IICWG Presentation to the WMO EC Panel of Experts on Polar Observations, Research and Services (PORS)

John Falkingham, IICWG Secretariat
September 2009

Introduction

The International Ice Charting Working Group (IICWG) is a working group of national ice services responsible for the provision of information about sea ice and iceberg conditions to support marine navigation. The IICWG was formed in 1999 and has met annually since then. To date, ten ice services have signed the IICWG Charter including, including those from Canada, Finland, Germany, Greenland (Denmark), Iceland, Norway, Russia, Sweden and the United States, as well as the International Ice Patrol. Ice services from several other countries including Australia, China, Japan, Latvia and Lithuania, as well as the British Antarctic Survey and the private ice service of AGIP KCO, have participated in the IICWG on an occasional basis. As an ad-hoc body, the IICWG serves to advise the JCOMM Expert Team on Sea Ice (ETSI) and provide more frequent coordination and action than is possible for the ETSI. There is substantial overlap in the membership of the IICWG and that of the ETSI. Participants in the IICWG come together at their own expense out of mutual interest. The U.S. National Snow and Ice Data Center hosts a website for the IICWG at http://nsidc.org/noaa/iicwg/ where the Charter, Terms of Reference, meeting records and various reports can be found.

In addition to the ice services, many other organizations and individuals participate in the IICWG meetings including academics, national space agencies and users of ice information services. The IICWG attempts to focus on matters of practical concern to the ice services while maintaining an awareness of the scientific basis of their activities. In the interest of improving the safety of navigation in icy waters, the IICWG encourages an open sharing of information and technology.

This overview paper has drawn extensively from two publications of the IICWG:

- Ice Information Services: Socio-Economic Benefits and Earth Observations Requirements – 2007 Update; available at http://nsidc.org/noaa/iicwg/.
- Ice Service Requirements Questionnaire – Summary Report; 2009; in preparation.

Users of Ice Information

Ice information is required by a wide spectrum of users operating in ice-affected regions over a wide range of latitudes:

- Marine transportation operators and regulators
- Meteorological organizations
- Marine security agencies
- Search and rescue organizations

- Resource developers
- Policy-makers in Circumpolar nations
- Marine Engineers
- Residents in ice-affected regions

Requirements for Ice Information

A wide variety of user requirement inventories for ice information have been developed to support different benefit areas. The key features of ice user requirements are:

- The ice parameters to be measured
- The spatial scale of the observations
- The frequency of the observation

In addition, the time between an observation and the delivery of a useful information product to the user is an important characteristic, particularly for operational users. The Near-Real-Time (NRT) requirement of these users has significant implications for the revisit capabilities of observation systems, and the speed and robustness of the reception, processing, and delivery infrastructure.

Another significant group consists of users that require access to an archive of imagery, observations, and derived ice products. There is a wide range of applications for time series of consistent, objective sea ice measurements - from calculating ice statistics for defining the best location and design of a wharf, to large-scale global change climate studies.

Table 1 summarizes the observational requirements for three key user areas:

- Near-Real-Time Marine Operations
- Regional Numerical Weather Forecasting
- Climate Monitoring and Science

Ice Information Services

IICWG members largely concentrate on the production of near-real-time ice information products to meet the requirements of their users, with non-real-time climatological products being produced as a secondary activity in many cases. In a recent survey to which ten ice services responded, all reported operating a *routine* service requiring regular monitoring to produce ice analyses daily to weekly. Eight of the ten reported that they provide a *real-time* service requiring repetitive observations over small areas to directly support shipping activity in the vicinity of ice. Products to support these services include ice charts, bulletins, images and weather maps. The analyses of archived ice observations are used to create non-real-time products such as climatological atlases of ice conditions, statistics on the presence of ice and the occurrence of extreme ice events, and the long-term record of changing ice conditions.

Ice products are created by combining data from satellites, aerial and shipboard observations, and in-situ sensors, using computer models and expert analysis. The different data sources each have their advantages and disadvantages. Information from vessels and weather stations is specific, but sparse. Visual and airborne radar surveys are detailed, but expensive, provide only

limited coverage, and are frequently restricted by adverse weather conditions. Satellites, while not as detailed or specific as other sources, provide the best means of observing large areas in remote and hostile conditions and are the main source of observations. In the recent survey, nine ice services reported using a total of over 16,000 satellite images per month. The breakdown of these data by satellite sensor is shown in Table 2.

Collaborative Activities of the IICWG

In addition to sharing information and coordinating their individual activities, the members of the IICWG have undertaken a number of activities in concert. Most notable among these has been their representations to the European and Canadian Space Agencies which has helped to secure the continuation of Synthetic Aperture Radar satellite missions that are essential for ice monitoring.

For the International Polar Year, the IICWG, with the support of the ETSI, established and operated an Ice Logistics Portal. This portal is a public website where ice charts from all of the participating services can be obtained in one convenient location at http://ipy-ice-portal.com. With IPY concluding, the future of the portal is currently under discussion in the IICWG.

The IICWG has also been active, again in concert with the ETSI, in developing and promoting standards for the incorporation of ice information into Electronic Navigation Chart Systems. A number of pilot projects have been conducted to produce and distribute ice information in S-57 format to users with ENC Systems.

The IICWG member provided active participation in Ice Analyst Workshops in 2008 and 2009. The Workshops have been beneficial in sharing best practices among ice analysts from several countries and have laid the foundation to develop more universal analysis standards to ease the intercomparison of ice charts.

Conclusion

The IICWG includes all of the major ice information service providers in the world. It has been effective in sharing information among its members, in coordinating practices and in developing harmonized statements of requirements for satellite data suppliers.

The IICWG believes it can contribute significantly and looks forward to working with the EC Panel of Experts on PORS.

Further contact with the IICWG can be made through the Secretariat, John Falkingham at John.Falkingham@rogers.com.

Table 1: OBSERVATIONAL REQUIREMENTS FOR KEY ICE FEATURES

OPTIMUM FUTURE VALUE (*CURRENT THRESHOLD VALUE*)

Parameters	Marine Operations	Weather Forecasting Regional NWP	Climate Monitoring and Science
Ice Extent – relative edge location Ice Edge Location - absolute	- ± 50m-100m *(750m)*	5km *(50km)* -	15km *(50km)* -
Ice Concentration Accuracy Ice Concentration Range	±10% *(±20%)* 5% - 100%	5% *(50%)* 5% - 100%	5% *(50%)* 5% - 100%
Ice Stage of Development - probability of correct ice typing Ice Stage of Development Ice Thickness	90% *(70%)* Distinguish new, young, first-year and multi-year ice 10cm *(20cm-50cm)*	- - 50cm *(100cm)*	- - 50cm *(100cm)*
Fast Ice Boundary Forms of Floating Ice - floe diameter	Same as for ice edge 10m *(50m-100m)*	Same as for ice edge -	Same as for ice edge -
Leads/Polynas	25m width *(250m)*	-	1% of ice area *(10%)*
State of Decay - % area of meltponds	10% *(50%)*	10% *(-)*	5% *(25%)*
Sea Ice Topography - ridge height	1m *(2m)*	2m *(-)*	-
Ice Motion Accuracy Ice Motion Range	± 1km/day 0-50 km/day	-	± 1km/day 0-50 km/day
Icebergs – max. waterline dimension	25m *(-)*	-	-
River Ice Extent – relative edge location River Ice Edge Location Accuracy - absolute	3m-10m 3m *(10m)*	- -	- -
River Ice Concentration Accuracy River Ice Concentration Range	5% *(20%)* 5% -100%	- -	- -
Timeliness	< 1 hr *(3-6 hr)*	< 1 hr *(3-6 hr*)	-
Sampling Frequency	24 hr *(48 hr)*	1 day *(7 days)*	3 days *(7-30 days)*
Geographic Coverage	North of 30° north and south of 45° south	North of 30° north and south of 45° south	North of 30° north and south of 45° south

Table 2: VOLUMES OF SATELLITE IMAGES USED FOR ICE MONITORING

Type of Satellite Imagery	# Services Using	Number of Images/Month
NOAA AVHRR	9	10900
NOAA QuikSCAT	4	152
NOAA GOES	1	540
NASA MODIS	8	993
NASA AMSR-E	3	122
JMA MTSAT	1	300
CSA RADARSAT-1 & -2	7	805
ESA ENVISAT ASAR	7	235
ESA ERS-2	1	300
ESA ENVISAT GMM	2	122
DMSP SSM/I	6	390
DMSP OLS	1	1140
JAXA ALOS	1	300
TOTALS		**16299**