Quality Control Standard. This recommendation specifies that amendments to the Manual on Marine Meteorological Services (WMO-No. 558) and the Guide to Marine Meteorological Services (WMO-No. 471) be adopted and that a new version of the IMMT (the primary format for the exchange of marine climatological data) and the Minimum Quality Control Standard be implemented for all data collected as of January 1, 2011. The Expert Team on Marine Climatology was requested to review the implementation and value of these changes and to provide technical assistance as required.

2.3.7. JCOMM-III adopted Recommendation 10 detailing amendments to the WMO Global Maritime Distress and Safety System (GMDSS) Marine Broadcast Systems and specifying that the Manual on Marine Meteorological Services, Volume I, Part I, be amended accordingly. This recommendation requests the Expert Team on Marine Safety Services to keep the implementation and user response under review and to develop proposals for amendments as necessary.

2.3.8. JCOMM-III adopted Recommendation 11 which provides new procedures, including a "fast-track" procedure, for making amendments to the WMO technical regulations including the *Manual on Marine Meteorological Services* (WMO No. 558) and the *Guide to Marine Meteorological Services* (WMO No. 471).

2.3.9. The Commission recognized that increased activity in Arctic and Antarctic regions by the marine community (including commercial, military and scientific) required maritime safety services in these regions, which consist of ice-infested waters. It therefore requested the ETSI to collaborate with ETMSS, under the overall direction of the EC-PORS, in implementing such services in Arctic and Antarctic METAREAs, and in proposing sea ice specifications for Maritime Safety Information to be disseminated via SafetyNET and international NAVTEX services, and included in the Annex VI of the WMO Technical Regulations (*Manual on Marine Meteorological Services* – WMO-No. 558).

2.3.10. The Commission expressed its appreciation to Members/Member States and the European Space Agency through the EarthWatch GMES Service Element *PolarView* project for their contributions to and participation in the Ice Logistics Portal Website (http://ipy-ice-portal.com/), which was developed in support of the International Polar Year (IPY) 2007/2008. The Commission urged Members/Member States to provide to the WMO Secretariat the appropriate metadata in order to ensure that this Portal is compliant with the WIS, and contributes to the Global Cryosphere Watch (GCW).

2.3.11. The Commission recognized the importance of the *Ice Analysts Workshops* in the coordination of sea ice services, including assessing differences between current practices of ice analysis and charting at National Ice Services and estimating accuracies of ice charts to meet both operational and climate needs. In this context, the Commission requested the ETSI to continue to co-sponsor and co-organize workshops in the future in order to enhance the capability of Members/Member States concerned to provide harmonized sea ice services and to understand sea ice historical variations. Recognizing the value of sea ice technical guidance material in ensuring the provision of high quality, accurate, consistent and timely sea ice services, the Commission also requested the ETSI to keep under review the relevant publications on formats and standards for sea ice information.

2.3.12. Noting that sea ice in situ and space-based data are crucial to both operational and climate applications, the Commission requested ETSI to keep under review requirements for sea ice observations and services.

2.3.13. The Commission noted the growing demand from the user community for integrated sea ice information products and to this end endorsed further development of the coupled sea ice – ocean – atmosphere numerical model approach being adopted by a number of Members/Member States. It requested the ETSI to closely cooperate with ETOOFS to further develop these numerical models, and sea ice forecasting and data assimilation techniques.

2.3.14. The Commission noted that the Global Digital Sea Ice Data Bank held 7 or 10-day period mapped ice data for the Arctic starting from March 1950 and for the Antarctic from January 1973, up to near the present for both regions. From the 1970s, GDSIDB ice charts could serve as ground-truth for SSM/I products (based on a comprehensive usage of all available sources of ice information and expert knowledge) or could form a unique source of ice conditions and climate for the pre-1978 period. In order to expand sea ice climatologies in collaboration with the ETMC and enhance the GDSIDB, the Commission encouraged Members/Member States to submit sea ice data to the GDSIDB and requested ETSI to review and provide guidance to them on the operation of the database.

2.3.15. The Commission noted the successful development, in accordance with IMO, IHO and the International Electrotechnical Commission (IEC) standards and specifications for Marine Information Objects (MIOs), of product specification for sea ice information in Electronic Navigation Chart Systems (ENC) and the preparation of an *Ice Objects Catalogue*, which was integrated into the IHO Registry of MIOs in May 2008 (see http://195.217.61.120/iho_registry/). Taking into account that this Catalogue would provide an essential tool to enable Members/Members States to develop products specifically for ENC and would allow the implementation of software to decode and display ice information by the manufacturers of these systems, using the S-57 (in the future in S-100) chart data exchange standard, the Commission encouraged Members/Members States to make maximum use of these essential tools.

Collaboration with the Expert Team on Marine Safety Services

2.3.16. Noting the remarks at JCOMM-III, and in the context of expanding Arctic shipping, it is important for the ETSI to recognize the important role it has in collaborating with the ETMSS with respect to the implementation of Marine Safety Information in the Arctic METAREAS. In particular, the ETSI has important responsibilities with respect to sea ice in:

- The implementation of maritime safety services in the Arctic and Antarctic regions and in particular the new Arctic METAREAs
- The implementation of the IMO/WMO Worldwide Met-ocean Information and Warning Service
- Amendments to the WMO technical regulations including the *Manual on Marine Meteorological Services* (WMO No. 558) and the *Guide to Marine Meteorological Services* (WMO No. 471).

International Ice Charting Working Group

2.3.17. During October 12-16, 2009, the Secretariat hosted the 10th meeting of the IICWG at WMO Headquarters in Geneva. As an advisory body to the ETSI, the IICWG-X was successful in validating a number of items that are before the ETSI 4th Session including:

- Sea ice information in Electronic Navigation Charts;
- Updates to SIGRID-3 formats; and
- The Ice Logistics Portal.

2.3.18. Dr. Valeri Martyschenko, Coordinator for METAREAs XX and XXI, intervened to thank all of the participants and acknowledge the good presentation by Mr. Cabrera. He stressed the success of joint actions including the activities of the IPY which will provide further success in both the Arctic and Antarctic. He noted that joint activities have great benefit that allow us to solve local and global problems and specifically identified the recent events in Chile as a concrete examples of joint action.

2.4. Reports of the Members of ETSI

2.4.1. The Chairman invited the ET members to presented their reports to the meeting. The full reports are attached as Appendix VIII.

Report by the Canada

2.4.1.1. Ms. Marie-France Gauthier presented the report from Canadian Ice Service (CIS). She informed the ET that the level of service being provided by the CIS has increased significantly because of increased demands from clients and an extending navigation season in the Arctic. She also noted that the CIS website is undergoing major changes to give it the same look and feel as the parent organization, the Meteorological Service of Environment Canada.

2.4.1.2. Ms. Gauthier told the meeting that the airborne ice reconnaissance program, which only a few years was almost extinct, had been rejuvenated through partnership with other Canadian programmes. Three aircraft routinely intermingle ice reconnaissance, marine pollution and security patrols over Canada's ice covered waters. As of June 2009, all of these aircraft were outfitted with a new Swedish Space Corporation MSS-6000 SLAR system.

2.4.1.3. The team was informed of the implementation of a new tool that will allow the automated identification of ice motion between sequential SAR images. ALOS PALSAR data has been acquired through the partnership with the NIC in the NAIS. It has been used in

operations for several months.

Report by Denmark

2.4.1.4. Mr. Keld Qvistgaard of the Greenland Ice Service of the Danish Meteorological Institute (DMI) presented the report to inform about the activities of the Greenland Ice Service. The main clients are commercial shippers and the Coast Guard who generally operate close to the coast and to the ice edge. He stressed that the environment in which these clients operate is very harsh, a situation that must always be kept in mind.

2.4.1.5. Mr. Qvistgaard informed the Expert Team that 2009 marked the 50th anniversary of the founding of the Greenland Ice Service. In commemoration a book on the history of the service has been published (in Danish only) and several events were held to celebrate the anniversary. In addition, DMI plans to digitize 50 years of historical ice charts and contribute these to the GDSIDB. This project is expected to be completed in 2011.

2.4.1.6. The Expert Team congratulated the Greenland Ice Service on its 50 years of history.

Report by Finland

2.4.1.7. The report by the Finnish Ice Service of the Finnish Meteorological Institute (FMI) was presented by Mr. Ari Seina. He noted that the volume of input data has increased significantly because of the Finnish Ice Service's participation in the GMES project MyOcean (Appendix IX).

2.4.1.8. In response to a question from the Team, Mr. Seina reported that there has been good progress in automated ice thickness classification in the Baltic Sea based on satellite SAR imagery, modeling and in situ observations. Products are provided operationally and are being improved continuously.

Report by Germany

2.4.1.9. The report by Germany was presented by Dr. Jürgen Holfort of the German Ice Service. He noted that they are having a problem with NAVTEX messages exceeding the maximum allowable length when ice conditions are difficult. This year, there ice is very extensive in the Baltic Sea, reaching Kattegat for the first time in many years.

2.4.1.10. The German Ice Service, in cooperation with the Deutscher Wetterdienst (DWD), is broadcasting 4 charts per day – a western Baltic ice chart, the Swedish ice chart, the iceberg charts from the International Ice Patrol or the CIS, and the Norwegian ice chart.

2.4.1.11. The German Ice Service collaborated in a description of ice conditions in the Baltic Sea between 1952-2005, which was published in the Monograph "State and Evolution of the Baltic Sea, 1952-2005" (ISBN 978-0471979685). The German ice charts are being digitized in cooperation with a high school - the students digitize the ice charts and are doing so very quickly and accurately. This data, which extends back to 1927, will be contributed to the GDSIDB.

2.4.1.12. Germany has a project to publish S-57 ice charts but there has been no demand for this product – mainly because there is no presentation library for the S-57 product. Additional funding to further this project is being sought.

2.4.1.13. The Ice Logistics Portal software has been transferred to the German Ice Service and a test version of the portal is up and running. Dynamic data is being updated 4 times a day. Static information has yet to be put into the system.

2.4.1.14. In the framework of Antarctic Treaty, Germany is responsible for licensing ships to travel into the Antarctic. At an Expert meeting of the Treaty organization, Dr. Holfort introduced the idea of establishing an Antarctic ice service. A paper will go forward to the Antarctic Treaty Consultative Meeting (ATCM) for consideration. PolarView currently produces a daily mosaic of SAR images that is the primary source of ice information for mariners. However, with PolarView funding being uncertain, the future of this activity is also in jeopardy. Mr. Seina (Finland) noted that the European Commission is now planning to cover the PolarView cost and the funding is secured for this activity to continue.

2.4.1.15. Dr. Holfort suggested that we need to add objects for climatological ice information in Ice Objects Catalogue. This information is important for some S-57 products.

Report from Japan

2.4.1.16. In the absence of a representative from the Japanese Meteorological Agency, the Chairman presented the report from the Japanese Ice Service. He informed the ET that the information has been incorporated into WMO Publication No 257 *Sea Ice Information Services in the World*.

Report from Norway

2.4.1.17. Mr. Nick Hughes of the Norwegian Ice Service (NIS) of the Norwegian Meteorological Service presented the report. He noted that the area of responsibility for the NIS is the entire Arctic Ocean north of Norway but that the NIS concentrates on waters around Svalbard. He also indicated that the NIS just started producing an ice chart for the Antarctic area of the Weddell Sea.

2.4.1.18. Mr. Hughes informed the ET that, under the European Ice Services (EIS) collaboration, NIS aims to develop a new ice charting platform combined with a database shared between all EIS partners. This is still in the initial stages of determining what software is available and could be adapted for the foundation of a new system.

2.4.1.19. Mr, Hughes noted that NIS has recently created a new research position with the ice service. This will allow a Forecast Modeller to work within the ice service, providing short- to medium-range forecasts of ice conditions. The position was advertised during February 2010 and the ice service intends to start development of forecast products later in 2010.

Report from Russian Federation

2.4.1.20. The report from the Arctic and Antarctic Research Institute of the Russian Federation was presented by Dr. Vasily Smolyanitsky. He noted that ice information is provided by AARI and also by PLANETA, the Russian Scientific Research Center for Space Hydrometeorology in Moscow, which complements the AARI charts with satellite-based route information. AARI provides ice charts in both Russian national symbology as well as the International Ice Symbology. Dr. Smolyanitsky informed the Expert Team that many of the products, including an extensive suite of short-term prognostic information for the Arctic Ocean, are available freely on Internet.

2.4.1.21. The ET noted that both Russia and Finland produce ice charts for the Gulf of Finland and asked whether any comparison of results had been done. It was proposed that it be a task of the ETSI to do an intercomparison of these charts in the intention of improving the quality of ice charts. Dr. Smolyanitsky replied that this is precisely the objective of the Ice Analysis workshop. The report from this last Ice Analysis workshop is in draft form only and the ET requested that Dr. Smolyanitsky finalize it as soon as possible **(Action: ETSI Chairperson).**

Report from the United States

2.4.1.22. The report by the National Ice Center (NIC) was presented by Ms. Caryn Panowicz. She informed the ET that the NIC has started producing a daily marginal ice zone edge in the southern hemisphere and that the NIC and the Natioanl Weather Service Ice Desk in Anchorage, Alaska are now alternating ice charts for the Beaufort Sea, Chukchi Sea, Bering Strait, and Cook Inlet so that charts for the areas are available 5 days a week. She also noted that the demand for tailored ice info support is increasing.

2.4.1.23. The NIC now imports shape files from the CIS to integrate directly into their global analysis. This has resulted in the saving of considerable resources.

2.4.1.24. Ms. Panowicz informed the Expert Team that the NIC is in the process of developing a COMET module for training about the products and services produced by the NIC. She indicated that the NIC has funding to develop a second ice training module and asked the ET members for their ideas on what is most needed.

2.4.1.25. Ms. Panowicz noted that, while the International Arctic Buoy Program continues to operate, it is in desperate need of resources – particularly to deploy buoys.

2.4.1.26. Ms. Panowicz closed by noting that the NIC is hosting the International Ice Charting Working Group in Washington in October 2010.

Report from Sweden

2.4.1.27. In the absence of a representative from Sweden, the Chairman presented the report. He informed the ET that the information has been incorporated into WMO Publication No 257 *Sea Ice Information Services in the World*.

2.4.1.28. The ET agreed that the chair of BSIM should provide reports on behalf of the small ice services around the Baltic Sea **(Action: BSIM Chairperson)**.

2.4.2. **Regional Reports**

Baltic Sea Ice Meeting

2.4.2.1. Dr. Jürgen Holfort, Chair of the BSIM, informed the ET that the last meeting of the BSIM was held in Helsinki in 2008 and the next meeting will be held in 2010 in Rostock. A decision was made, that in the future the BSIM chair will always be the head of the ice service where the next meeting will be held. The BSIM decided on several action items including the revision of documents, the provision of input to JCOMM and the ice analyst workshop. Some of the revised documents/information are now available at the BSIS web page (www.bsis-ice.de). Regarding standards, it was decided to revise the Baltic Ice code to include navigation information and discuss possible changes at the next meeting. On the operational basis, the daily exchange of ice information proceeds without complication. The website was overhauled

and now includes an overview composed off all actual available ice reports, a list of traffic restrictions and information on the icebreaker services.

2.4.2.2. Dr. Holfort noted that, for the smaller ice services, it is sometimes difficult to arrange participation at the BSIM and other meetings like the Ice Analysts Workshops. Sometimes it is a problem of time and personnel but cost is also a difficulty at times, as some ice services run on a very restricted budget. Special emphasis therefore was given to find mechanisms to facilitate meeting attendance in order to foster better collaboration.

2.4.2.3. Dr. Holfort also informed the ET thata Nomenclature in the Baltic languages is available on-line on the BSIS website (www.bsis-ice.de).

European Ice Services

2.4.2.4. Mr. Ari Seina presented the report on the European Ice Services (Appendix X) a cooperative venture by Denmark, Finland, Norway and Sweden. The Area of Responsibility (AOR) for the EIS is all waters of Europe including Greenland, which contain sea ice, and which are of operational interest to users.

2.4.2.5. He informed the Team that the concept of the EIS is to create a harmonized suite of products and services for ice information for the AOR to serve the needs of users for safety of navigation and informed decision-making. The virtually integrated service shall combine the strengths of the existing centres and result in seamless products of high quality and consistency – thus avoiding as much as possible duplication of work and ice information products. The objective of this cooperation in the field of basic ice service is to work together as a network, to help providing an ice service with a higher quality and better cost efficiency than the former level, providing better ways to distribute products and services, providing uninterrupted services in the case if the mission of one of the member's service has critical failure, improving the capacity to participate and contribute in an international infrastructure development, providing common opportunities for the participating Parties to benefit from the cooperation.

2.4.2.6. The EIS is governed by a Board that consists of one member from each participating country. The EIS chair is elected for a two year period. The first Chair was Helge Tangen, met.no in 2007-2009, and the second chair is Ari Seina, FMI for 2009-2011.

North American Ice Service

2.4.2.7. Ms. Marie-France Gauthier presented the report of the North American Ice Service (Annex D), a collaborative venture of the Canadian Ice Service, the National Ice Center and the International Ice Patrol. She noted that there has been an increased demand for products. A challenge for the NAIS will be the need to recruit and train staff because of staff turnover and increased demands.

2.4.2.8. All of the NAIS co-directors will be changing in 2010 due to promotions and transfers. Ms. Gauthier informed the ET that the success of the NAIS can be attributed to dedicated support by management and regular contact at the working level. The co-directors hold monthly teleconferences and the Operations Committee meets face-to-face twice a year and has regular intervening telecons.

International Ice Charting Working Group

2.4.2.9. The report of IICWG (Appendix XI) was presented by Mr. John Falkingham, as secretariat of the IICWG. Mr. Falkingham noted that the IICWG is an ad-hoc working group open to the ice charting nations of the world. It has been meeting approximately annually since 1999 to address issues of coordination of products and services among the ice charting services. It serves as an advisory body to the Expert Team on Sea Ice.

2.4.2.10. Mr. Falkingham explained the nature of the relationship between the IICWG and the ETSI by noting that the IICWG, as an ad-hoc body that exists solely by virtue of the continued participation of its members, has the advantage of being free from many of the encumbrances of a formal organization. It is able to establish and amend its own rules and can react quickly to circumstances as they arise. However, he noted that this is also a disadvantage in that there is little sense of permanency for the group and little infrastructure to support it. On the other hand, the ETSI must operate within the constraints of the JCOMM that create overhead and delays in action but that also give a stable infrastructure and a sense of permanence. The IICWG is best at undertaking rapid short term projects while the ETSI is better at maintaining standards, guidelines and regulations. IICWG and ETSI address many of the same topics but do so in a complementary manner with the IICWG often initiating and scoping projects, assessing feasibility and undertaking pilots while the ETSI finalizes results, implements decisions and maintains infrastructure. The two organizations work closely together by virtue of a large overlap in membership and complement one another effectively.

2.4.2.11. The meeting noted that there are a large number of providers of ice information in the context of new Arctic METAREAs. A fundamental principle of GMDSS is that marine safety information is delivered and it is the “Issuing Service” that is responsible for delivering a single set of information – even though the information can be produced by multiple preparation services. There should be a single point of entry for each METAREA. The ET noted that, for the Arctic METAREAS, Canada, Norway and the Russian Federation are the issuing services and therefore the single point of entry.

2.5. Provision of Marine Safety Information

2.5.1. Report of the Chairperson of the Expert Team on Marine Safety Services

The report of the ETMSS (Appendix XII) was presented by Nick Ashton on behalf of the chairperson of the ETMSS, Henri Savina.

2.5.1.1. The ET noted that the Expert Team on Maritime Safety Services (ETMSS) continues to assist Members/Member States in implementing met-ocean services in support of the international maritime navigation. ETMSS experts have participated in several International Maritime Organization (IMO) and International Hydrographic Organization (IHO) meetings to coordinate the expansion of the Global Maritime Distress and Safety System (GMDSS) into the Arctic waters and the revision of relevant regulatory publications and IMO Resolutions.

2.5.1.2. The ETSI was informed that ETMSS has reviewed the Manual on Marine Meteorological Services (WMO-No. 558) and the Guide to Marine Meteorological Services (WMO-No. 471) and proposed amendments for consideration by JCOMM-III. These documents are available at http://wdc.aari.ru/wmo/docs/.

2.5.1.3. Since 1999, ETMSS has been working on the implementation of graphical/numerical Maritime Safety Information (MSI) broadcast within the GMDSS. The imminent increase of ENC systems on SOLAS vessels as regulatory material and the emergence of the e-navigation concept within IMO should reinforce the priority given to this requirement and the need to find

appropriate resources to develop a suitable service. Both the ETMSS and ETSI have been working on this issue and ETSI has already developed the Sea Ice Objects Catalogue in accordance with IHO standards [see section 6 below]. The ETMSS has initiated the development of a catalogue on Met-Ocean Object Classes and Attributes, which would be an essential tool to enable NMHSs to develop products specifically for Electronic Navigation Chart Systems, allowing the implementation of software to decode and display met-ocean information by the manufacturers of these systems, using the S-57 and S-100 chart data exchange standards.

2.5.1.4. The ET noted that JCOMM-III modified the Terms of Reference of the ETMSS to bring all operational activities related to marine pollution (MPERSS) and SAR activities under the umbrella of ETMSS. In accordance with the ToRs, the ETMSS liaises with and gathers input from other SFSPA teams, ETSI, ETWS and ETOOFS, on all aspects of sea ice, sea state, storm surge and ocean circulation relevant to the operation and improvement of maritime safety services and maritime accident emergency support.

2.5.1.5. The ET was informed that JCOMM-III endorsed the priority activities for the next intersessional period for ETMSS, which include, the following that are directly related to ETSI:

- Keep under review the implementation of the GMDSS and MPERSS in the Arctic and continue to support the Issuing Services and AMOCs, to reach the expected target in 2011 for the GMDSS;
- In association with ETWS and ETSI, develop guidelines and recommendations to update WMO-Nos. 471 and 558, especially for the provision of sea state and sea ice in MSI;
- Continue to develop the catalogue on Met-Ocean Object Classes and Attributes to define standards for ENC and e-Navigation, in collaboration with ETSI and guidance from IMO and IHO;

2.5.1.6. The priority is clearly to make sure that the component of GMDSS met-ocean MSI for the arctic METAREAs, including the provision of sea ice information, will be operational at the end of 2010 or the very beginning of 2011, for IMO, IHO and WMO to be able to officially declare this system fully operational in 2011. In the mean time, it is a good opportunity to update as necessary the WMO-Nos. 471 and 558 for the provision of sea ice in MSI in text form (for GMDSS, bullets b and f of paragraph 7 doc. 2.5.5). The aim is to ensure that those documents are consistent with the practises put in place for the GMDSS, and that similar type of information will be provided to SOLAS vessels throughout the Arctic (for navigable waters).

2.5.1.7. The ETMSS report identified the need for strong support from ETSI to continue to develop the catalogue on Met-Ocean Object Classes and Attributes to define standards for ENC and e-Navigation. The experience of ETSI experts in this field and the links they have built with relevant IHO group(s) will be very helpful. A focal point could be identified to work with ETMSS on this topic **(Action: ETSI Chairperson)**.

2.5.1.8. Mr. Ashton suggested that it would be appropriate to add on the GMDSS website (http://weather.gmdss.org), either sea ice graphical/numerical safety products or appropriate links with other portals providing such information, such as the IPY Ice Logistics Portal (http://ipy-ice-portal.com/). The ET discussed this suggestion and recommended that the full set of ice information should be available on the Ice Logistics Portal and a link made from the GMDSS website to the Ice Logistics Portal. It was further suggested that the sea ice information on the Ice Logistics Portal be selectable by METAREA in addition to being selectable by

geographic area (as at present) **(Action: Jürgen Holfort)**. The SFSPA Coordinator noted that the SFSPA Workplan projects 19 and 20 relate very closely to this initiative. The ET agreed that, from the user's perspective, it would be best to have weather and ice information available in a single integrated fashion but, as a first step, having links from the Ice Logistics Portal to the GMDSS website and vice-versa would be valuable **(Action: Jürgen Holfort)**. There is also a need to define what ice information constitutes Marine Safety Information (MSI). We would have to be careful to ensure that this boundary is respected.

2.5.1.9. The ETSI Chairperson asked ETSI members to review the Terms of Reference of the ETSI and those of the ETMSS to ensure that they provide for appropriate interaction between the Expert Teams. In particular, there should be no duplication in the responsibility for maintenance of the standards **(Action: ETSI Members)**.

2.5.2. Report of the Chairperson of the Joint IMO/IHO/WMO Correspondence Group on MSI services.

2.5.2.1. Mr. Nick Ashton presented the report of the Joint IMO/IHO/WMO Correspondence Group on MSI services. Mr. Ashton informed the ET that, at its tenth session (6-10 March 2006), the COMSAR Sub-Committee of IMO agreed to establish this CG on MSI services and specifically the introduction of new services in the Arctic Region. This Correspondence Group has been re-established by subsequent Sub Committee sessions and at its thirteenth session (19-23 January 2009), the Sub-Committee noted the report of the Joint IMO/IHO/WMO Correspondence Group (CG) on Arctic MSI Services and considered that it would be necessary to continue with the work of the CG until such time that the new NAVAREA/METAREA services were operational. The CG was chaired by Mr. Peter Doherty (IHO).

2.5.2.2. The JCOMM Expert Team on Maritime Safety Services has been active in this joint IMO/IHO/WMO Correspondence Group in ensuring that all relevant issues for the METAREA Issuing Services are properly addressed.

2.5.2.3. The Joint IMO/IHO/WMO Correspondence Group on Arctic MSI Services was tasked with giving consideration and providing comments and recommendations relating to:

- monitoring the testing of Arctic NAVAREAs/METAREAs including status, infrastructure, monitoring of messages and relationships with information providers (i.e., International Ice Patrol, METAREA Issuing Authorities, Search and Rescue Authorities, National Administrations and other NAVAREA Coordinators);
- facilitate the coordination of transmissions on the NAVTEX frequencies of 518 kHz, 490 kHz and 4209.5 kHz through the NAVTEX Coordinating Panel;
- facilitate the coordination of transmissions of SafetyNET messages through the International SafetyNET Panel, including identification of prospective Service Providers;
- determine NAVAREA/METAREA overlap zone limits in the use of rectangular
- area addressing for SafetyNET;
- develop Arctic NAVAREA/METAREA/NAVTEX coverage diagram including
- service areas and times of transmissions;
- monitor Inmarsat's progress on updating the System Definition Manual; and
- monitor the status of training, assistance and support to achieve operational
- capability of Arctic MSI services.

2.5.2.4. Mr. Ashton reviewed the progress to date of the CG:

- Canada's NAVAREA XVII and XVIII facility will be operated by the Canadian Coast Guard. Canada will begin its Initial Operational Capability (IOC) testing in January 2010 via transmission of NAVAREA warnings through the POR and AOR-W satellites utilizing the approved broadcast schedule timeframe listed below. Canadian METAREA service preparations are continuing on an appropriate pace to reach testing status by May 2010. Specifications have been developed for upload services in order to establish a contract with an upload service provider, and the equipment required to monitor the METAREA messages has been identified. Monitoring of the three INMARSAT-C satellites (POR, AOR-W and AOR-E) will be routed to a central location for monitoring purposes.
- Norway's NAVAREA XIX facility will be operated by the Norwegian Coastal Administration (NCA). Norway began its IOC testing in January 2010 via transmission of NAVAREA warnings through the AOR-E satellite utilizing the approved broadcast schedule. Norway's METAREA services will be provided by the Norwegian Meteorological Institute (met.no). Met.no is coordinated with the Norwegian Coastal Administration (NCA) in the planning towards operational capability in 2011. To date, there has been no testing of messages for METAREA XIX; however the checking of range for the HF NBDP signals is ongoing (Coast Guard and Telenor Maritime Radio). In addition, a contact has been established with UK Met Office to help with training and advice.
- Both Canada and Norway have now been issued with SafetyNet Broadcast certificates by the International SafetyNet Panel.
- The Russian Federation's NAVAREA XX and XXI facility is located at the State Hydrographic Department Ministry of Transport of the Russian Federation. The Russian Federation was issued a Certificate of Authorization for SafetyNET services in 2000 and has been providing transmission of NAVAREA warnings through the IOR and POR satellites, utilizing the approved broadcast schedule. Russian Federation METAREAs services are coordinated by the Arctic and Antarctic Research Institute of Roshydromet.

2.5.2.5. The use of rectangular addressing for the Arctic NAVAREAs/METAREAs was approved at COMSAR 13 and the CG has established overlap zones between the new Arctic NAVAREAs/METAREAs, in order to ensure that ships receive relevant information prior to arrival in a NAVAREA/METAREA. It was agreed that an overlap zone of approximately 300 miles would be used, as appropriate. The CG worked with the IHO WWNWS, the IMO SafetyNET Panel and Inmarsat to determine the necessary overlap zones for each of the Arctic NAVAREAs/METAREAs which have subsequently been agreed by all parties.

2.5.2.6. Linked to this, Inmarsat is preparing a Change Proposal (CP) for the Inmarsat-C System Definition Manual (SDM). This is a technical requirement's document for the Mobile Earth Station manufacturers and will contain a revised EGC SafetyNET matrix showing boundaries of all NAVAREAs/METAREAs to be implemented in the firmware of Inmarsat-C and mini-C maritime terminals which support the EGC SafetyNET function. Updated firmware should be available in mid 2010 following relevant changes in the SDM and ships navigating in the Arctic with updated firmware will then be able to receive MSI addressed to these areas automatically.

2.5.2.7. With respect to the implementation of Arctic MSI areas, the aim of "Full Operational Status" being declared at COMSAR 15 in 2011 was declared by the CG (this session is

provisionally scheduled for March 2011). The CG, supported by the IHO WWNWS, considers this event to be a significant milestone in the delivery of MSI worldwide, and is worthy of major IMO, IHO and WMO celebration. WMO Secretariat has been advised of this, with a view that it may be considered appropriate for the Secretary-General to attend such an event.

2.5.2.8. In addition to the assistance provided by the Joint IMO/IHO/WMO Correspondence Group on Arctic MSI services to the Arctic NAVAREA coordinators and METAREA Issuing Services in developing their operating plans for the implementation of the GMDSS in the Arctic areas, focal points for METAREAs I (UK Met Office), II (Météo-France) and IV (NOAA/NWS) also agreed to provide assistance. The forthcoming MSS Workshop scheduled for May 2010 (Melbourne, Australia) and the ETMSS-III in autumn 2010 will offer the opportunity for additional discussions and the finalising of implementation plans.

2.5.2.9. A map showing the delimitation of Arctic NAVAREAs/METAREAs is at Annex E.

2.5.2.10. The ETSI chairperson asked about the situation in the Antarctic with respect to NAVAREAs and METAREAs. The Team discussed this and was advised that, apart from tourism and research vessels, there seems to be little demand for additional ice information. There is information provided currently by several countries. At a recent Antarctic Treaty Consultative Meeting (ATCM) to discuss the issue of Antarctic tourism, which Dr. Holfort attended, the need and availability of ice information was discussed but no clear decision or direction was taken. It was agreed by the ET that a summary of ice information available in the Antarctic should be prepared and made available to the METAREA coordinators responsible for the Southern Ocean METAREAs **(Action: Caryn Panowicz)** and, as a follow on activity, this summary could be used as a starting point to consider whether the level of ice information services is adequate or should be improved along with the appropriate mechanism for doing so.

2.5.2.11. Dr. Valeri Martychenko, pointed out some disagreement with the map of NAVAREAs/METAREAs in the Antarctic region. The division of responsibility for information around Antarctica is the responsibility of the Antarctic Treaty Secretariat and they must approve this. The ET verified that the map agrees with the descriptions of the METAREAs provided on the METAREA website.

2.5.3. Intentionally Blank

2.5.4. Mandatory Sea Ice Information for Marine Safety Information

2.5.4.1. The Chairperson introduced three documents relevant to the discussion of this item:

- "Excerpt of the IHO S-53 Appendix 1 with references to 'Sea Ice'" (Appendix XIII);
- "Ice Information Services: Socio-Economic Benefits and Earth Observation Requirements" as a valuable reference for information on user requirements (available at http://nsidc.org/noaa/iicwg/pdf/IICWG_SE_2007_Update_Final_.pdf); and,
- The Russian Federation warning criteria for the Arctic and South Oceans and offshore (250 km) areas in Appendix XIV.

2.5.4.2. The ET discussed the list of parameters in Russian warning criteria and noted that they include several non-ice parameters. It was agreed that, at this stage at least, ETSI should focus on sea ice and icebergs.

2.5.4.3. After considerable discussion of the pros and cons, including verbal descriptions of

the current practice by several countries, it was agreed by the Expert Team that the ***"ice edge" is the primary warning information and is the only information that the ice services will consider mandatory*** to provide in the context of GMDSS. Beyond this level of information, each individual ice service can decide what to provide depending on its own unique circumstances.

2.5.4.4. The discussion of the Team turned to the definition of "ice edge". Mr. Keld Qvistgaard (Denmark) informed the Team of a survey of practical use of ice terminology that he had conducted which indicates that there are varying definitions for "ice edge" in practical use at the present time. It was agreed that, for Marine Safety Information, it is essential to use a single common definition of "ice edge". Further discussion on this definition was deferred to Item 2.6.

2.5.4.5. The level of detail, i.e. the spatial resolution that must be provided on the ice edge, was discussed by the Team. It was noted that there is a restriction on GMDSS bandwidth and so the ET agreed to ***limit the delineation of the ice edge to a maximm of 10 points per sub-area*** **(Action: ETSI Chairperson)**.

2.5.4.6. MSI are received automatically onboard depending on the ship's position which implies that Issuing Services must broadcast MSI for navigable waters assuming that ships may be operating there.

2.5.4.7. It was also agreed that sea ice Marine Safety Information must include information on bergy waters but this discussion was tabled for later in the meeting.

2.5.5. Updates to Guidelines for Sea Ice Marine Safety Information (MSI) in WMO Manuals and Guides

2.5.5.1. The ET recalled that JCOMM-II (September 2005) adopted Recommendation 8 that the Manual on Marine Meteorological Services (WMO-No. 558) Volume 1, Part I, Section 4 "Provision of Information by Radio-Facsimile", item 4.2.9 "Model SI – sea-ice information – charts" be amended as to read: The "International System of Sea-Ice Symbols (WMO-No. 259, Volume III) and the "Ice chart colour code standard" (WMO/TD-No. 1214) should be used. Sea-ice climatological information should be provided using SIGRID gridded and vector archive formats for sea ice charts (WMO-No. 716, WMO-No. 792, WMO/TD-No. 1214)".

2.5.5.2. Further to this, the ET was informed that JCOMM-III (November 2009) adopted Recommendation 8.3/1 to establish an IMO/WMO World-Wide Met-Ocean Information and Warning Service (WWMIWS). The recommendation contains a guidance document for the WWMIWS and states that the Manual on Marine Meteorological Services (WMO-No. 558), Volume I, Part I be amended accordingly. The guidance document (Appendix III) indicates in items 4.2.2.1 and 4.2.3.1 that "Services for the High Seas ... shall consist of ... synopses [containing, in part] Ice conditions, where applicable (concise description of sea ice: position of ice edge, total concentration, stages of ice development, etc.)." The similar amendments are indicated for Section 4.3 Services for the Coastal and Offshore Areas.

2.5.5.3. In addition, the ET noted that Recommendation 12/2 adopted by JCOMM-III (Appendix IV) proposes concurrent amendments to the Manual on Marine Meteorological Services (WMO-No. 558), Part I-bis, "WMO GMDSS Marine Broadcast System", Section 2.2 Procedures, referencing "ice conditions, where applicable (concise description of sea ice: position of ice edge, total concentration, stages of ice development, etc.)" in items 2.2.4.7 (subsection Warnings) , 2.2.5.4 (subsection Synopses) and 2.2.6.1 (subsection Forecasts).

2.5.5.4. It was noted that several countries transmit ice charts by radiofax as an additional information service. It was agreed by the Team that the details of what is available should be included in WMO No.9 Volume D **(Action: ETSI Chairperson, Members)**. The following types of information may be available to users as part of this additional service if transmission is not restricted to HF fax:

- routine ice charts with daily – weekly periodicity, providing regional recommendations (graphic HFax product);
- routine and customized ice charts with various complexity, scale and periodicity (hours - 7 days), providing tactical and regional recommendations (binary SIGRID-3/JPEG/S-57/etc product);
- high-resolution annotated satellite imagery, commonly providing tactical recommendations to the masters (1 hour – 1 day) (binary product);
- prognostic (hours - 7 days) ice charts for ice parameters critical for safety and success of navigation (binary product);
- supplementary synoptic and prognostic (hours - 7 days) meteorological charts or grids (binary or textual products);
- medium to long-term ice and meteorological phenomena forecasts with a lead-time of more than 7 days (commonly based on empirical models) (mostly textual products).

2.5.5.5. The Expert Team recalled that it had previously adopted a recommendation (ETSI-III, 2007) to the NAVTEX manual that sea ice information should be issued in plain language. However, recognizing the need for brevity and clarity for marine communications, JCOMM-II noted (Recommendation 9/1) that external factors [related to communications] so that abbreviations are often necessary to fit the essential information into the time available. A list of common abbreviations for NAVTEX has been recommended (Appendix XV) but the ET noted that this list does not include specific terms related to sea ice.

2.5.5.6. In the course of reviewing the use of NAVTEX for sea ice information, Swedish Ice Services have made some amendments to the abbreviations related to sea ice for use in NAVTEX and recommended that these abbreviations be adopted by the ETSI passed to the ETMSS for incorporation into the list of common NAVTEX abbreviations. In discussion, the ET noted that there could be confusion between these abbreviations and the common abbreviations. One of the possible inconsistencies pointed out could be in the Baltic Sea were ice thickness in cm is routinely provided. This could be confused with concentration numbers. ET should review the consistency of the abbreviation list and provide comments to the Chair of the BSIM **(Action: ETSI Members)**. Chair of BSIM to produce final draft list for approval by the ET intersessionally **(Action: BSIM Chairperson)**. In addition, the ETMSS expert noted that, in addition to the abbreviations, there should be an agreement on a standard format for the NAVTEX ice bulletins**(Action: BSIM Chairperson, ETSI Members, ETSI Chairperson)**.

2.5.5.7. At JCOMM-III, a new Guidance Document was approved for the IMO/WMO World-Wide Met-Ocean Information and Warning Service (Appendix XVI). In this document, it is assumed to cover all METAREAs, it:

- a) defines only MSI; and,
- b) relies on NAVTEX/SafetyNet broadcast systems which do not presently support graphical, mostly binary, sea ice informational products.

2.5.5.8. The ET reviewed this document and agreed that it is consistent with the views of the ETSI members with respect to the provision of ice information. However, the Team also noted that the Guidance Document is deficient in describing ocean products for the Polar Regions. The ET agreed that it will provide information to describe other information that may be available (such as binary products). The document should also provide a reference to WMO No, 574 – Sea Ice Information Services in the World **(Action: ETSI Members, ETSI Chairperson)**.

2.5.6. Progress Reports of the METAREA Coordinators

Progress Report from the Coordinator of METAREAs XVII and XVIII (Canada)

2.5.6.1. The Team reviewed the document prepared by Mr. Dave Wartman (Appendix XVII) and presented by Ms. Gauthier noting that in December 2007, Canada accepted official recognition as the Issuing Service for marine weather forecasts and warnings for MetAreas XVII and XVIII as part of the Global Maritime Distress and Safety System (GMDSS). Canada (Canadian Coast Guard) is the Issuing (and preparation) Service for Associated NavAreas XVII and XVIII. Norway is recognized as the Issuing Service for MetArea XIX and Russia for MetAreas XX and XXI.

2.5.6.2. Ms. Gauthier noted that Arctic METAREAs are dynamic – a decreasing ice cover will lead to increasing demand for weather and ice information, both temporally and spatially. Canada's approach will be to start with existing products and increase products and services in association with increasing needs. It is anticipated that in first several years, the broadcast service for weather and ice information will essentially be seasonal with "null" bulletins being issued during the winter months.

2.5.6.3. At the present time, Canada is working with assistance from METArea Coordinator Henri Savina. Preparations continue with the target of being in testing status by May 2010. Product preparation and development is underway and internal testing began in the Fall of 2009. Acquisition of INMARSAT-C receivers is in process and work on a service contract for upload to begin soon. Installation of equipment is planned for Spring 2010.

2.5.6.4. The broadcast of METArea information beyond 75N will be through the Canadian NAVArea issuing service, the Canadian Coast Guard. Arrangements for monitoring of METArea information has begun with the acquisition of equipment. Facilitation of the coordination of transmissions for SafetyNET and NAVTEX with International Panels is occurring. A Certificate of Authorization to Participate as an Information Provider in the International SafetyNET Service has been issued from IMO. NAVArea, METArea, and NAVTEX coverage diagrams, including service areas and times of transmission are being developed as products and transmission times are being negotiated.

2.5.6.5. Initial discussions with the United States as a Preparation Service have taken place and it is expected that further conversations with American colleagues and discussions with Danish colleagues, as Preparation Services, will occur over next few months. Discussions with Norway and Russia, for coordination and consistency across METArea boundaries, is being planned…possibly at a GMDSS meeting in Melbourne in late April however it is hoped that some planning will take place prior to this.

2.5.6.6. Sea ice information will consist of NAVTEX bulletins describing the ice edge. An overlap of 300 NM is planned between adjacent METAREAs.

Progress Report from the Coordinator of METAREA XIX (Norway)

2.5.6.7. Nick Hughes (met.no) presented the report on bahalf of Helge Tangen, the coordinator for METAREA XIX. In 2007, Norway accepted official recognition as the Issuing Service for marine weather forecasts and warnings for METAREA XIX as part of the Global Maritime Distress and Safety System (GMDSS). Norwegian Coastal Administration (NAC) is the Issuing (and preparation) Service for Associated NAVAREA XIX. Canada is recognized as the Issuing Service for METAREAs XVII and XVIII and Russia for METAREAs XX and XXI.

2.5.6.8. Mr. Hughes noted that Arctic METAREAs are dynamic – a decreasing ice cover will lead to increasing demand for weather and ice information, both temporally and spatially. Norway's approach will be to start with weather information for ice free areas and information on the ice edge.

2.5.6.9. The broadcast of METAREA information beyond 76N will be through Telenor Maritime Radio, responsible for Norwegian Coastal Radio. An agreement between Telenor Maritime Radio, NAC and met.no is signed. Transmission via HF-NBDP (Narrow Band Direct Printing) is tested and will be the broadcasting system N of N76. A Certificate of Authorization to participate as an Information Provider in the International SafetyNET Service has been issued to met.no from IMO.

2.5.6.10. NAC and met.no are both preparing for testing periods. Today's HF NBDP will not cover properly the northernmost areas (N of approx. 81N). The agreement mentioned in Paragraph 4 includes enhancement of broadcast system, and will be ready by Oct 1, 2010. NAVAREA, METAREA, and NAVTEX coverage diagrams, including service areas and times of transmission are being developed as products and transmission times are negotiated.

2.5.6.11. Sea ice information will consist of NAVTEX bulletins describing the ice edge. An overlap of 300 NM is planned between adjacent METAREAs, except between METAREAS XVIII and XIX; because this area is not navigable.

2.5.6.12. It was clarified for the Team that information will be broadcast north of 75N by HF radio from Canada and Norway. The mechanism for transmission from Russia is uncertain at this time. A new satellite communication system in highly elliptical orbits, Arktik, is planned for the future – projected to be operational in 2012.

Progress Report from the Coordinator of METAREAs XX and XXI (Russian Federation)

2.5.6.13. Dr. Valeri Martyschenko, the coordinator for METAREAs XX and XXI presented the report (Appendix XVIII) noting that, in 2007, Russia accepted official recognition as the Issuing Service for marine weather forecasts and warnings for METAREAs XX and XXI as part of the Global Maritime Distress and Safety System (GMDSS). Russia (Federal Agency of Marine and River Transport) is the Issuing (and preparation) Service for Associated NAVAREAs XX and XXI. Canada is recognized as the Issuing Service for METAREAs XVII and XVIII and Norway is recognized as the Issuing Service for MetArea XIX.

2.5.6.14. It should be noted that Arctic METAREAs are characterized by the ice cover occurrence during the whole year which is the serious obstacle for navigation and a factor of risk. The Russian approach is that the sufficient safety level can be reached only with individual (customer-oriented) support with provision of detailed ice information, but the goal of the GMDSS ice information circular transmission is to warn on the ice with definite characteristics in

a certain area to prevent incidental entry of vessels into this area.

2.5.6.15. Plain language sea ice information will consist of NAVTEX and SafetyNET bulletins describing the ice edge and concise description of sea ice conditions. An overlap of 300 nautical miles between adjacent METAREAs will be taken into account in the future plans. NAVAREA, METAREA, and NAVTEX coverage diagrams, including service areas and times of transmission are being developed as products and transmission times are negotiated.

2.5.6.16. The broadcast of METAREA information beyond 76N is the problem which is currently being resolved. At the moment INMARSAT-C is used to transmit the information on the safety of navigation to the ships in the Western and Eastern zones of the Northern Sea Route.

2.5.6.17. Dr. Martyschenko's presentation included information on the provision of sea ice information within the SafetyNet system for certain areas of the Northern Sea Route. He noted that the minimum ice information issued under the GMDSS does not assure the safety of ship navigating through ice. In the case of the ship entering ice-covered areas, special information is provided, including satellite images, detailed ice charts and forecasts. This additional ice information is superimposed on the navigation chart in the Electronic Navigation Chart system. The information production is based on the complex analysis of data from NOAA, TERRA , AQUA, RADARSAT and ENVISAT satellites. He noted that AARI is planning to install a ground station in Barentsburg, Spitsbergen to obtain complete coverage of the Arctic Ocean.

2.5.6.18. The ET recognized that there are a number of questions that must be resolved before the implementation of the operational service in 2011, including:

- Definition of ice edge – Canada recommended that the METNAV bulletins use 10% ice concentration as the ice edge with a disclaimer that there may be trace ice and bergs outside the ice edge. However, this is inconsistent with current Russian practice **(Action: Keld Qvistgaard)**.
- Ice edge reconciliation – there must be continuity of the ice edge from one METAREA to the adjacent METAREA in addition to consistency of information in the agreed 300 nm overlap area. Dr, Martyschenko proposed that information be exchanged between the METAREAs one hour before it is transmitted to users to allow for this coordination **(Action: ETSI Chair)**.
- Disclaimer - Concern was expressed that the more detailed local ice information may be missed or ignored in favour of the METNAV bulletin. It is proposed that all the METNAV area bulletins take a common approach to providing a Disclaimer such as "For detailed local ice information go to…." A**greed**

2.5.6.19. The Expert Team noted that cross-area coordination and consistency must be discussed among the coordinators as soon as possible. It proposed that Canada, Norway and Russia prepare and exchange sample bulletins for a single day as a means of verifying the formats and coordination of information at the boundaries **(Action: ETSI Members for Denmark, Canada, Norway and Russia)**. The ET also recognized that the broadcast times for MSI in the Arctic METAREAs must be clarified and staggered so each Issuing Service can properly follow the previous. It recommended that the 3 Issuing Services meet together for joint training / back-up plan discussion at the UK Met office. UK Met Office has offered to provide some expertise based on their experience with METAREA I.

2.5.6.20. The ET also discussed the need for on-going training in the interest of continuous

improvement of Arctic METAREA sea ice information. In this context, the use of the Ice Analysts Workshop and the IICWG as regular venues for such on-going training was proposed.

2.5.7. Coordination of Sea Ice MSI Provision and Implementation of the Arctic GMDSS

2.5.7.1. The ET was informed that the U.S. NOAA (coordinator Mr. Timothy Rulon) maintains a world-wide schedule of radiofax transmissions on the Internet at http://www.nws.noaa.gov/om/marine/rfax.pdf. The experience of AARI is that meteorological charts broadcast from Canada and Germany can be received very well in the high Arctic.

2.6. WMO Sea Ice Publications and Documents

2.6.1. Harmonizing Sea Ice Nomenclature, SIGRID-3 and the ENC Ice Objects Catalogue

2.6.1.1. Marie-France Gauthier introduced the documents for this discussion. She reminded the ET that at the 3rd Session of the Expert Team on Sea Ice in March 2007, Mr. John Falkingham (Canada) presented a report on additional recommendations for changes to ice coding and mapping standards, including to SIGRID-3 and the Sea Ice Nomenclature and Symbology intended to resolve internal inconsistencies in the standards or between standards. ETSI had agreed to discuss these recommendations during the intersessional period by email and/or teleconference and had invited Mr.Falkingham to coordinate these actions and act as the leader. The Team recommended that after the approval, these definitions should be available in English, French, Russian and Spanish **(Action: ETSI Members for Argentina, Canada, Russia, ETSI Chairperson)**.

2.6.1.2. The Expert Team reviewed and discussed each of the proposals individually with the following results:

- LACICE –the proposal was accepted with the exception that the document will not be re-named. The ET recognized that, even though the title may not be exactly correct, it has long standing recognition and renaming it would cause confusion.
- BRGARE – the proposal was accepted.
- ICEBERG – the proposal was accepted with the addition to add words to 4.3.7.6 add “This is also referred to as a twinned iceberg” as recommended in a previous message from Argentina.
- ICEKEL – there is a problem with distinction from the Baltic symbol for Jammed Brash Barrier. Therefore, this proposal was not approved and the ET invited other proposals for an ICEKEL symbol in future if necessary. It was noted that this is not a symbol in general use and there is no apparent urgency to include it.
- ICEFRA – the proposal was accepted.
- ICEACT – the proposal was accepted.
- ICEAPC – the proposal was accepted.
- ICESOD – the proposal was accepted with the exceptions that no additional term for Windrow will be added. Rather, the definition for Jammed Brash Barrier will be amended to include the expression “… This is also known as a Windrow in the Baltic Sea.”
- ICELSO – the proposal was accepted.
- ICEFLZ – the proposal was accepted.

- ICEFLZ – the proposal was accepted.
- ICEMLT – the proposal was accepted.

The accepted proposals are summarized in Annex F.

2.6.1.3. It was noted by the ET that the removal of the Code 00 from the tables results in an inconsistent set of codes being used for Ice Free across the tables. The Team asked that this be reviewed to determine if a single consistent code number could be applied to Ice Free across all of the Tables **(Action: John Falkingham)**.

2.6.1.4. The ET was informed that the ENC Ice Objects Catalogue Version 4.1 (DRAFT) as presented incorporated all of the proposals that were made above. Since some of these proposals were amended or not approved, the Draft of the Catalogue Version 4.1 must be revised to reflect the decisions of the ET **(Action: John Falkingham)**.

2.6.2. **Sea Ice Nomenclature and Illustrated Glossary**

2.6.2.1. The Chairman introduced this agenda item by noting that the WMO publication No. 259 "Sea Ice Nomenclature" is a top level WMO sea-ice standard. The first complete version was published in 1970 with several later revisions through 1989 and includes 3 volumes:

- Volume 1 – Terminology and Codes
- Volume II – Illustrated Glossary
- Volume III – International System of Sea-Ice Symbols

2.6.2.2. Dr. Smolyanitsky informed the ET that the current Volume I contains 193 terms and definitions. Following ETSI-II recommendations, Volume I was translated by the AARI expert into an electronic form in 4 four WMO languages (English, French, Russian and Spanish). The storage format is a MySQL database in UTF-8 coding with backup as a master .CSV-format file also in UTF-8 coding with the following 9 fields: wmo_id, wmo_name_en, wmo_def_en, …., wmo_name_es, wmo_def_es. This MySQL terminology database is presently hosted by the AARI GDSIDB center and supervised by the ETSI chair. During 2009, an interface to the database was rewritten in PHP-language and is now available as http://www.aari.ru/gdsidb/XML/wmo_259.php. The PHP-interface provides the ability of a) including all possible combinations of English, French, Russian and Spanish; b) sorting by subject and alphabet; and, c) searching for output as .html which maybe further converted to .pdf. Changes to the terminology database are made by local editing of the master .CSV file with subsequent update to the MySQL database. It is proposed to follow this approach during the next intersessional period to incorporate agreed amendments. The Chairperson of the ETSI proposed to follow this practice of amending the Sea Ice Nomenclature electronically and in all languages as soon as possible after approval by the ETSI. The ET approved this proposal.

Sea ice nomenclature for the Baltic Sea

2.6.2.3. Following recommendations from BSIM-23, the ETSI chair received documents containing sea-ice terminology and an illustrated glossary for winter navigation in the Baltic Sea in English, Finnish, Swedish, Estonian, Russian and Polish languages. The purpose of these documents is to promote winter navigation in the Baltic Sea by providing seafarers with a common sea ice nomenclature for communication. Documents were prepared in additional languages in accordance with the WMO Sea Ice Nomenclature (WMO, 1989) and are based on an English-Finnish-Swedish glossary published by the Finnish Institute of Marine Research in

2001 (Seinä et al., 2001) and corresponding publications in Estonia, Poland and Russia.

2.6.2.4. The Chairman informed the ET that the current Baltic version contains 85 terms and definitions in English, Finnish, Swedish, Estonian, Russian and Polish languages. It is anticipated that terms and definitions in remaining BSIS languages will be also provided to ETSI chair. He proposed to incorporate these Baltic Sea ice terms into the WMO Sea Ice Nomenclature as a supplement to ensure consistency of terminology. If there are contradictions between the Baltic Sea ice terms and the WMO Sea Ice, they should be referred to the ETSI members for resolution. The ET agreed with this proposal **(Action: ETSI Chair, BAS)**.

New Additions to the Sea Ice Nomenclature

2.6.2.5. The Chairman reminded the meeting of the discussion at the 3rd Session of the Expert Team on Sea Ice in March 2007 (Ref: Meeting Summary Paragraph 2.8.1.2), in which the Expert Team had "agreed to also consider under this discussion the "frost flowers" term (proposed by United Kingdom) and additional terms posted on the ASPeCt web site. The Team had recommended that after approval, these definitions should be available in English, French, Russian and Spanish."

2.6.2.6. The Secretariat corresponded with the experts in the Antarctic Sea Ice Processes and Climate (ASPeCt) Scientific Steering Group (SSG) to arrive at the definitions proposed in Annex F. The ET reviewed these proposed definitions and approved the resulting amendments to the WMO Sea Ice Nomenclature.

2.6.2.7. The Chairperson introduced a discussion paper prepared by the AARI describing several proposed additions to the Sea Ice Nomenclature to ensure consistency with extensions to the "Ice Objects Catalogue". The Expert Team reviewed and discussed these proposed additions individually with the following results:

- Residual Ice - the proposal was accepted.
- Snow Cover Concentration - the proposal was accepted.
- Ice Rafting Concentration - the proposal was accepted.
- Ice Ridge Concentration – the proposal was accepted.
- Fractures Concentration – the proposal was accepted.
- Dirty Ice and Contamination - there was considerable discussion about these terms with the point being made that it is difficult to determine the concentration without a notion of the severity of the dirt in the ice. The ET agreed to adopt the definition for the term "Dirty Ice" but not the definition for Contamination.
- Hillocky Multi-Year Ice and Concentration of Hills - there was a significant discussion over the these terms with no agreement to include these terms in the Sea Ice Nomenclature **(Action: ETSI Chairperson, AARI, CIS)**.

2.6.2.8. The resulting approved additions are summarized in Annex F.

Practical Use of the Sea Ice Nomenclature

2.6.2.9. Mr. Keld Qvistgaard (Denmark) introduced this topic noting that it was first raised at the International Ice Charting Working Group where the Data, Information and Customer Support Standing Committee were asked to canvass the ice services for their practices in preparation for this ETSI meeting. As a result of this effort, Mr. Qvistgaard reported that there

are minor differences in how various national ice services use Sea Ice Nomenclature in daily practice. Particularly important are the terms “old ice” and “ice edge”. A table of the current practice is presented in Appendix XIX.

2.6.2.10. The ET noted that shipping is a global industry and more and more ships are encroaching into ice frequented waters. It is becoming more important for the safety of mariners to have definitions for these important sea ice terms that are global and universally understood. These definitions are also important from a climatological perspective when integrating and comparing ice charts from various services.

2.6.2.11. The Chairperson pointed out that the current definition of “Ice Edge” in the WMO Sea Ice Nomenclature is somewhat problematic. The current definition is “The demarcation at any given time between the open sea and *sea ice* of any kind, whether fast or drifting. It may be termed compacted or diffuse.” The offending term is “open sea” which itself is not defined. It was **agreed** that the definition of “ice edge” should be revised to “The demarcation at any given time between open water or bergy water or ice free and *sea ice* in concentrations greater than 1/10, whether fast or drifting. It may be termed compacted or diffuse.” **(Action: ETSI Chairperson)**.

Illustrated Glossary of Sea Ice

2.6.2.12. The Chairman introduced the Illustrated Glossary of the WMO Sea Ice Nomenclature containing 176 photos of ice. During the intersessional period, the 176 photos in the hardcopy edition of Volume II were scanned and processed in the same manner as Volume I, forming a MySQL database and catalogue of photos in JPEG format, both hosted by the AARI GDSIDB center and supervised by the ETSI chair. The glossary database has the following 5 fields: wmo_id, number of photo, author, air_rec_height, comment and is relationally linked to the database of terminology with access available under the same interface http://www.aari.ru/gdsidb/XML/wmo_259.php. The PHP-interface provides the capability to a) add captions in English, French, Russian and Spanish; b) sort by subject and alphabet; and, c) search for output as .html which maybe further converted to .pdf. Changes to the illustrated glossary database are made in the same way as for the terminology.

2.6.2.13. The present glossary contains photos which are mostly black and white with low quality and taken from aircraft reconnaissance. There is a need for its amendment by modern colour photos with higher resolution and possibly complementing the ground photos with corresponding simultaneous satellite imagery. ETSI-III discussed and noted following possible sources for such an update:

- CIS - MANICE and a huge ad-hoc collection of photos;
- Argentina – poster for the mariners;
- ASPeCT CD-ROM;
- USA - NOAA ad-hoc resources;
- FIMR - ad-hoc resources;
- UK – BAS photo library http://www.photo.antarctica.ac.uk/external/guest;
- UK – Marine Observers handbook and Admiralty mariners’ handbook.

2.6.2.14. It was agreed that proposals for new photos should be submitted to the Chairperson for inclusion into the database. The Expert Team further recommended that the Chairperson update the Illustrated Glossary with new photos as they become available. Following a discussion on a process for inclusion of new photos, it was agreed that the “fast track” approval

process, that has been approved for use by ETMSS, be also used for sea ice technical publications, in particular, the WMO Sea Ice Nomenclature and Illustrated Glossary **(Action: ETSI Members, ETSI Chairperson)**.

Understanding and Identifying Old Ice in Summer

2.6.2.15. Mr. John Falkingham (WMO Secretariat) informed the Team of a new publication produced by the Canadian Hydraulic Centre of the National Research Council. He noted that dramatic changes in the condition of Arctic sea ice have made the Arctic more accessible to shipping in recent years. The Arctic shipping season extends earlier in the summer and later in the fall. Tourism in the Arctic is rapidly increasing and the recovery of oil and gas deposits and developing the significant mineral wealth in the Arctic is becoming economically feasible. Increased shipping means an increase in the number of mariners with little or no Arctic experience. Tools are needed to help them gain this experience safely.

2.6.2.16. While the rise of remote sensing is important for ice charting at the macro scale, visual observation is still the best means of detecting hazardous ice at ship scales. Ships and structures operating in ice-covered waters require personnel to reliably recognize and, when possible, avoid the most dangerous forms of sea ice. Old ice represents a significant hazard in the Arctic and sub-Arctic.

2.6.2.17. Experienced mariners and professional ice observers know that identifying the varied appearance and forms of old ice is not straightforward. With the Arctic warming in recent years, the appearance of old ice in summer is becoming even more varied and confusing.

2.6.2.18. During 2006-2008, Drs. Michelle Johnston and Garry Timco of the National Research Council (NRC) of Canada organized Ice Service Specialists and Captains on Canadian Coast Guard icebreakers to photograph and gather information about many different forms of Arctic sea ice in summer. Johnston and Timco used these photographs as the basis for a comprehensive publication entitled “Understanding and Identifying Old Ice in Summer”. It is designed to be a reference tool to help ship and off-shore structure operators distinguish first year ice from second- and multi-year ice.

2.6.2.19. NRC holds the copyright for the publication but does not have the intention to maintain a distribution of it. In an informal conversation, Dr. Johnston indicated that the NRC may be quite willing to give distribution rights for the publication to WMO so that it could receive a wider circulation and improve Arctic marine safety as a result. Alternatively, elements of the publication could be used to update and enhance the WMO Illustrated Glossary of Sea Ice.

2.6.2.20. The Expert Team agreed that this publication has significant merit and would be a valuable addition to the library of Arctic sea ice documents. The ET agreed to ask WMO to consider adoption of this document **(Action: Secretariat)**.

2.6.2.21. The ET discussed the idea of developing a new format for the Sea Ice Illustrated Glossary, perhaps using the NRC publication as a template **(Action: ETSI Chairperson, ETSI Members)**. To help further this discussion Mr. Falkingham agreed to investigate whether the document is available in electronic format **(Action: John Falkingham)**.

International System of Sea Ice Symbols

2.6.2.22. At present, Volume III of the International System of Sea-Ice Symbols only exists as

a hardcopy, although its subsets are included in the coding tables of tjhe SIGRID and SIGRID-3 formats, “Colour Standard for Ice Charts” and “Ice Objects Catalogue”. For the next intersessional period, The Chairman proposed that an electronic update of Volume III be developed. The Expert Team supported this proposal **(Action: NIC, AARI, CIS, Argentina)**.

2.6.3. Sea Ice Services in the World

2.6.3.1. The Chairman recalled that the WMO publication ‘Sea Ice Services in the World’ (WMO No. 574) is intended to provide to mariners and other users the latest snapshot of the sea ice services available world-wide, effectively extending the WMO publication No. 9, Volume D – Information for Shipping. In 2007, the ETSI-III finalized the 3rd edition and agreed on further updates of the electronic version of the publication annually, using the following scheme (JCOMM Meeting report No.51):

- Using content of the third edition of the publication as a model;
- National ice services to submit corrections to the ETSI Chairperson and WMO Secretariat for appropriate paragraphs of Parts I-II and annexes, as needed and as appropriate;
- After revision, the ETSI Chairperson in collaboration with the WMO Secretariat should incorporate these corrections or amendments, update the contents of the electronic version (including the 'Table for noting supplements received') within a three month period (this period may be extended, as necessary based on resources) and make the updated version officially available on the appropriate JCOMM SPA website via .pdf format in a restricted area;
- The WMO Secretariat should inform the respective National Ice Services and sea ice community on the availability of the updated electronic version with the use of a mailing list and/or appropriate news sections and methods (similar to 'ArcticInfo');
- Updated or amended CD-ROM versions of the publication and/or supplements are prepared by the WMO Publishing Department on an annual basis.

2.6.3.2. The ETSI-III session also agreed that it would be more appropriate for the publication to start each section for a national ice service on an individual page, to use a single-column layout and to include the following additional annexes:

- List of abbreviations;
- Hemispheric map showing max/min ice extent plus dots showing location of ice services;
- List of contact persons, which serve as editors for the electronic version of the publication.

2.6.3.3. By May 2009, updates for the 4th edition (Part-II and Annexes) were provided to the ETSI chair by 13 national ice services and included into the annual 2009 edition of the publication, available at http://wdc.aari.ru/wmo/docs/wmo_574_2009.pdf. During 2009, the ETSI chair:

- prepared a master copy of the publication with a single-column layout using the 3rd edition as a model;
- collected and included available updates to Part-II REGIONAL AND NATIONAL PRACTICES and corresponding annexes;

- summarized information on contact persons and time of updates in the 'Table for noting supplements received';
- introduced several amendments to Part I GENERAL, section 'International cooperation' reflecting new regional alliance (EIS), development of a new transfer format for ice charts ('Ice Objects Catalogue') and development of a new mechanism of ice charts dissemination (' Ice Logistics Portal');
- included a list of abbreviation as a first new annex;
- introduced a second new annex 'Sea-ice products by areas of the World Ocean available via the Ice Logistics Portal' on a basis of two schematic charts for the Northern and Southern hemispheres.

2.6.3.4. The Expert Team reviewed the draft revision 2009 and approved the concept for its layout. The ET further agreed to make suggestions for further revisions, in particular for Part I GENERAL, 'Ice observing methods' and 'Ice information services' to reflect the technical progress of the last years **(Action: ETSI Members)**. The ET further agreed that the "fast track" procedure should be used to revise this document and that it should be published on the JCOMM Services Website **(Action: ETSI Chairperson, Secretariat)**.

2.6.3.5. The Expert Team requested the SFSPA Coordinator, in cooperation with ETMSS and ETSI chairs, to ensure that linkages are made to the Sea Ice Service in the World from the WMO publication No. 9, Volume D – *Information for Shipping* **(Action: Secretariat)**. The WMO Secretariat agreed to inform the National Ice Services and the sea ice community about the availability of this updated electronic version by means of a mailing list and/or appropriate newsletter articles **(Action: Secretariat)**.

2.6.4. Sea Ice in Electronic Navigation Charts: Progress Reports

Russian Federation – AARI and Transas

2.6.4.1. Mr. Konstantin Ivanov (Transas) provided an update on the work that AARI and Transas have done jointly in this area. He noted that ETSI-III in March 2007 adopted the "Ice Objects Catalogue Version 4.0" as the sea ice extension of the IHO S-57 format for the ENCs and agreed on a formal mechanism for its maintenance and development with JCOMM ETSI recognized as the competent international technical group on sea ice and icebergs by the WMO, IOC and IHO Committee on Hydrographic Requirements and Information Systems (CHRIS), the WMO Secretariat as Register Owner and Manager, Register Users as anyone interested in sea ice or iceberg MIOs, the Control Body as the ETSI ENC Ice Objects Task Group (TG ENCIO), the Submitting Organization as WMO and proposers as ETSI Members from Canada, Germany, Russian Federation and USA. In May 2008 the TG ENCIO finalized inclusion of the "Ice Objects Catalogue Version 4.0" into the IHO Register, so that presently the S-57 sea ice extensions are freely available within the Open Geospatial Consortium (OGS) Geospatial Data Abstraction Library (GDAL). The JCOMM-III session noted this unique situation, with ETSI being a bridge between CHRIS and WMO, as being stimulating for JCOMM.

2.6.4.2. Since the summer of 2007, the Arctic and Antarctic Research Institute (AARI) has worked with Transas (a major multi-national Electronic Navigation Charts systems manufacturer) to implement mechanisms of displaying ice chart information on ENC systems. In the course of this activity, AARI and Transas have developed and implemented software and tested a number of specifications for ice objects classes (polygon, linear and point) presentation

schemes (colour, hatching) and sea ice information data file naming convention and structure in ENC.

2.6.4.3. The following tasks were completed:

a) Ice charts in vector S-57 format product specification has been developed;
b) Extended S-57 ice object and attribute catalog has been prepared;
c) Details of the items (a) and (b) above are provided in document “Report -002P-2”;
d) Presentation rules and data file naming conventions were developed (Annex J) and,
e) Symbol library was prepared in a format that complies with IHO S-52 symbol library.

2.6.4.4. The approach allows ECDIS software to use existing algorithms for ENC symbolization. Some modifications were required in ECDIS to follow the rules described in a pseudo lookup table and to implement new symbols.

2.6.4.5. Another challenge faced during the implementation of Ice charts in ECDIS is a need to provide ice chart transparency so that important navigation information from the ENC is not obscured. A user-configured transparency allows the user to combine and view ice charts from different sources as well as satellite images and forecast ice charts in S-57 format and also navigational information is presented under the ice chart overlay.

2.6.4.6. Additional attributes SYMINS and SYMINR are used to define color of ice coverage area according to the Russian or international symbology rules.

2.6.4.7. When work on development of the AARI Ice product specification was started (2007), there was no information about standardized product specification for Ice Marine Information Overlays. The Ice Coverage MIO product specification was introduced by the Canadian Ice Service in late 2008. These two implementations proceeded in parallel resulting in some discrepancies between the Russian and Canadian provision of S-57 datasets including the File Naming conventions and Chart Header implementations.

2.6.4.8. Mr. Konstantin Ivanov gave a very informative presentation (Annex G). Later in the day, the ET toured the Transas facilities in St Petersburg to see their chart production facilities and ENC systems in action on a ship simulator.

Canada – Canadian Ice Service & CARIS

2.6.4.9. Marie-France Gauthier presented the update report on activities in Canada noting the objects, attributes and associated enumerations that comprise the Ice Objects Catalogue V4.0, approved by ETSI-III, were entered into the IHO Feature Catalogue Register managed by the U.K. Hydrographic Office.

2.6.4.10. Marine Information Overlays (MIOs) consist of supplementary information to be used with Electronic Navigation Charts in ECDIS or ECS shipboard equipment. The Canadian Ice Service has produced a Product Specification for sea ice MIO products based upon the Harmonization Group on Marine Information Objects (HGMIO) “General Content Specifications for Marine Information Overlays (MIOs)”, Ver 1.1.1, 28 August 2007.

2.6.4.11. During the winter ice season 2008-2009, CIS regularly produced sea ice MIO products for the Gulf of St. Lawrence and for Labrador waters, for evaluation and testing purposes. It was hoped that these operational products could be used in a “test bed” trial in the Gulf of St. Lawrence during the winter shipping season 2008-2009.

2.6.4.12. In order to transmit and display sea ice information on ECDIS or ECS, a Product Specification was required. It needed to conform to the General Content Specification for MIOs Version 1.1.1 that was developed by the IHO-IEC Harmonization Group on MIOs (HGMIO) and endorsed by IHO. In 2008, a contract was issued to CARIS Canada for the development of the technical documents related to the development of an MIO Product Specification.

2.6.4.13. Prototype ice overlay products were assembled and discussed with Canadian Coast Guard Icebreaking Services. An MIO product with ice polygons was decided upon. It was also agreed that semi-transparent coloring of ice polygons would be an effective way to not obscure the navigation chart information underneath the ice MIO.

2.6.4.14. A set of Ice Objects and Attributes were formulated and passed to CARIS. These were accepted and formed the set that comprised the test bed products. Additionally, CIS provided CARIS test ice data in SHP file format, to be used for test purposes.

2.6.4.15. Under their contract, CARIS delivered a final set of documents as follows (Annex H):

- Marine Information Objects Overlays, Ice Coverage Product Specification, Edition 1.0, Nov, 2008;
- Marine Information Objects Overlays, Ice Coverage Object Catalogue – Objects, Edition 1.0, Nov, 2008;
- Marine Information Objects Overlays, Ice Coverage Object Catalogue – Attributes, Edition 1.0, Nov, 2008; and,
- Ice MIO Product - Portrayal Recommendations document.

In addition, CARIS provided a completed S-57 MIO Exchange Set from the CIS test data and complete installers for CARIS S-57 Composer and CARIS EasyView – for supporting the ice MIO Overlays.

2.6.4.16. In consultation with clients, it was decided to include only four objects – the iceberg limit, ice drift, recommended route centerline, and sea ice – and as well a smaller number of attributes to describe those ice objects. Scripts were developed to generate SHP file data from the ISIS operational database. Regular generation of SHP file data was initiated. The process of producing S-57 files was semi-automatic. SHP files were imported into CARIS Composer software which produced the S-57.

2.6.4.17. The following ECDIS/ECS manufacturers were contacted and were sent a package of material to assist them in implementing upgrades to their systems so that users will be able to accept and display sea ice MIO products: ICAN Canada, Offshore Systems Ltd., Transas Marine USA, and NavSim Technology Inc. An ongoing dialogue has occurred with these companies, as they progress towards software support of sea ice MIO products.

2.6.4.18. In early February 2009, production of test bed sea ice MIO products for Gulf and Labrador waters was initiated by CIS. Products were produced once per day, Monday to Friday, and placed on an “ftp” site. By end of the winter season, April 2009, operational clients were not fully prepared to accept these products. However, the products were made available to manufacturers for testing of their ECDIS/ECS software offerings. At the present time (March 2010), the CIS is awaiting feedback from the Canadian Coast Guard and the industry. It has not generated S-57 products since April 2009.

2.6.4.19. There was a discussion about the complexity of the AARI-Transas development versus the simplicity of the CIS-CARIS development. AARI feels that all possible ice information should be made available for ice navigation. The Transas representatives explained that the producer of the S-57 ice chart does not have to use all of the objects and can use a simpler subset.

2.6.4.20. Following these presentations, the Expert Team discussed how to move forward with ice information in ENCs. The differences between the parallel approaches of AARI/Transas and CIS/Caris were discussed at a high level and the consensus was reached that these differences should be resolved so that a single path toward standardization can be followed (see Annexes J and H). It was noted that, regardless of the path chosen, one or the other of the implementations to date will have to change. However, it was felt that the investments to date are not so great as to outweigh the advantages of moving forward on a joint path. Some of the differences will be relatively simple to resolve, such as the Data file naming convention. Other differences will be more challenging such as the Data structure. It was agreed by the ET that the TG-ENCIO should work with AARI/Transas and CIS/Caris to harmonize the standards as soon as possible and make a formal presentation to IHO to adopt these as a standard. The TG-ENCIO will report its progress to the IHO TSMAD meeting scheduled for May 2010 in Rostock **(Action: TG ENCIO)**.

2.6.5. Ice Information for Electronic Navigation Charts Ice Objects Catalogue Version 5.0

2.6.5.1. The meeting was informed that, over the course of their activities to implement mechanisms of displaying ice chart information on ENC systems, AARI and Transas have identified a number of amendments to the Ice Objects Catalogue necessary to incorporate their work. These amendments are included in the proposed ENC Ice Objects Catalogue Version 5.0 (Annex I).

2.6.5.2. Although there was some concern in the ET about possible contradictions between Russian and International symbologies that could arise in the Catalogue, Mr. Falkingham, the leader of the TG-ENCIO, recommended that the Team approve Version 5.0 of the ENC Ice Objects Catalogue as a means of going forward. The ET approved this recommendation and asked the TG-ENCIO to implement the catalogue in the IHO Database **(Action: TG ENCIO)**.

2.6.5.3. The SFSPA Coordinator requested that a demonstration suite of Ice Objects in ENCs be developed for presentation during the 4th session of JCOMM**(Action: TG ENCIO)**.

2.6.6. Updates to SIGRID-3 and Ice Chart Colour Standards Formats

2.6.6.1. The ETSI Chairman introduced this item noting that two technical documents, the *SIGRID-3: A Vector Archive Format for Sea Ice y Charts* and the *Ice Chart Colour Code Standard*, both developed in cooperation with the IICWG, finalized by ETSI-II (April 2004) and published by the WMO Secretariat in 2004 in JCOMM Technical Reports (WMO/TD No. 1214 and No. 1215) now extend the *WMO Sea-Ice Nomenclature* Volume III International System of Sea-Ice Symbols by providing standards for operational ice chart coding and delayed-mode presentation in additional to raster *SIGRID* (WMO, 1989) and *SIGRID-2* (WMO, 1994) formats primarily intended to support sea ice climatology.

2.6.6.2. The ETSI-III agreed on 4 amendments to SIGRID-3 format and the Team chair inserted the stated amendments into the SIGRID-3 document and published the revised version

at the formal depository on the JCOMM SFSPA web-site http://www.jcomm-services.org/documents.htm?parent=136

2.6.6.3. Discussions on the SIGRID-3 format implementation across the ice services and potential constraints of the Color Code were held during the "Ice Analysts Workshops" (June 2008, June 2009). It was felt that the addition of icebergs and growlers symbols into the CT colour table would be useful and ETSI experts were asked to develop a detailed description of how this could be accomplished.

2.6.6.4. Following the existing WMO Sea Ice Nomenclature definition of bergy water ("An area of freely navigable water in which ice of land origin is present in concentrations less than 1/10. There may be sea ice present, although the total concentration of all ice shall not exceed 1/10"), it was proposed that an additional light-blue colour with iceberg symbols in red or black color for bergy water be added as a new row number 3 to table 1 of the Standard, as portrayed below.

Table 1. Total Concentration Colour Code Standard

		150-200-255	Less than one tenth (open water)	4.2.6
▲ ▲ ▲	▲ ▲ ▲	150-200-255	Bergy water	4.2.7
		140-255-160	1/10 - 3/10 (very open ice)	4.2.5

2.6.6.5. The ET discussed this proposal and, while the Team agrees in principle with the proposed change to the colour code, the implications and impacts on products and processes must be further investigated. The ice services agreed to discuss this further at the Ice Analysts Workshop or at the IICWG **(Action: DMI, NAIS)**.

2.6.7. Vision and Strategy for the Standards for Sea Ice Coding and Presentation

2.6.7.1. The Chairman introduced this topic by recalling that, in recent years, the ETSI has made rapid progress in adopting new standards for sea ice information – colour codes, SIGRID-3, ENC Ice Objects. There has been a concerted attempt to harmonize these standards with each other but there is a concern that the standards may not be as compatible as possible with relevant external standards. The ensuing discussion focused on geospatial standards as a concrete example but could apply to all standards issues.

2.6.7.2. The ET further noted that the ice analysts during the 1st Ice Analysts Workshop (June 2008) expressed their views on possible constraints of the existing WMO/IHO regulatory documents and provided a vision on the further formal actions based on their practical experience. In particular, it was noted that, in most of the cases, there is no need for additional standards for annotated imagery since a plain grey scale suits the masters best. Further notes included that development of an accurate coding schema describing timeliness and validity of the imagery within the ENC is critical and that coastlines should not be a must but the possibility to have a standard for the coastline would be a good choice. Other notes included that it is better to firstly finalize the implementation of the SIGRID-3 and the presentation schema for ice charts to the fullest extent and then to proceed to imagery. Some demands for the future were then formulated, agreed by all ice analysts, including:

- there is need for the standards for forecasting charts to be presented in dynamic way, possibly in isolines with particular standards for metadata describing validity;
- there is need for the standards for routing; and,
- sea ice community should not care much about the imagery except standards for its georeference, timeliness, validity.

2.6.7.3. The ET agreed that it should develop a vision and strategy for development of its standards in liaison with other expert bodies such as the WMO Commission for Basic Systems. To this end, it was agreed that a white paper should be prepared for discussion at the IICWG prior to ETSI-V **(Action: ETSI Chair in consultation with ETSI Members)**.

2.6.7.4. To help guide this activity, the Team agreed on some basic principles:

- Any standards chosen must be able to support the outputs required of the services
- The ETSI is not a competent body to make decisions on standards that are outside of its domain of expertise (e.g. geospatial standards) and should seek the advice of competent bodies
- The ETSI must maintain an awareness of potential changes in the requirements, capabilities and infrastructures of its clients and partners, as well as potential changes to its own operating environments, in order to anticipate the need to revise, or adopt new, standards.
- The ETSI should maintain a continuing dialogues with other WMO bodies, such as the WMO Commission for Basic System, that have responsibility and expertise in various standardization areas.

2.6.8. Other JCOMM Sea Ice Related Publications

Manual for Ice Experts – Ice Observers

2.6.8.1. The Chairman informed the ET about a new publication that has been developed by AARI for the training of ice observers and analysts. He noted that in the delivery of ice services in the Arctic regions today, there are definite difficulties related to a shortage of ice experts due to the ageing of staff, increasing demand due to increasing activity in the ice-covered offshore regions and the need to provide ice information to support constantly increasing cargo traffic.

2.6.8.2. In 2007, a course for the training of ice experts – ice observers was developed, arranged and given. The training was carried out at the Arctic and Antarctic Research Institute, Saint Petersburg, Russian Federation. The basis for performing the work was the contract on conducting research for the BP Arctic and Cold Regions Technology and Engineering Programme. The concept of the course was developed and the curriculum of the theoretical course including 11 main themes was approved. Four training courses were delivered. Educational materials were collected, systematized, edited and published as a *Manual for Ice Experts – Ice Observers* in 2009. The manual was published as a book version in Russian and as an electronic version in English.

2.6.8.3. The ET agreed to review the English language version of the Manual and identify any corrections or amendments that may be required. Dr. Smolyanitsky will make the English version of the manual available on a website to facilitate this review **(Action: ETSI Chairperson, ETSI Members)**. Once finalized, the manual should be sent to WMO with a

recommendation that it be published as a new WMO publication Manual for Ice Experts – Ice Observers **(Action: ETSI Chairperson)**.

2.7. Sea Ice Information Systems and Products Delivery

2.7.1. Ice Analysis Harmonization Issues

2.7.1.1. The Chairman introduced the issue by recalling that the highlights of achievements in sea ice capacity building support include provision of the 1st (June 2008, Rostock, Germany, BSH) and the 2nd (June 2009, Tromso, Norway, met.no) joint ETSI/IICWG/GCOS "Ice Analysts Workshops". The workshops encompassed:

- Case studies/discussion from Ice Services on the techniques used in analyzing imagery and preparing ice charts in order to exchange views, techniques, learning diverse practices and philosophies from different Ice Services; and
- Breakout expert groups by region (Arctic, Antarctic and Baltic Sea) and a 'merged' Barents Sea group (only IAW-II) to analyze imagery and prepare ice charts during the workshop in order to develop a methodology to harmonize the analysis process.

2.7.1.2. The proceedings of the 1st workshop are available as WMO Td. No. 1441 in the form of a CD. The scientific results of the 1st workshop included identification of uncertainties on current and historical ice charts. It was agreed that it would be more valuable to have this published as a formal technical publication **(Action: ETSI Chairperson)**.

2.7.1.3. A valuable conclusion of the more practically-oriented 2nd workshop related to harmonization of ice charts from different Ice Services is that, potentially, Arctic ice charts are interchangeable for MSS within new Arctic METAREAs, provided that the timeliness, accepted accuracy of the boundaries and amount of additional information (leads, cracks, compactness) is sufficient for operational purposes. The Report of the 2nd workshop is available in CD form as WMO Td. No. 1517. A presentation summarizing the workshop was prepared for the last IICWG meeting (Annex K).

2.7.1.4. The idea of producing a formal technical document containing the results of the 1st two workshops was discussed by the Team. It was agreed that, although this would be a very worthwhile activity, it does not have sufficient resources to do so.

2.7.1.5. Proposals for the 3rd Ice Analysts Workshop, which were drafted during the round-table discussion among the participants of the 2nd Workshop, included the following:

Background

- Critical tasks for preparatory period:
- Descriptions of philosophies by services prior to Workshop,
- Better and longer preparation for the Workshop,
- More extensive and harmonized presentation

Themes for agenda:

1. Rerun of case study "Online analysis of routine dataset shared by met.no (SAR/VIS/IR, weather stations) and ice charting for a single test region (e.g. Greenland/Barents Sea) by 3-4 teams of ice analysts
2. Case study on assimilation of SIGRID-3 (shapefiles) from different ice services
3. Investigation on philosophies for ice analysis and requirements from individual clients
4. Discussion on standards for annotating imagery

5. Case study on differences in ice charts in time
6. Investigation on sea ice climatology used by ice services to reference their ice charts
7. Discussion on automated products in MyOcean project to be used

2.7.1.6. Prior to IAW-3 the Organizing Committee should consider whether IAW should be divided by themes e.g.: 3 days for 1st focus (themes 1-4) and 2 days for 2nd focus (themes 5-7). In considering that it is operational ice analysts who should attend these workshops and that it is a challenge to replace these people in their operational duties, the ET decided that there should be a single focus for the workshop so that the most appropriate analysts can be identified to attend. The focus for the 3rd workshop was discussed by the Team and a consensus emerged that the procedures and standards for producing annotated image products may be most appropriate. A related focus on ice edge definition could also be considered. This information was referred to the organizing committee for consideration in developing the theme and agenda for the next workshop **(Action: Keld Qvistgaard, Marie-France Gauthier, Nick Hughes, Jürgen Holfort, Vasily Smolyanitsky)**.

2.7.1.7. In discussion, the ET decided that a longer period of time is required to adequately prepare for the workshop and so decided that the 3rd Ice Analysts Workshop should be held at DMI in June 2011. The organizing committee will be Keld Qvistgaard, Marie-France Gauthier, Nick Hughes, Jürgen Holfort and Vasily Smolyanitsky.

2.7.1.8. Recalling the prominence that JCOMM-III has placed on the Ice Analysts Workshops, the Team also agreed that it a longer term vision for the Ice Analysts workshop series should be developed **(Action: Keld Qvistgaard, Marie-France Gauthier, Nick Hughes, Jürgen Holfort, Vasily Smolyanitsky)**.

2.7.2. Ice Logistics Portal and WIS

2.7.2.1. Dr. Jürgen Holfort (Germany) informed the Team that the Ice Logistics Portal has been transferred from PolarView to the BSH and is running in parallel mode at the current time. All of the dynamic portions of the Portal are working and data is being downloaded four times per day. There is still some work to be done to implement the static portions of the Portal, such as real names for the charts instead of file names. The test version of the Portal is at http://www.bsis-ice.de/IcePortal. Dr. Holfort provided a live demonstration of the Portal. The presentation is very similar to the previous implementation by PolarView.

2.7.2.2. In contrast to the previous implementation, only the most recent version of each product is kept on the Portal rather than all of them. It was noted that the Portal is designed for operational purposes and is not an archiving system. The ET agreed that a number of recent instances of each product should be available on the Portal and left the determination of the precise number up to the implementation group under Dr. Holfort.

2.7.2.3. As a valuable enhancement, Dr. Holfort indicated that the products will also be selectable by METAREA in addition to the geographic areas. He also proposed that, if resources permit, a mechanism to select products by latitude/longitude.

2.7.2.4. Dr. Jürgen Holfort is the manager of the Portal. For technical issues, e-mail can be sent to Ice@bsh.de which is monitored 7 days a week.

2.7.2.5. The ET thanked the German Ice Service and Dr. Holfort for taking on this task and congratulated him on the accomplishments to date.

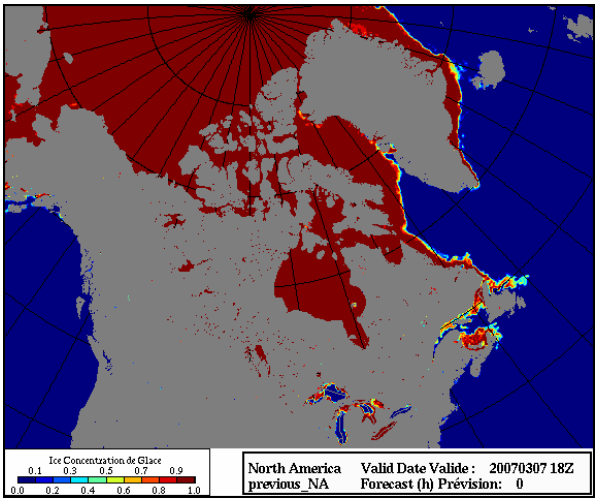
2.7.3. Assimilation of Ice Charts into Numerical Now and Forecasting Systems

Status of Activities in Canada

2.7.3.1. Ms. Marie-France Gauthier informed the meeting about the progress that has been achieved in Canada noting that, in collaboration with the Environment Canada Data Assimilation Section, CIS has been developing a sea ice data assimilation system for use in sea ice analysis and forecasting and numerical weather prediction. Using a 3D variational (3DVar) approach, a variety of ice observations can be assimilated with this system including: passive microwave data from the AMSR and SSMI instruments, gridded data from CIS image analysis and daily charts and CIS lake ice analysis data. One of the crucial elements in assimilating these observations is to define the error statistics associated with each observation and the trial field as well as developing a forward model that relates the analysis fields to the observations. Initial global estimates of these have been made but the system is quite flexible in that future refinements can easily be incorporated.

2.7.3.2. Several implementations are underway or nearing completion:

a) An automated sea ice analysis at 5 km resolution for North America. This system uses a persistence model and the output products available four times per day are gridded sea ice concentration and days since last observation. It is planned to implement this system in experimental mode at the Canadian Meteorological Centre (CMC) in the next few months. Subjective evaluation by CIS Operations of the model output as an ice edge product over a full year has indicated that it should meet operational accuracy requirements. Objective evaluations using CIS regional charts and the MODIS ice extent product both demonstrate that this system is more accurate than the current CMC sea ice analysis system.



b) The 3DFGAT (First Guess at Appropriate Time - a 3DVar variant) system has been coupled to an ice-ocean model for the east coast of Canada as described by Caya et al[1]. Results indicate that this system is generally superior to the current operational nudging technique. Both the operational and new techniques assimilate ice thickness distributions provided by egg code data extracted from CIS ice charts. The new system is able to assimilate passive microwave data, image analysis charts and daily ice charts while the operational system only ingests daily charts. The new system will be running at CIS in experimental mode this winter.The model extends from 40 to 66 N at a resolution of roughly 15 km.

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[1] Analysis and forecasting of sea ice conditions with three-dimensional variational data assimilation and a coupled ice-ocean model by Alain Caya, Mark Buehner and Tom Carrieres. J. Atmos. Oceanic Technol., 27, 353–369.

c) A very similar system to b) has been developed for a coupled atmosphere-ice-ocean model. This system will replace the semi-operational nudging system in the coming months. Both systems assimilate CIS image analysis charts but the new system also assimilates passive microwave data and daily ice charts. The ice-ocean model covers the Gulf of St Lawrence at a resolution of 5 km.

d) A northern hemisphere (NH) sea ice analysis system that is almost identical to a) has been developed as a step towards a global system. The NH system is running in experimental mode at 15 km. It is planned to replace this system with a global system that will have a resolution of around 5 km. Once developed and thoroughly tested, this system will replace the current operational sea ice analysis running at CMC.

2.7.3.3. In addition to the implementations discussed above, several research projects are underway. These include: development of a radiative transfer model for passive microwave data (in collaboration with the Danish Meteorological Institute): development of techniques for assimilating AVHRR data (in collaboration with MetNo); and development of techniques for assimilating active radar data. Other R&D currently underway or planned includes using displacement errors and spatially varying error statistics.

Status of Activities in Russian Federation

2.7.3.4. Dr. Sergey Klyachkin (AARI) gave an excellent presentation to the ET (Annex L) to explain the data assimilation process in operation at AARI. A noticeable progress has been achieved in automating the preparation of initial ice data for numerical ice forecasting. Less than 15-20 years ago this procedure was done manually with the help of a transparent grid put on the hard copy of ice chart. Later, the special software which allowed drawing the ice chart (both ice zone boundaries and ice cover characteristics in every zone) on the monitor in an interactive manner was developed. Both procedures were very labor-intensive and took much time.

2.7.3.5. At the present time, with geographic information system (GIS) technologies, the process of ice data preparation is significantly improved. An expert decoding the satellite image works directly within the GIS ArcView medium and develops the ice chart as a vector shape-file containing information on the uniform ice zones and ice characteristics in every zone. These characteristics are recorded into the attribute table in strict accordance with the international standard SIGRID-3. The shape-file is input to numerical forecasting technology, by means of a specially developed ArcView application which analyzes the coordinates of ice zones along with the coordinates of the grid cells and creates the ASCII matrix file containing the ice characteristics in every grid cell.

2.7.3.6. If necessary, this file is complemented with the data taken from other sources (as a rule – from previous forecast). The need for this is due to several reasons. Firstly, the satellite image often does not cover the entire calculation area (position of orbit, cloudiness, disturbances, etc.). In this case, the information for the zone missing on the image is taken from the previous forecast and combined with the data taken from the image. As a result, one obtains the composite ice matrix which is directly used as the initial data for the new forecast. Secondly, when decoding the satellite image, the expert often is not able to assess some important ice parameters (ice thickness, ice ridge concentration, stage of ice melting). Moreover, in summer, the partial concentration of ice stages is also included in the list of “indefinite” parameters because in summer only the total concentration can be identified from the satellite image. All these parameters are taken from previous forecast (diagnosis).

2.7.3.7. The process of composite ice chart preparation is implemented automatically. All

results of all forecasts are accumulated in a special archive, and the software selects the forecast which (a) has the smallest lead time; and (b) has the minimum temporal lag relative to the image. Data assimilation is implemented by direct substitution of forecast data by the new observed data.

2.7.3.8. The following AARI numeric short-term prognostic products utilize (entirely or partially) assimilation of different information from the AARI ice charts (regional and local) (Annex L):

- Diagnostic and forecast patterns (0..+6d) of ice drift, surface currents and sea level elevation in the Arctic Ocean based on AARI hydrodynamic model with viscous ice rheology, http://www.aari.ru/projects/ecimo/index.php?im=102&sub=4;
- Diagnostic and forecast patterns (0..+6d) of the evolution of ice cover in Barents and Kara Seas (total concentration, stages of ice development, hummocks concentration and level of compacting) based on AARI thermo hydrodynamic with elastic viscous-plastic ice rheology, http://www.aari.ru/projects/ecimo/index.php?im=102&sub=1;
- Diagnosis and forecast charts (00…+72h with 6-h interval) for winds, wave significant height and direction and ice accretion for open water areas in the Eurasian Arctic Seas based on AARI spectral parametric wave model, http://www.aari.ru/projects/ecimo/index.php?im=102&sub=2.

2.7.3.9. The Chair requested other ice services to also prepare and submit reports on their activities in sea ice modeling systems and assimilation into numerical weather prediction models **(Action: ETSI Members)**.

2.7.3.10. The SFSPA Coordinator recommended that a presentation on these developments be prepared for the ETOOFS meeting in October 2010 in Tokyo. The CIS agreed to send a modeler to this meeting to make this presentation, if possible **(Action: CIS)**. A presentation for the Services Coordination Group meeting in May 2010 would also be very valuable **(Action: CIS)**.

2.7.3.11. The Session noted that during 2007-2009 two IICWG workshops on sea ice modelling and data assimilation were convened. The agenda of the workshops included discussions on data types (summary of work being done, data priority, retrievals versus direct assimilation, data/product access, areas for future research and collaboration), assimilation techniques (summary of work being done, advantages & disadvantages for sea ice applications), models (summary of work being done, simple versus complex, importance of ocean dynamics and thermodynamics, atmospheric coupling/effects) and operational systems (summary of work being done, verification, usage). The 3rd Modelling/Data Assimilation Workshop is planned to be held in 2010 at SMHI in Sweden. The Session endorsed this activity and requested the ETSI Chair and Members to continue cooperation with IICWG on this subject with feedback both to ETSI and ETOOFS **(Action: ETSI Chairperson, ETSI Members)**.

2.8. Updates for Sea Ice in the WMO Rolling Requirements Review

2.8.1. Mr. Cabrera introduced the WMO Rolling Requirements Review (RRR) Process noting that the RRR jointly reviews users' evolving requirements for observations and the capabilities of existing and planned observing systems. Statements of Guidance, as to the extent to which such capabilities meet requirements, are produced as a result. Initially, the process was applied to the requirements of global NWP and the capabilities of the space-based

subsystem but more recently the range of requirements has been expanded and the technique has begun to be applied successfully to surface based observing systems and other application areas.

2.8.1.1. The Fifth Session of the CBS Expert Team on the Evolution of the Global Observing System (ET-EGOS) held in Geneva from 30 November to 4 December 2009, nominated Mr. **Ali J. Mafimbo** as a Point of Contact (PoC) for the Statement of Guidance (SoG) for Ocean Applications.

2.8.1.2. The latest JCOMM input to the Rolling Review of Requirements (RRR), with specific Actions Nos. 35, 36, 37 and 38 in the ET-EGOS Action sheet-Annex IV of the final report is available on the WMO website at: http://www.wmo.int/pages/prog/www/CBS-Reports/IOS-index.html.

2.8.1.3. Each JCOMM relevant Team is invited to check the relevant fields in the requirements document for met-ocean forecasts and services provided as an Excel table, by looking at the areas relevant to their work under column "R" (Use) and update the information given either by adopting those aspects with which the Team agree, retaining existing values where the Team thinks they are justified, or propose other values and report back to PoC. This process should be undertaken through a consultative forum where the issues are crosscutting.

2.8.1.4. The Team reviewed the existing set of requirements and noted some inconsistencies with requirements previously stated in other documents such as the IICWG Socio Economic Document. It agreed that requirements from the latter should be used to provide input to the RRR by April 2010 **(Action: ETSI Chairperson)**.

2.8.1.5. The Team also considered the "Statement of guidance for ocean applications" document (November 2009 - available at http://www.wmo.int/pages/prog/sat/documents/SoG-Ocean.doc) and noted that, although the document is much improved over the previous version, some amendments are still required with respect to sea ice. The Chair will lead a review and revision of this document by e-mail with the members of the ET for completion in April 2010 **(Action: ETSI Chairperson in consultation with ETSI Members)**.

2.8.2. JCOMM Questionnaire and User Feedback

2.8.2.1. Mr. Cabrera informed the meeting that the JCOMM questionnaire (Appendix XX) was distributed by WMO through the normal GMDSS channels but no responses were received from new Arctic METAREAs or the ice-covered regions of the established METAREAs. It is unclear to the ETSI members whether the questionnaires were received by mariners. The ET agreed that the WMO Secretariat to contact IMO to determine the best method to distribute the questionnaire **(Action: Secretariat)**.

2.9. Polar Decade Activities

2.9.1. The Secretariat informed the meeting that, at the Fifteenth Session of the WMO Commission for Atmospheric Sciences (CAS) (Incheon, November 2009), the CAS discussed several vision papers including one entitled "ADVANCING WEATHER, ICE AND ENVIRONMENTAL PREDICTIONS IN THE POLAR REGIONS: AN IPY LEGACY" (Annex M). The following is an excerpt from the approved record of the meeting dealing with this paper:

8.4 ADVANCING WEATHER, ICE AND ENVIRONMENTAL PREDICTIONS IN THE POLAR REGIONS: AN IPY LEGACY (agenda item 8.4)

8.4.1 The Commission noted that research activities of CAS will help improve weather and climate prediction in polar regions, which will benefit all Members.

8.4.2 The Commission noted that the Executive Council Panel of Experts on Polar Observations, Research and Services decided that the design and development of polar prediction systems is an important task that will require effective collaboration across the relevant Technical Commissions along with other partners as appropriate. The Commission recommended that efforts be made to further polar prediction for weather and climate and to extend efforts to snow, ice, carbon and ecosystem modelling and analysis.

8.4.3 It was agreed that the successful development of polar prediction systems requires the involvement within the Commission of WWRP including THORPEX, GAW and WCRP. The Commission also agreed that collaboration and cooperation with other WMO technical commissions and their programmes as well as WMO Member support is essential.

8.4.4 As important steps forward in the polar analysis and prediction, the Commission noted in particular:

(i) the success of the THORPEX IPY cluster including a high-resolution sea-ice modelling system in Canada;

(ii) the success of the JCOMM IPY Ice Logistics Portal;

(iii) the European GMES Marine Core service and its polar prediction and sea ice information provision services; and

(iv) the scientific and operational advances in satellite data assimilation.

It agreed, given the scarcity of in-situ observations in the polar regions, that these achievements will result in improvements in numerical weather prediction, the accuracy of the climate record and improvements in other modelling systems that will use atmospheric and surface fields in their initial conditions.

8.4.5 The Commission concurred with the Executive Council Panel of Experts on Polar Observations, Research and Services on the requirement for effective collaboration and therefore recommended that any efforts to develop a future prediction system include outcomes from the IPY-THORPEX cluster of projects, and from the planned THORPEX Legacy Project.

8.4.6 The Commission recommended support by Members of the concept of the International Polar Decade with the following main tasks in mind:

(a) Long-term integrated monitoring of changes in the physical, chemical and biological state of polar regions;

(b) Study of large-scale and local changes in the environment of polar regions and their role in global climate processes;

(c) Improvement in the predictions of severe and high impact events in polar regions, and the development and establishment of systems of hydrometeorological safety for population and territories.

2.9.2. At the International Ice Charting Working Group meeting (Geneva, October 2009),

Vladimir Ryabinin (WMO) gave a presentation prepared by Dr. Barry Goodison on the Global Cryosphere Watch (GCW) (Appendix 2). In his presentation, Dr. Goodison noted potential contributions that national ice services could make to the GCW including:

- *Development of Guidelines and Standards of Observation and Measurement of Sea Ice*
  - *For in-situ, airborne and satellite products for operational and research use*
  - *Compilation of existing guidelines and procedures (IICWG, JCOMM, WCRP/CliC, GOOS etc. and consolidation/development as required)*
- *•Development of GCW portal*
  - *Test of interoperability between ice logistics portal and GCW and possible provision of IICWG products to GCW*
- *Evaluation/validation of sea ice products for climate analyses, model validation and initialization*
  - *Intercomparison of commonly used algorithms and the resulting products*
  - *Define "reference data sets"*
  - *Develop intercomparison protocols and metadata requirements*
- *Contribution/development of ice climatologies from operational ice charting initiatives*

2.9.3. At the meeting of Senior Arctic Officials (SAO) of the Arctic Council (Copenhagen, November 2009), officials discussed the Legacy of IPY. From the meeting report: "*Some SAOs supported the WMO initiative on the Polar Decade, suggesting that the discussion should be taken up separately at a later SAO meeting. With the reference to the Ministers' Tromsø decision "to consider the proposal to arrange an International Polar Decade" and noting the growing support of the IPD idea in WMO and other international organizations organizations, Russia suggested that this proposal be studied by AMAP together with IASC and WMO and the outcome of the study reported at the next SAO meeting* ...". SAOs also noted that "*Some focus areas, such as data, observations issues are being addressed through the SAON and other related initiatives such as IPY Data Management.*" The decision by the SAOs was that "*the Arctic Council would continue to contribute to the legacy of IPY by asking the working groups to make use of the most up-to-date research results in ongoing assessment processes, as well as through contributions to, inter alia, SAON.*"

2.9.4. Ice Logistics Portal will continue to provide an infrastructure support for scientific expeditions in the Arctic throughout the Polar Decade. Although, it should be noted that there may be an expectation that the Ice Logistics Portal will be expanded. Outcomes from the Ice Analysts Workshop related to accuracy of ice charts is another potential contribution to the Polar Decade. The ET also noted that there will be a direct input from the GDSIDB throughout the Polar Decade which will continue to provide sea ice climatology.

2.9.5. ETSI Members agreed that they should make an effort to contribute ice charts in SIGRID-3 format to the GDSIDB centers (NSIDC and AARI). ETSI will discuss with the GDSIDB centers the best method of hosting these charts in the context of the Polar Decade (whether through a new dataset or an existing one) **(Action: ETSI Chairperson, ETSI Members)**.

2.10. Relations with Other JCOMM Bodies

2.10.1. Relations with Other JCOMM Bodies

2.10.1.1. The Secretariat noted that, at JCOMM-III, the Commission recognized the need to improve coordination amongst, and integration of, the different Programme Areas in response to crosscutting requirements, and requested that this be a priority issue for the Management Committee during the coming intersessional period. It recommended that the Coordination Groups explore better and more frequent mechanisms for communication and coordination within the PA, including alternative methods of communication such as tele- and videoconferences.

2.10.1.2. As was noted in the reports of the FSSPA Coordinaotr and the Chairpersons of the Expert Teams, a number of the Expert Teams have common interests with ETSI. Foremost among these are the Expert Team on Maritime Safety Services (ETMSS), the Expert Team on Operational Ocean Forecasting Systems (ETOOFS) and the Expert Team on Marine Climatology. The specifics of these common interests had been discussed throughout this ETSI meeting.

2.10.1.3. The ET discussed how the ETSI can best be integrated with the work of the other Expert Teams and it was suggested that a member of the ETSI, from Canada, Norway or Russia, participate in the meetings of the ETMSS. This may be appropriate for the next few years as services in the new Arctic METAREAs become implemented. The ET agreed to create a core sub-group of 4 experts (Canada, Russia, Denmark and Norway) who will represent activities related to sea ice at the ETMSS and related meetings **(Action: ETSI Chairperson)**.

2.10.1.4. ETOOFS Providing summaries on sea ice data assimilation activities and will task an expert from the Ice services to present these activities to the ETOOFS – refer to previous action item

2.10.1.5. ETMC – the chairman noted that there is a large gap in understanding of the ETMC on sea ice issues and there is a need for ETSI to inform the ETMC of the availability of information. The session noted that one of the optimum approaches is for one of the experts from the NSIDC to assist the chair in coordinating with the ETMC.

2.10.1.6. Linkages to the other ETs are well identified in the SFSPA work program through the priorities of the Programme Areas. The Team agreed that it should concentrate working with the other ETs in these priority areas – rather than trying to develop a holistic inter-collaboration.

2.10.1.7. SFSPA coordinator will discuss with ETOOF the necessity for an expert on sea ice modelling on the ETOOF **(Action: SFSPA Coordinator)**.

2.10.2. Support for JCOMM Capacity Building

2.10.2.1. At JCOMM-III, the Commission recognized that it was essential that all maritime Members/Member States should be in a position to both contribute to and benefit from the work of JCOMM. In this context, a set of *Guiding Principles for Oceanography and Marine Meteorology Capacity-Building* were adopted. It noted that JCOMM is jointly sponsored by the WMO and the UNESCO/IOC and therefore its capacity-building activities must operate within, and draw upon, the overall principles of its governing bodies. The WMO and UNESCO/IOC should also assist with the development of partnerships with potential donor agencies and with links with other UN and other relevant regional and global organizations. The activities also must be compatible and work with similar efforts in other WMO and UNESCO/IOC Programmes. In addition, the JCOMM should seek partnerships to pursue mutual objectives in

the development of capability.

2.10.2.2. JCOMM should support capacity development elements that are not fully included in other ocean or atmosphere programmes, and draw attention specifically to other capacity-building programmes of the WMO or UNESCO/IOC. Examples include specialized observations and resulting products, e.g., those of some satellite missions, the Argo profiling float programme, or the Data Buoy Cooperation Programme, and other applications. The three JCOMM Programme Areas each should include capacity-building activities for a more integrated, focused and proactive approach.

2.10.2.3. The JCOMM capacity-building principles are, in no particular order:

(i) The primary objective of JCOMM capacity-building is to enhance the implementation of the overall JCOMM Programme through enhancing capacity in all Members/Member States to contribute to and benefit from the programme;
(ii) The Activity Leader on Capacity-Building should work with the PA coordinators and the Secretariats to revise the JCOMM capacity-building strategy that builds on existing capacity-building work in both WMO and UNESCO/IOC, to implement a range of JCOMMfocused capacity-building activities;
(iii) Specific JCOMM-focused capacity-building activities should be implemented by the respective Programme Areas and included in their respective workplans;
(iv) JCOMM capacity-building activities should aim to fill-in gaps and avoid overlapping at national, regional and international levels. It is highly desirable that national partners from both JCOMM themes (i.e., oceanography and marine meteorology) be involved so the complementary and “symbiotic” benefits of JCOMM are clearly demonstrated;
(v) JOMMM capacity-building will include continuous professional development;
(vi) JCOMM capacity-building will aim, where possible, for a “train the trainer” approach to help ensure continuity by countering staff turnover/brain drain problems and to promote the wide spread of knowledge and practices;
(vii) At the regional level, JCOMM capacity-building will develop programmes and projects that follow WMO and UNESCO/IOC strategies (e.g. the ODIN strategy, developed by IODE of UNESCO/IOC; the SWFDP, developed by WMO/CBS; the PANGEA concept, developed by the JCOMM OPA);
(viii) At the regional level, JCOMM capacity-building will develop, preferably, medium to longterm programmes and projects that will result in national structural and embedded capacity that can be sustained by national funding sources;
(ix) Creating awareness in the minds of the public and policy makers is essential for raising national and international support;
(x) JCOMM capacity-building activities will include assessment of feedback regarding the satisfaction and requirements of users of JCOMM observations, products and services;
(xi) One member of the JCOMM Management Committee will be responsible for liaison with the three Programme Areas regarding capacity-building activities;
(xii) JCOMM capacity-building activities should endeavour to utilize existing methods, courses, tools and other capacity-building aids, particularly those of the WMO and UNESCO/IOC.

2.10.2.4. Among other training tools, JCOMM-III specifically noted “Bilko” as a complete data analysis system developed primarily for learning and teaching remote sensing image analysis skills. Bilko is supported by UNESCO and is available free of charge. ETSI-III noted the availability of Bilko and requested the Canadian Ice Service to evaluate its suitability for ice

analysis training. The CIS was only able to undertake a cursory review and concluded that it did not have enough resources to even learn the Bilko system sufficiently to do a proper analysis.

2.10.2.5. COMET is another training system specifically mentioned by JCOMM-III. The National Ice Center has initiated a project to develop a COMET module that will overview the NIC, products and services available to clients and including introductions to egg code interpretation, seasonal climatology, ice formation/ablation and iceberg types and identification. This first module is planned for release in September 2010. The NIC has sufficient funding available to develop a second COMET module and is seeking the advice of the ETSI members on the content that should be priority. The ETSI members asked Caryn to circulate information on the content of the first module to the Team **(Action: Caryn Panowicz)**. Team members are asked to provide their proposals for content of the second module by the end of April **(Action: ETSI Members)**.

2.10.2.6. The chairman introduced an AARI proposal on the organization of international courses for the training of ice experts on the interpretation of satellite images. This initiative is closely related to the COMET developments. By way of background, he reminded the Team that satellite remote sensing in the various spectral ranges is the main and a very often the only source of the information on an ice cover state in the Arctic and freezing seas. However methods of remote sounding of an ice cover, basically, are indirect. Reliable interpretation of satellite images is provided when the expert has long-term working experience, knowledge of an ice regime for the defined areas, skills of joint processing of satellite images of an ice cover in various spectral ranges, and also knowledge of peculiar properties of satellite images of various ice types. Such experience is gained during teamwork with skilled ice experts on interpretation of satellite images after initial training.

2.10.2.7. In 2009, a course for the training of ice experts on interpretation of satellite images was developed, arranged and given at the Arctic and Antarctic Research Institute, Saint Petersburg, Russian Federation. The basis for performing the work was the contract on conducting research for the BP Arctic and Cold Regions Technology and Engineering Programme. Sixteen trainees, all AARI employees, graduated from this course and received corporate certificates.

2.10.2.8. To increase the quality of ice information derived from satellite imagery, it is proposed to consider merging the educational materials and curriculum of different ice services and organize international courses for the training of ice experts on interpretation of satellite images. The AARI Manual for Ice Experts – Ice Observers introduced in paragraph 2.6.8 could be a valuable source of content for COMET modules. The ET proposed that the AARI contact the COMET team working on these activities to determine if some joint collaboration is possible **(Action: AARI)**.

2.11. ETSI Future Activities and Work Plan for the Next Intersessional Period

2.11.1. The workplan developed by the Expert Team for the next intersessional period is attached at Appendix XXI. Further the Team reviewed and developed the list of its activities, outcomes and deliverables for the overall SFSPA Work Plan for the Intersessional Period (Appendix III, items #20, 22, 24, 25, 28, 32, 33).

3. TWELFTH SESSION OF THE STEERING GROUP FOR THE GDSIDB

3.1. Reports of the GDSIDB Centers

3.1.1. The chairman welcomed the participants to this 12th session explaining the history of the relationship between the ETSI and the Steering Group for the GDSIDB. The GDSIDB is a project of the WMO that pre-dates the formation of JCOMM and the ETSI. The co-chairs of the Steering Group are formally Dr. Roger Barry (NSIDC) and Dr. Ivan Frolov (AARI) but, for practical purposes, the ETSI has been given responsibility for the management of the GDSIDB. The workplan for the past intersessional period of the GDSIDB is attached at Appendix XXII.

Arctic and Antarctic Research Institute

3.1.2. The Arctic and Antarctic Research Institute (AARI) of Roshydromet, St. Petersburg, Russian Federation, continued to support the WMO Global Digital Sea Ice Data Bank project during the intersessional period of 2007-2009. The Steering Group experts for the project, co-chaired by the AARI Director, Dr. Ivan Frolov, provided expert resources to maintain and extend archived data and enhance processing techniques in the interest of climate-oriented programmes. Information regarding GDSIDB project information and data at the Arctic and Antarctic Research Institute can be located at the following web addresses: http://www.aari.ru/gdsidb, http://www.aari.ru/projects/ecimo/index.php?im=100 and http://wdc.aari.ru.

3.1.3. Up to the present, historical ice charts in SIGRID format (WMO, 1989) continue to dominate in the project archive at AARI. The AARI ice charts for the Eurasian Arctic (which date back to 1933) comprise the longest temporal series, the CIS ice charts for Canadian Arctic being the second longest one, while the NIC ice charts provide the unique hemispherical view.

3.1.4. The Japan Meteorological Agency (JMA) continues to provide information in SIGRID-2 format (WMO, 1994), as well as text, both of which are translated into SIGRID at the AARI. Other formats include the NSIDC Ease-Grid for NIC ice charts (1972-2004) and SIGRID-3 (WMO, 2004) for AARI ice charts for the Arctic Ocean (since 2008). Table 1 summarizes sea ice charts stored in the project archive at AARI as of December 2009. Datasets updated during 2007-2009 are marked by grey.

Table 1. Sea ice charts presently archived within GDSIDB (AARI)

#	Data set title	Format	Interval / periodicity	Gaps	Sea ice parameters	Number of charts
1a	AARI 10-days period ice charts for the Eurasian Arctic	SIGRID	1933-1992 /10d	Yes	CT, SD, FI	2372
1b	AARI 10-days period ice charts for the Antarctic Region	SIGRID	1971-1990 /10d	Yes	CT, SD, FI	475
1c	AARI 7-days period ice charts for the Eurasian Arctic	SIGRID	1997 – 2008 / 7d	No	CT/SD mask, FI	624
1d	AARI 7-days period ice charts for the Arctic	SIGRID-3	2008 -.../7d	No	CT/SD mask, FI	> 104

	Ocean					
2a	NIC weekly ice charts for the Northern Polar Region (northward 39°N)	SIGRID, e00	1972-1994 / 7d	No	CT, SD, FI	1200
2b	NIC weekly ice charts for the Northern Polar Region (northward 39°N)	EASE-GRID	1972-2004 / 7d (14d from 2001.07.09) days	No	CT, MY, FY, FI	1628
2c	NIC weekly ice charts for the Southern Polar Region (southward 50°S)	SIGRID	1973-1994 / 7d	No	CT	1150
3	CIS ice charts for Canadian Arctic (Eastern Arctic, Eastern Coast, Western Arctic, Hudson Bay)	SIGRID	1968-1998 / 7d	Yes	CT, SD, FI	3437
4a	BSIM ice charts for the Baltic Sea	Baltic code SIGRID	1960-2007 / 3-4d	No	CT, SV, FI	> 2000
5	JMA total concentration ice charts for the Sea of Okhotsk	SIGRID SIGRID-2 .txt	1970-2007/ 5d	No	CT	>1200

Notes:

a) Sea ice identifiers: CT – total concentration, SD – stages of development, SV – ice thickness, MY, FY – MYI, FYI concentrations, FI – fast ice indicator, CT/SD mask – general CT (summer period) or SD (winter period) gradations;

b) Institutions acronyms: AARI – Arctic and Antarctic Research Institute, St Petersburg, Russian Federation, BSIM – Baltic Sea Ice Meeting (Finnish and Swedish ice services), CIS – Canadian Ice Service, JMA – Japan Meteorological Agency, NIC – USA National Ice Center.

3.1.5. Other sea ice data sets in non-SIGRID format include:

a) Sample ice concentration and thickness 0,1° by 0,1° daily grids for the Sea of Bohai for the periods of 1998 to 2000 from the National Marine Environment Forecast Center (NMEFC) and Qingdao Marine Forecasting Observatory (QMFO) of State Ocean Administration (SOA), China;
b) Routine coastal station and ship-borne observations from the Glaciological Division of the Argentine Navy Meteorological Service (SMARA) in the Weddell and Bellingshausen Seas from 1990s to present;
c) Summer (June - September) 10-days period ice extent in the Eurasian Arctic Seas (Barents - Chukchi) provided by the AARI for 1900-... (with gaps).

User access to information

3.1.6. Presently the GDSIDB page at AARI is undergoing revision within the development of a dedicated WDC B Sea Ice server. Not all of the datasets are directly available within the old interface at http://www.aari.ru/gdsidb/. Most of the GDSIDB (or general sea ice climatology) is

available via the portal of the national project ECIMO (Unified System of Information for the World Ocean). Following intermediate links are available to users:

- http://www.aari.ru/projects/ecimo/ModuleLoad.php?mod=d0015&in=1 – collection of weekly review ice charts for the Arctic Ocean in GIF and SIGRID-3 formats (since January 2008);
- http://www.aari.ru/projects/ecimo/ModuleLoad.php?mod=d0003&in=1 - collection of weekly review ice charts for the Eurasian Arctic in GIF format (January 1997 – December 2008);
- http://www.aari.ru/projects/ecimo/ModuleLoad.php?mod=d0004&in=1 - collection of monthly (weekly) ice charts for the Eurasian Arctic Seas (Greenland – Sea of Okhotsk) in GIF and SIGRID-3 formats (since winter 2004);
- http://www.aari.ru/projects/ecimo/ModuleLoad.php?mod=d0002&in=1 – monthly sea ice total concentration climatology based on blended GDSIDB data in GIF format;
- http://www.aari.ru/projects/ecimo/ModuleLoad.php?mod=d0005&in=1 - summer (June - September) 10-days period ice extent and ice extent climatology in the Eurasian Arctic Seas (Kara - Chukchi) and their subareas since 1935;
- http://www.aari.ru/projects/ecimo/ModuleLoad.php?mod=d0006&in=1 - summer (June - September) 10-days period ice massifs area and climatology in the Eurasian Arctic Seas (Kara - Chukchi) since 1938.

3.1.7. The new location of the GDSIDB project archive at AARI will be at http://wdc.aari.ru.

National Snow and Ice Data Center

3.1.8. Roger Barry was unable to attend this meeting of the GDSIDB. Florence Fetterer (NSIDC) provided the report in the following paragraphs following the meeting. Ms Fetterer noted that NSIDC wishes to continue working with operational ice services to expand the user base for ice service products among the scientific community. Of particular interest now are exploring the possible utility of ice charts in arctic observing networks. Sustaining Arctic Observing Networks (SAON, http://www.arcticobserving.org/) is an 'umbrella' for the network we are most involved with, the Arctic Observing Network (AON, http://www.aoncadis.org/).

3.1.9. NSIDC is working closely with the National Ice Center (NIC) to develop the Multisensor Analyzed Sea Ice Extent – Northern Hemisphere (MASIE-NH). This product will use the NIC IMS product as a data source for ice extent, and will be updated daily. It is expected to give a much more accurate rendition of the ice edge position than does the widely used Sea Ice Index (http://nsidc.org/data/g02135.html) upon which it will be loosely modeled. Still, we will be careful to direct users to operational services for the most accurate information on the ice edge.

3.1.10. NSIDC published the following datasets during the intersessional period :

- *Sea Ice Charts of the Russian Arctic in Gridded Format, 1933-2006,* (http://nsidc.org/data/g02176.html) was published in collaboration with AARI.
- *Sea Ice Edge Location and Extent in the Russian Arctic, 1933-2006* (http://nsidc.org/data/g02182.html) is derived from the previous data set.
    - The data sets have been the basis of a number of research papers including: Mahoney, A. R., R. G. Barry, V. Smolyanitsky, and F. Fetterer (2008), Observed

sea ice extent in the Russian Arctic, 1933–2006, *J. Geophys. Res.*, *113*, C11005, doi:10.1029/2008JC004830.

- In 2008, the data set *Arctic sea ice melt pond statistics and maps, 1999-2001* (http://nsidc.org/data/g02159.html) was published. These data can assist research to improve how melt pond development is parameterized in coupled ice-ocean-atmosphere models. Ideally, such research will improve forecasting capability.
- *Canadian Ice Service Arctic Regional Sea Ice Charts in SIGRID-3 Format* (http://nsidc.org/data/g02171.html) was published in 2009. NSIDC worked with CIS to make these analysis chart data, for five regions, available as they are created at CIS. We see this collaboration as a model for future work with operational ice services interested in distributing data to a broader user base.
- *Recurring spring leads and landfast ice in the Beaufort and Chukchi Seas, 1993-2004* (http://nsidc.org/data/g02173.html) was published in 2008. The data are available in a number of formats including ArcGIS geodatabases (.mdb), shapefiles (.shp), ArcGIS grids (.adf), ArcGIS grids in ArcInfo interchange format (.e00), and GeoTIFFs (.tif). Statistics are also provided in Microsoft Excel spreadsheets (.xls) and metadata in several formats including XML (.xml), SGML (.sgml), HTML (.html), and ASCII text (.txt). Quick-view browse images in JPEG (.jpg) format are provided for the shapefiles, grids, and GeoTIFFs. This data set is an example of how we work with data providers to bridge the gap between GIS users and other users by providing data in multiple formats when resources allow.
- *Arctic Ice Dynamics Joint Experiment (AIDJEX) Second Pilot Study, March - May 1972: A Documentary Film* (http://nsidc.org/data/g02183.html) was published in 2008. AIDJEX brought together several nations and institutions in the largest western sea ice experiment constructed specifically to answer emerging questions about sea ice.
- *International Geophysical Year, 1957 – 1958, Drifting Station Alpha* (http://nsidc.org/data/g02183.html) is a film narrated by project leader, Norbert Untersteiner, that chronicles the life of the team as they built their camp and set up experiments.
- The *Sea Ice Index* (http://nsidc.org/data/g02135.html) data set is used for monitoring trends in ice extent by a wide variety of users, and is the data source for the prototype NOAA National Climate Service “Global Climate Dashboard” (http://www.climate.gov/) Arctic ice plot. The web interface was extensively updated in 2009.

3.2. REPORT OF THE CHAIRPERSON OF THE EXPERT TEAM ON MARINE CLIMATOLOGY

3.2.1. The Chairperson introduced the report submitted by the Scott Woodruff, Chairperson of the ETMC (Appendix XXIII). The Session noted the request from the ETMC to continue to explore making products more readily discoverable and accessible; and the integration of oceanographic and sea-ice climatologies together with marine meteorological information. The Session noted that its decisions and action in Paragraph 3.4 correspond to this request.

3.2.2. The Session also recommended that the ice services should take a greater role in presenting sea ice climatology at relevant workshops such as CLIMAR.

3.2.3. The Session noted that there are currently a large number of projects involved in

digitizing ship log books. It was proposed that an inventory of these projects be developed and that these projects be requested to extract sea ice information along with other ocean and atmospheric data **(Action: Nick Hughes)**.

3.3. GCOS REPORT ON SST&SI WORKING GROUP ACTIVITIES

3.3.1. The Session noted that Dr. Leif Toudal Pedersen (DMI) is the current chair of this group but has lack of resources available to support with no specific report available for ET. His intention is to ask the NSIDC to assume responsibility for the Working Group. However, the chairman brought the attention of the Session to the discussion on "Identification of uncertainties and verification of the passive microwave ice information products" during the 1st Ice Analysts Workshop (June 2008) and the corresponding presentation by Dr. Pedersen which directly relates to the prime tasks of the WG. In his presentation, Dr. Pedersen notes that passive microwave radiometry (PMR - SMMR, SSM/I and AMSR) data are now available for more than 30 years and are used extensively for climate studies. Attempts are undertaken by the ice centers, in particular the DMI, to evaluate uncertainties in the PMR record and provide algorithm selection to reduce errors, where possible, for PMR use for strategic charts and climatology. For the purpose of analysis, low concentration errors were estimated at DMI by analyzing data from areas of no ice and high concentration errors were estimated by analyzing data from the central Arctic in winter. Principal error sources were identified as: (1) atmospheric including wind, (2) dry ice/snow emissivity (thin ice, snow layering and grain size effects), (3) mixing of footprints and (4) sensor noise (<2%). In summer, error sources, in addition, include (5) snow wetness, (6) melt ponds, open and refrozen, (7) extreme diurnal variation and (8) breakdown of ice type signatures. Atmospheric errors are found to be important at low ice concentrations while ice emissivity errors are important at high ice concentrations. Results of the intercomparison analysis based on 59 classified SAR scenes showed an error standard deviation variation between 2.5% and 4.9% for the best SAR data subset with overall best performance by Bristol and algorithms using 85 GHz channels. Full results are summarized in: Andersen, S., R. Tonboe, L. Kaleschke, G. Heygster, and L. T. Pedersen (2007); *Intercomparison of passive microwave sea ice concentration retrievals over the high-concentration Arctic sea ice, J. Geophys. Res., 112, C08004, doi:10.1029/2006JC003543.*

3.4. DEVELOPMENT OF SEA ICE HISTORICAL DATA PROCESSING

3.4.1. The GDSIDB holds mapped ice data on a 5- to 30-day period from 1933 to the present for the Arctic and from 1971 to the present for the Antarctic. There are a number of gaps in factual data: temporal (mostly in wintertime) and spatial (mostly outside navigable areas like Eastern passage/Northern Sea Route or Western passage). From the 1970s, the GDSIDB ice charts may serve as ground-truth to SSM/I products (as it is based on comprehensive usage of all available sources of ice information and expert knowledge), or be the unique source of ice conditions and climate for the period earlier than 1978. Ice charts from the separate ice services have different temporal attributes (i.e., starting time, validity period) and in a number of cases overlap each other, so blending of individual data sets enhances usage of factual data.

3.4.2. During the periods of 2002 to 2003, the first blending technique for Northern Hemisphere GDSIDB charts was developed and implemented at the AARI. The principal blending scheme for constructing the monthly 15'x15' total concentration dataset for the periods of 1950 to1998, included merging of five GDSIDB datasets (specified in table 1 – AARI, BSIM, CIS, JMA, NIC) to monthly spacing by means of averaging to middle of month. Output dataset (as consequent revised versions) was provided in 2003-2005 for the testing and intercomparison purposes to the United Kingdom Met Office (Hadley Center) and presented at

MARKDAT-II seminar (October 2005). This scheme was repeated in October 2007 using material described in table 1 and for the period 1933-2004.

3.4.3. Output contains total concentration values with 1% resolution and corresponding flags of origin for each value. As the resultant blended data set presently contains the greatest amount of factual ice data available for the period 1933-2004, the Session recommends that the GDSIDB be used by the ETMC and other climatology experts in their assessments and other activities.

3.4.4. The Chairman brought the attention of the Session to the discussion on "Identification of uncertainties in the climatological series of the ice charts by regions, seasons and time intervals" during the 1st Ice Analysts Workshop (June 2008) and corresponding presentation by Holly Titchner (Hadley Center, UK MetOffice) describing analysis of the blended gridded GDSIDB data. Holly Titchner in her work aims to produce a long term time series of global sea ice concentration fields. These will be used in the next version of HadISST, the Met Office Hadley Centre sea surface temperature and sea ice concentration dataset (http://hadobs.metoffice.com/hadisst/), which is used for many applications of climate research. As a first necessary stage analysis of the uncertainties in the blended GDSIDB data was carried out which in a brief revealed the following. Several distinct periods were found in terms of data coverage (1901-1939, 1940-1945, 1946-1952, 1953-1971 and 1972-2004). Coverage also varied seasonally and regionally, with more observations in the summer months and along the coast of Siberia. The regions and times containing no data have the largest uncertainties, and climatologies were used instead. This reduced the variability within the time series of extents/areas and introduced biases. Example fields and distributions highlighted inconsistencies within individual fields, particularly at high concentrations. These corresponded to the use of different data sources. However, the concentration differences were small (5 % or less) and were likely due to differences in reporting formats. Unrealistic variations within individual sources could also be seen through time. The difference between using the mean and the median to calculate the monthly averages was discussed. It was noted that information regarding the number of sea ice charts used to calculate each monthly average would provide useful information, as well as the range of concentrations given by the charts.

3.4.5. The Session considered a submission prepared by Frode Dinessen (met.no) concerning the progress in extending and using the netCDF format within the MyOcean project. Current practices of data exchange between the services and centers (at least CIS, AARI, met.no) show the need for a new generation format to support sea-ice gridded information in addition to raster SIGRID (WMO, 1989), SIGRID-2 (WMO, 1994) and vector SIGRID-3 (WMO, 2004). The main idea is that such a new format should be: a) open format(s); b) compatible with the WMO Sea Ice Nomenclature including coding tables; c) supported by mainstream software; and, d) friendly to data providers at ice services and climatic centers. It is also desirable that such a future format to be capable to support both vector and raster data.

3.4.6. The SIW TAC (Sea Ice and Wind Thematic Assembly Centre) in the MyOcean project will deliver all sea ice data in the netCDF format. Met.no cooperated with the SIW TAC to produce a draft description of the sea-ice content in the netCDF file. (Annex N). This draft may be considered as a possible prototype for sea ice gridded data exchange. It was also noted that the AARI uses Net CDF as a transport format to present output from the numerical modelling.

3.4.7. The Session endorsed the activity of the IICWG task team of Vasily Smolyanitsky, Tom Carrieres, Frode Dinessen and Helge Tangen which is currently considering the

applicability of NetCDF and is expected to make a recommendation at the next IICWG meeting. The Session agreed to ask this task team to also assess the appropriateness of GRIB in this context **(Action: Nick Hughes)**.

3.4.8. The Session also noted that NetCDF is not a controlled standard and therefore some NWP centres do not accept it. It was informed that there is a WMO CBS working group assessing the appropriateness of NetCDF for NWP centres. The work of this group should be considered. The Session also noted that it is possible for software to convert SIGRID-3 into NetCDF or GRIB and recommended that this could be a preferable solution for making sea ice data more easily useable by numerical modellers.

3.5. SUBMISSION OF NEW SEA ICE DATA INTO THE GDSIDB

3.5.1. This was discussed under Paragraph 3.1.

3.6. SEA ICE ATLASES AND SEA ICE CLIMATOLOGY

3.6.1. Sea Ice Atlases

Report from Canada

3.6.1.1. Marie-France Gauthier informed the Session about two major activities in the Canadian Ice Service related to sea ice atlases.

Polar Continental Shelf Project Ice Atlas Digitization Project

3.6.1.2. The Objective of the project is to contribute to the extension of the period of record of digitized ice charts in the Canadian Ice Service Digital Archive. Since 1998, most CIS ice charts have been produced using Geographical Information Systems (GIS) and electronically stored in a digital graphics format. Charts prior to 1998 were all archived in hardcopy paper format. Over the years, CIS has undertaken the electronic digitization into vector graphic format of hardcopy archived regional ice charts. CIS is now in the process of completing the vector digitization of approximately 300 climatological ice charts in the Canadian Arctic Archipelago produced by The Polar Continental Shelf Project (PCSP) during the 1960's and the 1970's. The purpose of this work is to expand the vector chart data set held by CIS and contributed to the GDSIDB. This will provide additional data on historical ice coverage in the Canadian Arctic and will result in improved climatological statistics, charts and information products.

Climatic Ice Atlas Update

3.6.1.3. The CIS is initiating a project to update its Climatic Ice Atlases. The "Sea Ice Climatic Atlas – East Coast of Canada 1971-2000" and the Lake Ice Climatic Atlas – Great Lakes 1973-2002 will be updated in 2010. The plans for 2010 are to publish the new 30 years normals to include data from 1980/81-2009/10 seasons. The final formats have not yet been determined but there will be at least a CD/DVD version.

Report from Russian Federation

3.6.1.4. Vasily Smolyanitsky provided an on-line demonstration of output available from the GDSIDB including ice extent and ice massif statistics for Arctic seas. He noted that AARI plans to develop sea ice atlases for the Eurasian Arctic seas in both vector and raster formats during

2010 and 2011.

Report from Denmark

3.6.1.5. Mr. Keld Qvistgaard informed the Session that DMI is in the process of digitizing its sea ice charts for a 50 year period back to 1959 with funding from the Commision for Scientific Research in Greenland as part of a socio-economic project "Vulnerability and Adaption of South Greenland Economies to natural variability of multi-year ice". This data will be contributed to the GDSIDB. The project is expected to be completed in 2011. Navigation ice charts for South Greenland back to 1959 are in the process of being digitized and will be available to GDSIDB in SIGRID3 in 2011. General ice charts for all Greenland Waters for 1999-2004, 2008-09 are available in SIGRID-3 and will be submitted to GDSIDB. General ice charts for 2005-07 will through 2010 be available in SIGRID3.

Report from the German Ice Service

3.6.1.6. Dr. Jürgen Holfort advised the ET that, at the German Ice Service, sea ice data for the whole Baltic is available on a 0.5°x0.5° grid. Ice concentration data spans the period 1956–2005 and ice thickness the period 1982–2005. Updates for years after 2005 are planned. The temporal resolution is approximately twice week.

3.6.1.7. Together with the Polish Ice Service and input from the Swedish Ice Services work is underway to produce an ice atlas of the western and southern Baltic. For this work gridded 2'x4' ice data is available for most of the region, one exception is the easternmost part.

3.6.1.8. Ice information from stations along the German coast, some of them dating back to the end of the 19th century, are available in a database. An index of the ice winter severity at the German Baltic coast is available back to the year 1301.

3.6.1.9. Sea ice charts for the period 1927 to 1951 are being photographed and then digitalized, but many constraints present in these old charts still need to be accessed more closely before the digital version could be generally distributed. (examples can be found at http://www.bsh.de/de/Meeresdaten/Beobachtungen/Eis/Historische_Karten.jsp)

3.6.2. Sea Ice Climatology

3.6.2.1. Marie-France Gauthier informed the Session about an on-line tool used to generate statistics about ice in Canadian waters. The Ice Graph tool is a program that computes statistics from a number of pre-defined areas. The data is based on the Canadian Ice Service Digital Archive - Regional Charts collection. For every available area, information regarding the concentration of various stages of development of ice is extracted from all available Regional Ice Charts in Geographic Information System (GIS) compatible data and summarized in a database that is used by this tool. The tool is freely available for public use and is found on the Canadian website at: http://ice-glaces.ec.gc.ca/IceGraph/IceGraph-GraphdesGlaces.jsf?id=11874&lang=eng. For more detailed information about Ice Graph, go to: http://ice-glaces.ec.gc.ca/App/WsvPageDsp.cfm?ID=11873&Lang=eng#interpret

3.6.2.2. Marie-France Gauthier also informed the Session that the Canadian Ice Service has been producing a Seasonal Summary for the Eastern Canadian Waters, the Great Lakes and the Canadian Arctic for many years. These documents provide a post-seasonal summary of prevailing ice conditions and related weather. Recent editions are available in PDF format on

the CIS website http://www.ice-glaces.ec.gc.ca/ under “Ice Archive”. In light of increasing demand on resources the Canadian Ice Service is currently meeting with users and re-evaluating the need for this product and its format.

3.7. Arctic Marine Shipping Assessment (AMSA)

3.7.1. John Falkingham, a lead author of the AMSA, updated the Session on the status of the AMSA project recalling that during 2005-2008, a multi-national team led by the United States, Canada and Finland, and under the leadership of Dr. Lawson Brigham of the US Arctic Research Commission, prepared a comprehensive study and evaluation of Arctic marine activity today and in the future. The main focuses of the Arctic Marine Shipping Assessment (AMSA) are marine safety, marine environmental protection, infrastructure needs of ships and the impacts from ships in the Arctic Ocean. The AMSA took into consideration the concerns and ideas from Arctic communities about the future of Arctic marine activity. The AMSA 2009 Report is designed to educate and inform people about the current state of Arctic marine use and future challenges.

3.7.2. John Falkingham gathered and synthesized input from the members of the Expert Team on Sea Ice to provide the sections on sea ice that are contained in the AMSA Report. A page of the Arctic Marine Geography, Climate and Sea Ice chapter is devoted to describing, in plain language, the nature of sea ice and icebergs with a view to educating the non-expert (in sea ice) intended audience of the publication.

3.7.3. The Arctic Marine Infrastructure chapter contains a section on “Ice Information in the Arctic” that describes, at a necessarily high level, the needs of mariners for ice information and how they are addressed. One of the key findings of this chapter is:

> *“For safe operations, ships navigating in the Arctic need the same suite of meteorological and oceanographic data, products and services as in the other oceans plus a comprehensive suite of data, products and services related to sea ice and icebergs. As the shipping season becomes extended, significant increases in resources will be needed to expand the information services accordingly.”*

3.7.4. The AMSA was sponsored by the Protection of the Arctic Marine Environment Working Group on behalf of the Arctic Council. On the occasion of its Sixth Ministerial Meeting in Tromsø, Norway on 29 April 2009, the Arctic Council approved the Arctic Marine Shipping Assessment (AMSA) 2009 Report including “*its recommendations on enhancing Arctic marine safety, protecting Arctic people and environment and building Arctic marine infrastructure and request[ed] Senior Arctic Officials (SAOs) to develop appropriate follow up actions.”*

3.7.5. Mr. Falkingham thanked the members of the ETSI/GDSIDB for their kind and generous assistance in providing input and providing valuable comments on draft documents. The complete AMSA report is available for free download at www.pame.is.

3.8. Working Plan for the Next Intersessional Period

3.8.1. The Session developed the following table identifying the plans for submissions to the GDSIDB in the next intersessional period:

Institute	Region	Time interval	Exchange date

			(notes)
AARI	Antarctic Arctic	Twice monthly, 2009 ongoing forward in time 2010, ongoing forward in time	SIGRID-3 SIGRID-3
Argentine Navy Hydrographic Service	Weddell and Bellingshausen Seas	Current observations	Point coastal and ship observations in NIC-code in .db format, submitted with weekly interval to NSIDC and AARI ftp-servers
BSIM (SMHI)	Baltic Sea	2008, ongoing forward in time	SIGRID
CIS	Canadian Arctic	Ongoing weekly charts Historical ice charts starting 1959 produced by Polar Continental Ice Shelf Project and ending in 1974	SIGRID-3 SIGRID-3
State Oceanic Administration of China	Bohai Bay/Yellow Sea	TBD	GDSIDB co-chairs will request SOA on the details of data provision
DMI	Greenland waters	2010, forward in time 1959-2007 Prior to 1959	SIGRID-3 SIGRID-3 TBD, possibly in graphic format
Federal Maritime and Hydrographic Agency (BSH)	Baltic Sea (south of 56°N and to the west of 14°20' E) Whole Baltic Sea	3 times a week, 1960-1996 2010, forward in time Gridded concentration, twice per week 1952-2005 1927-1945 Digitized ice charts	SIGRID-3 SIGRID-3 NetCDF, .txt TBD, possibly in graphic format
Icelandic Meteorological Office	Icelandic waters	1971-1974 2002, ongoing forward and back in time	GDSIDB co-chairs will request IMO on the details of data provision
UK BAS	Antarctic ship and coastal stations observations	1950s forward in time	Metadata
JMA	Sea of Okhotsk	Every 5 days, forward in time	Once a year in SIGRID-2 format

NIC	Arctic, Antarctic	Ongoing hemispheric bi-weekly charts	SIGRID-3
	Antarctic	Corrected and updated version of hemispheric 1973-2004 weekly and bi-weekly ice charts	SIGRID-3 (TBC)
	Arctic, Antarctic	Daily ice edge from 2004 forward in time	.txt, SIGRID-3 (TBC)
Norway	Barents and Greenland Seas	Weekly and daily Ice concentration charts from 1967 up to the present	Shapefile, SIGRID-3 (in progress)

4. RELATIONS TO OTHER WMO/IOC AND INTERNATIONAL PROGRAMMES

4.1. The following information was submitted by the Secretariat for the information of the ETSI and the GDSIDB Steering Group.

4.1.1. JCOMM works in collaboration with many other WMO/IOC and International programmes. JCOMM-III noted many of these relations and identified the nature of the relationship. The following paragraphs note the relationships that are of specific interest to the ETSI.

4.1.2. The International Hydrographic Organization (IHO) is an intergovernmental consultative and technical organization that was established in 1921 to support the safety in navigation and the protection of the marine environment. The object of the IHO is to bring about:

- The coordination of the activities of national hydrographic offices;
- The greatest possible uniformity in nautical charts and documents;
- The adoption of reliable and efficient methods of carrying out and exploiting hydrographic surveys;
- The development of the sciences in the field of hydrography and the techniques employed in descriptive oceanography.

4.1.3. The ETSI relationship with the IHO concerns the development of sea ice information for Electronic Navigation Charts. In this context, the Transfer Standard Maintenance and Application Development Working Group (TSMAD) is the IHO body responsible for the S-57 and S-100 standards. The TSMAD is a working group of the IHO Hydrographic Service and Standards Committee (HSSC) which was formerly known as the Committee on Hydrographic Requirements for Information Systems (CHRIS). TSMAD is chaired by Mr. Barrie Greenslade of the UH Hydrographic Office. It is this body that has been assisting in the development of the ENC Ice Objects Catalogue.

4.1.4. The Harmonization Group on Marine Information Overlays (HGMIO) is a subsidiary of two committees:

- IHO HSSC; and,

- International Electrotechnical Commission (IEC) Technical Committee No. 80 – Maritime Navigation and Radiocommunications Equipment and Systems (TC80).

4.1.5. The objective of the HGMIO is to harmonize the activities of the IEC and the IHO related to Marine Information Overlays (MIO). Ice information is proposed to be contained in an MIO. The HGMIO is chaired by Dr. Lee Alexander and has been very helpful in the development of the Ice MIO Product Specification.

4.1.6. The ETSI point of contact with the IHO is through the Task Group on Electronic Navigation Chart Ice Objects (TG-ENCIO). The ETSI-III nominated Canada, Germany, Russian Federation and USA to be members of the TG-ENCIO with a leader to be elected by the TG itself. The TG-ENCIO leader since ETSI-III has been John Falkingham. During the meeting, the ETSI accepted gratefully the offer of Canada to support Mr. Falkingham as leader of the TG-ENCIO for a short while into the future **(Action: Marie-France Gauthier)**.

4.1.7. The WMO Commission for Basic Systems (CBS) has very broad responsibilities within WMO. Two of these are of immediate importance to the ETSI.

4.1.8. CBS is responsible for implementing the WMO Information System (WIS). At JCOMM-III, the Commission urged the WMO Commission for Basic Systems to give full consideration to the requirements of JCOMM for real-time data transmission, storage and access when implementing WIS plan, and to invite JCOMM experts to be involved in the implementation of the WIS plan. In expressing its appreciation to Members/Member States and the European Space for their contributions to and participation in the Ice Logistics Portal Website, the Commission urged Members/Member States to provide to the WMO Secretariat the appropriate metadata in order to ensure that this Portal is compliant with the WIS, and contributes to the Global Cryosphere Watch (GCW). In light of this, and the stated intention of the IICWG that the Portal should be integrated with the WIS within 5 years, the ETSI should develop and maintain a close collaboration with the CBS **(Action: ETSI Chairperson)**.

4.1.9. CBS is also leads the standardization of coded format documentation to ISO standards. The ETSI standards documents do not meet ISO standards at the present time and so ETSI should seek the CBS advice and expertise when revising its documentation **(Action: ETSI Chairperson)**.

4.1.10. JCOMM-III noted that the idea of an International Polar Decade had been received positively at several international forums, including the Arctic Council Ministerial Meeting, and that the WMO Executive Council, at its sixty-first session (Geneva, June 2009), requested its Panel on Polar Observations, Research and Services (EC-PORS) to consider modalities and plans for the Decade, focusing on decadal needs and issues of long-term character, the Commission recommended that the Observations Programme Area provide a contribution to these activities, as required. The Commission called upon Members/Member States to be actively involved in the preparation of the International Polar Decade. The ETSI could have an important role in this preparation and should liaise with the EC-PORS as appropriate **(Action: ETSI Chairperson)**.

4.1.11. The Meeting noted all of these relations and agreed to work towards strengthening the ETSI relations with them.

4.1.12. The World Climate Research Programme (WCRP) is sponsored by the International Council for Science (ICSU), the World Meteorological Organization (WMO) and the

Intergovernmental Oceanographic Commission (IOC) of UNESCO. The two overarching objectives of the WCRP are:

- to determine the predictability of climate; and
- to determine the effect of human activities on climate

...to facilitate analysis and prediction of Earth system variability and change for use in an increasing range of practical applications of direct relevance, benefit and value to society.

4.1.13. As climate analysis and prediction becomes more sophisticated, the critical role of sea ice in the climate system is becoming more and more apparent. The GDISDB holdings are of considerable interest to the work of the WCRP. The Meeting requested that the WMO Secretariats to coordinate for an ETSI presentation at the next WCRP Joint Scientific Committee meeting on ETSI historical sea ice data products **(Action: WMO Secretariat, GDSIDB SG)**.

5. DATE AND PLACE OF THE NEXT SESSION

5.1. The ET discussed the timing for the next meeting, noting that there are several very critical issues to be addressed over the coming months. The highest priority of these is the implementation of operational services in the new Arctic METAREAs. The next highest priority is the implementation of the decisions made at ETSI-IV with respect to Ice Information in ENCs. A large quantity of technical documentation must be prepared and revised to support the ETMSS in these priorities. In light of the importance of these issues and the need to inform the JCOMM-IV of progress, the Expert Team stressed the importance of holding the next ETSI meeting in two years and in advance of JCOMM-IV. The Team also underscored that it is essential to confirm the exact dates and agenda for the meeting at least six months in advance so that the Secretariat has adequate time and can plan resources to support the meeting. In light of this discussion, the Canadian Ice Service offered to host the meeting in Ottawa in early May 2012. The Secretariat noted this and will include it in the meeting plan for 2012 **(Action: Marie-France Gauthier, Secretariat)**.

6. CLOSURE OF THE SESSION

6.1. The meeting agreed to accept conditionally the draft summary prepared by the Secretariat during the meeting. This report will be transmitted to the ET for final review, corrections and approval.

6.2. In closing the meeting, the Chairperson, Dr. Vasily Smolyanitsky, thanked all the experts from ETSI and GDSIDB, the FSSPA Coordinator, experts from other JCOMM ETs and the WMO Secretariat for stimulating discussions and valuable input to very productive ETSI and GDSIDB meetings. He noted the very important priorities that must be addressed and looked forward to working with the ET and its collaborators during the next intersessional period. He also thanked the Secretariat for providing excellent documentation for the participants of the meeting.

6.3. On behalf of the Secretariat, Mr. Edgard Cabrera expressed his sincere appreciation and thanks to all participants, especially to the ETSI Chairperson, Dr. Vasily Smolyanitsky, who in addition to keeping the formal discussions moving fruitfully, provided superb hospitality promoting the close working relationship among the Team members and meeting participants.

He concluded by expressing his appreciation to John Falkingham, as a WMO contractor, for the preparation of the documents and for the meeting itself.

6.4. The fourth session of the JCOMM Expert Team on Sea Ice and the twelfth session of the Steering Group for the Global Digital Sea Ice Data Bank closed at 12.00 hours on Friday, 06 March 2010.

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Appendix I - AGENDA

1. OPENING OF THE MEETING

1.1 Opening
1.2 Adoption of the agenda
1.3 Working arrangements

2. FOURTH SESSION OF THE JCOMM ETSI

2.1 Report of the Services Programme Area Coordinator
2.2 Report by the Chairperson of the ETSI
2.3 Report by the Secretariat
2.4 National and regional reports
  2.4.1 Reports by the Members of the ETSI
  2.4.2 BSIM, EIS, NAIS and IICWG reports
2.5 Provision of Marine Safety Information (MSI) related to sea ice
  2.5.1 Report by the ETMSS chairperson
  2.5.2 Report of Joint WMO/IHO/IMO Correspondence Group on MSS
  2.5.3- 2.5.4 Requirements for sea ice MSI (mandatory sea ice information for MSS)
  2.5.5 Updates to guidelines for sea ice MSI in WMO manuals and guides (WMO-No. 471, WMO No. 558, GMDSS Guides, Navtex, SafetyNet, etc.)
  2.5.6 Progress reports of the Arctic METAREAs coordinators
  2.5.7 Coordination of sea ice MSI provision and implementation of the Arctic GMDSS
2.6 WMO sea ice documents and publications
  2.6.1 Harmonizing Sea Ice Nomenclature, SIGRID-3 and the ENC Ice Objects Catalogue
  2.6.2 Sea ice nomenclature and illustrated glossary
  2.6.3 Sea ice services in the World (WMO-No. 574)
  2.6.4 Sea ice in Electronic Navigational Charts (ENC): Progress Report
  2.6.5 Sea ice in Electronic Navigation Charts (ENC): Ice Objects Catalogue, presentation schemes and support for other MSI
  2.6.6 Updates to SIGRID-3 and ice chart color standards formats
  2.6.7 Vision and strategy for the standards for sea ice coding and presentations
  2.6.8 Other JCOMM sea ice related publications
2.7 Sea ice information systems and products delivery
  2.7.1 Ice analysis harmonization issues (based on Ice Analysts Workshops)
  2.7.2 Ice Logistics Portal and WIS
  2.7.3 Assimilation of ice charts into numerical now and forecasting systems
2.8 Requirements for sea ice information
  2.8.1 Updates for sea ice in the WMO Rolling Requirements Review
  2.8.2 JCOMM Questionnaire and user feedback
2.9 Polar Decade activities (GCW, SAON etc)
2.10 Relations to other JCOMM bodies
  2.10.1 Relations with other JCOMM bodies
  2.10.2 Support for JCOMM CB
2.11 ETSI future activities and working plan for the next intersessional period

3. TWELTH SESSION OF THE STEERING GROUP FOR THE GDSIDB

3.1 Reports of the GDSIDB centers
3.2 Report of the ETMC chair

3.3 GCOS report on SST&SI WG activities
3.4 Development of sea ice historical data processing
3.5 Submission of new sea ice and iceberg data to the GDSIDB
3.6 Sea ice and icebergs products based on GDSIDB data
    3.6.1 Sea ice atlases
    3.6.2 Sea ice climatology
    3.6.3 Arctic Marine Shipping Assessment (AMSA)
3.7 New Contributions to the GDSIDB from Member States
3.8 Working plan for the next intersessional period

4. RELATIONS TO OTHER WMO/IOC AND INTERNATIONAL PROGRAMMES

5. DATE AND PLACE OF THE NEXT SESSION

6. CLOSURE OF THE SESSION

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Appendix II - LIST OF PARTICIPANTS

Mr Nick Ashton
Technical Account Manager
Met Office
Grays Inn House
127 Clerkenwell Road London EC1R 5LP
United Kingdom
Tel: +44 (0)1392 885402
Fax: +44 (0)02 7204 7479
E-mail: nick.ashton@metoffice.gov.uk

Mr Sergey Brestkin
Head, Center for Ice and Hydrometerological Information
Arctic and Antarctic Research Institute (AARI)
38 Bering str., St.Petersburg, 199397
Russian Federation
Tel. +7 812 3522226 Fax. +7 812 3522683
E-mail: svb@aari.ru

Mr Edgard Cabrera
Chief, Marine Meteorology and Ocean Affairs Division
Weather and Disaster Risk Reduction Services
World Meteorological Organization
7 bis, Avenue de la Paix
Case postale No. 2300 CH-1211 GENEVE 2
Switzerland
Tel: +41-22 730 82 37
Fax: +41-22 730 81 28
E-mail: ecabrera@wmo.int

Mr Oleg Devyataev
Chief specialist
Center for Ice and Hydrometerological Information
Arctic and Antarctic Research Institute (AARI)
38 Bering str., St.Petersburg, 199397
Russian Federation
Tel.: +7 812 3522226
Fax.: +7 812 3522683
E-mail: osd@aari.ru

Ms Marie-France Gauthier
Chief of Forecast Operations
Canadian Ice Service (CIS), Environment Canada
373 Sussex Drive, E-3, Ottawa, K1A 0H3
Canada
Tel : +1 613-996-4552
Fax: +1 613-996-4218
E-mail: Marie-France.Gauthier@ec.gc.ca

Dr Ming Ji
Director, Ocean Prediction Center
National Weather Service
5200 Auth Rd., Rm 410
Camp Springs, MD. 20746
USA
Tel : +1 301-763-8000x7400
Fax : +1 301-763-8085
E-mail: Ming.Ji@noaa.gov

Dr Juergen Holfort
German Ice Service, Head
Bundesamt fuer Seeschifffahrt und Hydrographie (BSH)
Neptunallee 5 18057 Rostock
Tel: +49 (0) 381 4563-782
Fax: +49 (0) 381 4563-949
E-mail: juergen.holfort@bsh.de

Mr Nick Hughes
Norwegian Ice Service, Leader
Norwegian Meteorological Institute (met.no)
Forecasting Center for Northern Norway
Kirkegårdsv, 60
P.O. Box 6314, NO-9293 Tromsø
Norway
Tel.: +47 77 62 13 15
Fax: +47 77 62 13 01
Skype: Polarnix
E-mail: nick.hughes@met.no

Mr Konstantin Ivanov
Senior design engineer
Transas Ltd.
54-4 Malij pr., V.O., St. Petersburg, 199178
Russian Federation
Tel. +7 812 325-3131
Fax.: +7 812 325-3132
E-mail: Konstantin.Ivanov@transas.com

Dr Sergey Klyachkin
Head of laboratory for sea ice numerical modelling
Arctic and Antarctic Research Institute (AARI)
38 Bering str., St.Petersburg, 199397
Russian Federation
Tel.: +7 812 3522226
Fax.: +7 812 3522688
E-mail: svkl@aari.ru

Mr John Falkingham
International Ice Charting Working Group (IICWG)
Secretariat
Canada
Tel: +1 613-355-4552
E-mail: John.Falkingham@rogers.com

Ms Caryn Panowicz
Operations Technical Advisor
National Ice Center (NIC)
4251 Suitland Road
Washington, DC 20395
USA
Tel. +1 301-394-3028
Fax: +1 301 394 3200
E-mail: caryn.panowicz@noaa.gov

Mr Keld Qvistgaard
Chief of Ice Operations
Danish Meteorological Institute (DMI)
Lyngbyvej 100 2100 Copenhagen
Denmark
Tel: +45 3915 7344
Fax:+ 45 3915 7300
E-mail: kqh@dmi.dk

Mr Ari Seina
Head of Ice Research and Ice Service
Finnish Meteorological Institute (FMI)
Erik Palmenin aukio 1
Mail: P.O. Box 503, FI-00101 Helsinki
Finland
Tel. +358 9 1929 4440
Fax. +358 9 323 1025
E-mail: ari.seina@fmi.fi

Mr Valery Martyschenko
Deputy head of department
Russian Federation Service for Hydrometeorology & Environmental Monitoring (Roshydromet)
Novovagan'kovsky st., 123995 Moscow
Russian Federation
Tel: +8 499 2524511
Fax: +8 499 7952090
E-mail: seadep@mcc.mecom.ru

Dr Vladimir Smirnov
Head of department of satellite information
Arctic and Antarctic Research Institute (AARI)
38 Bering str., St.Petersburg, 199397
Russian Federation
Tel.: +7 812 3521043
Fax.: +7 812 3521043
E-mail: vgs@aari.ru

Dr Vasily Smolyanitsky
Head of laboratory of sea ice climate manuals
Arctic and Antarctic Research Institute (AARI)
38 Bering str., St.Petersburg, 199397
Russian Frderation
Tel. +7 812 352-2152
Fax. +7 812 352-2688
E-mail: vms@aari.aq

Ms Polina Soloschuk
Baltic Russian Ice Service
Hydrometeorological Center of St..Petersburg
Vasilievskij ostrov, 23 line, 2-a
St..Petersburg, 199106
Russian Federation
Tel/Fax: +7(812)321-30-18
E-mail: sea@meteo.nw.ru

Appendix III - SFSPA Work Plan for the Intersessional Period

30 December 2009

	Workplan / expected outcome, deliverables	How (Key Activities/Actions)	Lead (bold) Members	Timelines	Associated meetings (discussion item in)	Resource Required for (apart from meetings)	ETs (bold)/ Linked with
1	Develop a Guide to Operational Ocean Forecasting (Rec 8.1/1)	· (example) ET members provide input · (example) Consultant work to consolidate input	**Gary Brassington** … …	· '11 outline agreed · … · May'12: intermediate outcome at JCOMM-IV	ETOOFS (?')	(example) consultant contract	**ETOOFS** DMPA OPA
2	Define (assess) operational ocean observation requirements	· (example)Input from experts, to be agreed by SCG ·	**Gary Brassington** … …	·			
3	Develop operational performance metrics to monitor operational ocean forecasts	·	**Gary Brassington** … …	·			
4	Implement a survey on user requirements for ocean services	· Conduct surveys, analysis of the response	**Gary Brassington** **Henri Savina** …	· Dec'10 survey design agreed · '11 survey conducted · Mar'12 analysis on responses completed	ETMSS (Apr'10) ETOOFS (?)		**ETOOFS, ETMSS**
5	Improve capacity in terms of technology transfer and access to existing products and services	· GODAE Summer School	**Gary Brassington** … …	· Jan. 2010			GOV ETOOFS
6	Address issues relating to the transition of a GODAE data service into operations	·	**Gary Brassington** … …	·			
7	Facilitate implementation of Quality Management Systems (QMSs) for NOP among Members for the provision of Marine Accident Emergency Support	·	**Gary Brassington** … …	·			ETOOFS ETMSS
8	Implement the recommendations from the 1st JCOMM SS Symposium: Support developing extreme wave database	· Template for extreme wave documentation agreed (ETMC) · Request input from countries, through OPA groups & Secretariat	**Val Swail** … …	· May'10 template agreed, and request input from countries (continue)	ETMC (Feb'10) ETWS (May'10)		ETWS, **ETMC** NOAA/NODC, OPA groups

	Workplan / expected outcome, deliverables	How (Key Activities/Actions)	Lead (bold) Members	Timelines	Associated meetings (discussion item in)	Resource Required for (apart from meetings)	ETs (bold)/ Linked with
9	· Implement the recommendations from the 1st JCOMM SS Symposium: Support developing SS climatology	·	**Val Swail** … …	· … · Sep'10 discussion session on SS climatology	ETMC (Feb'10) ETWS (May'10) SSC2010 (Sep'10)		**ETWS**, ETMC LOICZ
10	Implement the recommendations from the 1st JCOMM SS Symposium: Support related S&T fora	· Support SSC2010 (JCOMM experts participation to organization & presentations) · Plan the 2nd SS Symposium	**Val Swail** Kevin Horsburgh Thomas Bruns …	· Sep'10 SSC2010 discussion on SS climatology · May'12 approval on 2nd SS Symposium (after 2012) plan	ETWS (May'10) SSC2010 (Sep'10)	Expert participation to SSC2010 (external resources)	**ETWS**, ETMC LOICZ
11	Support UNESCO pilot project on coastal hazard forecasting	· SS Experts/ET members participation in NIO workshop · Review project progress in view of JCOMM workplan implementation	**Kevin Horsburgh** Val Swail Hans De Vries Don Resio …	· Feb'02 conduct NIO workshop	ETWS (May'10) PP meeting (?'10) UNESCO NIO workshop (Feb'11)	Expert participation to NIO workshop (external resources: UNESCO/IOC)	**ETWS**, IOC/ICAM
12	Support JCOMM/CHy Coastal Inundation Forecast Demonstration Project	·	**Val Swail** **Don Resio** …	·			ETWS
13	Facilitate the development of Storm Surge Watch Schemes (SSWS) for regions subject to tropical cyclones	·	**Val Swail** … …	·			ETWS
14	Support WMO Severe Weather Forecasting Demonstration Project (SWFDP) with respect to wave and storm surge issues	·	**Val Swail** … …	·			ETWS
15	Participate in two DBCP Pilot Projects on wave measurement from buoys	· Review & update wave measurement requirements as necessary · Participate in intercomparison exercise & analysis	**Val Swail** **Bob Jensen** …	· Jan'10 intercomparison website launch · Nov'10 PP 1st phase PP complete, plan for 2nd phase	PP-WET SC (Feb'10) ETWS (May'10) DBCP-26 (Sep'10)	Website development (external resources)	OPA/DBCP
16	Expansion of the Wave Forecast Verification Exchange Project in coordination with the ESA GlobWave project	· Review & update wave measurement requirements as necessary · ET members / experts participation	**Val Swail** Jean Bidlot …	·	ETWS (May'10)		

	Workplan / expected outcome, deliverables	How (Key Activities/Actions)	Lead (bold) Members	Timelines	Associated meetings (discussion item in)	Resource Required for (apart from meetings)	ETs (bold)/ Linked with
17	Develop and update guidance documents	· Update wave guide by ET input + consultant work · Update dynamic part of SS guide as necessary (ET input)	**Val Swail** … …	· May'10 outline/contents of Wave guide agreed · … · May'12 Wave guide publication	ETWS (May'10)		
18	Enhance Capacity Building activities	· Support & participate in North Indian Ocean SS workshop (Feb 2011) · Support training series (WMO/TCP workshop, JCOMM/IODE Jamboree, etc) by updating contents and providing lecturers	**Val Swail** Shishir Dube …	·	ETWS (May'10) UNESCO NIO workshop (Feb'11)	Experts participation to training events (external resources)	WMO/TCP IOC/IODE
19	Improve interaction between the GMDSS Issuing Services and AMOCs representatives of MPERSS	· create links to NMHC marine weather product websites for relevant METAREAS	**Henri Savina** … …	·			**ETMSS**
20	Supporting Issuing Services and AMOCs for GMDSS in the Arctic Ocean	Outcomes: - Experimental suite of Met-Ocean products for the Arctic (text) - Experimental suite of Met-Ocean products for the Arctic (graphic) Key activities: - Development of integrated sea ice-marine weather text products - Development of integrated sea ice-marine weather graphic products	**Henri Savina** Vasily Smolyanitsky	- Apr'10 outline agreed - End'11 complete	ETSI (Mar'10) ETMSS (Apr'10)		**ETMSS**, ETSI, ETOOFS
21	In association with ETWS and ETSI, develop guidelines and recommendations to update WMO n°471 and 558, especially for the provision of sea state and sea ice in MSI	·	**Henri Savina** Vasily Smolyanitsky	· Apr'10 outline agreed · … · End'11 complete	ETSI (Mar'10) ETMSS (Apr'10)		**ETMSS**, ETSI

	Workplan / expected outcome, deliverables	How (Key Activities/Actions)	Lead (bold) Members	Timelines	Associated meetings (discussion item in)	Resource Required for (apart from meetings)	ETs (bold)/ Linked with
22	Catalogue on Met-Ocean Object Classes for ENC and e-Navigation	Outcome: - Met-Ocean object class for wind, wave height, surface current based on templates from the Ice Objects Catalogue Key activities: - Coordinate with IHO to validate requirement - Finalize the draft object catalogue	**Henri Savina**	- Oct 2010: Meeting between WMO/IHO/WMO - Jan 2012: Finalize the met-ocean object class	ETSI (Mar'10) ETMSS (Oct'10)		**ETMSS**, ETWS, ETSI, IMO, IHO
23	Facilitate implementation of Quality Management Systems (QMSs) among Members for the provision of MMS	.	**Henri Savina** … …	.			
24	Update sea ice standards	Outcome: - WMO Sea Ice Nomenclature - Vol 1 – Terminology and Vol 2 Illustrated Glossary - Supplement 6 – Baltic Sea Ice Terms - SIGRID-3, Prototype for New Format for Sea Ice Data Assimilation Key activities: - Update and Publish WMO Sea Ice Nomenclature	**Vasily Smolyanitsky**	- Sept 2010: Publish SIGRID-3 update - Mar 2011: Publish Sea Ice Nomenclature - June 2012: New Format Prototype	IICWG (Oct 2011-2012) ETSI (May 2012)		**ETSI**, ETOOFS, SCG
25	Develop sea ice climatology based on ice charts and maintenance of the Global Digital Sea Ice Data Bank (GDSIDB)	Outcome: - GDSIDB updated with historical Sea Ice charts and logs - updated normals for sea ice based on GDSIDB Key activities: - Historical data submitted and quality controlled - - Advertisement of new data	**Vasily Smolyanitsky**	- Updated once a year - June 2012: Normals updated	ETSI (May 2012)		ETSI, NSIDC

	Workplan / expected outcome, deliverables	How (Key Activities/Actions)	Lead (bold) Members	Timelines	Associated meetings (discussion item in)	Resource Required for (apart from meetings)	ETs (bold)/ Linked with
28	Coordinate the implementation of GMDSS in the Arctic Ocean	Outcomes: - GMDSS services implemented in the Arctic METAREAs in 2011 Key activities: - Revise WMO Manuals and Guides for Marine Meteorological Services for GMDSS - Procedures for coordinated delivery of services in the Arctic METAREAs	**Henri Savina** **Vasily Smolyanitsky**	- June 2010: Revise Manuals and Guides - Oct 2011: Procedures established - Jan 1, 2011: GMDSS services implemented in the Arctic Ocean			ETMSS ETSI
32	Sea Ice Analysis Training	Outcome: - COMET training modules, Workshop and Manuals Key activities: - 1st two COMET sea ice modules developed - 3rd Ice Analysts Workshop - English version of Manual for Ice Experts – Ice Observers reviewed	**Vasily Smolyanitsky**	- Sep 2010: COMET Module 1 - Dec 2011: COMET Module 2 - IAW Workshop June 2011	IAW-III (Jun 2011) ETSI (May 2012)		ETSI
33	Ice Information in ENCs	Outcomes: - Standard for Exchange File; - Ice Objects Catalogue 5.0, Presentation Schemes, Data Structure, File Naming Conventions, - Demonstration Suite for JCOMM-IV Key activities: - Harmonize the standards documents that have been developed in parallel by CIS and AARI/Transas - Develop data and software package as a demonstration	**Vasily Smolyanitsky**	- Jun 2011: harmonize standards - Jun 2012: demonstration package	ETSI (May 2012)		ETSI, experts from TRANSAS

Green – Project outcomes achieved by JCOMM-IV
Yellow – Possible to achieve the outcomes by JCOMM-IV
White – Completion time line to be determined
Blue – Lead by other PAs/Organizations

Appendix IV – Report of the ETSI Chair

1. The Expert Team on Sea Ice (ETSI) was formally constituted at the First Session of JCOMM (JCOMM-I, Akureyri, Iceland, June 2001) and re-established at the Second Session, (JCOMM-II, Halifax, Nova Scotia, Canada, September 2005) as a part of the JCOMM Services Programme Area (SPA) as well as at the Third Session, (JCOMM-III, Marrakesh, Morocco, November 2009) as a part of the JCOMM Services and Forecasting Systems Programme Area (SFSPA).

2. During the intersessional period Dr. Vasily Smolyanitsky (Russian Federation) served as Chairperson of the ETSI. The Members of the ETSI included the Chairperson and eleven experts representing the national services related to sea ice and the ice-covered regions from Argentina, Canada, China, Denmark, Finland, Iceland, Japan, Norway, Sweden, United Kingdom and USA, and invited representatives of regional and international sea ice bodies, in particular, the Global Digital Sea Ice Data Bank (GDSIDB) Project, the Baltic Sea Ice Meeting (BSIM) and the International Ice Charting Working Group (IICWG). The Group's old Terms of Reference are provided in the Appendix 1 to this document.

3. The past work plan for the ETSI was developed at ETSI-III (March 2007) on the basis, and following priorities, of the JCOMM intersessional work programme for 2005-2009 (JCOMM-II, September 2005), decisions of the 3rd Session of the Services Coordination Group (SCG-III, Exeter, United Kingdom, November 2006) and recommendations from the 2nd Session of the Expert Team on Maritime Safety Services and the 1st Session of the Expert Team on Marine Accident and Emergency Support (ETMSS-II and ETMAES-I, January 2007).

4. Key issues of the Team's intersessional activity included response to a new level of requirements for sea ice products and services for the safety and efficiency of ice navigation as well as support for IPY 2007/2008 and the new Arctic METAREAS.

5. The work plan for 2007-2009 encompassed coordination and advice of the Members' ice services to support navigation and sea ice monitoring, interaction with the Expert Team on Marine Safety Services (ETMSS) on sea ice Marine Safety Information (MSI), development and revision of sea ice technical guidance material and standards, support for CB, interaction with the Expert Team on Marine Climatology (ETMC), guidance of the Global Digital Sea Ice Data Bank, tailored support for the IPY 2007/2008 and linkages with other relevant bodies, in particular GCOS, IHO TSMAD and regional and international sea ice projects and alliances including IICWG, BSIM and CliC. ETSI completed most of the parts of its past work plan, included as Appendix 3 and containing notes for achieved tasks.

6. Among the highlights of the achievements is the establishment and maintenance of the Ice Logistics Portal during and beyond the IPY 2007/2008. The "Ice Logistics Portal" (http://ipy-ice-portal.com/) is a joint JCOMM-IPY-PolarView project providing a single web-gate to operational sea-ice information from the national ice services both in low- (customers in field) and high-speed (customers in office) connection versions for the regions of the Northern and Southern hemispheres by means of clickable maps. The portal became operative in May 2007 and was endorsed by the WMO EC-LX in June 2008. The portal utilizes a provider-flexible operating schema resembling E2EDM, is estimated as one of the IPY observing system

legacies and is planned to be integrated in the future with the WMO WIS, GCW and EC MyOcean.

7. Important interaction aimed at enhancement of ice services has been carried out between ETSI and ETMSS to respond to issues related to establishment of the new Arctic METAREAs. This includes ETSI input to WMO (No. 471, 558) and joint WMO/IHO/IMO Guides and Manuals on Marine Safety Services (MSS) to ensure completeness related to marine safety in ice infested waters as well as ETSI coordination of the provision of sea ice MSS in the Arctic and sub-polar METAREAs for GMDSS by national ice services. The Team (at the ETSI-III session) agreed on its approach to sea ice NAVTEX abbreviations (recommended to use plain text) and on extension of the MMSM Questionnaire to cover ice products. It should be noted that present ice services do include but are not restricted to MSI by containing a variety of MMO products intended to ensure both efficiency and safety of navigation inside and outside of the ice edge.

8. Another important interaction is the maintenance of successful cooperation and joint meetings between ETSI and the national ice services' regional and international alliances, in particular the IICWG (8th – 10th sessions, October 2007 - 2009) and BSIM (23rd session, September 2008) with merged action items in work plans. Among others, practical results of cooperation include interaction with the IICWG on user requirements and update of the"Ice Information Services: Socio-Economic Benefits and Earth Observation Requirements" document used as a template for JCOMM sea ice requirements (http://nsidc.org/noaa/iicwg/pdf/).

9. A significant achievement is the development of the "Ice Objects Catalogue" which is a first standard for providing sea ice information in Electronic Navigational Charts (ENC). The standard was developed on the basis of a CIS Catalogue Ver. 4.0, adopted by ETSI-III in March and submitted to the IHO Registry of Marine Information Objects by May 2008. (http://195.217.61.120/iho_registry/). The Catalogue provides the basis for ice services to deliver ice charts information to customers at sea directly in S-57 format (in a future in S-100). The important vision of the relationships between the Sea Ice Nomenclature and the Ice Objects Catalogue elaborated by the Team is that the *Ice Objects catalogue represents a subset of the WMO Sea Ice Nomenclature being at the same time a driving force for amending the Sea Ice Nomenclature with an intention of including the navigators' feedback in the future*.

10. According to agreement with IHO TSMAD, JCOMM ETSI is the formal body responsible for "Ice Objects Catalogue" as of November 2005 and the WMO Secretariat is the manager of the catalogue together with ETSI Electronic Navigational Chart Ice Objects Task Group (TG ENCIO). The terms of reference for the TG ENCIO are included as Appendix 2 (chair – Mr. John Falkingham). This provides a unique position for the Team in JCOMM, which can and should be used by other ETs to achieve efficiency in developing S-57(S-100) extensions for other MMO information. As one of the priority activities for the 2010-2012 for the whole SFSPA is to create an initial catalogue of marine and oceanographic parameters for ENC, the Team is invited to check the necessity for explicit reference of this activity and the TG ENCIO in its new ToRs as was proposed by ETSI-III (...including management of an ice objects register within ECDIS…).

11. During the winters 2008-2009, the Catalogue underwent testing by the Canadian Ice Service (CIS) (Gulf of St. Lawrence) and the Arctic and Antarctic Research Institute (AARI)

(Baltic Sea, EU Arctic, Kara Sea). The development of sea ice product transmit and display specifications was undertaken with a target date of the end of 2009 with further proposals for discussion at the ETSI-IV session.

12. Other achievements related to development of the sea ice technical documentation, terminology, coding and mapping standards include update of a multi-language (EN/FR/RU/SP) electronic version of the WMO No. 259 “Sea Ice Nomenclature” (Volume I – terminology and codes and Volume II - Illustrated Glossary), annual update of the WMO No.574 "Sea Ice Information Services in the World”, updates to WMO/TD. No.1214 “SIGRID-3: a vector archive format for sea ice charts” with electronic versions maintained at the JCOMM Services web-site documents section (http://www.jcomm-services.org/documents.htm?parent=39). In 2008-2009, activities to extend the “Sea Ice Nomenclature” with Baltic Sea Ice Services linguistic terms (in cooperation with BSIM) were initiated and a “4th annual update of the "Sea Ice Information Services in the World” was completed. This latter publication provides a 2009 snapshot and full description of sea ice services and products available and extends WMO No.9, vol. D, with special sections describing numerical modelling and ice charts data assimilation.

13. Development of sea ice climatology based on ice charts included maintenance of the Global Digital Sea Ice Data Bank. By 2009, ice charts for the period 1933-2008 from a number of national ice services are available in standard SIGRID family formats with continuing annual updates. GDSIDB data was used to provide information for the Arctic Marine Shipping Assessment (AMSA) in 2007-2008 and assessment of extreme 2007 and 2008 conditions in terms of sea ice climatology. The ETSI interacts with GCOS SST&SI WG and WCRP on the development of requirements for sea ice information as an Essential Climate Variable (ECV) within GCOS.

14. Highlights of achievements in sea ice capacity building support include provision of the 1st (June 2008) and the 2nd (June 2009) joint ETSI/IICWG/GCOS “Ice Analysts Workshops”. The workshops encompassed case studies and discussions, including online exercises on analysis of the multi-sensor satellite imagery and compilation of ice charts, providing a platform for ice analysts to exchange views, techniques, expertise and share best practices. The Proceedings of the 1st workshop are available as WMO Td. No. 1441. The scientific results of the 1st workshop included identification of uncertainties on current and historical ice charts. A valuable conclusion of the more practically-oriented 2nd workshop related to harmonization of ice charts from different Ice Services is that, potentially, Arctic ice charts are interchangeable for MSS within new Arctic METAREAs, provided that the timeliness, accepted accuracy of the boundaries and amount of additional information (leads, cracks, compactness) is sufficient for operative purposes.

JCOMM-III

15. The JCOMM at its third session in November 2009 analyzed the progress achieved by its bodies including the ETSI and endorsed among others, the Team’s work. The JCOMM-III re-established the Team, though, it should be noted here, the last JCOMM Management Committee in December 2008, in seeking the best structure for the Commission, discussed other structural options.

16. The JCOMM-III endorsed the priority activities for the next intersessional period for the individual Expert Teams and requested tighter collaboration across the Programme Areas and individual Teams. For ETSI, the following priority activities were outlined (agenda item 8.4):

- Update sea ice standards;
- Continue to develop and manage technical documentation for ENC and sea ice services and information;
- Develop sea ice climatology based on ice charts and maintenance of the Global Digital Sea Ice Data Bank (GDSIDB);
- Contribute to the development and implementation numerical forecasting systems;
- Enhance the efficiency and safety of navigation in ice infested waters by harmonizing sea ice products.

17. In this respect, a revised version of the Team Terms of Reference was approved by JCOMM-III (given as Appendix 4) with the concept of core-membership introduced. Dr. Vasily Smolyanitsky (Russian Federation) was re-elected as chairperson with the following experts to serve as core members of the Expert Team on Sea Ice: Ari Seina (Finland), Baohui Li (China), Beatriz Enriqueta Lorenzo (Argentina), Jonathan Shanklin (United Kingdom), Jürgen Holfort (Germany), Marie-France Gauthier (Canada) and Nick Hughes (Norway) with representatives of regional and international sea ice bodies, in particular the Baltic Sea Ice Meeting, European Ice Service, International Ice Charting Working Group and North American Ice Service, as invited experts. According to other ToRs, the ETSI chair or his representative serves as a core-member of ETMSS and ETMC. Jonathan Shanklin is also the member of Ship Observation Team (SOT).

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Appendix V – ETSI Terms of Reference

Annex to Resolution 4 (JCOMM-III)

TERMS OF REFERENCE AND GENERAL MEMBERSHIP OF THE COORDINATION GROUP AND TEAMS OF THE SERVICES AND FORECASTING SYSTEMS PROGRAMME AREA

...

4. Expert Team on Sea Ice

a. ***Terms of reference***

The Expert Team on Sea Ice (ETSI) shall:

(b) Coordinate and advise Members/Member States on products and services required by user communities in sea ice areas, to support navigation, coastal and off-shore activities, monitoring of the sea ice cover;
(c) Provide advice to ETMSS on all aspects of impacts of sea ice relevant to maritime safety, marine pollution response and search and rescue services;
(d) Maintain linkages with the Expert Team on Operational Ocean Forecasting Systems on the relevant sea ice modelling and forecasting techniques;
(e) Maintain linkages with projects and programmes related to the role of sea ice in the global climate system, including through the World Climate Research Programme and the Global Cryosphere Watch;
(f) Develop technical advice and guidance material, software exchange, specialized training and other appropriate capacity-building activities with regard to sea ice observations, analysis and services, and provide assistance to Members/Member States as required;
(g) Keep under review and provide guidance as appropriate on the operations of the Global Digital Sea Ice Data Bank, in collaboration with the Expert Team on Marine Climatology;
(h) Maintain and develop formats, nomenclatures and procedures for sea ice data and information exchange as well as relevant terminology, coding and mapping standards;
(i) Maintain linkages with relevant international organizations and programmes, in particular the Baltic Sea Ice Meeting, CLIC, European Ice Services, International Ice Charting Working Group, North American Ice Services, ASPeCt, Global Climate Observing System and the International Hydrographic Organization.

As a general principle, these terms of reference will be implemented through specific, defined, time-limited projects.

a. General membership

Up to eight Members, including the chairperson, representative of a range of activities related to sea ice and the ice-covered regions within JCOMM, and to maintain an appropriate geographical representation. It is expected that, in general, the ETSI will be self-funding. ETSI representatives will also act as full members of ETMSS and the Expert Team on Marine Climatology.

Representatives of regional and international sea ice bodies in particular the Baltic Sea Ice Meeting, European Ice Service, International Ice Charting Working Group and North American Ice Service will also be invited to participate at their own expense.
Additional experts may be invited as appropriate, representative of the range of activities related to sea ice, on a self-funded basis, and in general with no resource implications to JCOMM.

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Appendix VI – Terms of Reference of TG ENCIO

TERMS OF REFERENCE OF THE TASK GROUP ON ELECTRONIC NAVIGATIONAL CHART ICE OBJECTS (TG ENCIO)
(ETSI-III Report, March 2007, JCOMM Meeting Report No. 51)

1. Objective

To develop and to maintain an international standard for Ice Objects as a class of Marine Information Objects (MIO) that is based on the standards of the International Hydrographic Organisation (IHO) for Electronic Navigational Charts (ENC).

2. Guiding Principles

The framework for the Ice Objects standard includes:

- Use of **IHO S-57** including:
  - Object Catalogue;
  - MIO Product Specification;
  - MIO Encoding Guide.
- Establishment of an **Ice Objects Register** for additional real-world, ice features, attributes, and enumerations that are not already contained in IHO S-57 Edition 3.1 Object Catalogue.
- Use of the ***Open ECDIS Forum*** (OEF) as a means of communication and discussion for continuing development and maintenance of the Ice Objects Register.
- Alignment with the future **IHO S-100** Standard for Geospatial Data.

3. Authority

JCOMM ETSI is recognized as the competent international technical group on sea ice and icebergs by:

- World Meteorological Organization;
- Intergovernmental Oceanographic Commission;
- International Hydrographic Organization (IHO) – Committee on Hydrographic Requirements and Information Systems (CHRIS).

4. Participants

Register Owner:	WMO Secretariat
Register Manager:	WMO Secretariat
Register Users:	anyone interested in sea ice or iceberg MIOs
Control Body:	ETSI ENC Ice Objects Task Group
Submitting Organization:	WMO
Proposers:	ETSI Members from Canada, Germany, Russian Federation and USA

5. Composition

The Ice Objects Task Group will be composed of at least three standing ETSI Members appointed by the ETSI, in addition to the Register Manager. The Task Group Members shall serve until the subsequent intersessional meeting of the ETSI, at which time they may be re-appointed or replaced. The Task Group will elect a Chairperson from among them.

6. Meeting Schedule

The Task Group will meet on an as-required, as-agreed basis. Members will fund their own attendance at meetings. Much of the business of the Task Group will be conducted by e-mail and telephone.

7. Management of the Ice Objects Register

Any Member of the ETSI can submit a proposal to the Ice Objects Register but the proposal must:

- be in a format established by ETSI;
- describe how the new object (or feature) will be accommodated in the Ice Objects Encoding Guide.

The **Ice Objects Register Manager**:

- reviews the submitted proposal for completeness, and may request additional information/clarification from the Proposer. The proposal is also distributed to Ice Objects Task Group (Control Body) and other Register Managers for review/comment.
- officially posts the proposal on the Ice Objects ENC Register. It is initially flagged as **NOT-VALID**.
- places the proposal on the Ice Objects Discussion Forum (OEF website) for discussion.

Eight weeks after the proposal is placed on the Ice Objects Register:

- if a consensus is reached to accept, the proposal is then flagged as **VALID**.
- if no consensus is achieved, it remains flagged as **NOT-VALID**. In this case:
  - the submitter can decide to withdraw the proposal;
  - the proposal can be revised and re-submitted;
  - any participant of the ETSI can ask that the proposal be considered at the next meeting of the ETSI.
- the Register Manager announces the outcome on the Ice Objects Discussion Forum.

8. Regular ETSI Review

As owner of the Ice Objects Register, ETSI will carry as a standing agenda item on its meetings, a review of any outstanding recommendations from the Task Group.

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Appendix VII - ETSI Work Plan for Intersessional Period 2007-2009
(decisions from ETSI-III/GDSIDB-XI)

Ref.	Action	By whom	When	Progress
2.1.4	Provide delegates to represent the ETSI on the IMMSC Scientific Steering Team	ETSI Members and Secretariat	ASAP	Actions undertaken by the Secretariat
2.1.6	Provide content to the SPA website on ETSI sections	ETSI Chairperson and ETSI Members	Prior SCG-IV	Done
2.1.8	Provide input to the SPA coordinator for consideration of ETSI requirements in the JCOMM Statement of Guidance	ETSI Chairperson	Mid-2007	Done
2.2.2	Make available the electronic version of the WMO publications, in particular 558 and 471	WMO Secretariat	ASAP	Done in May 2009
2.5.7	Develop a selection of IICWG publications to be made available via the JCOMM SPA website	ETSI Members and IICWG representatives to ETSI	Prior ETSI-IV	Done
2.5.9	Encourage the participation of countries from the South Hemisphere in ETSI activities	ETSI Chairperson and Secretariat	Continuing	Continuing in cooperation with IICWG
2.6.1.2	Ensure that sea ice information is included in the proposed Resolution to the IMO on Met-Ocean services	ETSI Members to TT PMSI	Late 2008	Done
2.6.2.3	Include references to potential occurrence of sea ice and links to ice services where appropriate based on the information provided in the WMO-No. 574	ETSI and ETMSS Chairpersons and Secretariat	Prior ETMSS-III	Ongoing, action need by ETSI-IV
2.6.3.5	Submit the Ice Objects Catalogue to the IHO Registry of marine Information Objects	WMO Secretariat	ASAP	Done in May 2008

Ref.	Action	By whom	When	Progress
2.6.3.5	Develop the appropriate documents to effectively implement and maintain the Ice Objects Catalogue as an IHO Register as well as develop a testing scheme	Register Manager and TG ENCIO	Continuing	Continuing, IceCat 4.1 and 5.0 were developed
2.6.3.5	Contribute to the work Expert on Met-Ocean information in graphical form	TG ENCIO	Prior JCOMM-III	Done
2.6.3.6	Present the result of the current ETSI session to the forthcoming HGMIO meeting	Mr. John Falkingham (Canada)	May 2007	Done
2.6.4.4	Provide a Number and publish the Ice Objects Catalogue as a WMO/TD Publication	WMO Secretariat	Late 2007	???
2.7.1.4	Manage the electronic version of the Sea Ice Nomenclature and its database	ETSI Chairperson	Continuing	Continuing, volume II included
2.7.1.4	Create a mirror of the Sea Ice Nomenclature database in the SPA website	ETSI Chairperson	Prior ETSI-IV	Static versions posted
2.7.1.5	Make the necessary harmonization between the Sea Ice Nomenclature and the Ice Objects Catalogue	TG ENCIO	Prior ETSI-IV	Done
2.7.1.6	Update the Sea Ice Nomenclature	ETSI Members with the coordination of the ETSI Chairperson	Late 2008	Proposals developed for ETSI-IV
2.7.1.7	Provide illustrations to the ETSI Chairperson to be included in the Sea Ice Nomenclature	ETSI Members with the coordination of the ETSI Chairperson	Late 2008	Electronic version of Volume II developed, “Old ice in summer” and Baltic Glossary are ready for inclusion
2.7.2.1	Submit corrections in the WMO-No. 574 to the ETSI Chairperson and WMO Secretariat	ETSI Members	Continuing	Done in Sep’08 – May’09

Ref.	Action	By whom	When	Progress
2.7.2.1	Incorporate corrections in the electronic version of the WMO-No. 574 and make available on web the updated version	ETSI Chairperson and WMO Secretariat	Continuing	Version 2009 ready
2.7.2.1	Inform the National Ice Services and sea ice community on the availability of the updated electronic version of the WMO-No. 574	WMO Secretariat	Continuing	Action need by ETSI-IV
2.7.2.1	Update the hardcopy version of the WMO-No. 574 in an annual basis	WMO Secretariat	Continuing	Action need by ETSI-IV
2.7.2.2	Make the appropriate arrangements to start each section of the WMO-No. 574 for a National Ice Service and include additional annexes	WMO Secretariat	ASAP	Done
2.7.2.3	Establish a mechanism to publish officially the electronic versions of the WMO technical publications	WMO Secretariat	ASAP	Posted at SFSPA site and AARI GDSIDB site
2.7.3.2	Review the abbreviations list for NAVTEX messages related to sea ice	Mr. Amund Lindberg (Sweden)	Prior ETMSS-III	??? Action need by ETSI-IV
2.7.4.2	Define the mandatory sea ice products to be included in WMO Guides and Manuals	ETSI Members to the TT PMSI	Prior ETMSS-III	Proposals ready for discussion by ETSI-IV
2.7.4.6	Prepare a short report on the transmission of MSI via radio facsimile and submit it to the WMO Secretariat	ETSI Chairperson	Late 2007	Done
2.7.4.6	Update the WMO-No. 9, Volume D based on the report on the transmission of MSI via radio facsimile prepared by the ETSI Chairperson	WMO Secretariat	Early 2008	???

Ref.	Action	By whom	When	Progress
2.8.1.1	Incorporate the proposed amendments in the electronic version of the SIGRID-3 Code and harmonize the changes with the WMO Nomenclature, supplement on symbology	ETSI Chairperson	Late 2007	Done Additional proposals for harmonization ready for discussion by ETSI-IV
2.8.1.1	Inform all relevant bodies about the amendments in SIGRID-3 Code	WMO Secretariat	Early 2008	???
2.8.1.2	Discuss additional recommendations for changes to ice coding and mapping standards	ETSI Members	Prior JCOMM-III	Proposals ready for discussion by ETSI-IV
2.8.1.2	Coordinate the discussion of additional recommendations for changes to ice coding and mapping standards	Mr. John Falkingham (Canada)	Continuing	Continuing action by TG ENCIO
2.8.1.2	Make available in English, French, Russian and Spanish the changes to ice coding and mapping standards definitions	ETSI Members and Secretariat	Prior JCOMM-III	Action need by ETSI-IV
2.8.2.2	Ensure that ETSI standards are compatible with the requirements of the JCOMM DMPA strategy	ETSI Members	Continuing	Action need by ETSI-IV
2.9.1.5	Prepare a SOG for sea ice applications	TT SIR	Mid 2007	Action need by ETSI-IV
2.9.1.5	Provide examples of the JCOMM SOG and requirements for the WMO/CEOS database	WMO Secretariat	ASAP	???
2.9.2.3	Provide contact details from potential users, in particular the icebreaking services, to WMO Secretariat	ETSI Members	Late 2007	Done
2.9.2.3	Contact the Antarctic Treaty Secretariat to request to circulate the MMSM questionnaire to all ships sailing in the Antarctic region	Secretariat and Mr. Manual Picasso (Argentina)	Late 2007	???

Ref.	Action	By whom	When	Progress
2.9.2.3	Disseminate the MMSM questionnaire through the radio-fax services provided by BHS Deutscher Wettwetterdienst RMC	Secretariat and Dr. Jürgen Holfort (Germany)	Late 2007	???
2.9.2.3	Develop an on-line questionnaire for the MMSM	SPA Coordinator	Late 2007	Done by the Secretariat
2.10.2	Provide contributions to IPY	ETSI Members and GDSIDB Co-chairpersons	Ongoing	Done in cooperation with the IICWG
2.10.6	Convey to Polar View that Dr. Vasily Smolyanitsky (Russian Federation), Mr. John Falkingham (Canada) and Mr. Jonathan Shanklin (United Kingdom) are the content advisers for the Ice Portal	Mr. John Falkingham (Canada)	ASAP	Done
2.11.2.3	Investigate the feasibility of using existing training material to create a Bilko lesson	Mr. John Falkingham and Ms Marie-France Gauthier (Canada)	ASAP	???
2.11.2.3	Explore the feasibility of preparing a Bilko lesson on sea ice climatology	GCOS SST&SI Working Group	ASAP	???
2.11.2.3	Examine the possibility of preparing a Bilko lesson on sea ice climatology	GDSIDB Co-Chairperson (USA)	ASAP	???
3.1.8	Provide new contributions to the GDSIDB Project	ETSI Members	Continuing	New datasets for 2007-2009 (JMA in SIGRID-2, AARI, CIS, DMI, NIC - SIGRID-3), 1980-2007 – BSIM
3.1.8	Include new contributions to the GDSIDB Project in the database	ETSI Chairperson	Continuing	On-going
3.1.8 and 3.6.1	Assist the GDSIDB Co-chairpersons in obtaining data from China and Iceland to the GDSIDB Project	GDSIDB Co-Chairpersons and Secretariat	Continuing	Action need by ETSI-IV

Ref.	Action	By whom	When	Progress
3.1.9	Undertake technical actions to make more web-visibility all datasets archived within the GDSIDB project	GDSIDB Co-Chairpersons	Continuing	Action need by ETSI-IV in cooperation with ETMC
3.3.4	Make the necessary arrangements to convene the “Ice data Analysis and Assimilation Workshop” in Germany between April to October 2008	Secretariat and Dr. Jürgen Holfort (Germany)	Prior Mid 2008	IAW-I and IAW-II convened
3.3.4	Develop detailed proposals for the “Ice data Analysis and Assimilation Workshop” agenda	ETSI Chairperson, and representatives of the GCOS SST&SI and IICWG to ETSI	Late 2007	Done twice in 2008 and 2009 in cooperation with the IICWG and GCOS SST&SI
3.3.8	Participate in the TT-MOCS	ETSI Chairperson	Ongoing	
3.5.3.2	GDSIDB consider providing a Northern Hemispheric overview of ice conditions for each month of 2004	GDSIDB Co-chairpersons	Late 2007	Done
3.5.3.4	Review the expected scenarios for the years 2020 and 2050 for plausibility	ETSI Members	When requested by Mr. John Falkingham (Canada)	Done
3.5.3.5	Review of material prepared by other bodies and the AMSA report	ETSI Members	Early 2008	Done
3.5.3.5	Circulate material prepared by other bodies and the AMSA report	Mr. John Falkingham (Canada)	Late 2007	Done
4.4	Provide the appropriate support to continuing implementation of the USIABP	Mr. Paul Seymour (USA), ETSI Chairperson and Secretariat	Continuing	Done via proposals for JCOMM-III documents
5.1	Make the appropriate arrangements, including notify the Team, for convening the following ETSI and GDSIDB sessions in Norway or United Kingdom, between April to May 2009	ETSI Chairperson and Secretariat	Early 2008	Date and place changed

Ref.	Action	By whom	When	Progress
6.2	Make the necessary arrangements to award a Certificate of Recognition to Mr. John Falkingham (Canada) for his outstanding services	Secretariat	Ongoing	Done

Appendix VIII – Member Reports

Canada

March 2010

Introduction

1. The Canadian Ice Service (CIS) provides information about floating ice in the major navigable waters of the Canadian economic zone for the present, the future and the past. This information in intended to meet two main objectives; to ensure the safety of Canadians, their property and their environment by warning them of hazardous ice conditions; and to provide present and future generations of Canadians with a knowledge of their ice environment sufficient to support environmental science and the development of informed policies. The CIS works with the international community to foster a global awareness of floating ice for operational and scientific purposes.

Operational Support

2. Throughout the intersessional period, the CIS provided operational ice information on a 7 day-a-week basis throughout the year. In the December to May period, the main areas of support included the Great Lakes, the Gulf of St Lawrence and the east coast of Canada. From June to December, the support areas shifted to the Canadian Arctic, including Hudson Bay, Baffin Bay, the Canadian Archipelago and the Beaufort Sea. Several levels of products are issued including:

- Weekly regional scale charts for planning purposes – these cover the complete Canadian area and double as the basis for climatology. During January to March, when ice in the Canadian Arctic is historically landfast and shipping activity ceases, the frequency of Arctic regional charts is reduced to bi-weekly.
- Daily tactical scale charts for vessel routing – produced where vessels are operating in the vicinity of ice
- Daily ice hazard bulletins – text messages including warnings of hazardous ice conditions present or developing within the next 36 hours
- Daily iceberg distribution chart showing the estimated numbers of icebergs in each degree latitude/longitude square as well as the Limit of All Known Ice (copied from the International Ice Patrol when IIP is in operation)
- 30-Day Forecasts – text forecasts issued about the 1st and 15th of every month describing expected changes in ice conditions over the next 30 days
- Seasonal Outlooks – text and graphical products issued about December 1st to provide an outlook for the freeze-up and development of the ice season in southern Canadian waters, and about June 1 to provide an outlook for the break-up and development of the navigation season in northern Canadian waters
- Seasonal Summaries – text and graphical products issued at the end of each season (summer and winter) summarizing the recently completed ice season as a brief climatological record.

The most active ice area is the Gulf of St Lawrence with approximately 1,500 ship transits during the ice season, mostly to the ports of Montreal, Sept Iles, Belledune and Port Cartier.

About 20 ships routinely sail throughout the ice season between the Great Lakes Erie, Huron and Michigan. In recent years the Soo Locks into Lake Superior have been remaining open longer into the winter allowing increased winter shipping to the upper Lake. There are about 100 voyages into the Canadian Arctic each summer, including an increasing number of cruise ships, scientific expeditions and adventure cruises (e.g. small sailboats).

3. The CIS produces over ½ million ice information products annually resulting in some 2 million product deliveries. The CIS Website http://ice-glaces.ec.gc.ca continues to grow as the primary means of providing ice information products to users, receiving about 1.5 million visitors and 40 million hits per year. The CIS annually responds to about 400 telephone calls and 900 e-mail messages requesting ice information.

4. The Canadian Coast Guard (CCG), which operates the fleet of icebreakers and is responsible for marine safety, is a major partner of the CIS. Ice Service Specialists from the CIS work aboard CCG icebreakers to directly advise the captain on ice navigation and also in regional Coast Guard ice offices to support vessel traffic routing through ice-covered waters.

5. Climate change is increasingly evident in the Canadian Arctic with more ships venturing into the Arctic and remaining later and later in the fall. For several years now, vessels are routinely remaining in Hudson Bay into November, a month later than the historical end of the shipping season. In mid-season, ships are now scattered more widely across the Canadian Arctic rather than being concentrated in well defined routes. This has created a significant increase in the workload of the Canadian Ice Service which is reflected in the number of daily ice analysis charts produced increasing from 737 in 2005 to 1164 in 2009.

6. The CIS continued to ensure delivery of a service to provide arctic communities with information regarding the position and condition of local “floe edges” (fast ice edges) which are important hunting and social gathering places. Using satellite remote sensing and ancillary data, products are made automatically and placed on a web page for access by two communities to assist them in planning on-ice travel to avoid potentially dangerous situations. This service has been well received by the communities and the information is regularly consulted before trips to the ice are made. The service is actually provided by the Polar View initiative of the Global Monitoring for Environment and Security (GMES) as a cost effective way of assuring the safety of northern residents.

7. The CIS also monitors the ice cover on 134 inland lakes using satellite data for numerical weather prediction. The Canadian Meteorological Service reports that this information is now essential for weather forecasts over Canada.

Data Sources

8. The CIS relies on a mix of satellite, aircraft and surface observations. The most important data sources are RADARSAT-1 and RADARSAT-2 from which about 7,000 images are acquired annually. Envisat ASAR is used regularly with about 500 images being acquired annually. Over the past year, CIS has been receiving PALSAR L-band SAR images from the Japanese ALOS satellite via the National Ice Center. AVHRR optical imagery from U.S. satellites is of almost equal importance despite their vulnerability to cloud cover. MODIS, AMSR-E and OLS provide additional optical information. SSM/I data provide useful background information but have limited resolution.

9. Aircraft ice reconnaissance is an important source of tactical data in direct support of navigation as well as “ground truth” for satellite data. Three aircraft routinely intermingle ice reconnaissance, marine pollution and security patrols over Canada’s ice covered waters. As of

June 2009, all of these aircraft were outfitted with a new Swedish Space Corporation MSS-6000 SLAR system.

10. The CIS is now comfortable with the availability of satellite SAR data for the coming years. The current mix of satellites and the advanced stage of planning for Sentinel-1 and the RADARSAT Constellation Mission provide an adequate degree of security of data availability.

Information Technology

11. The CIS continues to update its main computer system known as "ISIS", now at Version 3.6.1 (see previous ETSI report for a more complete description of ISIS). All products are produced digitally and made available via the CIS website (http://ice-glaces@ec.gc.ca) and other means. Charts, bulletins and satellite images are sent to icebreakers by ftp using MrSID image compression.

12. Previously, it was reported that CIS and the Canadian Coast Guard had completed a joint development and implemented pen computer technology as a means of producing observed ice charts from aircraft in digital form directly on a computer. The system, known as "ICEggs", allowed significantly decreased time and effort to integrate aerial reconnaissance charts with other data. However, the system is no longer supported by the developer and CIS and Canadian Coast Guard are examining new options.

Sea Ice Climatology

13. The "Canadian Ice Service Digital Archive (CISDA) – Regional Charts" dataset (1968 – present) is updated in real-time and available on our web site at:

http://www.ice.ec.gc.ca/App/WsvPageDsp.cfm?Lang=eng&lnid=3&ScndLvl=no&ID=11715

This dataset constitutes the climate database used in the production of the climatic ice atlases also available on our web site at:

http://www.ice.ec.gc.ca/App/WsvPageDsp.cfm?ID=11700&Lang=eng

This dataset is also used for the production of climate products in real time such as "Departure from Normal" and various "Ice Cover Graphs" comparing current conditions to normal and past years. A new tool called "Ice Graph Tool" allowing users to create their own Ice Cover Graphs is available on the web.

14. Since January 2006, all current CIS charts are available in Sigrid-3 format and the regional products are provided to NSIDC in real time.

15. CIS is currently digitizing the "Historical Chart" collection 1959-74 to be added to our climate database. The digitization should be completed in 2011.

Training

16. CIS has continued to develop its "Ice University" concept in which experts in various topics deliver ½ day modules on various science topics for delivery to all analysis and forecasting staff. Week-long sessions are scheduled twice each year, in spring and fall. The US National Ice Center is a regular participant in these sessions.

17. CIS held two Team Retreats with staff to discuss the current and potential impacts of climate change and new Government initiatives on the Ice Service programs and to postulate what the future holds in terms of new information products; services and production/delivery model in the years to come. The CIS is planning to develop and implement standards and performance

programs for its ice analysis and forecast component over the next few years and to increase its focus on training.

Standards

18. The CIS undertook to produce an S-57 Product Specification for an Ice Overlay for Electronic Navigation Charts. S-57 format ice charts were produced in a semi-automated manner during 2009 but with little interest from industry.

Science

19. Evaluation of Dual Channel RADARSAT-2 for CIS Operations - After the successful launch of RADARSAT-2, a core focus of the CIS was to evaluate the spacecraft's new imaging capabilities. After a successful transition of CIS Ice and Oil Operations to RADARSAT-2's heritage modes (SCW-HH), the utility of dual channel ScanSAR, i.e. HH+HV, for CIS Ice Operations was investigated. While pre launch investigations indicated significant potential value in adding the HV channel, it was important that these findings be validated with actual RADARSAT-2 data and they be assessed first hand by CIS Operations. Also, it was recognized that the regular use of dual channel ScanSAR data by Operations could carry real costs and associated risks to the present operation. As a result, CIS completed a six month study identifying and studying the potential costs and benefits associated with the regular use of HH+HV ScanSAR data in CIS Ice Operations. The results of the study enabled CIS Operations to make an informed decision regarding the adoption of dual channel ScanSAR in its daily ice workflow. This evaluation has resulted in several conference presentations/papers as well as a comprehensive technical report.

20. New Automated SAR products - Ice Motion - Natural Resources Canada (NRCAN) has been leading the mapping of Canada's continental shelf in support of an upcoming Canadian UNCLOS submission. CIS' role in this interdepartmental initiative is to provide ice and marine weather support to the on-ice participants. Critical to this suite of CIS products is output from an in-house developed ice motion algorithm. The CIS ice motion system operates with two overlapping and sequential Synthetic Aperture Radar (SAR) images from RADARSAT-2 and takes into account two main components of ice movement: parallel shift and rotation. The output from the ice motion system provides a set of sea ice displacements with low, medium and high levels of confidence. After the 2010 UNCLOS experiment, CIS will continue to generate sea-ice motion products on all incoming RADARSAT-2 image pairs in support of its daily operations.

21. ALOS-PALSAR Evaluation - The PALSAR sensor onboard JAXA's ALOS satellite provided CIS with an opportunity to examine the potential synergies between L-Band and C-Band SAR for ice operations. CIS in partnership with the US National Ice Centre (NIC) used both quantitative and qualitative analysis to identify the unique and complementary sea ice information PALSAR can provide. The sensor's detection of large scale topographic features coupled with its ability to penetrate through the wet snow volume in melt conditions provides valuable information not available using C-Band SARs. Through its membership in the North American Ice Service (NAIS), CIS began to operationally receive ALOS-PALSAR data in June 2009. Validation and analysis will continue as CIS gains more experience using this data in daily operations.

22. Seasonal Ice Forecasting - A multiple linear regression system has been implemented in research mode to assess its skill as guidance to CIS extended range forecasts. In addition a much simpler Optimal Filter Based Model is also being tested. Using these two models,

individual and multi-model forecast guidance has been provided to CIS Operations for use in preparing their seasonal outlooks. A totally model-based 18 month forecast the Canadian east coast has also been provided to the Canadian Coast Guard for their evaluation as input to their planning process for Coast Guard icebreaker deployments. At the same time, another model based on Classical Canonical Analysis is being adapted for the Beaufort Sea.

23. Sea ice modeling - A moderate resolution (10 km) coupled ice-ocean model (CECOM Canadian East Coast Ocean Model) has been developed at the Bedford Institute of Oceanography and is currently being evaluated at CIS as a replacement for the current operational model. In preparation for migrating sea ice model operations to the Canadian Meteorological Centre, we are evaluating two state of the art ice models (CICE 4 and LIM 3) for their applicability to forecasting for CIS Operations and CMC Numerical Weather Prediction. Current research issues include: determining the effect of floe size on ice forecasts; modeling the behaviour of land fast sea ice; modeling the seasonal evolution of ice strength; and, tracking multi-year and deformed ice.

24. Iceberg modeling - A joint IIP-CIS report recommending the future operational iceberg model will be released shortly. This report is based on an evaluation of the IIP and CIS iceberg models for predicting the drift of approximately 200 iceberg drift tracks observed along Canada's east coast. In addition to comparing the two models, four different sources of ocean current forecasts are being evaluated. Within the limitations of this preliminary study, it was found that the new CECOM ocean current forecasts were better for predicting iceberg drift than the operational CIS model, the IIP currents and forecasts available from Mercator. The CIS iceberg model has also been extended to allow it to provide ensemble forecasts of iceberg drift. It has been found that an ensemble size with 250 members is adequate to describe the variability of iceberg drift. In addition to providing an ensemble mean forecast, this system provides information on the uncertainty in the forecast iceberg position. Work is also underway to investigate the effects of sea ice on icebergs.

25. Data assimilation - In collaboration with the Environment Canada Data Assimilation Section, CIS has been developing a sea ice data assimilation system for use in sea ice analysis and forecasting and numerical weather prediction. Using a 3D variational (3DVar) approach, a variety of ice observations can be assimilated with this system including: passive microwave data from the AMSR and SSMI instruments, gridded data from CIS image analysis and daily charts and CIS lake ice analysis data. One of the crucial elements in assimilating these observations is to define the error statistics associated with each observation and the trial field as well as developing a forward model that relates the analysis fields to the observations. Initial global estimates of these have been made but the system is quite flexible in that future refinements can easily be incorporated. Several implementations are underway or nearing completion: a) an automated sea ice analysis at 5 km resolution for North America; b) a 3DFGAT (First Guess at Appropriate Time - a 3DVar variant) system has been coupled to an ice-ocean model for the east coast of Canada as described by Caya et al; c) a very similar system to b) has been developed for a coupled atmosphere-ice-ocean model that covers the Gulf of St Lawrence at a resolution of 5 km; and d) a northern hemisphere (NH) sea ice analysis system that is almost identical to a) has been developed as a step towards a new global system. In addition to the implementations discussed above, several research projects are underway. These include: development of a radiative transfer model for passive microwave data (in collaboration with the Danish Meteorological Institute): development of techniques for assimilating AVHRR data (in collaboration with MetNo); and development of techniques for assimilating active radar data. Other R&D currently underway or planned includes using displacement errors and spatially varying error statistics.

26. Historical Chart Digitization and Analysis for IPY - With the support of Canada's International Polar Year program, CIS has been digitizing its historical ice charts (1958-1968) for inclusion into its regional chart historical chart database (1968-present). The goal of this recently completed project was to extend the CIS ice chart record as far back as possible to permit longer time series analysis and a clearer indication of trends in ice concentration in Canadian coastal waters. The new database and resultant ice trends are the subject of two journal papers now under review with the hope of being published in late 2010.

International Activities

27. Under the North American Ice Service (NAIS) banner, Great Lakes ice charts and bulletins, 30-day forecasts, Seasonal Outlooks and Seasonal Summary are now produced jointly. As a NAIS partner, the National Ice Center has been providing daily ice information to the Canadian Coast Guard icebreaker Sir Wilfrid Laurier as she transits to the Arctic through the Bering Strait. – an activity that is saving considerable resources in the CIS.

Work that started in 2007 to develop a common ice chart production system for the NAIS is now proceeding in earnest. The common system has been named "Polaris" and has a target completion of December 2010.

28. The CIS has been active in the International Ice Charting Working Group that has now held ten annual meetings.

29. The CIS undertook an active role to support scientific activities during the International Polar Year. In addition to its participation in the ETSI-Polar View Ice Information Portal, the CIS provided ice information support for 10 IPY projects in Canadian waters including the Canadian Flaw Lead project that had the icebreaker CCGS Amundsen over-winter in the Beaufort Sea. Additional staff were hired and a special IPY section on the CIS web site was established. The primary focus of the CIS effort was the safety of researchers in the Canadian Arctic but a secondary goal was to provide ice information that is of "common good" to many projects so that individual projects did not have to duplicate efforts.

30. In 2008 and 2009, CIS worked jointly with the Danish Meteorological Institute to provide ice and weather information for UNCLOS seabed mapping projects in the Lincoln Sea and Arctic Ocean. These projects involved large numbers of people and several aircraft working on the sea ice for several weeks in the spring of each year. Despite difficult weather and some surprising ice conditions, the work was completed successfully and without incident. Support was also provided cooperatively with the NIC to the joint seismic operation conducted by the CCGS Louis S St Laurent and USCGC Healy in the Beaufort Sea in 2009. In this project, a seismic array was towed through the sea ice by the Louis while the Healy broke ice ahead.

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Denmark

February 2010

Introduction

1. The Danish Meteorological Institute (DMI), Greenland Ice Service, is responsible for operational monitoring and charting of sea ice conditions in the waters around Greenland and distributes this information to ships primarily as ice charts and reports. In recent years also annotated quicklooks of various satellite data have provided significant support to shipping as these products often deals with physical details not included in standard ice charts. The purpose of the sea ice service is to aid navigation and provide tactical and strategic support to the shipping community. The present ice service was established in 1959 but information about sea ice conditions has been gathered by the DMI since 1872. The ice service is managed by DMI and is located at DMI headquarters in Copenhagen and in Narsarsuaq (southern Greenland). The Greenland Ice Service is now a division under the DMI Center for Ocean and Ice, established at 01st January 2006. The Copenhagen ice branch is manned with DMI staff plus one navigator from Royal Arctic Line. The Narsarsuaq branch is staffed purely with navigators from Royal Arctic Line.

Operations, data, services and products

2. The service provided by the Danish Meteorological Institute, Greenland Ice Service, is mainly based on the SAR satellite platforms, e.g. RADARSAT-1/2 and ENVISAT. DMI's current usage of SAR imagery is 250-300 Radarsat images per year and numerous Envisat ASAR Wide scenes (HH-polarisation), partly delivered via a contracted ground station and partly via MyOcean/ESA Rolling Archive. Near Real Time access to SAR data in combination with visible satellite data sources like NOAA-AVHRR and AQUA/TERRA MODIS constitute the most important source of information for the ice service production of navigation ice charts. A fully automatic ingest and processing system has been implemented to make available SAR images from RADARSAT and ENVISAT in near real time for the ice analysts.

3. The operational use of SAR data from satellites since 1999 for ice charting has indeed proven very successful. Therefore, the need for air reconnaissance has been reduced only to be performed by helicopter in support of inshore shipping and passenger routes. Main area of activity is the South Greenland Waters south of 62N. Here ice charts for navigation are normally issued 3-5 times weekly. Other regions are mapped infrequently ship traffic dependent. Twice a week (normally every Monday) a general ice chart for all Greenland waters is published as part of the GMES/ESA PolarView programme. All products are freely available at http://www.dmi.dk/dmi/en/index/gronland/iskort.htm or at http://ocean.dmi.dk/polarview More than 420 navigation ice charts, 104 general ice charts and numerous inshore ice reports are issued every year. NAVTEX messages with relevant ice information are circulated routinely from Ice Patrol Narsarsuaq. All ice charts are produced in Near Real Time seven days a week.

4. Near shores ice reports and ice piloting are carried out on a routine basis from

Narsarsuaq with a contracted helicopter. More than 70 locations south latitude 62N may potentially be surveyed during one helicopter recce. A written near shore ice report in Danish and Greenlandic is published after the recce.

Ice Charting System

5. In February 2006 DMI's new ice charting system called SIKU was launched for operational ice analysis and chart production. SIKU is a new state of the art development based on ESRI ArcGIS. The current version is now based on ArcGIS 9.3.1. SIKU follows all international ice charting standards and WMO Nomenclature including export of ice analyses in SIGRID-3, graphical formats and NetCDF.

Distribution of ice information

6. Operational ice information (ice charts and ice reports) is typically distributed via dmi.dk or directly to dedicated users on attachments to emails. Specific requests on ice conditions or offline requirements are handled by the ice operations team hooked up on iskort@dmi.dk.
7. Once a year DMI has an annual user meeting to obtain feedback and present services/changes. Meeting user requirements with an open dialogue has proved its value.

Research, Development and Other Activities

8. Research and quality assurance projects have been conducted to optimize the use of SAR data and to increase customer satisfaction. The primary goal of the Greenland Ice Service is to provide timely and accurate information to the customers. Combined use of satellite observations and oceanographic models would certainly support this goal. To investigate this possibility the DMI setting up an experimental high resolution sea ice model for the North Atlantic including the Greenland Waters. DMI has developed an operational module which in a semi automated fashion can extract ice thickness data from Synthetic Aperture Radar. This is in a test phase for Greenland.
9. Secondly investigations of new SAR sensors and modes are ongoing for example with respect Radarsat-2 dual polarization or the KosmoSkyMed constellation. Long term priority is to ensure data continuity, backup, methods for classification of sea ice and icebergs

Sea Ice Climate

10. No regular products.
11. The Greenland Ice Service has received funding from national sources for digitization of all ice charts produced for the South Greenland Water since 1959. All ice charts will be vectorized into the ArcGIS environment at DMI. Several output formats for this data base can be produced. This includes SIGRID-3. The South Greenland sea ice database is expected to be completed in 2011. Data will also be passed to GDSIDB. This includes also general ice charts produced for all Greenland waters.

Icebergs

12. No routine products. Regular navigation ice charts contain iceberg information using the WMO symbology in terms of bergy water and few/many icebergs/growlers eventually polygons with concentrations of glacial ice.

Training

13. Since the introduction of SAR satellite based ice charting in 1999 training of ice analysts has been improved and adjusted to the specific needs of the Greenland Ice Service.
14. A significant amount of training material has been compiled; most of which is developed in house but valuable material has also been made available by other ice services through international cooperation. This has helped to make the training more effective and to decrease the amount of time needed to perform the training. A substantial part of the ice analyst training takes place in open sea as onboard training on some major client vessels operating in ice infested waters. It is important to be familiar with the offshore environment as well as the crews' daily routines and decision making. This also includes exchange of information, product contents, ship focused requirements, ice recognition.
15. The DMI Ice Team has benefited significantly from Ice Analyst Workshop I and II.

International Cooperation

16. The Greenland Ice Service is also involved in international cooperation with the aim of improving cooperation, services and products. The cooperation between the ice centres within the International Ice Charting Working Group is fruitful and recognized internationally. DMI participates in a number of international projects. Some examples are GMES MyOcean and ESA PolarView

Commercial activities

17. Since February 2005 DMI has been contracted to provide Near Real Time ice information for the North Caspian Sea to operating oil companies and local Kazakh authorities. The current contract also include training of Kazakhs and transfer expertise to the Kazakh agencies
18. Since 2006 oil/gas exploration at the Greenland continental shelf has increased significantly. The local authorities and oil companies has a strict set of Health, Safety and Environment regulations which through the recent years had required many ice related field/desktop studies or operational requirements which have involved DMI significantly.

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Finland

March 2010

Introduction

1. Operational ice service started in Finland in 1915 under the Finnish Scientific Society. In 1919-2008 the Finnish Ice Service has operational under the Finnish Institute of Marine Research, and since 2009 under Finnish Meteorological Institute. The Service is responsible for charting and forecasting of the Baltic Sea ice conditions. The main purpose of the service is to secure smooth marine transportation and decrease risk of ship accidents during the Baltic Sea ice season.

Operational support

Drivers and users

2. Marine transport is the main driver when ice services are developed. Marine transportation in Finland has grown about 33% in last ten years, and the trend seems to continue at the same level. In Finland more than 100 million tonnes were marine transported in 2009 of which about 40-45% during winter months. In the Baltic Sea about 800 million tonnes were marine transported in 2009 of which about 40% during winter months. Marine transportation is expected to grow into 1.2 billion tonnes by 2020.

3. The users of operational ice information are vessels, icebreakers, pilots, icebreaking leaderships, maritime authorities, ports, shipping companies, export and import companies, etc. The main users are Finnish and Swedish icebreakers, Finnish and Swedish icebreaking authorities (Finnish Transport Agency [ex Finnish Maritime Administration] and Swedish Maritime Administration), and Arctia Shipping Ltd (operator of Finnish icebreakers, ex Finstaship Ltd). Since October 2005 ice charts and ice reports have been available free-of-charge at Internet. In 2009 more than 300,000 requests were for ice charts, and about 40,000 requests for ice reports. From 2007 Finnish ice service has also provided ice information to Baltic Icebreaking Management (BIM) via its web pages.

Coverage, products and services

4. Ice monitoring area covers the Baltic Sea, Kattegat, Skagerrek, and Swedish lakes of Vanern and Malaren. Ice season starts in mid October with sea surface temperature charts published twice a week, followed by daily ice charts normally between mid of November and end of May.

5. Sea surface temperature charts updated on Mondays and Thursdays including means of 1970/1971-1999/2000 for comparison. SSTs are included the ice charts. Ice charts on daily basis covering the Baltic Sea, Kattegat, Skagerrek, and Swedish lakes Vanern and Malaren (about 53º 20'N 9º 00'E -66º20'N 31º00'E). The B&W and colour coded ice charts include ice conditions in WMO ice symbols, icebreakers, restrictions to navigation and traffic control information. Ice reports in plain language are published in Finnish, Swedish and English on daily basis. They include description of ice conditions, information of Finnish icebreakers, restrictions to navigation and traffic control information. Ice conditions in Baltic Sea Ice Code are provided on daily basis. All SAR images and useful Modis images are sent in near real time to Finnish and Swedish icebreakers. High-resolution ice thickness charts based on SAR data are published with the spatial resolution of 500m always when SAR data is available. Ice forecasts for 45h are published on daily basis in 3h time-steps and with 7 parameters.

Products and services are available free-of-charge

Ice charts and ice reports:

http://www.itameriportaali.fi/html/icef/jaakartta.pdf
http://www.baltice.org
http://www.bsis-ice.de

High-resolution ice thickness charts at:

http://polarview.fimr.fi
http://www.baltice.org
http://www.polarview.org

45h Ice forecasts at:

http://polarview.fimr.fi
http://www.baltice.org
http://www.polarview.org

Selected Modis data at:

http://www.baltice.org

Other services and products are available on request.

Data sources

6. Main data sources are satellite data and in situ measurements. Main space-borne data are Wide Swath SAR data from RADARSAT and Envisat. About 240 images were used in ice season of 2008-2009 (in 2010 this is expected to grow into 400-700 images). NOAA AVHRR data is used on daily basis, and 8-12 images used in a day. Modis data has been used operational since 2007. AMSR is used as background information because of poorer spatial resolution. In situ data consists of icebreaker observations delivered by both Finnish and Swedish icebreakers many times a day (edges, boundaries, thickness, pressure fields, deformation, drift, etc.); about 20 ships are providing both ice information and they are also measuring sea surface temperatures. FMI has about 25 ice observation stations, where black ice, snow ice and snow thickness are measured and observation on ice conditions are recorded on daily or weekly basis.

Validation

7. Main validation data of products and services are collected on regular basis from icebreakers (edges, boundaries, thickness, drift), and during various field campaigns.

Medium range forecasting

8. Medium range ice forecasts are provided to Finnish icebreakers, Finnish icebreaking authorities (Finnish Transport Agency, ex Finnish Maritime Administration), Arctia Shipping Ltd, and shipping companies. This service includes 7-10 day forecasts of development of ice conditions.

Training

9. Training of icebreaker personnel is done in 1-2 times a year by organizing workshops. Main purpose is to exchange ideas for developing new services and products, and develop present services and products to user friendly. Training of other user groups is not frequent.

Research and development

10. Over the intersessional period, FMI has developed high-resolution ice thickness charts and ice forecasts into operational phase. This was done under finance of ESA's GSE programme in Polar View project. FMI is participating EU's GMES My Ocean project, where e.g. in Sea Ice and Wind Tactical Assembly Center (SIW TAC) providing all ice information to My Ocean Forecasting Centers. Transferring the method from Baltic Sea to the Arctic first year ice, where high-resolution ice thickness charts are produced by using SAR data, is under development.

International activities

11. FMI has been active in Baltic Sea ice Meeting (BSIM).
12. FMI has been active in International Ice Charting Working Group.
13. FMI is the founding member of European Ice Services (EIS), and in 2009-11holding it's chairmanship.

Germany

March 2010

Introduction

The German ice service is a part of the German federal maritime and hydrographic agency (BSH) and has a long history dating back to 1896. Its main objective is to provide operational information about the ice conditions in the German waters of the Baltic and North Sea and to advice German and other vessels about navigation conditions in ice covered regions with special emphasis on the whole Baltic, but also elsewhere. International collaboration and data exchange is a key feature for such services.

Work outside the operational services are ice climatology and expert reports of ice situation for the planning of coastal and offshore structures. The ice service is also involved in the issuing of ship permits according to the Antarctic treaty.

Operational Products

Operational products are provided during northern winter. When ice is present in the waterways of the German coast a daily description of the ice conditions is prepared and distributed over German NAVTEX, GTS, Email and through the WWW. The NAVTEX messages are done in German and English and regionally separated for the German Bight (North Sea) and the Baltic coast. For international exchange over GTS and Email the English written German ice report combines and expands the information given in the NAVTEX Messages. On workdays a more detailed description, covering also smaller harbours and other local areas of interest, is made in German. A summary of the ice evolution of the last week and a outlook for the next week is made, in German, each Monday.

In mild winters ice charts of the German Waters are produced at irregular intervals as deemed necessary and are freely available at the BSH website. If considerable ice is present at sea in the Western Baltic, the North Sea, Skagerrak or Kattegat a daily ice chart of this region is produced and distributed as radio facsimile over Pinneberg Radio. This chart is also freely available at the BSH website.

During the ice season a bilingual report is prepared on workdays, describing the ice situation of the whole Baltic and North Sea. It includes a forecast for the following days and an overview over traffic restrictions, icebreaker and other ice related information. Twice a week it is accompanied by an ice chart. It is not freely available to the public but distributed (over FTP, and Email) on a subscription basis. It is send out free of cost to other ice services and made available to several libraries on an exchange basis (in this case also as printed version).

The web pages of the “Baltic Sea Ice Service” (http://www.bsis-ice.de/), are hosted and maintained at the BSH. A simple ice cover grid is produced to be used in the sea state/swell prediction of the DWD. In cooperation with the DWD daily facsimile transmissions over Pinneberg radio are done of the daily iceberg distribution chart in the northwest Atlantic (from the IIP and CIS), the Swedish ice chart of the Baltic and the Norwegian ice chart of the European part of the Arctic.

Data sources and information technology

As in most years ice in German waters is found only along the shore and in inner waters, the most important data source are ice observers at land and on coastal vessels. Generally these

are early morning observations, delivered between 8:00 and 9:00 o'clock, and comprise information about ice extent, ice type and ice thickness as well as the navigation conditions. In addition satellite data in the visible (NOAA, MODIS, Meteosat) and microwave (AMSR, Envisat-ASAR, ERS-1) range are used. The same satellite information, in conjunction with the ice information from other ice services, are used for the ice charts and the ice report of the whole Baltic.

A database is used to store the station ice information, coded according to the Baltic sea ice code, from all German stations and the international fairways stations of the whole Baltic and North Sea. Ice charts are drawn using the software ArcGIS. Meteorological data and forecast are available over a direct link to the DWD with the program Ninjo. NOAA data is received and processed directly at the BSH. AMSR data is available due a cooperation with the University of Bremen and the University of Hamburg. The main source for SAR data is the rolling archive from ESA and MODIS data are taken from the MODIS rapid response system available on the Internet.

Numerical modeling of sea ice is done on an operational basis. The forecast is done once daily for the region of the North Sea and the Baltic, with a forecast length of three days. As there is no ice data assimilation in the model, the model can diverge considerably compared to the actual ice situation and therefore model results are actually not directly used for the operational forecast.

Research, Development and Other Activities

Together with other partners a description of the ice conditions in the Baltic of the last 50 years was done and published in a monograph (State and Evolution of the Baltic Sea, 1952-2005, ISBN 978-0471979685). The climatological data is being expanded by digitalization of historic ice charts of the years 1926-1950. Large part of this work is done as a student project of a local school. A test run was made to convert the operational ice charts into an S-57 overlay for the use in ENCs. Although the test showed that this would be viable on an operational basis, at the moment the use is still hampered due to the lack of an harmonized ice representation scheme and viable near real time transmission to ships. Together with the Polish ice service and with data input from the Swedish ice service an ice atlas for the western and southern Baltic is developed. The atlas is planned as a printed version together with an S-57/ENC conform electronic version.

A test version of the Ice logistics portal is implemented and can be accessed at www.bsis-ice.de/Iceportal. There is still the need to include some static information and the URL of the portal has to be transferred to the BSH server. The data for the portal is updated automatically four times a day.

In the framework of the Antarctic treaty and together with the Umweltbundesamt several permission for ships entering the Antarctic treaty region were issued. The BSH, together with the AWI, issued a hydrographic chart of the region near Dronning Maud land (Atka iceport to Trolltunga), where the ice service contributed in the determination of the climatological ice edge.

International activities

An over 40 year's long cooperation with annual meetings exists with the Polish ice service. The first Ice analyst's workshop was held at the BSH in Rostock in 2008 and two persons from the German ice service took also part in the second workshop in Tromsø. The German ice service attended the Baltic Sea Ice Meeting in Helsinki and will host the next meeting in 2010. It also has been active in the International Ice Charting Working group. At the Antarctic treaty meeting

of experts about tourism shipping in Antarctic it was tried to propagate the idea of an Antarctic Ice service for the region around the Antarctic Peninsula in the summer season, when many tourist ships are in this area.

Future plans

A better, open access to the ice database over the BSH-GDI should be implemented in the next two years. There are several applications for project funding, but still none of them are accepted. One project deals with ice route optimization on the Northern Sea route, another related to the first about better use of high resolution SAR data in strategic and tactical routing and oil spill detection. Another deals with ice information in ENCs. The ice atlas of the Western and southern Baltic should be finished in 2011 or early 2012. Further, more political work is planned to propagate the implementation of an Ice service for the Antarctic Peninsula.

Japan

March 2010

Introduction

1. The Japan Meteorological Agency (JMA) has been operationally monitoring sea ice conditions and providing sea ice information in the Sea of Okhotsk since 15th December 1970, in support of fishing, shipping and coastal and harbour activities. Current status of the information services is described in this report.

Operational sea ice information services

2. JMA operationally analyzes sea ice conditions in the Sea of Okhotsk every day from November to July. The analysis area includes the northern and western parts of the Sea of Japan, Bohai Sea, and the seas east of Kamchatka Peninsula.

3. Sea ice analysis charts are broadcast on radio facsimile twice a week (on Tuesday and Friday) from December to May. The charts show sea ice edges, four classes of sea ice concentration with a description of sea ice conditions and one week forecast in both Japanese and English.

4. Numerical sea ice prognosis charts which show the distribution and concentration of sea ice of two and seven days ahead are also broadcast on radio facsimile twice a week (on Wednesday and Saturday).

5. Daily sea ice analysis charts are available on the NEAR-GOOS Regional Real Time Data Base website with other oceanographic products (e.g. sea surface temperature analysis and sea surface height analysis).

6. JMA started the global sea ice analysis in March 2006. It provides boundary conditions for JMA's Numerical Weather Prediction Model and Climate Prediction Model.

Data sources

7. The sea ice analysis in the Sea of Okhotsk is made based on satellite remote sensing data provided by MTSAT, NOAA-17, NOAA-19, Terra/MODIS, Aqua/MODIS, Aqua/AMSR-E and RADARSAT. Visible observation data from the Japan Ministry of Defense (JMD) and Japan Coast Guard (JCG) aircrafts, the Coast Guard ships, and four coastal meteorological stations are additionally used.

8. DMSP/SSM/I data are used for the global analysis.

Sea Ice prediction model

9. A numerical model to predict sea ice distributions was first utilized by JMA during the sea ice season in 1991. The JMA's model system provides 7-day forecasts of sea ice distributions in

the southern part of the Sea of Okhotsk and the neighbouring waters. The model contains physical processes of sea ice formation/melting and wind- and current-driven sea ice drift.

Future plan

10. We have developed algorism to calculate the sea ice motion vector in the Sea of Okhotsk. We plan to make the results publicly available as now cast information on sea ice and use them as initial conditions for our numerical sea ice model.

References

Japan Meteorological Agency, 2007: Outline of the operational numerical weather prediction at the Japan Meteorological Agency.

Appendix to WMO numerical weather prediction progress report.

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Russian Federation

March 2010

Introduction

1. Sea-ice services in the Russian Federation are provided by the Arctic and Antarctic Research Institute in St Petersburg (AARI), the Hydrometeorological Centre and the Scientific Research Center of Space Hydrometeorology "Planeta" in Moscow (Hydrometcentre) and local hydrometeorological offices in the Arctic, Far-Eastern Russia, Baltic, Black and Caspian seas; all belonging to the Russian Federal Service for Hydrometeorology and Environmental Monitoring (Roshydromet).

2. AARI provides centralized general and customer-oriented services for shipping and coastal and harbour activities within the Northern Sea Route (NSR), for the Central Arctic Basin and Arctic seas – Greenland, Kara, Laptev, Eastern-Siberian, and Chukchi as well as for the seas with the seasonal ice cover – Baltic, White, Bering, Okhotsk, Caspian and also Antarctic seas. AARI is responsible for coordination of the Marine Safety Information (MSI) provision for the GMDSS system for METAREAs XX and XXI. Most of the sea-ice services are provided by the AARI Centre for Ice Hydrometeorological Information while support for numerical operational and climatic modeling is provided by the AARI research department.

Data acquisition

3. Coastal weather polar stations of Roshydromet in the Arctic and Antarctic make daily visual and instrumental ice observations on sea-ice concentration and stages of ice development, ice thickness, forms of ice, ice drift and other phenomena. Icebreakers routinely report the same mentioned main ice parameters plus parameters describing ice navigation. Observational data are relayed to analyzing centers at AARI via the national meteorological network, WMO GTS and are generally available on-line via Cliware system – http://cliware.aari.ru and http://cliware.meteo.ru.

4. Before 1992 aircraft ice reconnaissance flights were conducted in the Arctic usually on a monthly basis from November to April and on a 10-day internal during the summer navigation period. Since 1993 aircraft ice reconnaissance flights have been conducted only occasionally during tailored hydrometeorological support of applied and scientific activities including support for AARI expeditions aboard research vessel “Akademik Fedorov”. The scope of ice information collected during air-ice reconnaissance included visual observations both on main ice parameters (mentioned above excluding thickness and ice drift) as well as discontinuities in sea-ice cover (leads, cracks, etc.) and various surface parameters (hummocks, ridges, snow, contamination, stages of melting, etc.). Collected data were fixed onboard by ice observers in log-books and in mapped form and further were used for sea-ice analysis onboard expeditionary vessels, at AARI and local meteorological offices. Huge collection of these historical log-books and ice charts (since 1930s till 1992) is archived at the AARI archive department, project of its digitization was initiated during last years and is going on at present time.

5. The AARI satellite reception station provides visible and infrared satellite images for major part of the Arctic both from USA (NOAA HRPT, EOS TERRA) and Russian (METEOR, OKEAN) satellites. Customized access to the operational and archived data is provided online (http://eostation.aari.ru/). Information for other regions (e.g. Antarctic) or from other satellites (Envisat, Radarsat etc.) is provided to AARI via Internet from other Roshydromet reception stations (Moscow, Khabarovsk etc) or from commercial satellite data providers (Scanex etc.). All data are further processed within an ice information system, including ArcMap version 9

software and utilized for regional and pan-Arctic sea-ice analysis by AARI. Satellite products are also available via the Planeta web pages (http://planet.iitp.ru/english/index_eng.htm).

6. AARI, Hydrometcentre, Planeta and the local meteorological offices of the Roshydromet exchange described sea ice data by facsimile, telex, Inmarsat, Global Star, Iridium and the Internet and disseminate derived products to users. In cases where the AARI operational centre lacks initial data to compile an ice map for a specific area, the necessary information is requested and if available, is obtained within several hours via communicational relays.

7. For the Baltic Sea region observers of the Northwestern Department of the Hydrometeorological Service (NW Hydromet) at the coastal hydrometeorological stations are providing visual and instrumental daily observations on ice conditions by phone or telegraph.. From 1960s till 1991 daily aircraft ice reconnaissance flights for the Gulf of Finland and the Gulf of Riga were carried out. From 1992 NOAA satellite imagery from up to 15 passes a day is used in operative work. An additional source of the satellite information is TERRA/EQUA imagery received via the Internet. Data from stations and satellite images are by the Baltic Ice Group of the NW Hydromet, and on basis of these data a daily set of information is produced including: SEA telegram, icebreakers report and ice chart. The Baltic Group maintains a vast archive of daily ice chards (since 1927) and the stages of ice development (since 1920).

Operational support

Ice charts and satellite imagery

8. General sea-ice conditions charts of the Arctic Ocean are prepared by AARI on weekly scale (every Wednesday) and available via the AARI web page for public use. Charts depict drifting and fast ice boundaries and five classes of sea-ice concentration in the summer period or stages of development in the winter period and are available in GIF and WMO SIGRID-3 format (http://www.aari.ru/projects/ecimo/ModuleLoad.php?mod=d0015&in=1).

9. Detailed sea-ice conditions charts for the 3 Antarctic sectors (Atlantic-Weddell Sea, Indian - Cosmonavtov-Sodruzhestva Seas and Pacific -Ross Sea) are prepared by AARI twice a month (every 10-15 and 25-31 days of month) to provide tailored support for operational activities of the Russian Antarctic Expedition (RAE – http://www.aari.aq) and general ice monitoring in the South Ocean. Generally these products are not available on-line at present moment.

10. Detailed regional sea-ice conditions charts and annotated imagery for the seas Greenland, Barents, Kara, Laptev, East-Siberian, Chukchi, Bering, Okhotsk and Baltic are prepared by AARI on weekly (every Wednesday) or shorter scales and on request and are disseminated via appropriate telecommunication means to the customers (masters, shipping companies, federal agencies, etc) requesting tailored support. Informational products are relayed to the users in graphic GIF/JPEG formats, in WMO SIGRID-3, ARC/INFO e00 and since 2009 in S-57 formats. Archive of detailed regional sea-ice charts in national coding is available via http://www.aari.ru/projects/ecimo/ModuleLoad.php?mod=d0004&in=1.

11. In the recent years there is a growing request from the customers for operational properly documented satellite imagery for tactical and strategic analysis on the bridge inside the ENC software (NaviSailor, IceNavigator). After processing (in GIS or special package environment like ENVI) the imagery is relayed by the AARI to the customers in georeferenced graphic formats (JPEG, JGW, PRJ). Mercator projection is preferred but used till 80Nº, polar stereographic projection is commonly used northward of 80Nº. In many cases an accompanying ice chart is provided along with the imagery and is superimposed over it to facilitate decision.

Plain language information

12. Coastal and open sea sea-ice and weather GMDSS and other plain language reports are prepared routinely on weekly, daily or shorter scales and on request by AARI and the local meteorological offices of Roshydromet for METAREAs XX, XXI and XIII and are disseminated via various telecommunication means to the customers. Synoptic bulletins on weather conditions in the Eurasian Arctic are prepared routinely on daily scale by AARI and are disseminated via various telecommunication means to the customers and published on AARI web-site (http://www.aari.ru/projects/ecimo/ModuleLoad.php?mod=d0011&in=1).

Gulf of Finland sea-ice products

13. Regular daily and longer term analysis and prognostic products for the Gulf of Finland are provided by the NW Hydromet Baltic Ice Group and include:

- Daily report for coastal points “SEA” / MORE” in KN-2 code.
- Daily ice report for fairway containing review of Gulf of Finland ice conditions, the Baltic sea ice code telegram, information about icebreakers, navigation restrictions, point of convoy formation for the ships steering. Ice report for fairway is produced in English and Russian by 8:00 GMT.
- Daily detailed ice chart produced by 10:00 GMT in international black-and-white and color coding.
- Ice bulletin produced twice a week (Monday and Thursday). The bulletin consist s of ice chart, detailed review of ice condition of the Gulf of Finland and short ice review of Baltic sea, short-term forecast (next 3-4 days) of ice condition’s development for the Gulf of Finland.
- Forecast of the ice condition along the fairway to the next month in English and Russian. It is made on last day of month for the 10-th, 20-th and 30(31)-th day of the next month. That forecast contains the probable ice thickness, concentration, hummocking, rafting for each part of fairway, probable position of fast ice boundary and ice edge location.
- Long-term forecasts of the ice appearance, total freezing, fracturing of fast ice, total disappearance of ice at the points of Gulf of Finland in advance of 20- 45 days.
- Preliminary forecast of maximum ice conditions for the Gulf of Finland for the coming ice season on July 31st with amendment on November 30th.

Forecasts and forecasts methods

Numeric short-term forecasts

14. Daily diagnosis and forecast tabular and mapped patterns of mean daily and instantaneous ice drift, surface currents and sea level elevation in the Arctic Ocean and at selected coastal points of Eurasian Arctic for period 0d…+6d are provided on the basis of an output from the AARI hydrodynamic model with viscous ice rheology, available at http://www.aari.ru/projects/ecimo/index.php?im=102&sub=4.

15. Weekly or shorter period diagnosis and forecast tabular and mapped patterns of the evolution of ice cover in Barents and Kara Seas including sea ice total concentration, thickness (stages of ice development), hummocks concentration and level of compacting for period 0d…+6d on the basis of the thermo hydrodynamic with elastic viscous-plastic ice rheology AARI model; available at http://www.aari.ru/projects/ecimo/index.php?im=102&sub=1.

16. Daily diagnosis and forecast charts for winds, wave significant height and direction and ice accretion for open water areas in the Western and Eastern Eurasian Arctic Seas for period 00…+72h with 6-h interval on the basis of the AARI spectral parametric wave model; available at http://www.aari.ru/projects/ecimo/index.php?im=102&sub=2.

Empirical and statistical long-term forecasts

17. Seasonal forecasts of ice conditions in the Eurasian Arctic seas and big Siberian rivers estuaries are produced in AARI in March, June and in August using empirical-statistical techniques in a form of textual bulletins. As a background to those forecasts a long-term AARI meteorological annual forecast with seasonal and monthly corrections is used.

18. Weekly-monthly forecasts of ice phenomena in the big Siberian rivers estuaries based on AARI empirical-statistical techniques are produced in spring (May-June) in a form of textual bulletins.

International cooperation and IPY

19. AARI and other institutions of Roshydromet participate in most of the projects aimed to support IPY 2007/2008 observing system legacy, including Sustaining Arctic Observing Networks (SAON), Southern Ocean Observing System (SOOS), Global Cryosphere Watch (GCW).

Training and capacity building

20. Hydrometerological University of Roshydromet in St. Petersburg and AARI are supporting a number of educational facilities and CB in the field of Polar and marine meteorology including the sailing *UNESCO/IOC* Universities (training of the undergraduates is conducted during the ship-borne marine research) in the Baltic and Caspian Seas and North Atlantic, joint Norwegian – Russian Fram Laboratory (http://www.fram.nw.ru) and the joint German – Russian Otto Schmidt Laboratory (http://www.otto.nw.ru). During the last years the AARI provided several bi-weekly training courses for the ice observers

Publications

21. The following publications are issued by AARI at different periods:

- The quarterly and yearly bulletin *Review of the hydrometeorological processes in the Arctic Ocean* (in Russian);
- The quarterly bulletin *State of the Antarctic Environment* (in Russian and English);
- Bulletin “Long-term forecast of the ice conditions in the Arctic seas”: 3 bulletins are published per year in the end March, June and August (in Russian);
- *Trudi AANII* (AARI Transactions): irregular two to three volumes are published per year (in Russian);
- *Problemi Arktiki i Antarktiki* (Problems of the Arctic and Antarctic): two volumes are published per year (in Russian);
- Irregular express information, informational bulletins of the Russian Antarctic expedition, monographs etc.

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JCOMM Expert Team on Sea Ice

Sweden

February 2010

1. Organization

The Swedish Meteorological and Hydrological Institute (SMHI) is responsible for the sea ice information service in Sweden since 1930. SMHI provides ice information for the Swedish icebreakers and international shipping through the National Maritime Administration, the Royal Swedish Navy and the general public and media. Further, the Swedish Ice Service is, as the national expert authority on sea ice, often involved in marine accident investigations as well as other external inquiries. The Swedish Ice Service is operational seven days a week during the ice season, and produce daily ice charts and ice reports as well as client specific products such as ice formation forecasts. The ice season in the Baltic Sea normally begins in late November when ice starts to form in the northernmost archipelagos of the Bay of Bothnia, and lasts until end of May. The Swedish Ice Service is represented in IICWG and the JCOMM Expert Team on Sea Ice as well as in other international collaborative forums.

2. Data acquisition

(a) Ice observations – plain language

When at sea, icebreakers report on current ice conditions 3-4 times per day. Ice information is also provided in plain language by merchant vessels, either on their own initiative or upon request, and by a few coastal observation stations.

Ice observations - Baltic Sea Ice Code

Ice observations in Baltic Sea Ice Code are reported by Vessel Traffic Services centres (VTS) for ports and fairway sections along the Swedish coast. National ice reports in Baltic Sea Ice Code from Sweden, Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Netherland, Poland and Russia are available via the WMO GTS network.

(b) Satellites

200 m resolution images from RADARSAT-2 (ScanSAR Wide) are used during ice season. These are received and processed by Norwegian KSAT and transferred to SMHI via the Finnish Ice Service. ENVISAT ASAR images at 200 m resolution are used when available, typically 1-2 times per week during ice season. NOAA AVHRR images (Visual/RGB and IR) at 1,1 km resolution are received at SMHI daily all year. OSISAF images are received daily and used in SST analysis.

(c) Sea surface temperature observations

Hourly or daily SST observation data is collected from buoys and automatic stations (both Swedish and international via ftp), coastal stations and some merchant and passenger vessels (mainly by Ferrybox).

(d) Meteorology forecasts

For meteorological forecasts the weather service at SMHI use a number of international meteorological models including SMHI's HIRLAM (High Resolution Limited Area Model) and the operational atmospheric model at European Centre for Medium-Range Weather Forecasts (ECMWF).

3. Output products

(a) Ice charts

Ice charts in Mercator projection are produced daily and cover the Baltic Sea including the Gulf of Finland and Gulf of Riga, Kattegat and Skagerrak, and the major Swedish lakes (Vänern and Mälaren). The scale at 60° N is 1:4 000 000. Charts display ice concentration, thickness and type using WMO international sea-ice symbols and colour code standard. Ice charts also include navigational restrictions for ports in the Baltic region and information on position of the operating icebreaker vessels. Twice weekly, the ice chart is complemented by a sea surface temperature (SST) chart for the same area.

All charts are uploaded on the SMHI webpage for public access. On request, vessels can receive the ice chart by email or fax. The Swedish ice charts are also transmitted on radio facsimile by the German stations Hamburg/Pinneberg.

(b) Ice bulletins /Ice reports

Daily bulletins, in Swedish and English, on current ice situations at sea, navigational restrictions and icebreaker information are distributed by NAVTEX, the GTS network and email, and are available for public access on the SMHI web page. The ice reports are also uploaded on the Baltic Icebreaker Management website. An abridged ice report is broadcasted daily on Swedish Public Radio.

(c) Baltic Sea Ice Code

Ice information for selected fairway sections is distributed in Baltic Sea Ice Code via WMO GTS network and is available on the SMHI web page. All Swedish and international Baltic Sea Ice Code data is stored in SMHI's Ice Database.

(d) Ice forecasts

SMHI produce ice forecasts for up to 15 days. The forecasting service is a commercial service available to clients, including the Swedish Maritime Administration, Swedish Navy and shipping companies. For more information on ice forecast methods see section 4.

(e) Other output products

Ice charts are converted to grid files which are used in data assimilation for SMHI's ocean circulation model HIROMB (see section 4). SMHI send daily wind, atmospheric pressure and water level forecast data to an external database for access and visualization onboard Swedish and Finnish icebreakers. SMHI is also the Baltic region's main provider of SIGRID-3

format ice charts to the Global Digital Sea Ice Database (GDSIDB).

4. Forecasts and forecast methods

Sea ice forecasts are prepared using SMHI's operational ocean circulation model HIROMB (High Resolution Operational Model for the Baltic Sea). HIROMB is a three dimensional baroclinic model, with a fully coupled ice model, which currently runs with horizontal resolutions of 3 and 1 nautical miles. The ice model in HIROMB is a viscous-viscoplastic model. The forecast parameters are; ice concentration, thickness, drift, ridged ice, ridge density and ridge height. The ice model can produce forecasts up to 15 days and is forced with the HIRLAM model or the operational ECMWF meteorological model. Using HIRLAM as the forcing model, ice forecasts of up to 48 hours are produced in both 3 nm and 1 nm resolution. For longer forecasts (up to 15 days) the ECMWF model is used to force HIROMB at 3 nm resolution. Long forecasts are produced both as deterministic prognoses, and as ensemble prognoses for ice concentration, thickness and ridging using a set of altered initial values and forcing the model with up to four consecutive ECMWF prognoses producing 20 ensembles. Currently, ensemble forecasts are run as 10 day forecasts, however trials on 14 day ensembles are currently underway. Initial conditions are determined by data from observations and gridded ice- and SST charts and satellite data assimilated through the method of successive correlations (SCM). SMHI is currently working on new methods of data assimilation and trials are running using the OI (Optimal Interpolation) method. The above described ice modelled forecasts are interpreted by analysts experienced in marine meteorology and thus used, along with weather information, as a basis for the commercial ice formation forecasts.

5. Publications

SMHI publish a monthly summary of meteorological, hydrological and oceanographic conditions in which ice conditions are presented during ice season.

Every year SMHI and the National Maritime Administration publish a joint report summarizing the past ice season. This report includes month by month description of ice development, statistical information on selected fairways, weather and SST summaries and a summary of icebreaking activities.

6. Mailing and Internet addresses

Swedish Meteorological and Hydrological Institute (SMHI)
Swedish Ice Service
601 76 Norrköping
Sweden
Telephone: +46 (0) 11 495 8533
Telefax: +46 (0) 11 495 8053
E-mail: ice@smhi.se
Internet:
http://www.smhi.se
http://www.smhi.se/iceservice (Ice products)
http://www.smhi.se/polarview (visual ice forecast)
http://www.baltice.org (icebreaker activities, ice reports)

Appendix IX - "MYOCEAN" Project
(http://www.gmes.info/pages-principales/projects/marine-projects/myocean/)

1. BACKGROUND

MyOcean is a European Commission project within the GMES ("Global Monitoring of Environment and Security") Program (7th Frame Program), with the objective to define and to set up a concerted and integrated pan-European capacity for ocean monitoring and forecasting. The areas of benefit are: Maritime Security, Oil Spill, Marine Resources management, Climate Change, Seasonal Forecast, Coastal Activities, Ice Survey and Water Quality and Pollution.

MyOcean is the first step toward the marine core service, one of the three GMES "Fast Track" services. GMES itself is a joint initiative of the European Commission and of European Space Agency. GMES aims to develop Europe's capability to supply independent and permanent access to reliable and timely information on the status of Earth's environment at all scales, from global to regional and local, in support of EU policy and sustainable development.

'MyOcean' is a consortium of 60 partners in 28 countries (the 22 states of the EU that have a sea coastline, plus Norway, Russia, Ukraine, Morocco, Israel and Canada). Two European bodies (JRC and ECMWF) are also partners of 'MyOcean', whilst the EEA (European Environment Agency) and the EMSA (European Maritime Safety Agency) are represented on the Board.

The total budget is €55M, of which €33.8M comes from a European subsidy (representing 61% of the total budget), over 36 months.

2. ORGANISATION

The project organization is matrix based, with 18 Work Packages, of which 12 are considered as 'Vertical' (the Production Centres) and 6 'Transverse' (centralised functions).

1- TAC (Thematic Assembly Centres) Production Centres: Their role is to collect the measurements or observations, whether satellite or *in situ*, and to calibrate, validate, edit, archive and distribute them. There are 5 TACs (WP Leader shown in brackets):

- Sea Level TAC (CLS)
- Ocean Color TAC (CNR)
- Sea Surface Temperature (UK Met Office)
- Sea Ice and Wind TAC (met.no)
- In Situ TAC (Ifremer)

2- MFC (Monitoring & Forecasting Centres) Production Centres: They correspond to the 6 European 'basins', plus the Global Ocean. By assimilating observation data in 3D Models, they are to predict the state of the ocean (or to say what the state of the ocean was between two observations). There are 7 of them:

- Global MFC (Mercator Ocean)
- Arctic MFC (NERSC)

- Baltic MFC (DMI)
- North West Shelves MFC (UK Met Office)
- Iberian, Biscay, Ireland MFC (Mercator Ocean)
- Med MFC (INGV)
- Black Sea MFC (MHI)

3- Centralised or Transverse Functions:

- WP 1 (Mercator Ocean): Project management, Management, Coordination
- WP 2 (CLS): Central Engineering, both to support the Production Centres and Management (definition and supply of methodologies, architecture, common standards, development plan and operational qualification) and to supervise production (supervision of operations, quality control of production, information systems, etc.)
- WP3 (CNRS): Central R&D
- WP16 (UK Met Office): Central Desk (Service provision)
- WP 17 (Mercator Ocean): Service Definition (Portfolio, SLA, etc.)
- WP 18 (HCMR): User Requirement (URD)

3. PRODUCTS

a. Current version (V0 Service):

The MyOcean service allows all users to access a catalogue of worldwide and European regional Ocean products (real time observations, analysis and forecast) that have been developed and made available under previous projects such as MERSEA, MARCOAST, POLARVIEW, ECOOP, GLOBCOLOR. The full catalogue of products is listed at http://catalogue.myocean.eu.org/resources/myOceanCatalog.pdf and all products are also accessible through an interactive portal at http://www.myocean.eu.org/index.php/products-services/catalogue ; in this version, the products are still hosted on their respective web portals (thus, by clicking on "access to products" you will be redirected to other web portals). Products and services are generally open and free (but subject to restriction in re-distribution) to any user and for any application, including commercial activities. As at October 2009, there are 128 “MyOcean” products.

b. Next release (V1 Service):

By the end of 2010, it is planned that the MyOcean pan-European service will offer a single and reliable entry point to users and direct access to all products. The web portal will be directly connected to production units all over Europe and the service will include functionalities compliant with the EC "INSPIRE" Directive - http://inspire.jrc.ec.europa.eu/ - and a 24/7 helpdesk. New "search" and "query" functionalities will be activated using criteria such as application domain, ocean parameter, ocean area, spatial resolution, forecast length, timeliness criteria, dedicated delivery function, source or any other textual information recorded in the product description.

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Appendix X – Report by the European Ice Services

Introduction

1. The **European Ice Services** (**EIS**) was founded when Memorandum of Understanding was signed in October 2007 by DMI (Denmark), FIMR (Finland), and met.no (Norway). In May 2008 SMHI (Sweden) signed the MoU. Responsibilities of FIMR were transferred to FMI in 2009. The Area of Responsibility (AOR) for the EIS is all waters of Europe including Greenland, which contain sea ice, and which are of operational interest to users.

Scope

2. The concept of the EIS is to create a **harmonized suite of products and services** for ice information for the AOR to serve the needs of users for safety of navigation and informed decision-making. The virtually integrated service shall combine the strengths of the existing centres and result in seamless products of high quality and consistency – thus avoiding as much as possible duplication of work and ice information products.

   The European Ice Services will offer **a single point-of-entry** for operational ice information and will provide a suite of common European ice products. Each national ice service will be recognized as a contributing partner to the EIS, and products may be issued jointly without specific attribution to the centre of production. Ultimately, the product suite of the EIS may evolve into a set of constantly updated data bases of past, current and forecast ice conditions, from which users will retrieve decided and available information in up to date standard formats.

   The **concept** recognizes and acknowledges each member's national responsibility, desire and ability to provide services to their own unique clients such as other government agencies, commercial clients, and research organizations.

   The **objective** of this cooperation in the field of basic ice service is to work together as a network, to help
   - providing an ice service with a higher quality and better cost efficiency than the former level,
   - providing better ways to distribute products and services,
   - providing uninterrupted services in the case if the mission of one of the member's service has critical failure,
   - improving the capacity to participate and contribute in an international infrastructure development,
   - providing common opportunities for the participating Parties to benefit from the cooperation.

Memorandum of Understanding

3. The **Memorandum of Understanding** for the implementation of cooperation between EIS is supposed to lead to:
   - Production of daily analysis of sea ice parameters at various spatial and time scales in order to improve operational ice monitoring and forecasting;

- Introducing new services complementing traditional ice services both at a global and regional scale tailored to meet user requirements in their operations at sea and on land,
- Implementing a reliable validation systems as an essential part of production to increase users trust in the products; and
- Implementing user-friendly information and decision support systems.

The proposed system will additionally:

- Increase public awareness of the ice-infested seas of Europe and sea ice, and better understanding of key climate processes at high latitudes and their impact on climate change;
- Be a strong and unified voice when needs and requirements for future satellite missions are discussed;
- Secure a substantial European capacity in the field of charting and forecasting of sea ice as a counterpart to a similar North American capacity;
- Increase the use of EO data by services where use is limited today in order to increase quality of products and services;
- Make a substantial European contribution to international programs in the European Polar areas; and
- Provide reliable access to high-resolution observation data sets for the climate change community.

Benefits to European citizens will be revealed through:

- Improved policy and decision making;
- Contributions to better management of environment, prevention and control of marine pollution and conservation of Arctic and Baltic ecosystems;
- Safer marine transportation and offshore operations in Polar and Baltic Sea regions including improved design criteria for vessels and marine constructions based on information from EIS; and
- Better understanding of climate change.

In separate **Terms of Reference** for the EIS, issues included are management, activities and projects, data and product exchange, terminology, data and mapping standards, operations and customer support, training, technology for analysis and forecasting, and applied science, research and development.

In the separate **Action Plan** for the EIS, issues to be included are identification of existing capacities, time frames, global component, structure, delivery systems, promotion and training.

EIS Board

4. EIS Board consists of one member from each participating country, and it has had four meeting:
    - December 13, 2007 at DMI, Copenhagen with Helge Tangen, met.no, Erik Buch, DMI, and Ari Seina, FIMR.
    - May 8, 2008 at met.no, Tromso with Helge Tangen, met.no, Erik Buch, DMI, and Ari Seina, FIMR.
    - February 19, 2009 at DMI, Copenhagen with Helge Tangen, met.no, Erik Buch and Keld Qvistgaard, DMI, Anette Jonsson, SMHI, and Ari Seina, FMI.

- October 13, 2009 at WMO, Geneva with Helge Tangen, met.no, Leif Toudal Pedersen, DMI, Anette Jonsson, SMHI, and Ari Seina, FMI.
- January 12-13, 2010 at SMHI, Norrkoping with Helge Tangen, met.no, Leif Toudal Pedersen, DMI, Anette Jonsson, SMHI, and Ari Seina, FMI.

EIS chair is elected for a two year period. The first Chair was Helge Tangen, met.no in 2007-2009, and the second Chair Ari Seina, FMI for 2009-2011.

EIS Workshops

5. EIS has organized two workshops where personnel of EIS member ice services have participated; the first one in met.no in Tromso, Norway in May 2008, and the second one in DMI, Copenhagen, Denmark in October 2009.

Other activities

6. Design and implementation is ongoing for an EIS web page. Expected launching is in 2010. Study is ongoing for finding out possibilities and design of the EIS Common Ice Production System.

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Appendix XI – Report of the IICWG

1. The IICWG is an ad-hoc working group open to the ice charting nations of the world. It has been meeting approximately annually since 1999 to address issues of coordination of products and services among the ice charting services. It serves as an advisory body to the Expert Team on Sea Ice.

2. The 10th meeting of the International Ice Charting Working Group (IICWG) was held at the headquarters of the World Meteorological Organization in Geneva October 12-16, 2009. Forty-three attendees representing 26 organizations from 12 countries participated in the meeting.

3. The theme adopted for the meeting was "Expanding Domains and Services" to help focus discussion on the increasing ship traffic in new regions and new seasons in the Arctic and the resulting increase in the need for ice information services. A Science Workshop was held on October 12 followed by three days of open meetings divided into 6 thematic sessions – Expanding Arctic Knowledge, Expanding Arctic Shipping, Expanding Arctic Services, Ice Charting Systems Management, Interactions with WMO Programs and an Earth Observation Update. The final day was devoted to a business meeting of the Ice Service heads and invited guests to decide on the action plan for the coming year.

4. Significant outcomes of the meeting included the following:

   a. Arctic METAREA Coordination - Substantial progress is being made on the implementation and coordination of ice information services for the new Arctic METAREAS to become operational in 2011. The initial service will concentrate on an ice edge broadcast with more detailed information in areas with greater marine traffic. The challenges of communication in the Arctic still present a significant hurdle but efforts are underway to address them with HF narrow-band communications. The group took action items to exchange operational contact information among the issuing services of Canada, Norway and Russia and the supporting services of Denmark and the United States. A potential gap in information for METAREAs XX and XXI was identified and will be discussed at JCOMM-IV and the upcoming meeting of the METAREA coordinators.

   b. Ice Information in Electronic Navigation Chart Systems - The working group was updated on the substantial progress that has been made by the Arctic and Antarctic Research Institute, in cooperation with Transas, to develop mechanisms to display ice information on Electronic Navigation Charts. Evgeny Anashkin gave a demonstration of the capability to merge Canadian and Russian ice chart information in the S-57 standard format in an ENC System. An action was taken to consider amendments to the Ice Objects Catalogue.

   c. Ice Logistics Portal - The Ice Logistics Portal was developed as an IPY initiative to provide a convenient point of access to ice charts globally. It has been operated successfully for the past three years by PolarView but on-going funding is not assured. It was agreed that, because the Portal provides a valuable service and is a good platform to further develop global ice information, it should be continued in operation in a more stable environment. The German Ice Service offered to assume operation of the Portal for the next 5 years. During this time, discussions will be held with the WMO Information Service towards integrating the Portal into the WIS for the long term.

   d. Ice Analysts' Workshop - Two workshops for ice analysts have been held by the IICWG in the past two years. The purpose of these workshops, in addition to providing training and sharing best practices, is to develop a method of quantifying the errors inherent in

ice charts and standardize the practices as much as possible. While progress is being made in understanding how analysts extract information into ice charts, there is still much work to be done. It was agreed that a third workshop should be held which will be hosted by the Danish Meteorological Institute.

e. IICWG News Release - Following reports on regional ice conditions from the ice services, the IICWG issued a news release warning of continuing navigation hazards due to ice. The news release stated, in part, that "Sea ice and icebergs present a significant marine hazard that, considering the increase in the number and size of ships venturing into the Arctic and Antarctic, should be considered serious."

f. Ice Information for NWP Centres - The IICWG is working to standardize the format of gridded ice chart information that its members provide to NWP Centres with the intention of making it easier for NWP centres to incorporate ice chart information. While not yet finalized, it is likely that a NetCDF implementation will be adopted.

g. Antarctic Ice Charting - Recognizing the large number of tourist cruise ships that are venturing into Antarctic waters without the benefit of regular ice charts, the IICWG discussed the possibility of implementing such a service. Since there is no obvious single institution that could assume this responsibility, further study of the implications is required. Jürgen Holfort of the German Ice Service was asked to raise the issue at the upcoming Meeting of Experts on Ship-borne Tourism to be held in Wellington in December, 2009.

5. A number of action items were adopted by both the IICWG plenary group and its two standing committees (Applied Science and Research; Data, Information and Customer Support). Of note:

   - efforts to consult with the World Climate Research Program towards developing a mechanism for inter-comparison of climatological ice products for verification of ice modules in NWP models
   - modification to the SIGRID-3 ice chart archiving standard to make visualization easier for users
   - interventions to reduce the turn-around time of Sentinel-1 data from the proposed 3 hours to 1 hour

6. Across all of the presentations and discussions, the importance of cooperative partnerships like those being developed within, and by, the IICWG was reinforced again and again.

7. The 9th meeting of the IICWG was held in Lulea, Sweden October 20-24, 2009 hosted by the Ice Service of Swedish Meteorological and Hydrographic Institute. The 8th meeting was held in Frascati, Italy hosted by the European Space Agency.

8. All of the meeting records and documents of the IICWG can be found on the IICWG website which is hosted by the National Snow and Ice Data Center at http://nsidc.org/noaa/iicwg/.

9. It is planned to hold the next IICWG meeting in Washington at the invitation of the National Ice Center during the week of October 18, 2010.

Appendix XII – Report of the ETMSS

1 The Expert Team on Maritime Safety Services (ETMSS) continues to assist Members/Member States in implementing met-ocean services in support of the international maritime navigation. ETMSS experts have participated in several International Maritime Organization (IMO) and International Hydrographic Organization (IHO) meetings to coordinate the expansion of the Global Maritime Distress and Safety System (GMDSS) into the Arctic waters and the revision of relevant regulatory publications and IMO Resolutions. ETMSS has reinforced its cooperation with the IHO World-Wide Navigational Warning Service Sub-Committee (IHO/WWNWS), whose results are as follows:

(a) IMO Resolutions A705(17) on Promulgation of Maritime Safety Information and A706(17) on the IMO/IHO World-Wide Navigational Warning Service, were updated. Those Resolutions, endorsed by the WMO Executive Council, were submitted to IMO/COMSAR-12 in April 2008 and adopted by IMO/MSC-85 in November/ December 2008, and will enter into force on January 2010;

(b) A new version of the *joint IMO/IHO/WMO Manual on Maritime Safety Information (MSI)*, containing an updated section on met-ocean MSI including the new METAREA map, was produced. This new version was endorsed by WMO and IHO in October 2008, and was subsequently submitted to COMSAR-13, in January 2009, and adopted by IMO/MSC-86 in May/June 2009;

(c) A new version of the *International SafetyNET Manual* was finalized at the first session of the IHO/PRNW, in August 2009. This new version is to be submitted to IHO Committee, WMO Executive Council and IMO/COMSAR for approval and subsequently adoption by IMO/MSC, in 2010;

(d) The new specifications for the *Inmarsat System Definition Manual*, including the new Arctic areas, have been prepared;

(e) Following the request by the WMO Executive Council, at its sixty-first session (Geneva, June 2009), an IMO/WMO World-Wide Met-ocean Information and Warning Service (WWMIWS) guideline document was prepared [see Appendix XVI], to complement the existing IMO/IHO World-Wide Navigational Warning Services (WWNWS, IMO Resolution A.706(17)). The WMO Executive Council will consider the WWMIWS, at its sixty-second session (Geneva, June 2010), and subsequently it will be submitted to IMO/COMSAR for adoption and inclusion in the regulatory publications.

2 Recognizing the increased use in the Arctic region by the marine community, the IMO decided to expand the GMDSS into the whole Arctic Ocean, enhancing a proposal submitted by the Russian Federation. It therefore established (IMO/COMSAR-10, London, March 2006) a joint IMO/IHO/WMO Correspondence Group on Arctic Maritime Safety Information (MSI) services to address this issue. The Expert Team on Maritime Safety Services has been active in this joint IMO/IHO/WMO Correspondence Group in ensuring that all relevant issues for the METAREA Issuing Services are properly addressed. This item is presented in details in doc. 2.5.2 .

3 ETMSS has reviewed the *Manual on Marine Meteorological Services* (WMO-No. 558) and the *Guide to Marine Meteorological Services* (WMO-No. 471) and proposed

amendments for consideration by JCOMM-III [see Appendices I and II of doc. 2.5.5].

4 The JCOMM GMDSS-Weather Website (http://weather.gmdss.org) continues to provide access, in complement to the official dissemination channels, to the official Maritime Safety Information and warnings supplied by the existing METAREA Issuing Services. Météo-France has been managing and hosting this website, which has been in operation for 6 years. The website, which will also include the GMDSS products for Arctic areas when available, includes:

(a) Met-ocean MSI prepared for SafetyNET dissemination (high seas);

(b) Met-ocean MSI prepared for International NAVTEX dissemination (coastal waters), which is under preparation. A number of NAVTEX bulletins are already available online (e.g., METAREAs I, II, III, IV and XI) [see for example http://weather.gmdss.org/II.html];

(c) A specific page gathering the available links to the NAVAREA Websites [see http://weather.gmdss.org/navareas.html]. This is the first step of cooperation with IHO towards the joint use of the URL *gmdss.org* for the provision of both meteorological and navigational warning information

(d) Relevant maps showing limits of METAREAs and sub-areas, which are available in publication WMO-No. 9, Volume D – *Information for Shipping*.

5 Direct interaction with and feedback from the marine users is required to ensure that services meet their requirements. It is also a requirement for a Quality Management System (QMS). The former Commission for Marine Meteorology (CMM) therefore initiated a Marine Meteorological Services Monitoring (MMSM) programme in 1981. The first survey was conducted in 1985. Subsequent sessions of CMM and JCOMM had reviewed the survey results, reiterated their value to WMO Members and endorsed their continuation. In the meantime, the questionnaire was regularly reviewed and updated by ETs (especially ETMSS and SOT). The last questionnaire was reviewed during the meeting of the Task Team on MSI (March 2009, Geneva, Switzerland), with ETSI and ETWS Chairpersons. This questionnaire was distributed in early 2009 to ships' masters through national PMOs as well as via the Weather-GMDSS Website. The results of the 883 returns confirm the satisfactory accuracy and usefulness of marine meteorological services through the GMDSS (SafetyNET and International NAVTEX services). Nevertheless, these results demonstrate also the increased demand for user-focused marine meteorological and oceanographic products and services and show that there remains considerable room for improvement with regards to both the quality and content of services, and their coverage and timeliness in some oceanic regions. Additionally, the great majority of respondents re-emphasized the usefulness of graphical information, like radio facsimile products, and reported significant dissatisfaction with the quality of these services (even if results were much better than the previous survey in 2005) and unannounced terminations. The provision of Sea Ice and Icebergs Information was judged as good service, providing clear and mostly accurate information on time. The results of the analysis were compiled into a report, which can be accessed at http://www.jcomm.info/SPA_MSS.

6 A first version of the template to be used for self-assessment reports by Issuing Services was prepared by the ETMSS Chairperson, based on the one used by the NAVAREA co-ordinators. This template was presented and discussed during the meeting of the Task Team on

MSI in March 2009. This template is expected to be used for, and reviewed during, the forthcoming Maritime Safety Services Enhancement Workshop.

7 Since 1999, ETMSS has been working on the implementation of graphical/numerical Maritime Safety Information (MSI) broadcast within the GMDSS. The WMO Executive Council, at its sixtieth session (Geneva, June 2008) re-emphasized the continuing importance to mariners in receiving graphical products via radio transmissions and requested JCOMM to continue researching methods for transmitting graphical products to marine users. On the other hand, the WMO Executive Council, at its sixty-first session (Geneva, June 2009), encouraged WMO Members to investigate low-cost options for on-demand approaches that are compatible with Electronic Navigation Charts (ENC). In addition, the imminent increase of ENC systems on SOLAS vessels as regulatory material and the emergence of the e-navigation concept within IMO should reinforce the priority given to this requirement and the need to find appropriate resources to develop a suitable service. Both the ETMSS and ETSI have been working on this issue and ETSI has already developed the *Sea Ice Objects Catalogue* in accordance with IHO standards [see section 6 below]. The ETMSS has initiated the development of a catalogue on *Met-Ocean Object Classes and Attributes*, which would be an essential tool to enable NMHSs to develop products specifically for Electronic Navigation Chart Systems, allowing the implementation of software to decode and display met-ocean information by the manufacturers of these systems, using the S-57 and S-100 chart data exchange standards.

Planned actions, projects or priorities for the next JCOMM intersessional period 2010-2012

8 JCOMM-III re-implemented the ETMSS (Resolution 5), but significantly modified the Terms of Reference of the Team (attached). In particular, all operational activities related to marine pollution (MPERSS) and SAR activities are now under the umbrella of ETMSS. In accordance with the ToRs, the ETMSS liaises with and gathers input from other SFSPA teams - ETSI, ET on waves and surges (ETWS) and ET on Operational Ocean Forecasting Systems (ETOOFS), on all aspects of sea ice, sea state, storm surge and ocean circulation relevant to the operation and improvement of maritime safety services and maritime accident emergency support. A core membership has also been selected. After JCOMM-III, the core members of the Team have proposed to identify 2 vice-chairpersons, Nick Ashton from UK (activities in liaison with MSI) and Oyvind Breivik from Norway (activities in liaison with MPERSS and SAR).

9 The Commission endorsed the priority activities for the next intersessional period for ETMSS, as described below, with no particular order :

- Improve interaction between the GMDSS Issuing Services and the AMOCs of MPERSS;
- Keep under review the implementation of the GMDSS and MPERSS in the Arctic and continue to support the Issuing Services and AMOCs, to reach the expected target in 2011 for the GMDSS;
- In association with ETWS and ETSI, develop guidelines and recommendations to update WMO-Nos. 471 and 558, especially for the provision of sea state and sea ice in MSI;
- Continue to develop the catalogue on Met-Ocean Object Classes and Attributes to define standards for ENC and e-Navigation, in collaboration with ETSI and guidance from IMO and IHO;

- Facilitate implementation of Quality Management Systems (QMSs) among Members for the provision of MMS (Recommendation 7,).

10 After JCOMM-III, the SFSPA coordinator prepared with ET chairs a draft list of projects. Those that could involve both ETMSS and ETSI are as follow:

- Coordination of Implementation of GMDSS, including sea ice bulletins, for Arctic Ocean by 2011 (**ETMSS/ETSI)**

- Preparation of a catalogue of marine and oceanographic parameters/attributes for Electronic Navigation Chart (S-57/S-100 compatible). Wind, wave height, surface currents have been suggested as the initial parameters (**ETMSS/ETSI)**

- Develop/Demonstrate an experimental suite of Arctic marine/sea ice service products that could be disseminated in the On-Demand fashion (**ETMSS/ETSI,** support: ETOOFS). This probably would consist of two parts/stages:
  - text product suite that would be disseminated via existing, low baud rate (cheap) means of communication (such as Iridium);
  - Numerical/Graphic product suite that may be disseminated via Internet or other higher bandwidth means.

- Produce a demonstration suite of numerical/graphical products, including satellite images, and provide them via the Weather.gmdss.org site (**ETMSS**, other ETs to support)

11 The priority is clearly to make sure that the component of GMDSS met-ocean MSI for the arctic METAREAs, including the provision of sea ice information, will be operational at the end of 2010 or the very beginning of 2011, for IMO, IHO and WMO to be able to officially declare this system fully operational in 2011. In the mean time, it is a good opportunity to update as necessary the WMO-Nos. 471 and 558 for the provision of sea ice in MSI in text form (for GMDSS, bullets b and f of paragraph 7 doc. 2.5.5). The aim is to ensure that those documents are consistent with the practises put in place for the GMDSS, and that similar type of information will be provided to SOLAS vessels throughout the Arctic (for navigable waters). The update that will be prepared during ETSI-IV could be presented during the forthcoming MSS Enhancement Workshop (see following paragraph), and adopted during ETMSS-III, that could take place in autumn 2010 (if WMO Secretariat resources permitted). It would be also appropriate to be able to declare operational the component of GMDSS met-ocean MSI for the arctic METAREAs during ETMSS-III.

12 A Maritime Safety Services Enhancement Workshop, gathering the representatives of all Issuing Services, is expected to take place 3-6 May 2010 in Melbourne, Australia. The Workshop will be focused on QMS training and practises (identified as a priority by the commission), but will also consider the maintenance and update of the GMDSS, including the implementation of the operational service on Arctic METAREAs.

13 ETMSS need a strong support from ETSI to continue to develop the catalogue on Met-Ocean Object Classes and Attributes to define standards for ENC and e-Navigation. The experience of ETSI experts in this field and the links they have built with relevant IHO group(s) will be very helpful. A focal point could be identified to work with ETMSS on this topic.

14 It would be appropriate to add on the GMDSS website (http://weather.gmdss.org), either sea ice graphical/numerical safety products or appropriate links with other portals providing such information, like the IPY Ice Logistics Portal (http://ipy-ice-portal.com/). The Team is invited to make suggestions.

Attachment

Terms of Reference and Membership of Expert Team on Maritime Safety Services (ETMSS)

Terms of reference

The Expert Team on Maritime Safety Services, in close collaboration with international organizations and other entities representing users' interests, such as the International Maritime Organization, International Hydrographic Organization, International Chamber of Shipping , International Mobile Satellite Organization, and other concerned organizations and bodies on maritime safety, search and rescue and marine pollution issues, including the Global Maritime Distress and Safety System (GMDSS), shall:

(a) In support of the Maritime Safety, Efficiency, and Search and Rescue (SAR) operations:

(i) Monitor and review the operations of marine broadcast systems, including for the GMDSS and others for vessels not covered by the International Convention for the Safety of Life at Sea;

(ii) Monitor and review technical and service quality standards for meteorological and oceanographic maritime safety information, particularly for the GMDSS, and provide assistance and support to Members/Member States as required;

(iii) Propose actions as appropriate to meet requirements for international coordination of meteorological and related communication services;

(iv) Develop technical advice and guidance material on Marine Meteorological Services, including keep under review the *Manual on Marine Meteorological Services* (WMO-No. 558), the *Guide on Marine Meteorological Services* (WMO-No. 471) and *Weather Reporting* (WMO-No. 9, Volume D – *Information for Shipping*), and provide assistance and support to Members/Member States as required;

(b) In support of the Marine Pollution Emergency Response Support System (MPERSS):

(i) Monitor implementation and operations of MPERSS; review and suggest, as necessary, improvements to the contents of the overall system plan; (in consistency with the International Convention for the Prevention of Pollution from Ships , and other international conventions);

(ii) Facilitate coordination and cooperation amongst the Area Meteorological and Oceanographic Coordinators (AMOCs) of MPERSS, in particular, with a view to ensuring full and ongoing operations in all areas, as well as the exchange of relevant advice, information, data and products between AMOCs, as appropriate and required;

(c) Monitor requirements by ensuring feedback from the user communities is obtained through appropriate and organized channels and applied to improve the relevance, effectiveness and quality of services;

(d) Liaise with and gather input from ETSI, ETWS and ETOOFS on all aspects of sea ice, sea state, storm surge and ocean circulation relevant to the operation and improvement of maritime safety services and maritime accident emergency support;

(e) Ensure effective coordination and cooperation with concerned organizations, bodies and Members/Member States on maritime safety issues and marine accident emergency support needs;

(f) Assist Members/Member States in the implementation of services and in the development of standardized methods for the quality assurance related to the provision of MSI, especially for the GMDSS, through capacity-building activities;

(g) Develop, in accordance with existing standards (for example, from the International Hydrographic Organization), graphical/numerical product specification for marine parameters, foremost wind, sea state, currents and sea ice, in Electronic Navigation Chart Systems;

(h) Provide advice to the Services and Forecasting Systems Coordination Group and other JCOMM groups, as required, on issues related to maritime safety services and marine accident emergency support;

(i) Continue to liaise closely with relevant groups and teams of organizations, such as IMO, IHO, ICS, IMSO, EMSA, etc., to coordinate and improve maritime safety services, SAR and marine accident emergency support.

As a general principle, these terms of reference will be implemented through specific, defined, time-limited projects.

General membership

The membership consists of a core membership of up to eight members, including the chairperson, selected to ensure an appropriate range of expertise in the provision of services for maritime safety and efficiency, SAR operations and marine pollution response.

The following experts serve as core members of the ETMSS :

Alasdair Hainsworth (Australia)
Mohamed Aitlaamel (Morocco)
Nicholas Ashton (United Kingdom)
Oyvind Breivik (Norway)
Timothy Rulon (United States)
Valery Martyshchenko (Russian Federation)
Zenghai Zhang (China)

Additional experts may be invited as appropriate, representative of a range of activities related to the implementation of services for maritime safety and efficiency, SAR operations and marine pollution response, as well as representatives of international organizations and other entities representing users' interests, such as the IMO, IHO, ICS, IMSO, and other user groups, on a self-funded basis, and in general with no resource implications to JCOMM.

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Appendix XIII - Excerpt of IHO S-53 with References to 'Sea Ice'

3 - RADIO NAVIGATIONAL WARNINGS FOR THE WORLD-WIDE NAVIGATIONAL WARNING SERVICE

3.1 GENERAL CONSIDERATIONS

3.1.1 Radio Navigational Warnings are essentially HAZARD WARNINGS. In accordance with the WWNWS Guidance Document, section 4.2.1.3 (IHO/IMO Special Publication S-53), the following subject areas are considered suitable for transmission as NAVAREA warnings. This list is not exhaustive and should be regarded only as a guideline. Furthermore, it presupposes that sufficiently precise information about the item has not previously been disseminated in Notices to Mariners:

1. casualties to lights, fog signals and buoys affecting main shipping lanes;

2. the presence of dangerous wrecks in or near main shipping lanes and, if relevant, their marking;

3. establishment of major new aids to navigation or significant changes to existing ones when such establishment or change might be misleading to shipping;

4. the presence of large unwieldy tows in congested waters;

5. drifting mines;

6. areas where search and rescue (SAR) and anti-pollution operations are being carried out (for avoidance of such areas);

7. the presence of newly discovered rocks, shoals, reefs and wrecks likely to constitute a danger to shipping and, if relevant, their marking;

8. unexpected alteration or suspension of established routes;

9. cable or pipe-laying activities, the towing of large submerged objects for research or exploration purposes, the employment of manned or unmanned submersibles, or other underwater operations constituting potential dangers in or near shipping lanes;

10. establishment of offshore structures in or near shipping lanes;

11. significant malfunctioning of radionavigational service and shore-based maritime safety information radio or satellite services.

12. information concerning special operations which might affect the safety of shipping, sometimes over wide areas, e.g. naval exercises, missile firings, space missions, nuclear tests, etc. It is important that where the degree of hazard is known, this information is included in the relevant warning. Whenever possible, such warnings should be originated not

less than five days in advance of the scheduled event. The warning should remain in force until the event is completed[1]; and

13. acts of piracy and armed robbery against ships.

Navigational warnings are issued in response to SOLAS V/2.b and carry information which may have a direct bearing on the safety of life at sea. It is the fundamental nature of navigational warnings that they will often be based on incomplete or unconfirmed information and mariners will need to take this into account when deciding what reliance to place on the information contained therein.

3.1.2 IMO Resolution A.706(17) requires the use of the English language for NAVAREA and Coastal Warnings of the WWNWS. It must always be remembered that the majority of mariners receiving radio navigational warnings are only professional users of English who do not speak or read it naturally. Warnings therefore must be written so as to be easily understood by all mariners.

3.1.3 In order to achieve maximum impact on the mariner it is necessary to present information so that it is CLEAR, UNAMBIGUOUS and BRIEF. This can be ensured by using structured messages which present the text in a standard format with key words to emphasize the most important features of the message.

3.1.4 The resources employed by administrations and the mariner are extremely limited. Thus only information which is vital to the safe conduct of vessels should be transmitted. Notices to Mariners and other means exist for passing less urgent information to ships after they have reached port. Information of a purely administrative nature should never be broadcasted on the regular international navigational warning schedules.

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4 - METEOROLOGICAL WARNINGS AND FORECASTS FOR THE HIGH SEAS

4.1 PROVISION OF WARNINGS AND WEATHER AND SEA BULLETINS (GMDSS APPLICATION)

Global Maritime Distress and Safety System (GMDSS) application which is compatible with and required by the radiocommunication provisions of the 1988 SOLAS amendments via the NAVTEX, International SafetyNET and HF MSI Services.

Principles

The principles for the preparation and issue of warnings and weather and sea bulletins are as follows:

Principle 1

For a purpose of the preparation and issue of meteorological warnings and the regular preparation and issue of weather and sea bulletins, the oceans and seas are divided into areas for which national Meteorological Services assume responsibility.

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[1] The IMO Maritime Safety Committee is authorized to review the provisions of this paragraph and, if appropriate, to provide for exemptions from this requirement, under special circumstances (NAVTEX Manual, paragraph 4.2.1.3.13).

Principle 2

The areas of responsibility together provide complete coverage of oceans and seas by meteorological information contained in warnings and weather and sea bulletins for the high seas.

Principle 3

The issue of meteorological warnings and routine weather and sea bulletins for areas not covered by NAVTEX shall be by the International SafetyNET Service for the reception of maritime safety information (MSI) in compliance with SOLAS, Chapter IV, "RADIOCOMMUNICATIONS".
Note: In addition, national Meteorological Services may have to prepare and/or issue warnings and routine forecasts for transmission by an HF-direct-printing telegraphy maritime safety information service for areas where such a service is provided for ships engaged exclusively on voyages in such areas.

Principle 4

The preparation and issue of warnings and weather and sea bulletins for areas of responsibility are co-ordinated in accordance with the procedures mentioned in the following section.

Principle 5

The efficiency and effectiveness of the provision of warnings and of weather and sea bulletins are monitored by obtaining opinions and reports from marine users.

Principle 6

Maritime Safety Information broadcasts are monitored by the originating Issuing Service to ensure the accuracy and integrity of the broadcast.

4.2 PROCEDURES

Definitions

A "Preparation Service" is a national Meteorological Service which has accepted responsibility for the preparation of forecasts and warnings for parts of, or an entire, designated Maritime Safety Information (MSI) area in the WMO system for the dissemination of meteorological forecasts and warnings to shipping under GMDSS and for their transfer to the relevant Issuing Service for broadcast.

An "Issuing Service" is a national Meteorological Service which has accepted responsibility for ensuring that meteorological forecasts and warnings for shipping are disseminated through the Inmarsat and SafetyNET service to the designated area for which the Service has accepted responsibility under the broadcast requirements of the GMDSS. The Issuing Service is responsible for composing a complete broadcast bulletin on the basis of information input from the relevant Preparation Services, and for inserting the appropriate EGC header, as specified in Annex 4(b) of the International SafetyNET Manual. The Issuing Service is also responsible for monitoring the broadcasts of information to its designated area of responsibility.

Preparation and issue of weather and sea bulletins for the high seas.

Weather and sea bulletins for the high seas shall include, in the order given hereafter:

Part I : Storm warnings;

Part II : Synopsis of major features of the surface weather chart and, to the possible extent, significant characteristics of corresponding sea-surface conditions;

Part III : Forecasts.

Weather and sea bulletins for the high seas may, in addition, include the following parts:

Part IV : Analysis and/or prognosis in IAC FLEET code form;

Part V : Selection of reports from sea stations;

Part VI : Selection of reports from land stations.

NOTES: (1) The reports included in Part VI should be for a fixed selection of stations in a fixed order.

(2) Parts IV, V and VI may be issued at a separate, scheduled time.

For area(s) for which an Issuing Service has assumed responsibility, the Service shall select the appropriate CES to service that area.

NOTES: (1) As there are several CESs which can serve an Ocean Region and hence an area of broadcast responsibility, Issuing Services may negotiate directly with the various CES operators to obtain the most favourable tariff (and service) consideration.

(2) In order to ensure reception of unscheduled broadcasts by shipping in an area which is served by more than one satellite and recognizing that the national Meteorological Services will not know to which of these satellites the ship's equipment is tuned, the following procedures shall be adopted by Issuing Services:

For scheduled broadcasts: These shall be issued for broadcast over at least a single nominated satellite, in accordance with a pre-arranged schedule, co-ordinated by WMO.

For unscheduled broadcasts: These shall be issued for broadcast under the SafetyNET Service through all Inmarsat ocean region satellites covering the Issuing Service's area of responsibility.

Weather and sea bulletins shall be prepared and issued at least twice daily.

The issue of the weather and sea bulletins shall be at a scheduled time and be in the following sequence: Part I to be followed immediately by Part II and then Part III. A schedule of transmission start times for these bulletins has been compiled for all MSI areas and the CESs which serve the areas and takes into consideration, *inter alia*, the existing WMO synoptic times for observations, data analysis and forecast production. Additionally, as these broadcast schedules for the International SafetyNET Service have to be co-ordinated, under the aegis of WMO, with other organizations such as IHO, Issuing Services should not independently change or request WMO to arrange frequent alterations to these co-ordinated and published schedules.

Issuing Services must ensure that the correct EGC message addressing formats are adhered to for all warning and forecast messages intended for broadcast by a CES.

Warnings, synopsis and forecasts shall be given in plain language.

Warnings, synopsis and forecasts intended for the International SafetyNET Service shall be broadcast in English.

NOTE: Additionally, if a national Meteorological Service wishes to issue warnings and forecasts to meet national obligations under SOLAS, broadcasts may be made in other languages. These broadcasts will be a part of a national SafetyNET Service.

In order to ensure the integrity of the warnings and forecasts being received by mariners, it is essential that Issuing Services monitor the broadcasts which they originate. Monitoring is especially important in a highly automated system which is dependent on careful adherence to procedure and format. This may be accomplished by the installation of an EGC receive-capability at the Issuing Service's facility.

NOTE: Each Issuing Service may use the EGC receiver to check the following:
(1) That the message has been broadcast;
(2) That the message is received correctly;
(3) That cancellation messages are properly executed;
(4) Any unexplained delay in the message being broadcast.

The language of the synopsis should be as free as possible from technical phraseology.

The terminology in weather and sea bulletins should be in accordance with the "Multilingual list of terms used in weather and sea bulletins".

NOTE: The multilingual list of terms used in weather and sea bulletins is given in Annex 1-2.A of the Guide to Marine Meteorological Services (WMO-N 471) and in Appendix II-6 hereto.

4.3 WARNINGS

Warnings shall be given for gales (Beaufort force 8 or 9) and storms (Beaufort force 10 or over), and for tropical cyclones (hurricanes in the North Atlantic and eastern North Pacific, typhoons in the Western Pacific, cyclones in the Indian Ocean and cyclones of similar nature in other regions).

The issue of warnings for near gales (Beaufort force 7) is optional.

Warnings for gales, storms and tropical cyclones should have the following content and order of items:

(a) Type of warning;
(b) Date and time of reference in UTC;
(c) Type of disturbance (e.g. low, hurricane, etc.) with a statement of central pressure in hectopascals;
(d) Location of disturbance in terms of latitude and longitude or with reference to well-known landmarks.
(e) Direction and speed of movement of disturbance;
(f) Extent of affected area;
(g) Wind speed or force and direction in the affected areas;
(h) Sea and swell conditions in the affected area;
(i) Other appropriate information such as future positions of disturbance.

Items (a), (b), (d), (f), and (g) listed above shall always be included in the warnings.

When warnings are included for more than one pressure disturbance or system, the system should be described in a descending order of threat.

Warnings shall be as brief as possible and, at the same time, clear and complete.

The time of the last location of each tropical cyclone or extra-tropical storm shall be indicated in the warning.

A warning shall be issued immediately the need becomes apparent, and broadcasted immediately on receipt, followed by a repeat after six minutes, when issued as an unscheduled broadcast.

When no warnings for gales, storms or tropical cyclones are to be issued, that fact shall be positively stated in Part I of each weather and sea bulletin.

Warnings shall be updated whenever necessary and then issued immediately.

Warnings shall remain in force until amended or cancelled.

Warnings issued as Part I of a scheduled bulletin do not need to be repeated after 6 minutes.

4.4 SYNOPSES

The synopses given in Part II of weather and sea bulletins shall have the following content and order of items:

(a) Date and time of reference in UTC;

(b) Synopsis of major features of the surface weather chart;

(c) Direction and speed of movement of significant pressure systems and tropical disturbances.

Significant characteristics of corresponding wave conditions (sea and swell) should be included in the synopsis whenever this information is available, as well as characteristics of other sea-surface conditions (drifting ice, currents, etc.) if feasible and significant.

Significant low-pressure systems and tropical disturbances which affect or are expected to affect the area within or near to the valid period of the forecast should be described; the central pressure and/or intensity, location movement and changes of intensity should be given for each system; significant fronts, high-pressure centres, troughs and ridges should be included whenever this helps to clarify the weather situation.

Direction and speed of movement of significant pressure systems and tropical disturbances should be indicated in compass points and metres per second or knots respectively.

Units used for speed of movement of systems shall be indicated.

4.5 FORECASTS

The forecasts given in Part III of weather and sea bulletins shall have the following content and order of items:

(a) The valid period of forecast;

(b) Name or designation of forecast area(s) within the main MSI area:
(c) A description of:
(i) Wind speed of force and direction;
(ii) Visibility when forecast is less than six nautical miles (ten kilometres);
(iii) Ice accretion, where applicable.

The forecasts should include expected significant changes during the forecast period, significant meteors such as freezing precipitation, snowfall or rainfall, and an outlook for a period beyond that normally covered by the forecast.

The valid period shall be indicated either in terms of number of hours from the time of issue of the forecast or in terms of dates and time in UTC of the beginning and the end of the period.

Visibility should be indicated in nautical miles or kilometres or given in descriptive terms.

Units used for visibility shall be indicated

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Appendix XIV – Russian Federation Warning Criteria for the Arctic and South Oceans and Offshore (250 km) Areas

Phenomenon	Parameter	Normal conditions	Moderate conditions	Dangerous conditions	Extreme conditions
Air temperature °C (negative, frost and icing)	Air temperature °C	–0 –14.9	–15 –24.9	–25 –34.9	≤–35
Water surface temperature °C (negative)	Water temperature, measured °C	>5	4.9-0.1	0.0 –1.0	–1.1 –2.0
Current speed, cm/s	Current: mean speed (cm/s)	0-12.9	13-19.9	20-29.9	≥30
Intense ice drift, cm/s	Instant ice drift speed (cm/s)	0-14.9	15-24.9	25-34.9	≥35
Edge	Total concentration	0	>0	>0	>0
Sea ice total concentration	Total concentration (tenths)	0	1-3	4-6	7-10
Bergy waters	Stage of development	≠98	98	98	98
Iceberg	Ice of land origin (geographic coordinates)	no	present	present	present
Compacting, level	Sea ice: compacting (level)	0-0.4	0.5-0.9	1.0-1.9	2.0-3.0
Surge, cm	Water level (cm)	0-49	50-99	100-149	≥150
Downsurge, cm	Water level (cm)	0 –49	–50 –99	–100 –149	≥–150
Wind, m/s	Wind: speed (м/с)	< 10	10-19.9	20-29.9	≥30
Waves height, m Coastal zone High sea Open ocean	Wind waves: height (m)	 0-1.9 0-2.9 0-3.9	 2-3.9 3-5.9 4-7.9	 4-4.9 6-6.9 8-8.9	 ≥5 ≥7 ≥9
Ice accretion, cm/h	Ice accretion (vessel): speed (cm/h)	0-0.6	0.7-1.9	2-2.5	≥2.5
Icing (level, points) Air temperature Mean waves height	Icing (points)	0 > (-2°)	1 ≤ (-2°) 1.5m	2 (-2°) - (-6°) 2.0m - 6.0m	3 ≤ (-3°) / < (-8°) >6.5m / > 2.0m

References:

a) RF Manual for hydrometerological stations and posts. Issue.9, part.III. Hydrometerological observations on shipborne stations carried out by observers.

b) RF Instruction. Criteria for dangerous hydrometerological phenomena and order of provision of warning message.

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Appendix XV - Common Abbreviations for International NAVTEX Service

All wind directions to be abbreviated as indicated below.

Terminology in full	NAVTEX Abbreviations
North or Northerly	**N**
Northeast or Northeasterly	**NE**
East or Easterly	**E**
Southeast or Southeasterly	**SE**
South or Southerly	**S**
Southwest or Southwesterly	**SW**
West or Westerly	**W**
Northwest or Northwesterly	**NW**

Note: The use of the above abbreviations for wind direction could generate savings of the order of 6-8% in the length of bulletins drafted for the International NAVTEX Service.

Terminology in full	NAVTEX Abbreviations
Decreasing	**DECR**
Increasing	**INCR**
Variable	**VRB**
Becoming	**BECMG**
Locally	**LOC**
Moderate	**MOD**
Occasionally	**OCNL**
Scattered	**SCT**
Temporarily/Temporary	**TEMPO**
Isolated	**ISOL**
Frequent/Frequency	**FRQ**
Showers	**SHWRS or SH**
Cold Front	**C-FRONT or CFNT**
Warm Front	**W-FRONT or WFNT**
Occlusion Front	**O-FRONT or OFNT**
Weakening	**WKN**
Building	**BLDN**
Filling	**FLN**
Deepening	**DPN**
Intensifying/Intensify	**INTSF**
Improving/Improve	**IMPR**
Stationary	**STNR**
Quasi-Stationary	**Q-STNR**
Moving/Move	**MOV or MVG**
Veering	**VEER**
Backing	**BACK**
Slowly	**SLWY**
Quickly	**QCKY**

Rapidly	**RPDY**
Knots	**KT**
Km/h	**KMH**
Nautical miles	**NM**
Metres	**M**
HectoPascal	**HPA**
Meteo…	**MET**
Forecast	**FCST**
Further outlooks	**TEND**
Visibility	**VIS**
Slight	**SLGT or SLT**
Quadrant	**QUAD**
Possible	**POSS**
Probability/Probable	**PROB**
Significant	**SIG**
No change	**NC**
No significant change	**NOSIG**
Following	**FLW**
Next	**NXT**
Heavy	**HVY**
Severe	**SEV or SVR**
Strong	**STRG**
From	**FM**
Expected	**EXP**
Latitude/Longitude	**LAT/LONG**

Remarks:

The overall savings by the use of the abbreviations in the above lists in the meteorological content of the International NAVTEX Service broadcasts could, it is estimated, generate savings more than 20% in transmission time.

“Expected” and “Latitude/Longitude” should, when possible, be omitted in the messages.

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Appendix XVI – WWMIWS Guidance Document

Annex to draft Recommendation 8.3/1 (JCOMM-III)

IMO/WMO WORLD-WIDE MET-OCEAN INFORMATION AND WARNING SERVICE

GUIDANCE DOCUMENT

1. INTRODUCTION

1.1 The International Convention for the Safety of Life at Sea (SOLAS), 1974, Chapter V (Safety of Navigation), Regulation 4 (Meteorological Services), as amended, states:

"(b) In particular, the Contracting Governments undertake to cooperate in carrying out, as far as practicable, the following meteorological arrangements:

(vii) To endeavour to obtain a uniform procedure in regard to the international meteorological services already specified, and, as far as is practicable, to conform to the Technical Regulations and recommendations made by the World Meteorological Organization, to which the Contracting Governments may refer for study and advice any meteorological question which may arise in carrying out the present Convention".

1.2 IMO Resolution A.705(17) on promulgation of maritime safety information, adopted by IMO/MSC-85 (2008), set out the organization, standards and methods which should be used for the promulgation and reception of maritime safety information, including navigational and meteorological warnings, meteorological forecasts and other urgent safety-related messages broadcast to ships, as documented in the International Convention for the Safety of Life at Sea (SOLAS). The WMO Executive Council, at its sixty-first session (June 2009), requested WMO to establish and develop, in collaboration with the IMO, terms of reference for an IMO/WMO World-Wide Met-ocean Information and Warning Service (WWMIWS), to complement the existing IMO/IHO World-Wide Navigational Warning Services (WWNWS, IMO resolution A.706(17)). In this context, this document is intended to provide specific guidance for the promulgation of internationally coordinated meteorological information, forecast and warnings services, which does not apply to purely national services.

1.3 The regulatory framework for the provision of marine meteorological services within the new WMO GMDSS Marine Broadcast System was developed from Recommendation 3 (CMM-XI) in 1993, endorsed by the WMO Executive Council at its forty-fourth session. This new system reflects the evolution since the advent of the Global Maritime Distress and Safety System (GMDSS), as adopted by the Conference of Contracting Governments to the International Convention for the Safety of Life at Sea, 1974, on the Global Maritime Distress and Safety System in November 1988, effective on 1 February 1992. The WMO GMDSS Marine Broadcast System is an integral part of the WWMIWS.

1.4 Future amendments to this guidance document will be considered formally and approved by both WMO and IMO. Proposed amendments shall be evaluated by the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) Expert Team on Maritime Safety Services, which includes an *ex-officio* representative of the IMO Secretariat, prior to any extensive WMO and IMO consideration.

2. DEFINITIONS

2.1 For the purposes of meteorological information, the following definitions apply:

2.2.1 *Coastal and off-shore area* applies to areas for which Member States issue weather and sea bulletins, governed by the procedures in WMO-No. 558 – Manual on Marine Meteorological Services.

2.2.2 *HF NBDP* means High Frequency narrow-band direct-printing, using radio telegraphy as defined in Recommendation ITU-R M.688.

2.2.3 *International NAVTEX service* means the coordinated broadcast and automatic reception on 518 kHz of maritime safety information by means of narrow-band direct-printing telegraphy using the English language.

2.2.4 *International SafetyNET service* means the coordinated broadcasting and automated reception of maritime safety information via the Inmarsat Enhanced Group Call (EGC) system, using the English language, in accordance with the provisions of the International Convention for the Safety of Life at Sea, 1974, as amended.

2.2.5 *Maritime Safety Information (MSI)* means navigational and meteorological warnings, meteorological forecasts and other urgent safety-related messages broadcast to ships.

2.2.6 *METAREA* means a geographical sea area established for the purpose of coordinating the broadcast of marine meteorological information. The term METAREA followed by a roman numeral may be used to identify a particular sea area. The delimitation of such areas is not related to and should not prejudice the delimitation of any boundaries between States.

2.2.7 *METAREA Coordinator* means the authority charged with coordinating Maritime Safety Information broadcasts by one or more National Meteorological Services acting as Preparation or Issuing Services within the METAREA.

2.2.8 *National NAVTEX service* means the broadcast and automatic reception of maritime safety information by means of narrow-band direct-printing telegraphy using frequencies other than 518 kHz and languages as decided by the Administration concerned.

2.2.9 *National SafetyNET service* means the broadcasting and automated reception of maritime safety information via the Inmarsat EGC system, using languages as decided by the Administration concerned.

2.2.10 *NAVAREA* means a geographical sea area established for the purpose of coordinating the broadcast of navigational warnings. The term NAVAREA followed by a roman numeral may be used to identify a particular sea area. The delimitation of such areas is not related to and should not prejudice the delimitation of any boundaries between States.

2.2.11 *NAVTEX coordinator* means the authority charged with operating and managing one or more NAVTEX stations broadcasting maritime safety information as part of the International NAVTEX service.

2.2.12 *Sub-Area* means a sub-division of a METAREA in which a number of countries have established a coordinated system for the promulgation of meteorological information. The delimitation of such areas is not related to and shall not prejudice the delimitation of any boundaries between States.

2.2.13 In the operating procedures *coordination* means that the allocation of the time for data broadcast is centralized, the format and criteria of data transmissions are compliant as described in the Joint IMO/IHO/WMO Manual on Maritime Safety Information and that all services are managed as set out in IMO Resolution A.705(17), as amended.

3. METEOROLOGICAL INFORMATION BROADCASTS

3.1 Guidance for handling and formatting meteorological information is given in the Joint IMO/IHO/WMO Manual on Maritime Safety Information, as approved by IMO under MSC1./Circ.1310, the NAVTEX Manual, the International SafetyNET Manual and the Manual on Marine Meteorological Services (WMO-No. 558), and is summarized as follows:

3.2 Methods

3.2.1 Two principal methods are used for broadcasting meteorological information as part of MSI in accordance with the provisions of the International Convention for the Safety of Life at Sea, 1974, as amended, in the areas covered by these methods, as follows:

3.2.1.1 NAVTEX: broadcasts to coastal and offshore waters; and

3.2.1.2 SafetyNET: broadcasts which cover all the waters of the globe except for sea area A4, as defined by resolution A.801(19), Annex 3, paragraph 4, as amended.

3.2.2 Information shall be provided for unique and precisely defined sea areas, each being served only by the most appropriate of the above systems. Although there will be some duplication to allow a ship to change from one system to another, the majority of messages will only be broadcast on one system.

3.2.3 NAVTEX broadcasts shall be made in accordance with the standards and procedures set out in the NAVTEX Manual.

3.2.4 SafetyNET broadcasts shall be made in accordance with the standards and procedures set out in the International SafetyNET Manual.

3.2.5 HF NBDP may be used to promulgate maritime safety information in areas outside Inmarsat coverage (SOLAS regulation IV/7.1.5).

3.2.6 In addition, Administrations may also provide maritime safety information by other means.

3.3 Scheduling

3.3.1 Automated methods (NAVTEX/SafetyNET)

3.3.1.1 Meteorological warnings shall be broadcast as soon as possible or as dictated by the nature and timing of the event. Normally, the initial broadcast should be made as follows:

3.3.1.1.1 For NAVTEX, at the next scheduled broadcast, unless circumstances indicate the use of procedures for VITAL or IMPORTANT warnings; and

3.3.1.1.2 For SafetyNET, within 30 min of receipt of original information, or at the next scheduled broadcast.

3.3.1.2 Meteorological warnings shall be repeated in scheduled broadcasts in accordance with the guidelines promulgated in the NAVTEX Manual and International SafetyNET Manual as appropriate.

3.3.1.3 At least two scheduled daily broadcast times are necessary to provide adequate promulgation of meteorological information.

3.3.2 Schedule changes

3.3.2.1 Broadcast times for NAVTEX are defined by the B1 character of the station, allocated by the IMO NAVTEX Coordinating Panel.

3.3.2.2 Times of scheduled broadcasts under the international SafetyNET service are coordinated through the IMO SafetyNET Coordinating Panel.

3.3.2.3 Information on broadcast schedules and the content of bulletins are contained in WMO-No. 9 (*Weather Reports*), Volume D (*Information for shipping*).

3.4 Language

3.4.1 All meteorological information shall be broadcast only in English in the International NAVTEX and SafetyNET services.

3.4.2 In addition to the required broadcasts in English, meteorological information may be broadcast in a national language using national NAVTEX and SafetyNET services and/or other means.

4. METEOROLOGICAL INFORMATION

4.1 General

4.1.1 Marine meteorological services are provided to satisfy the requirements for information on marine environmental conditions and phenomena, established by national practices and international conventions in relation to marine operations.

4.1.2 Marine meteorological services are designed for the safety of marine operations and to promote, where possible, the efficiency and economy of marine activities.

4.1.3 There are three types of marine meteorological information: forecasts and warnings for the High Seas, forecasts and warnings for Coastal and Offshore areas and services for Ports & Harbour areas. The Marine Meteorological Information guidance and coordination are involved with only two of them:

4.1.3.1 Services for the High Seas, which will comprise:

(a) Warnings of gales and storms;

(b) Weather and sea bulletins, which shall include, in the order given hereafter:

Part I – Storm Warnings;

Part II – Synopsis of major features of the surface weather chart and, to the extent possible, significant characteristics of corresponding sea-surface conditions;

Part III – Forecasts.

4.1.3.2 Services for Coastal and Offshore Areas, which will comprise Warnings, Synopses and Forecasts.

4.1.4 Operational guidance for handling and formatting meteorological information is given in detail in the Annex IV of the WMO Technical Regulations (Manual on Marine Meteorological Services – WMO-No. 558). It is summarized in the following paragraphs 4.2 and 4.3.

4.2 Services for the High Seas shall consist of:

4.2.1 Warnings

4.2.1.1 Warnings shall be given for gales, storms, hurricane wind force and for tropical cyclones (hurricanes in the North Atlantic and eastern North Pacific, typhoons in the Western Pacific, cyclones in the Indian Ocean and cyclones of similar nature in other regions). Warnings shall include:

(a) Type of warning;

(b) Date and time of reference in UTC;

(c) Location of disturbance in terms of latitude and longitude or with reference to well-known landmarks;

(d) Extent of affected area;

(e) Wind speed or force and direction in the affected areas.

4.2.1.2 Warnings for other severe conditions such as poor visibility, severe sea states (swell, risk of abnormal waves), ice accretion, ice conditions, etc. shall also be issued, as necessary.

4.2.1.3 When no warnings for gales, storms or tropical cyclones are to be issued, that fact shall be positively stated in Part I of each weather and sea bulletin.

4.2.2 Synopses

4.2.2.1 Synopses will be broadcast as part of routine meteorological information, within Part II of weather and sea bulletins, and shall have the following content and order of items:

(a) Date and time of reference in UTC;

(b) Synopsis of major features of the surface weather chart;

(c) Direction and speed of movement of significant pressure systems and tropical disturbances;

(d) Ice conditions, where applicable (concise description of sea ice: position of ice edge, total concentration, stages of ice development, etc.).

4.2.3 Forecasts

4.2.3.1 The forecasts given in Part III of weather and sea bulletins shall have the following content and order of items:

(a) The valid period of forecast;

(b) Name or designation of forecast area(s) within the main MSI area;

(c) A description of:

(i) Wind speed or force and direction;

(ii) Sea state;

(iii) Visibility when forecast is less than five nautical miles;

(iv) Ice accretion, where applicable;

(v) Ice conditions, where applicable.

4.2.3.2 The forecasts should include expected significant changes during the forecast period, significant meteors such as freezing precipitation, snowfall or rainfall, and an outlook for these factors and variables for the following 24 to 72 hours, as feasible. In addition, phenomena such as breaking seas, cross seas and abnormal or rogue waves could also be included, if feasible.

4.3 Services for the Coastal and Offshore Areas shall consist of:

4.3.1 Warnings

4.3.1.1 When included, warnings shall be placed at the beginning of the bulletin.

4.3.1.2 Warnings shall be given for:

(a) Tropical cyclones (hurricanes in the North Atlantic and eastern North Pacific, typhoons in the Western Pacific, cyclones in the Indian Ocean and cyclones of similar nature in other regions);

(b) Gales (Beaufort force 8 or 9) and storms (Beaufort force 10 or over);

(c) Ice accretion;

(d) Ice conditions.

4.3.2 Synopses and Forecasts

4.3.2.1 Synopses and Forecasts should have the following content:

(a) A synopsis of major features of the surface weather chart;

(b) The valid period of forecast;

(c) Name or designation of forecast area(s);

(d) A description of:

(i) Wind speed or force and direction;

(ii) Visibility when forecast is less than five nautical miles;

(iii) Ice accretion, where applicable;

(iv) Ice conditions, where applicable (concise description of sea ice: position of ice edge, total concentration, stages of ice development, etc.)

(v) Sea and swell.

5. ISSUING AND PREPARATION SERVICES

5.1 Issuing Service

5.1.1 An Issuing Service is a National Meteorological Service which has accepted responsibility for ensuring that meteorological forecasts and warnings for shipping are disseminated through the Inmarsat SafetyNET and NAVTEX services to the designated area for which the Service has accepted responsibility under the broadcast requirements of the GMDSS. The forecasts and warnings for broadcasts may have been prepared solely by the issuing service, or by another preparation service, or a combination of both, on the basis of negotiations between the services concerned, or otherwise, as appropriate. The issuing service is responsible for composing a complete broadcast bulletin on the basis of information input from the relevant preparation services and for broadcasting this in accordance with the guidelines contained within the International SafetyNET Manual and the International NAVTEX Manual. The issuing service is also responsible for monitoring the broadcasts of SafetyNET information to its designated area of responsibility.

NOTES:

(1) For some METAREAS there may be only one preparation service, which will be the same National Meteorological Service as the issuing service (e.g. United Kingdom for area I, Argentina for area VI and Australia for area X).

(2) An appropriate format for the attribution of the origins of the forecast and warning information contained in a broadcast bulletin may be developed on the basis of negotiations among the services concerned.

(3) In situations where appropriate information, data or advice from other designated preparation services for a given area of responsibility is not available, it is the responsibility of the issuing service for that area to ensure that complete broadcast coverage for the area is maintained.

5.2 Preparation Service

5.2.1 A Preparation Service is a National Meteorological Service which has accepted responsibility for the preparation of forecasts and warnings for parts of, or an entire, designated area (METAREA) in the WMO system for the dissemination of meteorological forecasts and warnings to shipping under the GMDSS and for their transfer to the relevant issuing service for broadcast.

6. METAREA COORDINATOR

6.1 METAREA Coordinator resources

6.1.1 The METAREA coordinator should have:

6.1.1.1 The expertise and information sources of a well-established Issuing Service;

6.1.1.2 Effective communications, e.g., telephone, e-mail, facsimile, internet, telex, etc., with National Meteorological Services in the METAREA, with other METAREA coordinators, and with other data providers.

6.2 METAREA Coordinator responsibilities

6.2.1 The METAREA coordinator should ensure that within its METAREA, National Meteorological Services which act as Preparation Services have the capability to:

6.2.1.1 Be informed of all meteorological events that could significantly affect the safety of navigation within their area of responsibility;

6.2.1.2 Assess all meteorological information immediately upon receipt in the light of expert knowledge for relevance to navigation within their area of responsibility;

6.2.1.3 Forward meteorological warnings and relevant associated information which may require wider promulgation directly to adjacent METAREA coordinators and/or others as appropriate, using the quickest possible means;

6.2.1.4 Ensure that information concerning all meteorological warning subject areas listed in paragraph 4 that may not require a METAREA warning within their own area of responsibility is forwarded immediately to the appropriate National Meteorological Services and METAREA coordinators affected by the meteorological event;

6.2.1.5 Maintain records of source data relating to meteorological information and warnings messages within their area of responsibility.

6.2.2 The METAREA coordinator should ensure that within its METAREA, National Meteorological Services which act as Issuing Services have the capability to:

6.2.2.1 Select meteorological information and warnings for broadcast in accordance with the guidance given in paragraph 4 and 5 above;

6.2.2.2 Monitor the SafetyNET transmission of their bulletins, broadcast by the Issuing Service.

6.2.3 The METAREA coordinator should also:

6.2.3.1 Act as the central point of contact on matters relating to meteorological information and warnings within the METAREA;

6.2.3.2 Promote and oversee the use of established international standards and practices in the promulgation of meteorological information and warnings throughout the METAREA;

6.2.3.3 Coordinate preliminary discussions between neighbouring Members, seeking to establish and operate NAVTEX services, prior to formal application; and

6.2.3.4 Contribute to the development of international standards and practices through attendance and participation in the JCOMM Expert Team on Maritime Safety Services meetings, and also attend and participate in relevant IMO, IHO and WMO meetings as appropriate and required.

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Appendix XVII – Report of the Coordinator for METAREAs XVII and XVIII

1. In December 2007, Canada accepted official recognition as the Issuing Service for marine weather forecasts and warnings for MetAreas XVII and XVIII as part of the Global Maritime Distress and Safety System (GMDSS). Canada (Canadian Coast Guard) is the Issuing (and preparation) Service for Associated NavAreas XVII and XVIII

2. Norway is recognized as the Issuing Service for MetArea XIX and Russia for MetAreas XX and XXI.

3. It should be noted that Arctic MetAreas are dynamic – a decreasing ice cover will lead to increasing demand for weather and ice information, both temporally and spatially. Canada's approach will be to start with existing products and increase products and services in association with increasing needs. It is anticipated that in first several years, the broadcast service for weather and ice information will essentially be seasonal with "null" bulletins being issued during the winter months.

4. At the present time, Canada is working with assistance from METArea Coordinator Henri Savina. Preparations continue with the target of being in testing status by May 2010. Product preparation and development is underway and internal testing began in the Fall of 2009. Acquisition of INMARSAT-C receivers is in process and work on a service contract for upload to begin soon. Installation of equipment is planned for Spring 2010.

5. The broadcast of METArea information beyond 75N will be through the Canadian NAVArea issuing service, the Canadian Coast Guard. Arrangements for monitoring of METArea information has begun with the acquisition of equipment. Facilitation of the coordination of transmissions for SafetyNET and NAVTEX with International Panels is occurring. A Certificate of Authorization to Participate as an Information Provider in the International SafetyNET Service has been issued from IMO.

6. NAVArea, METArea, and NAVTEX coverage diagrams, including service areas and times of transmission are being developed as products and transmission times are negotiated.

7. Initial discussions with the United States as a Preparation Service have taken place and it is expected that further conversations with American colleagues and discussions with Danish colleagues, as Preparation Services, will occur over next few months.

8. Discussions with Norway and Russia, for coordination and consistency across METArea boundaries, is being planned…possibly at a GMDSS meeting in Melbourne in late April however it is hoped that some planning will take place prior to this.

9. Sea ice information will consist of NAVTEX bulletins describing the ice edge. An overlap of 300 NM is planned between adjacent METAREAs.

10. Issues that must be resolved include:
- Broadcast times - need to be clarified and staggered so each Issuing Service can properly follow the previous.
- Definition of ice edge - recommended that the METNAV bulletins use 10% ice concentration as the ice edge with a disclaimer that there may be trace ice and bergs outside the ice edge

- Ice edge reconciliation – there must be continuity of the ice edge from one METAREA to the adjacent METAREA. An ftp site (or some similar solution) could be used for Issuing Services to place their ice information in advance of the broadcast allowing the next Issuing Service to integrate into their material as soon as possible.
- Disclaimer - Concern was expressed that the more detailed local ice information may be missed or ignored in favour of the METNAV bulletin. It is proposed that all the METNAV area bulletins take a common approach to providing a Disclaimer such as "For detailed local ice information go to…."
- Training – It is recommended that the 3 Issuing Services meet together for joint training / back-up plan discussion. The UK MET office is proposed as a most suitable venue.
- Cross-area coordination and consistency must be discussed among the coordinators as soon as possible.

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Appendix XVIII – Report of the Coordinator for METAREAs XX and XXI

1. In 2007, Russia accepted official recognition as the Issuing Service for marine weather forecasts and warnings for METAREAs XX and XXI as part of the Global Maritime Distress and Safety System (GMDSS). Russia (Federal Agency of Marine and River Transport) is the Issuing (and preparation) Service for Associated NAVAREAs XX and XXI

2. Canada is recognized as the Issuing Service for METAREAs XVII and XVIII and Norway is recognized as the Issuing Service for MetArea XIX.

3. It should be noted that Arctic METAREAs are characterized by the ice cover occurrence during the whole year which is the serious obstacle for navigation and a factor of risk. The Russian approach is that the sufficient safety level can be reached only with individual (customer-oriented) support with provision of detailed ice information, but the goal of the GMDSS ice information circular transmission is to warn on the ice with definite characteristics in a certain area to prevent incidental entry of vessels into this area.

4. The broadcast of METAREA information beyond 76N is the problem which is in the process of solving. At the moment INMARSAT-C is used to transmit the information on the safety of navigation to the ships in the Western and Eastern zones of the Northern Sea Route.

5. NAVAREA, METAREA, and NAVTEX coverage diagrams, including service areas and times of transmission are being developed as products and transmission times are negotiated.

6. Discussions with Canada and Norway, for coordination and consistency across METAREA boundaries are planned at the nearest ETMSS or METAREA coordinators dedicated GMDSS meeting of . in Melbourne in late April however it is hoped that some planning will take place prior to this.

7. Plain language sea ice information will consist of NAVTEX and SafetyNET bulletins describing the ice edge and concise description of sea ice conditions. An overlap of 300 nautical miles between adjacent METAREAs will be taken into account in the future plans.

8. Issues that must be resolved generally correspond to those proposed by Canada and Norway and may include:

- Broadcast times – need to be clarified and staggered so each Issuing Service can properly follow the previous.
- Definition of ice edge – it is necessary to consider the proposal of Canada and Norway to use 10% ice concentration as the ice edge with a disclaimer that there may be trace ice and bergs outside the ice edge
- Ice edge reconciliation – there must be continuity of the ice edge from one METAREA to the adjacent METAREAs. An 24/7 ftp/http site could be organized (e.g. by the AARI) and used by all Issuing Services to place their ice information in advance of the broadcast allowing the next Issuing Service to integrate into their material as soon as possible.
- Disclaimer – Concern was expressed that the more detailed local ice information may be missed or ignored in favour of the METNAV bulletin. It is proposed that all the METNAV area bulletins take a common approach to providing a Disclaimer such as "For detailed local ice information go to…."
- Training – It is recommended that the 3 Issuing Services regularly meet together for joint training / back-up plan discussion. One of possible choices may be Ice Analysts Workshops.

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Appendix XIX - Current Practice for Use of Sea Ice Definitions at international ice centres

(definitions from WMO Sea Ice Nomenclature – WMO No. 259)

(http://www.aari.ru/gdsidb/XML/volume1.php?lang1=0&lang2=0&arrange=0&self=0)

2.1 New ice: A general term for recently formed ice which includes *frazil ice*, *grease ice*, *slush* and *shuga*. These types of ice are composed of ice crystals which are only weakly frozen together (if at all) and have a definite form only while they are afloat.
2.3 Pancake ice: Predominantly circular pieces of ice from 30 cm - 3 m in diameter, and up to about 10 cm in thickness, with raised rims due to the pieces striking against one another. It may be formed on a slight swell from *grease ice*, *shuga* or *slush* or as a result of the breaking of *ice rind*, *nilas* or, under severe conditions of swell or waves, of *grey ice*. It also sometimes forms at some depth at an interface between water bodies of different physical characteristics, from where it floats to the surface; its appearance may rapidly cover wide areas of water.
2.6 Old ice: *Sea ice* which has survived at least one summer's melt; typical thickness up to 3m or more. Most topographic features are smoother than on *first-year ice*. May be subdivided into *second-year ice* and *multi-year ice*.
2.6.1 Second-year ice: *Old ice* which has survived only one summer's melt; typical thickness up to 2.5 m and sometimes more. Because it is thicker than *first-year ice*, it stands higher out of the water. In contrast to *multi-year ice*, summer melting produces a regular pattern of numerous small *puddles*. Bare patches and *puddles* prx usually greenish-blue.
2.6.2 Multi-year ice: *Old ice* up to 3 m or more thick which has survived at least two summers' melt. Hummocks even smoother than in *second-year ice*, and the ice is almost salt-free. Colour, where bare, is usually blue. Melt pattern consists of large interconnecting irregular *puddles* and a well-developed drainage system.
2.6.x (proposal) Residual ice: First-year ice that has survived the summer's melt and is now in the new cycle of growth. It is 30 to 180 cm thick depending on the region where it was in summer. After 1 January (in the Southern hemisphere after 1 July), this ice is called second-year ice.
4.2.5Very open ice: *Floating ice* in which the *concentration* is 1/10 to 3/10 and water preponderates over ice.
4.2.6 Open water: A large area of freely navigable water in which *sea ice* is present in *concentrations* less than 1/10. No *ice of land origin* is present.
4.2.7 Bergy water: An area of freely navigable water in which *ice of land origin* is present in *concentrations* less than 1/10. There may be *sea ice* present, although the total *concentration* of all ice shall not exceed 1/10.
4.2.8 Ice-free: No ice present. If ice of any kind is present this term should not be used.
4.4.8 Ice edge: The demarcation at any given time between the open sea and *sea ice* of any kind, whether fast or drifting. It may be termed *compacted* or *diffuse* (cf. *ice boundary*).
4.4.1.4 Ice patch: An area of *floating ice* less than 10 km across.
4.4.3 Belt: A large feature of *drift ice* arrangement; longer than it is wide; from 1 km to more than 100 km in width.
4.4.4 Tongue: A projection of the *ice edge* up to several kilometers in length, caused by wind or current.
4.4.5 Strip: Long narrow area of *floating ice*, about 1 km or less in width, usually composed of small fragments detached from the main mass of ice, and run together under the influence of wind, swell or current.
9.1 Puddle: An accumulation on ice of melt-water, mainly due to melting snow, but in the more advanced stages also to the melting of ice. Initial stage consists of patches of melted snow.

Country	**SMHI**	**FMI**	**USA**	**Denmark**	**Canada**
Area	Baltic Sea	Baltic Sea	Global	Greenland, (East, South, West, North)	Canadian Arctic, Eastern Canadian Waters
Parameter					
Ice edge (4.4.8)	Conc. <1/10	Conc. <1/10	Conc. 1/10 in daily ice edge products, conc. 15% in models	Normally 1 tenth is defining the ice edge. Sometimes polygons with less than 1 tenth of ice.	Ice edges are drawn between open water or bergy water (less than 1 tenth) and ice of one tenth or more of ice.
Ice edge, additional information (4.4.8)	New ice, SST	New ice, SST	Demarcation between open sea and sea ice	Symbols on the ice chart in terms of bergy water, new ice few/many icebergs/growlers or belts of ice.	symbology to label open water, bergy water, ice belts and ice free areas
Old Ice (2.6)	Not relevant	Not relevant	At Oct 01 any FY ice is labelled SY ice (8*). At Jan 01 all SY and MY ice is labelled Old Ice (7*)	Sea ice which has survived one summers melt is after 01 October defined as Old Ice.	**On October 1:** First Year Ice (6,7,8,9,1.,4.) will become Second-Year (8.) Second-Year (8.) will become Multi-Year (9.) Old Ice (7.) will become Multi-Year (9.) **On January 1:** Second-Year (8.) will become Old Ice (7.) Multi-Year (9.) will become Old Ice (7.)

Country	**Russia**	**Argentina**
Area	Eurasian Arctic Seas, Arctic Basin, Antarctic	Antarctica
Parameter		
Ice edge (4.4.8)	For the ice charts based on satellite imagery ice edges are drawn between ice free (4.2.8) and ice of 1-2 tenth (4.2.5) or more of ice. For the ice charts based on visual observations ice edges are drawn between ice free (4.2.6) and open water (4.2.8).	Boundary between open water (less than 1/10) and ice covered areas with 1/10 or more
Ice edge, additional information (4.4.8)	If present, new ice (2.1) or ice stripes (4.4.5) and patches (4.4.1.4) are demarcated outside of ice edge. For Antarctic region zones of pancake ice (2.3) of 50-100 km width occur in 90% of case and are demarcated in winter time. The same The same phenomenon for the Arctic region occurs and is demarcated in winter time in the Barents Sea.	None
Old Ice (2.6)	After the moment of stable ice formation (typical dates are region-specific: 1st 10-days period in Kara Sea, November in Chukchi Sea) the FYI is called residual ice (2.6.x). The moment of ice formation is determined by melt puddles (9.1) freezing. From the January 1st the residual ice on the charts based on satellite imagery is called old ice (2.6); in case of visual observations – SYI ice (2.6.1). In general case, for the ice charts based on satellite imagery there is no distinction between SYI and MYI, the term old ice is used; for the case of visual observations gradations SYI (2.6.1) and MYI (2.6.2) are used.	Sea ice which has survived more than one summers melt is defined as old ice at March 01

Awaiting information from the following countries:

Country	**Germany**	**Iceland**	**Chile**	**Australia**	**China**	**Norway**
Area						
Parameter						
Ice edge (4.4.8)						
Ice edge, additional information (4.4.8)						
Old Ice (2.6)						

Country	**Japan**	**Poland**	**Latvia**	**Lithuania**	**Estonia**
Area					
Parameter					
Ice edge					
Ice edge, additional information					
Old Ice					

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Appendix XX – JCOMM QUESTIONNAIRE

MARINE METEOROLOGICAL SERVICES MONITORING PROGRAMME

A. To masters, deck and radio officers of VOS

In order to monitor the effectiveness of the weather and sea bulletins produced and transmitted by Meteorological Services, the World Meteorological Organization would appreciate your cooperation in completing the following questionnaire. The objective of this programme is the improvement of meteorological support to shipping.

Ship's name (call sign).....
Country of registry.....
Name of master.....
Operational area(s).....
Voyage from.....to .....
Position of ship when questionnaire completed.....
Date and time.....

Please complete the following questionnaire by ticking the appropriate heading and inserting comments, as appropriate.

	Good	Fair	Poor	Met. Service issued by	CRS
1. Storm and gale warnings	_____	_____	_____	_____	
(a) Clarity of information	_____	_____	_____		
(b) Accuracy of information	_____	_____	_____		
(c) Timeliness	_____	_____	_____		
2. Weather bulletins					
(a) Clarity of information	_____	_____	_____	_____	
(b) Accuracy of information	_____	_____	_____		
(c) Timeliness	_____	_____	_____		
(d) Terminology used	_____	_____	_____		
3. Radio-facsimile broadcasts					
(a) Maintaining schedules	_____	_____	_____	_____	
(b) Accuracy of information	_____	_____	_____		
(c) Readability	_____	_____	_____		
(d) Symbology	_____	_____	_____		
(e) Quality of reception	_____	_____	_____		

4. Coastal Radio Stations (CRS)/Coast Earth Stations (CES)

(a) Establishing contact with receiving station (CRS/CES) _____ _____ _____

(b) Delays with OBS messages _____ Yes (Time…..)
_____ No

(c) Refusal of CRS/CES to accept OBS messages _____ Yes (CRS/CES……) _____ Yes

(d) Use of five- or ten-figure groups _____ 5 _____ 10

5. Other related problems (if any)
Date and time .....

Position of the ship .....
Radio frequency and station call sign.....

6. Suggested improvements
Use of additional sheets if necessary
For each case complete one questionnaire
After completion, please return to Meteorological Service at the following address:.....

Master's signature

B. A summary of the replies to the questionnaire addressed to Voluntary Observing Ships (VOS) received by (Meteorological Service)

	Number of ships which replied			Percentage of total replies		
	Good	Fair	Poor	Good	Fair	Poor
1. Storm and gale warnings						
(a) Clarity of information	_____	_____	_____	_____	_____	_____
(b) Accuracy of information	_____	_____	_____	_____	_____	_____
(c) Timeliness	_____	_____	_____	_____	_____	_____
2. Weather bulletins						
(a) Clarity of information	_____	_____	_____	_____	_____	_____
(b) Accuracy of information	_____	_____	_____	_____	_____	_____
(c) Timeliness	_____	_____	_____	_____	_____	_____
(d) Terminology used	_____	_____	_____	_____	_____	_____
3. Radio-facsimile broadcasts						
(a) Maintaining schedules	_____	_____	_____	_____	_____	_____
(b) Accuracy of information	_____	_____	_____	_____	_____	_____
(c) Readability	_____	_____	_____	_____	_____	_____
(d) Symbology	_____	_____	_____	_____	_____	_____
4. Coastal Radio Stations (CRS)/Coast Earth Stations (CES)						
(a) Establishing contact with receiving station	_____	_____	_____	_____	_____	_____
(b) Delays with OBS messages	_____	_____	_____	_____	_____	_____
(c) Refusal of CRS/CES to accept OBS messages	_____	_____	_____	_____	_____	_____
(d) Use of five- or ten-figure groups	_____	_____	_____	_____	_____	_____
5. Other related problems						

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6. Suggested improvements

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Appendix XXI - WORK PLAN FOR THE INTERSESSIONAL PERIOD 2010-2012

JCOMM EXPERT TEAM ON SEA ICE (ETSI)
Fourth Session
STEERING GROUP FOR THE GLOBAL DIGITAL SEA ICE DATA BANK (GDSIDB)
Twelfth Session
St Petersburg, Russian Federation, 1-5 March 2010

WORKING PLAN FOR THE NEXT INTERSESSIONAL PERIOD
(decisions from ETSI-IV/GDSIDB-XII)

Ref.	Action	By whom	When	Status at
2.2.11	Review ETSI Terms of Reference to ensure that they include appropriate reference to the work of the TG-ENCIO	TG-ENCIO	ETSI-V	
2.4.1.21	Finalize and distribute report from 2nd Ice Analysis workshop	ETSI Chair	As soon as possible	
2.4.1.28	Chair of the BSIM to provide reports on behalf of the small Baltic countries	BSIM Chair	ETSI-V	
2.5.1.7	Identify a focal point to work with ETMSS to help develop the catalogue of Met-Ocean Object Classes and Attributes	ETSI Chair	May 2010	
2.5.1.8	Organize sea ice information on Ice Logistics Portal by METAREAs	Holfort	June 2010	
2.5.1.8	Make links from Ice Logistics Portal to GMDSS website and request a reciprocal link from GMDSS website	Holfort	June 2010	
2.5.1.9	Review Terms of Reference of ETSI and of ETMSS to ensure they provide for appropriate interaction between Expert Teams; send comments to ETSI Chair	ETSI Members	Sep 2010	
2.5.2.10	Prepare summary of ice information available in the Antarctic and send to ETSI Chair for provision to METAREA coordinators in the Southern Ocean	Panowicz	Oct 2010	
2.5.4.5	Update relevant IHO and WMO publications to define the “ice edge” as being delineated by a maximum of 10 points per sub-area	ETSI Chair	June 2010	

2.5.5.4	Determine what countries transmit ice charts by radiofax and advise WMO Secretariat to update Publication No. 9 accordingly	ETSI Chair / Members	June 2010	
2.5.5.6	Review list of proposed NAVTEX abbreviations for completeness and consistency and provide comments to Chair of BSIM	ETSI Members	Jul 2010	
2.5.5.6	Produce final draft list of NAVTEX abbreviations for sea ice for approval by the ETSI; transmit to chair of ETMSS for inclusion in document	Chair of BSIM	Oct 2010	
2.5.5.6	Propose a standard format for ice information in NAVTEX messages and circulate to ETSI members for comment	Chair of BSIM	Jul 2010	
2.5.5.6	Adopt a standard format for ice information in NAVTEX messages; provide document to ETMSS Chair	ETSI Members; ETSI Chair	Oct 2010	
2.5.5.8	Review the IMO/WMO Guidance Document for the World Wide Met-Ocean Information and Warning Service to determine whether other information pertaining to the provision of ocean information in the Polar Regions should be added and provide comments to Chairman of ETSI	ETSI Members	Jun 2010	
2.5.5.8	Provide comments on the IMO/WMO Guidance Document for the World Wide Met-Ocean Information and Warning Service, including the addition of a reference to WMO No. 574 – Sea Ice Services in the World, to the Chair of the Expert Team on Marine Safety Services	ETSI Chair	Sep 2010	
2.5.6.18	Determine a consistent definition of “ice edge” to be used in GMDSS broadcasts	Qvistgaard	May 2010	
2.5.6.18	Establish operating procedures to coordinate ice information between adjacent Arctic METAREAs to ensure continuity of the edge at the METAREA boundary	ETSI Chair	Oct 2010	
2.5.6.19	Provide sample Arctic METAREA ice bulletins to the Arctic METAREA coordinators as a means of verifying formats and coordination of information to ETSI Chair	ETSI Members for Denmark, Canada, Norway and Russia	May 2010	

2.6.1.1	Translate additions to WMO No. 259 Sea Ice Nomenclature into Russian, French and Spanish, provide material to ETSI Chair for inclusion of these definitions to the on-line publication	CIS, Argentina, AARI, ETSI Chair	Jan 2011	
2.6.1.3	Review the SIGRID-3 code tables to determine if a single code could be used across all tables to indicate “Ice Free”	Falkingham	May 2010	
2.6.1.4	Revise the ENC Ice Objects Catalogue Version 4.1 to reflect the decisions of ETSI-IV	Falkingham	May 2010	
2.6.2	Revise WMO No 259 Sea Ice Nomenclature Volume I according to the decisions of ETSI-IV	ETSI Chair, BAS	Jun 2011	
2.6.2.4	Merge the Baltic Sea Ice Glossary into the Illustrated Glossary of WMO No 259 - Sea Ice Nomenclature	ETSI Chair, FMI	Dec 2011	
2.6.2.7	Discuss the proposed terms “Hillocky Multiyear Ice” and “Concentration of Hills” and recommend whether they should be included in WMO No 259 - Sea Ice Nomenclature	ETSI Chair, AARI, CIS	Apr 2011	
2.6.2.14	Submit new photos for the Illustrated Glossary of Sea Ice to the ETSI Chair	ETSI Members	On-going	
2.6.2.14	Update the Illustrated Glossary with new photos as they become available	ETSI Chair	On-going	
2.6.2.20	Ask WMO to consider adoption of the Canadian National Research Council document “Understanding and Identifying Old Ice in Summer”	Secretariat	Apr 2010	
2.6.2.21	Develop a new concept for the Sea Ice illustrated Glossary	ETSI Chair in discussion with Members	Jan 2012	
2.6.2.21	Investigate whether the document “Understanding and Identifying Old Ice in Summer” is available in electronic format	Falkingham	Apr 2010	
2.6.2.22	Develop an electronic update of WMO No 259 Volume III- International System of Sea Ice Symbols (English version)	NIC + AARI, CIS & Argentina	Jan 2012	
2.6.3.4	Make suggestions for further revisions to WMO No 259 Sea Ice Services in the World	ETSI Members	On-going	

2.6.3.4	Publish WMO No 259 Sea Ice Services in the World on the JCOMM Services Website and announce availability of updates to NMS	ETSI Chair, Secretariat	May every year	
2.6.3.5	Ensure that linkages are made to WMO No 259 Sea Ice Services in the World from WMO No. 9, Volume D – Information for Shipping	Secretariat	Oct 2010	
2.6.3.5	Inform the National Ice Services and the sea ice community about the availability of the updated electronic version of WMO No 259 Sea Ice Services in the World by means of a mailing list and/or appropriate newsletter articles	Secretariat	June every year	
2.6.4.20	Progress report on standards for Ice Charts in ENCs to Rostock Meeting	TG-ENCIO	May 2010	
2.6.4.20	Work with AARI/Transas and CIS/Caris to harmonize the standards for Ice Charts in ENCs	TG-ENCIO	End Summer 2010	
2.6.5.2	Implement the ENC Ice Objects Catalogue Version 5.0 in the IHO Database	TG-ENCIO	Mar 2011	
2.6.5.3	Develop a demonstration suite of Ice Objects in ENCs	TG-ENCIO	JCOMM-IV	
2.6.6.5	Discuss the proposed amendment to the Colour Code Standard for bergy water and advise the Chair whether this amendment should be consider again or dropped	DMI, NAIS	Oct 2010	
2.6.7.3	Develop a white paper on the “Vision and Strategy for the Standards for Sea Ice Coding and Presentation” for discussion at IICWG	ETSI Chair in consultation with Members	ETSI-V	
2.6.8.3	Review the English language version of the “Manual for Ice Experts – Ice Observers” and identify any corrections or amendments that may be required; provide comments to ETSI Chair	ETSI Chair / ETSI Members	Feb 2012	
2.6.8.3	After it is finalized, send the “Manual for Ice Experts – Ice Observers” to WMO with a recommendation that it be published as a WMO publication	ETSI Chair	May 2012	
2.7.1.2	Work with WMO Secretariat to prepare the proceedings of the Ice Analysts Workshops as a formal technical publication	ETSI Chair	May 2012	

2.7.1.6	Develop the theme and agenda for the 3rd Ice Analysts Workshop to be held in June 2011	Qvistgaard, Gauthier, Hughes, Holfort, Smolyanitsky	Oct 2010	
2.7.1.8	Develop a longer term vision for the Ice Analysts workshop series	Qvistgaard, Gauthier, Hughes, Holfort, Smolyanitsky	May 2011	
2.7.3.9	Prepare and submit reports on activities in sea ice modelling systems and assimilation into numerical weather prediction models to ETSI Chair	ETSI Members	Sep 2010	
2.7.3.10	Provide a brief update on sea ice modelling systems and data assimilation into NWP models for the Services Coordination Group meeting proposed for May 2010	Carrieres (CIS)	May 2010	
2.7.3.10	Prepare a presentation on sea ice modelling systems and data assimilation into NWP models for the information of the ETOOFS and participate in the ETOOFS meeting in Tokyo in October 2010	Carrieres (CIS)	Oct 2010	
2.7.3.11	Continue cooperation with IICWG for the Modeling/Data Assimilation Workshops and provide feedback to ETSI and ETOOFS	ETSI Chair / ETSI Members	On-going	
2.8.1.4	Provide input to the WMO Rolling Requirements Review based on the IICWG Socio-Economic Benefits and Observations Requirements document	ETSI Chair	Apr every year	
2.8.1.5	Revise the “Statement of Guidance for Ocean Applications” to better reflect sea ice	ETSI Chair in consultation with ETSI Members	Apr 2010	
2.8.2.1	Contact IMO to determine the best method to distribute the JCOMM questionnaire to users, especially in the Arctic METAREAs	Secretariat	Mar 2010	
2.9.5	Make a concerted effort to contribute ice charts in SIGRID-3 format to the NSIDC. Discuss with GDSIDB centres the best method of hosting these charts (in the context of the Polar Decade)	ETSI Members / ETSI Chair	On-going	

2.10.1.3	Report to ETMSS Chair on the results of ETSI-IV, including the creation of the sub-group of experts (Norway, Canada, Russia, Denmark)	ETSI Chair	May 2010	
2.10.1.7	Discuss with ETOOF the need for expert on sea ice modelling	SFSPA Coordinator	May 2010	
2.10.2.5	Circulate information on the content of the first COMET sea ice module to the ETSI	Panowicz	As soon as possible	
2.10.2.5	Provide proposals for content of the second COMET module to Caryn Panowicz	ETSI Members	Oct 2010	
2.10.2.8	Contact the COMET team to determine if joint collaboration is possible in the context of the Manual for Ice Experts – Ice Observers	AARI	June 2010	
3.2.3	Develop an inventory of projects that are digitizing ship log books and Ask ship log digitizing projects to extract sea ice information	Hughes	Oct 2010	
3.4.7	Ask the IICWG task team working on NetCDF to also assess the appropriateness of GRIB for sea ice data in NWP	Hughes	Mar 2010	
4.1.6	Canada to support John Falkingham as TG-ENCIO leader for the next few months after ETSI-IV to maintain close collaboration with IHO	Gauthier	Mar 2010	
4.1.8	ETSI to maintain a close collaboration with the WMO CBS with respect to the integration of the Ice Logistic Portal into the WIS	ETSI Chair	On-going	
4.1.9	Seek CBS advice and expertise concerning documentation standards when revising ETSI documentation	ETSI Chair	On-going	
4.1.10	Liaise with the EC-PORS as appropriate in the context of the International Polar Decade	ETSI Chair	On-going	
4.1.13	Request the WMO Secretariats to coordinate an ETSI presentation on historical sea ice data products at the next WCRP Joint Scientific Committee	WMO Secretariat / GDSIDB SG	Apr 2010	
5.1	Plan to hold ETSI-V in Ottawa in May 2012	Secretariat / Gauthier	Nov 2011	

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Appendix XXII - WORK PLAN OF THE GDSIDB FOR 2007-2009

1. Technique Development

The experts from the GDSIDB centers will continue to make available data browsers, translating and other necessary software for processing data in SIGRID 1,2 and 3, various GIS, and EASE-grid formats, and will make available software tools for working with the stated formats.

2. Data Exchange.

2.1 Data sets anticipated to be contributed by GDSIDB Members, on a schedule dictated by available resources, during the intersessional period 2007 - 2009

	Institute	Region	Time interval	Exchange date (notes)
1.	AARI	Antarctic Arctic	Prior to 1971 2007, ongoing, forward in time	SIGRID, EASE-GRID SIGRID
2	Argentine Navy Hydrographic Service	Weddell and Bellingshausen Seas	Current observations	Point coastal and ship observations in NIC-code in .db format, submitted with weekly interval to NSIDC and AARI ftp-servers
3.	BSIM (SMHI)	Baltic Sea	1980 – up to present, twice a week 2007, ongoing forward in time	In the first part of 2007, SIGRID-3, .txt SIGRID-3, .txt
4.	CIS	Canadian Arctic	Ongoing weekly charts Historical ice charts prior to 1969	SIGRID-3 SIGRID-3
5	State Oceanic Administration of China	Bohai Bay/Yellow Sea	TBD	GDSIDB co-chairs will request SOA on the details of data provision
6.	DMI	Greenland waters	2007, forward in time 1957-2007 XX century	SIGRID-3 (once a year, for the whole ice season) SIGRID-3 SIGRID-3, .txt
7.	Federal Maritime and Hydrographic Agency (BSH)	Baltic Sea (south of 56°N and to the west of 14°20’ E)	3 times a week, 1960-1996 2007, forward in time	SIGRID-3 SIGRID-3
8	Icelandic Meteorological	Icelandic waters	1971-1974	GDSIDB co-chairs will request IMO on the details of

	Office		2002, ongoing forward and back in time	data provision
9	UK BAS	Antarctic ship and coastal stations observations	1950s forward in time	Metadata
10.	JMA	Sea of Okhotsk	Every 5 days, forward in time	Once a year in SIGRID-2 format
11.	NIC	Arctic, Antarctic Antarctic Arctic, Antarctic	Ongoing hemispheric bi-weekly charts Corrected and updated version of hemispheric 1973-2004 weekly and bi-weekly ice charts Daily ice edge from 2004 forward in time	SIGRID-3, .e00 .e00, end of 2007 .txt, SIGRID-3
12	Norway	Barents and Greenland Seas Antarctic icebergs	Weekly and daily Ice concentration charts from 1967 up to the present from ship reports, second part of XX century and forward in time	SIGRID-3 Request from the GDSIDB co-chairs and the WMO Secretariat is needed

2.2 Technical assistance

2.2.1 Experts from AARI and NSIDC centers of GDSIDB will continue to assist data contributors and data users who wish to use formats other than SIGRID (EASE-grid, Contour, etc.) if resources are available.
2.2.2 NSIDC and AARI will continue to provide guidance on preparation of metadata and other necessary documentation accompanying data submitted or to be submitted to GDSIDB.
2.2.3 NSIDC and AARI will check the web visibility of the data collections and ensure it during the intersessional period

3. Modification of formats for data exchange

3.1 The GDSIDB centers will work with the ice services to assist with the implementation of SIGRID-3.
3.2 NSIDC and AARI, with the assistance of experts from operational centers, will prepare reports on the given activity for the next IICWG-VIII & IX meetings in 2007-2008.
3.3 CIS will assist JMA in implementation of SIGRID-3 format.

4. Use, validation and intercomparison of GDSIDB data

4.1 Experts from the GDSIDB will continue joint activity on development of blended sea ice data sets, including its prolongation to 2004, and sea ice climate estimates from the GDSIDB data.
4.2 GDSIDB Members will endeavour to establish linkages with the other programs and projects concerning the development of climate estimates, validation and intercomparison of GDSIDB data, in particular GCOS, IPY, SCAR, WCRP, CliC.
4.3 The project Members together with GCOS SST & SI and IICWG experts will collaborate in organisation of the «Ice Analysis's and data intercomparison» workshop planned for 2008.
4.4 During the 2007, the GDSIDB centers will provide a blended monthly data set for 2004 for AMSA objectives, including a blended product for the stages of ice development.

5. Future activity

5.1 The GDSIDB will advertise the ASPeCT data of ice observations from Antarctica.
5.2 The GDSIDB will request Members to update contributions of ice thickness data as an IPY activity.
5.3 The GDSIDB will construct monthly series of statistics on sea ice based on GDSIDB data and submit them to the WMO Secretariat so that the WMO Secretariat can encourage the scientific community to use these data in climatological studies and reanalysis.
5.4 Within the new TT on MMS, the GDSIDB will collaborate with the ETMC on formats and sea ice climatic indices.

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Appendix XXIII – Report of the Expert Team on Marine Climatology

1. Team Background

1.1. The Expert Team on Marine Climatology[2] (ETMC) is the successor group to the former Commission on Marine Meteorology's (CMM) Subgroup on Marine Climatology (JCOMM 2000). ETMC was originally established by the First Session of JCOMM (WMO 2001), and re-established by JCOMM-II (JCOMM 2005) and most recently by JCOMM-III (Marrakech, Morocco, 4-11 November 2009).

1.2. The Team's First Session (ETMC-I) was held in Gdynia, Poland (JCOMM 2004), its Second Session (ETMC-II) in Geneva, Switzerland (JCOMM 2007b), and its Third Session (ETMC-III) recently (8-12 February 2010) in Melbourne, Australia (JCOMM 2010). Extensive background documentation for ETMC-III, plus presentations from the accompanying scientific and technical works, are available at the meeting website3, and the Appendix provides the Executive Summary from JCOMM (2010). ETMC falls within the JCOMM Data Management Programme Area (DMPA), with its work programme over the preceding JCOMM intersessional period (i.e. 2005-09) therefore guided in part by the Data Management Coordination Group (DMCG) (JCOMM 2007a, 2008a).

1.3. As resolved by JCOMM-III, the Terms of Reference (ToR) of ETMC were left essentially unchanged. Furthermore, while the Team's membership was reduced from 12 to (up to) eight regular members, four additional representatives have now been added: one each from the two Global Collecting Centres (GCCs), in Germany and the UK, and one each from the JCOMM Services and Forecasting Systems Programme Area's (SFSPA) Expert Teams on Wind Waves and Storm Surges (ETWS) and on Sea Ice (ETSI).

1.4. Since 2005, a website for the Team4 has been hosted by the US National Oceanic and Atmospheric Administration (NOAA) under the International Comprehensive Ocean-Atmosphere Data Set (ICOADS) web-portal. However, appropriate portions of that website are planned for migration in due course to reside under official JCOMM web hosting.

2. Intersessional Activities

2.1. As a major thrust of the intersessional work, ETMC and DMCG initiated modernization of the Marine Climatology Summaries Scheme (MCSS) (established in 1963) via two new task teams: on Delayed-mode Voluntary Observing Ship (VOS) data (TT-DMVOS), and on Marine-meteorological and Oceanographic Climatological Summaries (TT-MOCS).

2.2. TT-DMVOS5 started its operations as from April 2007 with membership from both the JCOMM Observations Programme Area (OPA) and DMPA, focusing primarily on modernizing the management and quality control (QC) of delayed-mode VOS data, while exploring possible connections with Global Telecommunication System (GTS) and other ship-based data.

2.3. TT-MOCS6 is still at an early stage of development, but has discussed options for modernizing the content, format and dissemination methods for MCSS data and products to include respectively, satellite data, Geographical Information System (GIS) compatibility, and Internet-based web services.

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[2] : http://www.jcomm.info/etmc-tor
[3] : http://www.jcomm.info/etmc3
[4] : http://icoads.noaa.gov/etmc/
[5] : http://www.jcomm.info/tt-dmvos
[6] : http://www.jcomm.info/tt-mocs

2.4. A joint TT-DMVOS/TT-MOCS planning meeting was held in Gdynia, Poland, 10 May 2008; and a follow-up TT-DMVOS meeting was held in Venice, Italy, 22 September 2009 (in conjunction with the OceanObs'09 conference). For TT-DMVOS, a number of detailed new proposals are being developed for enhancing data flow, including refining and optimizing the roles of the GCCs (see Woodruff et al. 2010 for a brief summary, and the JCOMM website[7] for additional details). For TT-MOCS, it was agreed that the limited near-term focus would be on climatologies, and some preliminary work was done to engage science partners.

2.5. In conjunction with the MCSS modernization, a fairly extensive set of modifications and extensions (including extensive work to upgrade the documentation) was proposed for the International Maritime Meteorological Tape (IMMT) format, together with a smaller set of modifications for the Minimum Quality Control Standard (MQCS). The IMMT changes included clarifying the coding procedure for source of observation (elem. 40) and observation platform (elem. 41), and including space for an International Maritime Organization (IMO) number (unique for most VOS) at the end of each record. MQCS changes included increasing the limit of the maximum height of deck cargo above summer maximum load line (elem. 90) to 40 metres in order to allow for the latest generation of larger cargo vessels being built. Subsequently, these changes were adopted by JCOMM-III (Rec. 12/1), such that the new versions (IMMT-IV and MQCS-VI) are to be implemented generally for all data collected as from 1 January 2011.

2.6. As an important consideration related to the TT-DMVOS component of the MCSS modernization, ICOADS has implemented the widely used International Maritime Meteorological Archive (IMMA) format (Woodruff 2007). Similarly, related to the TT-MOCS component, ICOADS already maintains a variety of extensive monthly summary products (plus some QC climatologies), which furthermore are proposed to feed into the WMO Integrated Observing System (WIGOS) Pilot Project for JCOMM. The second TT-DMVOS meeting (22 Sept. 2009) discussed possibilities for convergence with ICOADS as part of the modernization, including greater interoperability in terms of formats (e.g. initially to introduce quarterly output by the GCCs of IMMA as a format option, in addition to IMMT), and in the development of a proposed Higher Quality Control Standard (HQCS).

2.7. ETMC lead organization of the Third JCOMM Workshop on Advances in Marine Climatology (CLIMAR-III, Gdynia, Poland, May 2008), with 69 participants from 19 countries representing all but one WMO Regional Association (JCOMM 2008b, Charpentier et al. 2008). That workshop recommended continuing two alternating workshop series: (1) "Advances in the Use of Historical Marine Climate Data" (Kent et al. 2007a), with a third such "MARCDAT" workshop around 2010; and (2) a fourth CLIMAR in that separate workshop series around 2012. In 2007, the CLIMAR-II special issue (Gulev 2005) was finalized as a revised (from WMO 2003) Dynamic Part of WMO (1994), and the *International Journal of Climatology* (of the Royal Meteorological Society) is publishing a second revision based on CLIMAR-III papers.

2.8. With support from the NOAA Climate Database Modernization Program (CDMP), imaging and digitization of VOS platform and instrumental metadata (WMO 1955, Pub. 47) was completed back to 1955, together with imaging of 1973-93 volumes (Kent et al. 2007b). In view of ongoing delays, WMO has been urged to allocate sufficient resources to the development and maintenance of Pub. 47.

2.9. The Ocean Data Acquisition System (ODAS) Metadata Service (ODASMS), operated by Chinese National Marine Data and Information Service (NMDIS), continued to develop its meta-database and website. ETMC-II recommended (with subsequent approval by JCOMM-III) that Service take over metadata formerly managed in the *On-line Information Service*

[7] : http://www.jcomm.info/MCSS-mod

Bulletin on Non-drifting ODAS operated by Integrated Science Data Management (formerly MEDS) of Canada.

2.10. Noting longstanding unresolved metadata issues, ETMC-II further recommended that for "rigs and platforms, manual observing systems should be treated as a 'ship' and their metadata included in Pub. 47; automated systems onboard rigs and platforms should be treated as a 'buoy' and their metadata included in the ODASMS." While the Ship Observations Team (SOT) later suggested excluding non-ship data types from Pub. 47, a coordinated strategy still needs to be devised for the preservation and archival of metadata associated with ocean rigs and platforms, and to determine the appropriate roles in this regard of WMO-No. 47 versus ODASMS (as well as other emerging international metadata activities, including JCOMMOPS and the "Meta-T" project).

2.11. ETMC-II recommended, and DMCG-III endorsed with a few caveats, both the general recommendation that work be undertaken to carefully validate the Binary Universal Form for the Representation of meteorological data (BUFR) and other Table Driven Codes (TDCs), so as to ensure that originally reported data are completely and accurately preserved; and a set of more detailed suggested requirements for continuing consideration (JCOMM 2007b). Since then, DMPA established a cross-cutting task team (TT-TDC[8]) to coordinate the development and evolution of the use of TDCs within JCOMM, and their implementation with the WMO Commission on Basic Systems (CBS).

2.12. ETMC-II discussed differences among VOS (and buoy) data sent on the GTS from different operational centres, apparently because of QC, storage, or archival decisions. To help improve and validate the data collection process, ETMC-II recommended a detailed intercomparison, which has been entirely focused on December 2007 ship data (available results to be discussed at this meeting).

2.13. DMCG-III requested an overview report on marine QC issues, focused on surface data reported by VOS and Research Vessels (R/Vs), to help initiate the process of standardizing QC (DMPA 2008). Possible broadened involvement has since been explored, but more work is needed to finalize the report for proposed submission to the IODE-JCOMM Standards process[9].

2.14. ETMC, DMPA, and ETWS cooperated to define and initiate an extreme wave events archive, which the US National Oceanographic Data Center (NODC) recently agreed to host. Work continues to identify events and provide initial data, and wider participation will be sought. Also, the potential for calculation of wave monthly summaries for the ICOADS remains under continuing discussion with ETWS.

2.15. ETMC and ETWS worked with the WMO Commission for Climatology (CCl) and the Climate Variability and Predictability (CLIVAR) program, through the CCl/CLIVAR/JCOMM Expert Team on Climate Change Detection and Indices. Potential new links with CCl were initially discussed at ETMC-II, where it was anticipated that TT-MOCS would form a useful point of interaction. An informal discussion during CLIMAR-III explored potential new links with CCl and future directions for marine climatology in the context of the WMO Strategic Plan. It was agreed that stronger links should eventually be established between JCOMM and CCl and synergies further developed. These could also include WIGOS, discovery and platform/instrument metadata, extreme events, integrated products, and capacity building.

2.16. ETMC-II discussed the status of historical data rescue, including the "Recovery of Logbooks And International Marine data" (RECLAIM[10]) project (Wilkinson et al. 2010; see also e.g. Brohan et al. 2009). ETMC continued work on other data and metadata

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[8] : http://www.jcomm.info/tdc
[9] : http://www.oceandatastandards.org/
[10] : http://icoads.noaa.gov/reclaim/

archaeology activities, including documenting the history of marine ship codes (e.g., WMO–No. 306, *Manual on Codes*). ETMC-II endorsed the decision to make available the Deutscher Wetterdienst (DWD) historical marine archive, in accordance with a recommendation from the GCOS AOPC/OOPC Working Group on Surface Pressure. High priority selections from the DWD archive were subsequently made available and blended into ICOADS Release 2.5 (Worley et al. 2010; Woodruff et al. 2010).

3. Discussion of Future Selected Priorities from JCOMM-III (ref. ETMC-III/Doc 2)

3.1. *Review the issue of reporting accuracy of GPS positions in coded reports and climate records (with SOT and TT-TDC)*: For "coded" data, this has a bearing on the development of improved BUFR templates for VOS and other data, as well as future improvements in the formats (IMMT and IMMA) used for VOS and other climate records. This also relates to a larger DMPA priority: *Endorse the upgrading of present BUFR encoding for marine variables to include instrument/platform metadata*.

3.2. *Continue to actively plan and implement the modernization of the MCSS (TT-DMVOS and TT-MOCS)*: These important modernization efforts are expected to continue to be a primary focus for ETMC. As part of the work, useful opportunities for interoperability, such as via the IMMA format and with ICOADS, should be fully explored in order to help achieve the goals of the modernization as quickly and efficiently as possible. As another important upcoming priority in the area of climatological product development and dissemination, the membership and work plans of TT-MOCS need to be updated and advanced as quickly as feasible.

3.3. *Continue to explore: making products more readily discoverable and accessible; and the integration of oceanographic and sea-ice climatologies together with marine meteorological information (TT-DMVOS and TT-MOCS)*: Improvements in product discoverability and accessibility will likely to rely on technological advances in the use of metadata (e.g. Snowden et al. 2010). Previously, JCOMM-II had also recommended that ETMC explore how oceanographic and ice climatologies could be coordinated with the marine meteorological data, so that the results could be viewed as an integrated product. That earlier guidance was considered in development of the ToR of TT-MOCS (however, as noted above the work of that task team now needs to be renewed).

3.4. *Devise a coordinated strategy for the preservation and archival of metadata associated with ocean rigs and platforms (with SOT, JCOMMOPS, and other interested groups)*: These offshore installations can provide high values of quality data; presently, however, they are not managed by JCOMM as an independent network. Other complications include how these metadata should be collected (e.g. E-SURFMAR currently acts as a temporary repository for Pub. 47 metadata); and that some mobile drilling rigs are ship-shaped and lend themselves more to the Pub. 47 format, whereas that format may be unsuitable for fixed platforms. JCOMM-III requested, since this issue was related other metadata activities that have also been under consideration by ETMC (e.g. Meta-T, ODASMS), that ETMC resolve discussion with the above-mentioned groups.

3.5. *Continue to contribute towards development of the extreme wave archive, and to evaluate the potential for calculation of wave monthly summaries for ICOADS (with ETWS and US NODC)*: While the initial concept for the extreme wave archive has been successfully established, together with its hosting at US NODC, much more work is needed to help populate the archive and eventually make products available. Moreover, preliminary comparisons of moored buoy for this purpose detected some US archive differences that will need to be resolved so as to identify genuine extreme events (and which will also be

indirectly beneficial to NOAA in harmonizing its permanent archives of the historical buoy data). The potential for calculating wave summaries for ICOADS has been under consideration for several years, but resource limitations and questions about the impacts of code changes within the historical VOS and other wave records have thus far slowed progress.

3.6. *Continuation of both successful workshop series with a MARCDAT-III around 2010-12, followed as appropriate in approximately two years by a CLIMAR-IV*: These two workshop series have proved to be a very successful focus for ETMC, with widely available published outcomes for example currently produced from CLIMAR via the *International Journal of Climatology* special issues. A variety of potential venues, and scheduling possibilities, for MARCDAT-III have already been discussed, but the timing of that next workshop may depend e.g. partly on the scheduling of JCOMM-IV.

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EXECUTIVE SUMMARY FROM: *THIRD SESSION OF THE JCOMM EXPERT TEAM ON MARINE CLIMATOLOGY, MELBOURNE AUSTRALIAN, 8-12 FEBRUARY 2010* DRAFT FINAL REPORT

The third meeting of the JCOMM Expert Team on Marine Climatology was held at the headquarters of the Australian Bureau of Meteorology (BOM), from 8 to 12 February 2010.

The main goals of the meeting were to review the status of the modernization of the Marine Climatological Summaries Scheme (MCSS), address guidance from the third session of JCOMM, Marrakech, Morocco, 4-11 November 2009, and advance the team work programme until the fourth session of JCOMM in 2012.

A scientific and technical workshop was organized during the first day and the morning of the second day of the session, and twenty-nine presentations made covering JCOMM aspects, contributions and requirements of the World Climate Research Programme (WCRP) and other climate related programmes, data and metadata issues including operational data flow and archaeology and archival aspects, marine meteorological and oceanographic climatological summaries, and data quality and exchange.

The meeting achieved consensus, and permitted to make substantial progress regarding a number of issues including in particular:

- A proposal to establish a pilot project to develop approaches for dissemination of bias adjustments and corrections alongside marine climate observations, and using presently available corrections to prove concept;
- A proposal to establish a pilot project on wave climate summaries;
- Thanks to the work of the cross cutting ETMC/SOT Task Team on Delayed Mode VOS Data (TT-DMVOS); substantial progress was made with regard to the definition of the data flow part of the modernization of the MCSS, including higher level quality control, and the use of co-located first guess field data from Numerical Weather Prediction (NWP), as well as satellite data;
- A strategy was proposed for addressing data preservability particularly in relation to the use of table driven codes;
- A proposal for the encoding of ship's identification for addressing the ship security issue in such a way as the marine climatology requirements are better addressed;

- A proposal to initiate a pilot study to investigate the current content of the Ocean Data Acquisition Systems (ODAS) Metadata Service (ODASMS) and the Water Temperature Metadata (META-T) servers in terms of metadata available from operational observing platforms;
- Solutions proposed for the management of rigs and platforms, and associated metadata;
- A proposal for establishing a network of mirrored WMO-IOC Centres for Marine-meteorological and Ocean Climatological Data (CMOC) where the International Comprehensive Ocean-Atmosphere Data Set (ICOADS) would be integrated;
- Proposed submission of a standard for the Quality Control of surface marine data to the JCOMM/IODE[11] standards process;
- Development of a template for documenting the requirements for long-term marine surface physical observations;
- Strengthening the links with the WMO Commission for Climatology (CCl) in particular regarding interoperability issues, marine indices and the monitoring of extremes events, data preservability, and data rescue, and contributions to the Global Framework for Climate Services (GFCS);
- Strengthening the cooperation with the satellite community, in particular for seeking the creation of match up satellite database;
- Compilation of catalogue of data available from Research Vessels;
- Strategy for improving the extreme wave database, and considerations for climatologies of storm surges, and sea-ice;
- Plans for the modernization of the Marine Climatological Summaries (MCS) part of the MCSS through the work of the ETMC Task Team on Marine Meteorological and Oceanographic Climatological Summaries (TT-MOCS);
- Plans for organizing a third International Workshop on Advances in the Use of Historical Marine Climate Data (MARCDAT) tentatively in Italy in the end of 2010 or early 2011 and in close relationship with the satellite community;

Plans for organizing a fourth JCOMM Workshop on Advances in Marine

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[11] : IODE : International Oceanographic Data and Information Exchange (of IOC)

Appendix XXIV - ACRONYMS AND OTHER ABBREVIATIONS

AARI	Arctic and Antarctic Research Institute
ACIA	Arctic Climate Impact Assessment
ACSYS	Arctic Climate System Study
AIRSS	Arctic Sea Ice Regime Shipping System
AIS	Automatic Information Systems
AMSA	Arctic Marine Shipping Assessment
AMSP	Arctic Marine Strategic Plan
AMSR	Advanced Microwave Scanning Radiometer (EOS)
AOPC	Atmospheric Observation Panel on Climate
APL	UW Applied Physics Laboratory
ARCTIC-HYDRA	The Arctic Hydrological Cycle Monitoring, Modelling and Assessment Program
ASPeCT	Antarctic Sea Ice Process & Climate
ATCM	Antarctic Treaty Consultative Meeting
BAS	British Antarctic Survey
BSH	Bundesamt für Seeschiffahrt und Hydrographie (Germany)
BSIM	Baltic Sea Ice Meeting
BUFR	Binary Universal Form for the Representation of Meteorological Data
CAS	Commission for Atmospheric Sciences
CASO	Climate of Antarctica and the Southern Ocean
CB	Capacity Building
CBS	Commission for Basic Systems (WMO)
CCl	Commission for Climatology
CEOS	Committee on Earth Observation Satellites
CDMP	US NOAA Climate Database Modernization Program
CG	Correspondence Group
CGOS	Global Climate Observing System
CHRIS	Committee on Hydrographic Requirements for Information Systems (IHO)
CHy	Commission for Hydrology (WMO)
CIS	Canadian Ice Service
CLIC	Climate and Cryosphere project
CLIVAR	Climate Variability and Predictability (WCRP)
CMM	Commission for Marine Meteorology (WMO)
COADS	Comprehensive Ocean Atmosphere Data Set
COMNAP	Council of Managers of National Antarctic Programs
COMPASS	Comprehensive Meteorological dataset of active IPY Antarctic measurement phase for Scientific and applied Studies
COMSAR	Sub-Committee on Radio-communications, Search, and Rescue (IMO)
CPRNW	Commission on the Promulgation of Radio Navigational Warnings (IHO)
CRYOS	Cryosphere Observing System
CSA	Canadian Space Agency
C&SMWG	Colours and Symbols Maintenance Working Group (IHO)
DBCP	Data Buoy Cooperation Panel
DMI	Danish Meteorological Institute
DMPA	Data Management Programme Area (JCOMM)
DMVOS	Deployed-Mode VOS
DPM	Disaster Prevention and Mitigation Programme (WMO)
DSMP	Defense Meteorological Satellite Program (USA)
EASE	Equal-Area Scalable Earth
EC	WMO Executive Council
ECDIS	Electronic Chart Display Information System
ECIMO	Russian Unified System of Information on World Ocean Conditions
ECS	Electronic Navigation System
ECV	Essential Climate Variable

EGOS	Evolution of the Global Observing 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
ETMAES	Expert Team on Marine Accident Emergency Support (JCOMM)
ETMC	Expert Team on Marine Climatology (JCOMM)
ETMSS	Expert Team on Maritime Safety Services (JCOMM)
ETSI	Expert Team on Sea Ice (JCOMM)
ETWS	Expert Team on Wind Waves and Storm Surges (JCOMM)
EU	European Union
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
EWG	Environmental Working Group
FIMR	Finnish Institute of Marine Research
GCMP	GCOS Climate Monitoring Principles
GCOS	Global Climate Observing System
GDSIDB	Global Digital Sea Ice Data Bank
GEO	Group on Earth Observation
GEOSS	Global Earth Observation System of Systems
GIS	Geographic Information System
GMDSS	Global Maritime Distress and Safety System
GMES	Global Monitoring of Environment and Security Programme
GML	Geography Markup Language
GODAE	Global Ocean Data Assimilation Experiment
GOOS	Global Ocean Observing System
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
ICOADS	International Comprehensive Ocean-Atmosphere Data Set
ICS	International Chamber of Shipping
ICSU	International Council for Science
IEC	International Electro-technical Commission
IGOS	Integrated Global Observing Strategy
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
LDC	Least Developed Countries
MACICE	Manual of Standards Procedures for Observing and Reporting Ice Conditions (Canada)
MAES	Marine Accident Emergency Support
MAN	Management Committee (JCOMM)
MCSS	Marine Climatological Summaries Scheme
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
MySQL	Structured Query Language
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
OPA	Observations Programme Area
OPAG	Open Programme Area Group
OSL	Russian Otto Schmidt Laboratory
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
PSC	Polar Science Center (USA)
QC	Quality Control
QMFO	Qingdao Marine Forecasting Observatory
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
SCDPM	IPY Sub-Committee on Data Policy and Management
SCOBS	IPY Sub-Committee on Observations
SCG	Services Programme Area (SPA) Coordination Group (JCOMM)
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
SHN	Naval Hydrographic Service (Argentina)
SIMS	Sea Ice Mapping System
SMARA	Argentine Navy Meteorological Service
SMHI	Swedish Meteorological and Hydrological Institute
SMN	Argentine National Meteorological Service
SOA	State Ocean Administration (China)
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
USIABP	US Interagency Arctic Buoy Programme
UW	University of Washington (USA)
VOS	Voluntary Observing Ship
WCP	World Climate Programme (WMO)
WCRP	World Climate Research Programme
WG	Working Group
WGAM	Working Group on Antarctic Meteorology
WIS	WMO Information System
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experimentation
WS	Wind Waves and Storm Surges
WWNWS	Worldwide Navigational Warning Service (IHO/IMO)
WWW	World Weather Watch (WMO)
XML	Extensible Markup Language