



International Ice Charting Working Group

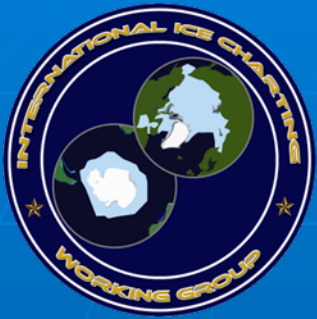
<http://nsidc.org/noaa/iicwg/>

Peter S. Rasch

Director, Collaboration & Innovation, Danish Meteorological Institute

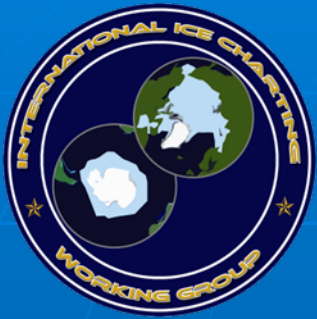
IICWG Co-Chair

PAME II, 16 September 2015



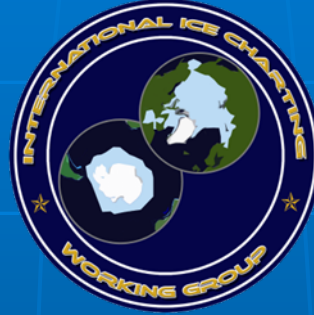
IICWG Charter

"Recognizing the ongoing interest of the national influenced by ice covered waters in the use and protection of those water; and further recognizing the value and economics of cooperative activities in operational ice services supporting maritime navigation; the ice charting services of the world formed the International Ice Charting Working Group ... to provide a forum for coordination of ice matters, including icebergs, and offers non-binding recommendations to senior management as appropriate."

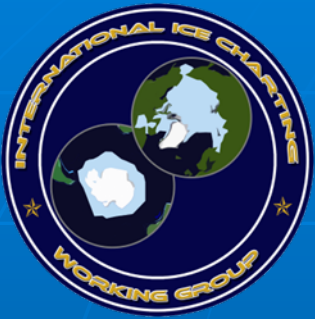


Outline

- Current state of ice charting and forecasting in the Arctic
- Contributing to implementation of the AMSA Report recommendations
- Areas of PAME IICWG cooperation

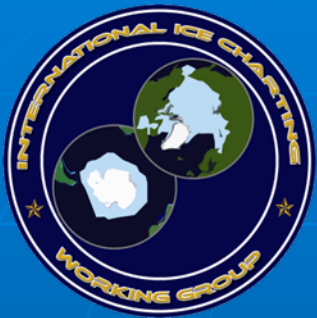


Current State of Ice Analysis and Forecasting



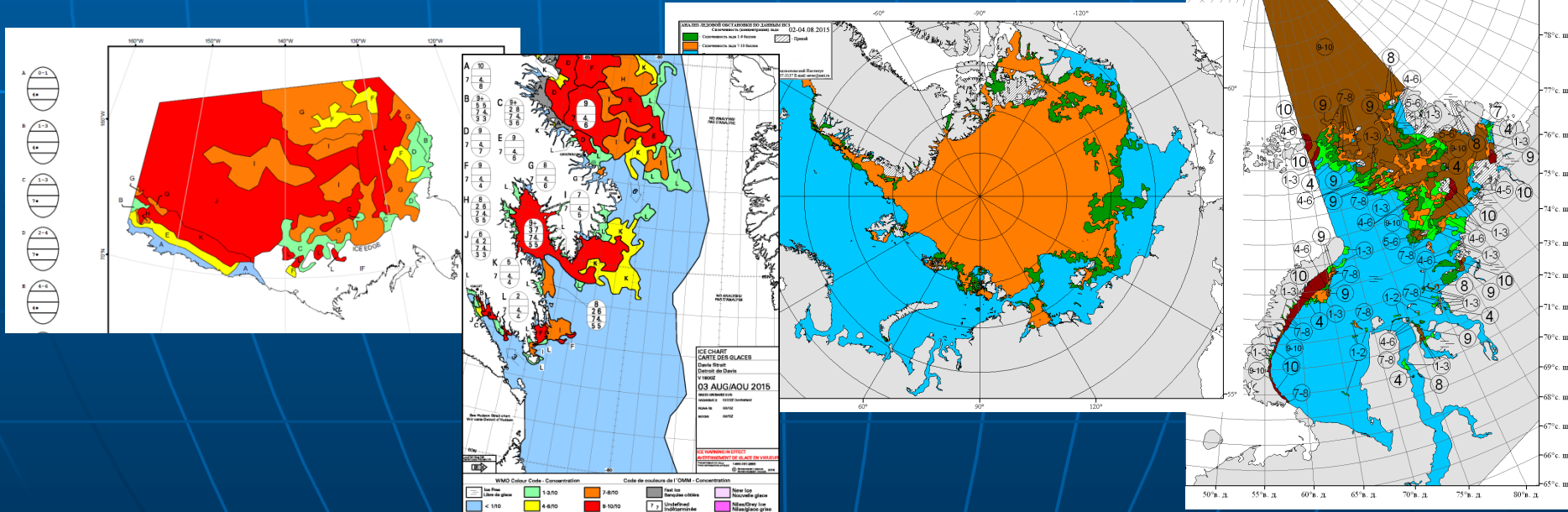
Ice Analysis and Forecasting

- Arctic and sub-Arctic seas that are encumbered by ice are relatively well provided with ice information ...
 - Canadian Ice Service
 - Danish Meteorological Institute (Greenland)
 - Norwegian Ice Service
 - Arctic and Antarctic Research Institute (Russia)
 - U.S. National Ice Center
- ... In areas where there is regular ship traffic
- ... During historically normal shipping seasons



Ice Charts

- Weekly or bi-weekly for strategic planning and climatology
 - Usually year-round
- Daily or more frequently for ship routing and tactical passage planning
 - During shipping season
- Standardized terminology and symbology





Text Bulletins & Long Range Forecasts

- Daily text bulletins describing ice conditions distributed via NAVTEX and GMDSS
- Seasonal Outlooks giving predictions of the evolution of the ice distribution in a region over the whole summer season

FICN14 CWIS 041346 Ice forecasts for the Western and Central Arctic issued by Environment Canada at 10:00 a.m. EDT Tuesday 4 August 2015 for today tonight and Wednesday.
The next scheduled forecasts will be issued at 10:00 a.m. Wednesday.

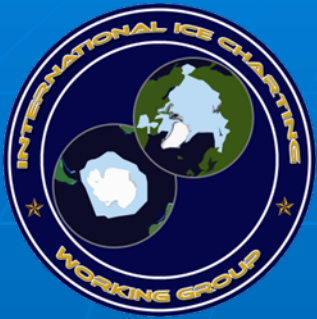
Ice edge is outside the forecast region.

Prince Alfred. 1 tenth of first-year ice including a trace of old ice except 8 tenths of old ice in the northern and western sections.

Prince of Wales. Open water except 6 tenths of old ice in the northern section.

Yukon Coast. Open water except 1 tenth of first-year ice in the extreme western section.

Mackenzie. Open water except 4 tenths of old ice in the northern section.



Satellite Images

- Visual / infrared
- Synthetic Aperture Radar
- Passive Microwave



MODIS Composite
Composé MODIS

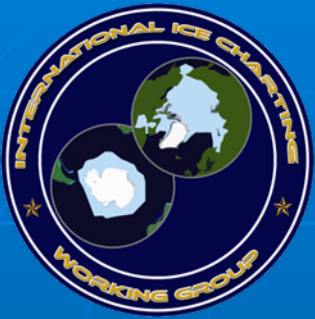
Jul 21-27, 2015
21-27 Jui, 2015

Canadian Ice Service
Service canadien des glaces

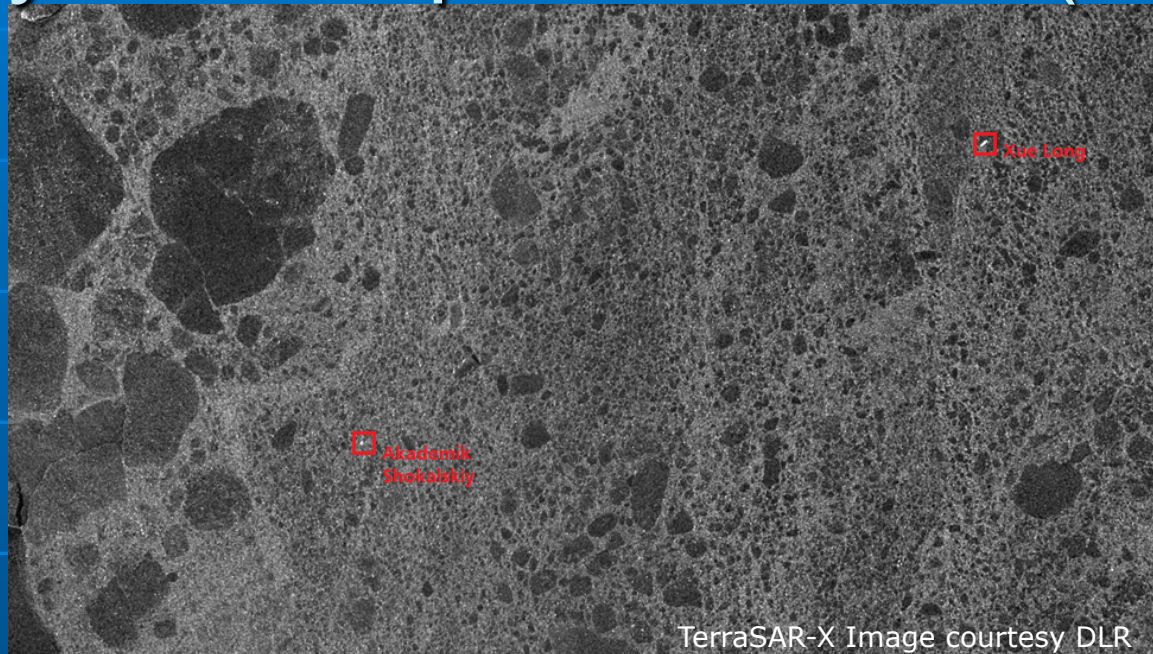
Environment Canada
Environnement Canada

www.ice-glaces.ec.gc.ca

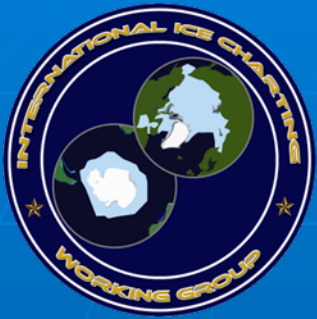
The data were acquired from
Les données ont été obtenues par
"Goddard Space Flight Center, NASA"



Synthetic Aperture Radar (SAR)



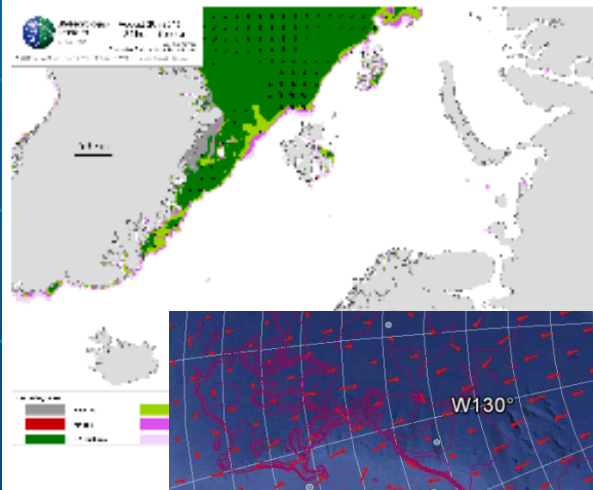
- Satellite SAR is the workhorse observation platform for ice services
 - Provides reliable, high resolution observation of the ocean surface, in all weather and light conditions
- IICWG has been successful in maintaining a long term commitment to SAR from the space agencies
 - Radarsat, ERS, Radarsat-2, Sentinel-1, Radarsat Constellation Mission, TerraSAR, ALOS



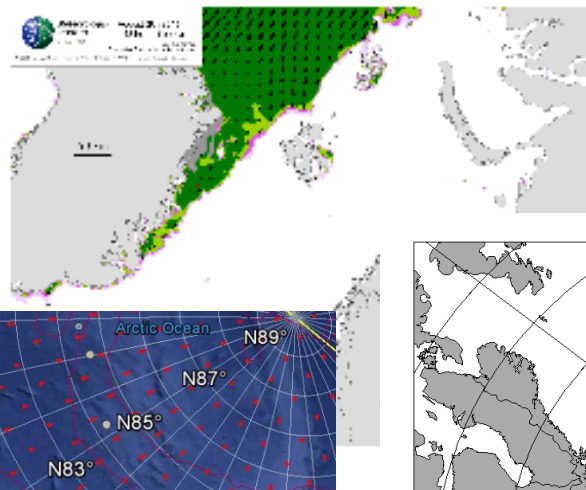
Short Range Ice Forecast Charts

- Drift, concentration, thickness and other ice characteristics

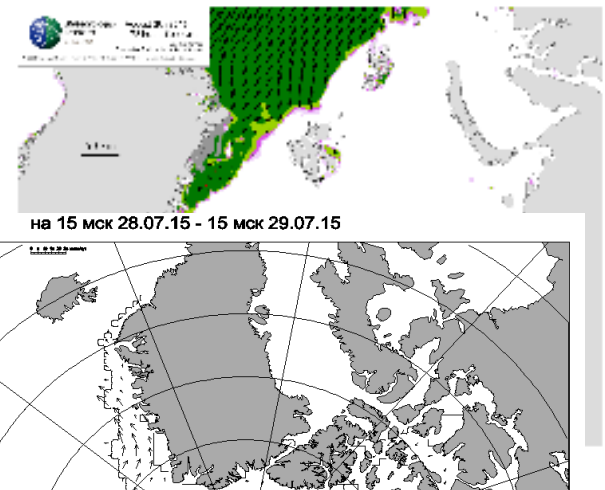
Forecast +24



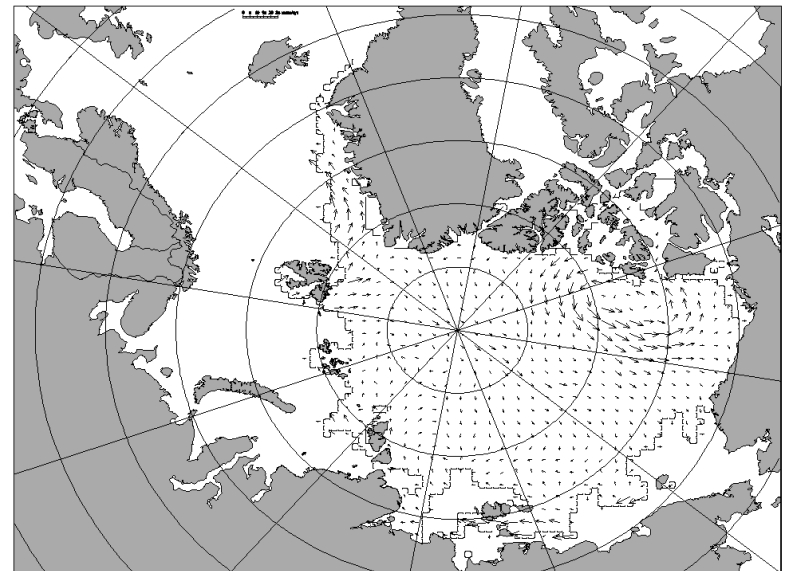
Forecast +48

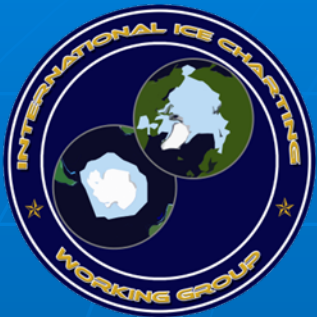


Forecast +72

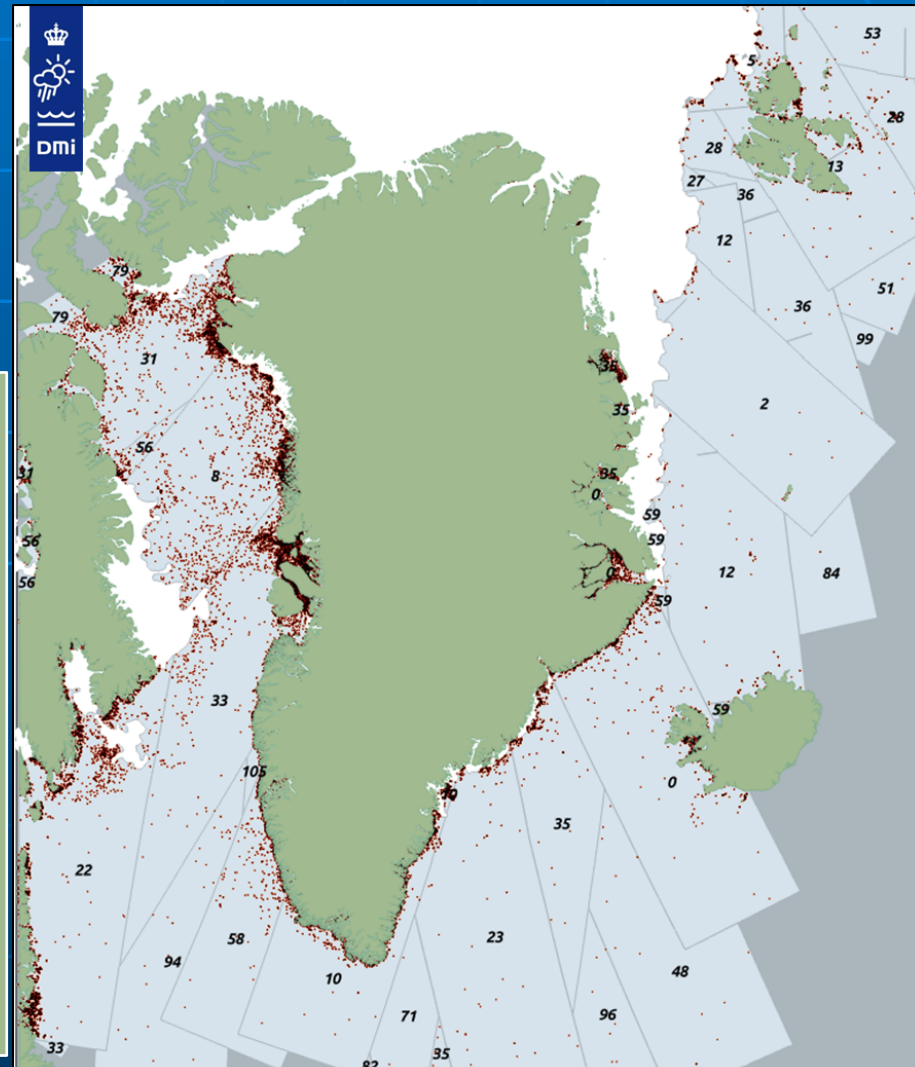
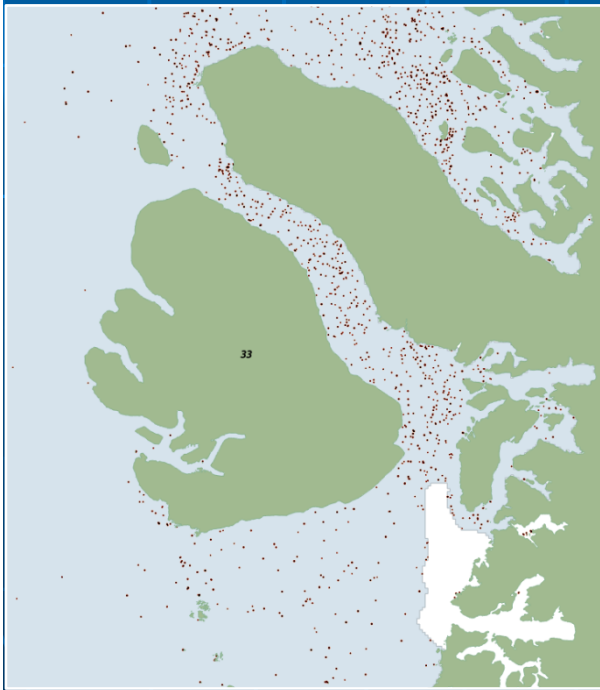
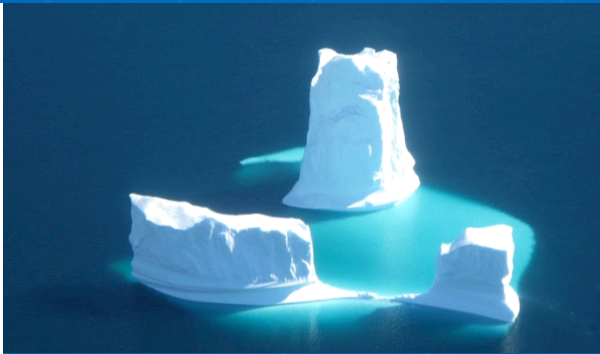
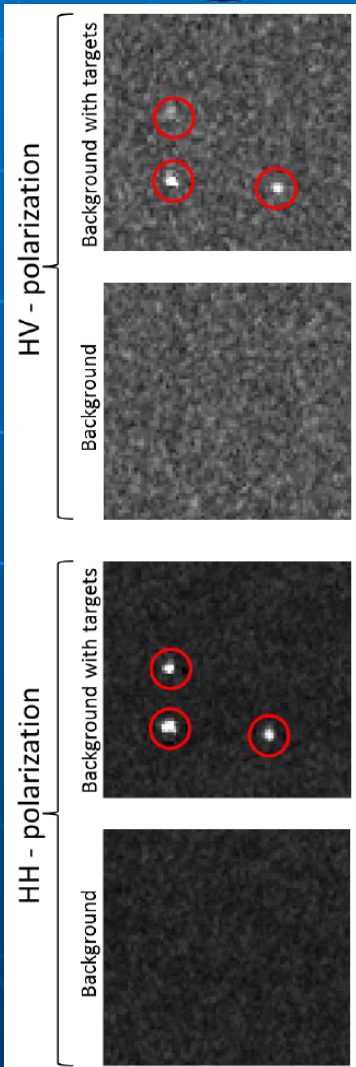


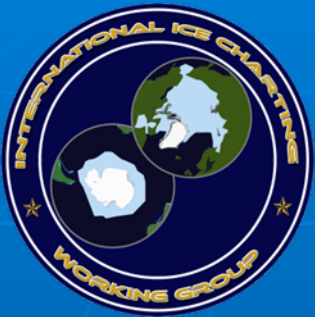
Ha 15 мск 28.07.15 - 15 мск 29.07.15





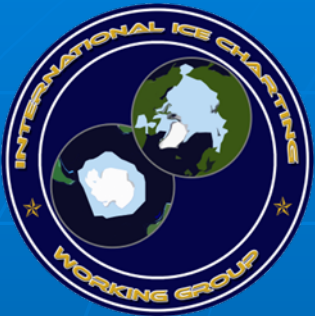
Ice-berg detection





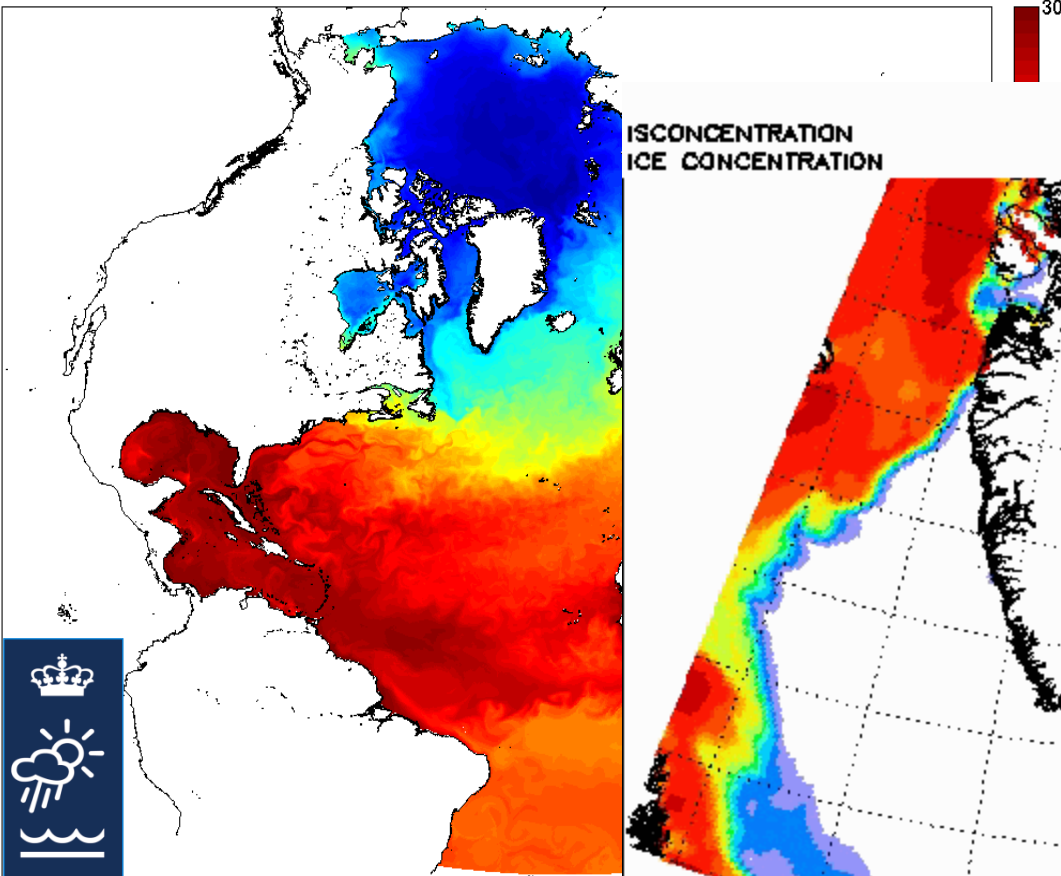
Ice Modelling – Forecasting ?

- Most Numerical Weather Prediction centres operate coupled ocean-atmosphere models that include sea ice with a coarse resolution
 - Initialized with Passive Microwave Satellite data – 10 km
- While most national ice services run higher resolution numerical models to support operational ice forecasts, the reliability is inferior to that of numerical weather models
 - Major challenges are with model initialization and inaccuracies of NWP in the polar regions
 - Prime research focus has been on assimilation of high resolution satellite data to improve model initialization
- IICWG Sub-Group on Data Assimilation and Modelling has held 6 workshops – most recently in October 2014
 - Broad representation from national ice services, universities and research institutes
 - Recognized challenge is getting meaningful critique from operational users to improve useability of model results



Operational use of models

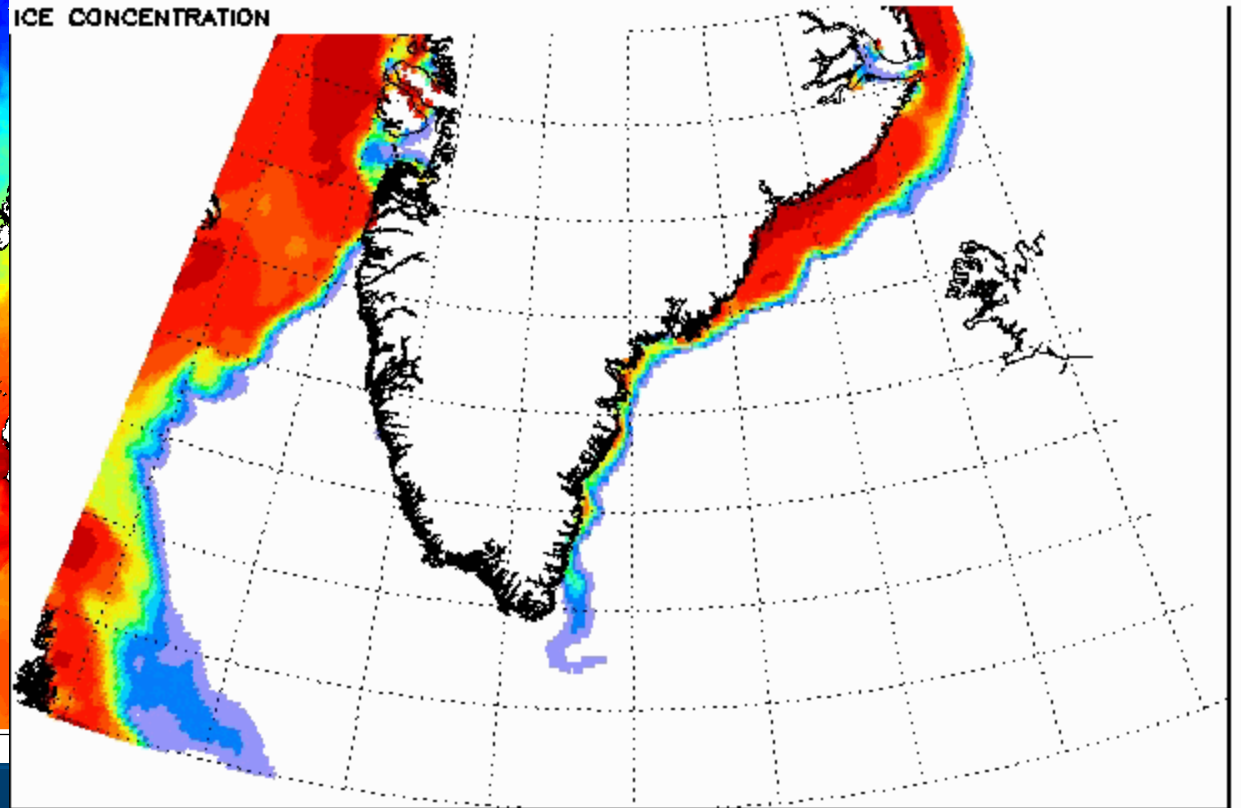
Sea surface temperature (degrees Celsius) for 10-Sep-2010 23:00:00



- Operational 5 day forecast – twice daily – 1km, 10km resolution

ISCONCENTRATION
ICE CONCENTRATION

2014 FEB 09 12GMT





Limitations

■ Seasonal

- As the summer shipping season becomes longer, ice services are being stressed to maintain their levels of service over longer periods of time

■ Geographic

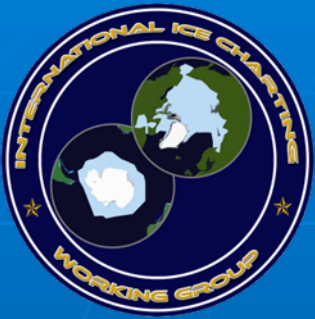
- vessels are travelling into areas beyond the boundaries of regular ice information
 - Further stressing resources
 - Extending beyond areas of historical knowledge

■ Knowledge of the Arctic Environment

- Forecast accuracy limited by inaccurate weather forecasts and a lack of knowledge of oceanographic conditions
 - Atmospheric and oceanographic observations are extremely sparse



IICWG Contributions to Implementing AMSA Recommendations



Recommendation I(A) re: Arctic METAREAs

- IICWG Workshop developed protocols to coordinate content, production and distribution of GMDSS ice bulletins
 - Canada, Norway, Russia responsible issuing services
 - U.S., Denmark participating production services
 - Minimum content is ice edge position to a standard degree of resolution
 - First step in anticipation of a larger volume of ship traffic in future

ICE AT 041200UTC

YERMAK PLATEAU-LITKE TROUGH-BANKS
N NORDAUSTLANDET
ICE N TO 8043N 00634E, 8101N 00923E,
8121N 01303E,
8103N 01805E, 8054N 02004E, 8025N
02021E.

A5-A4

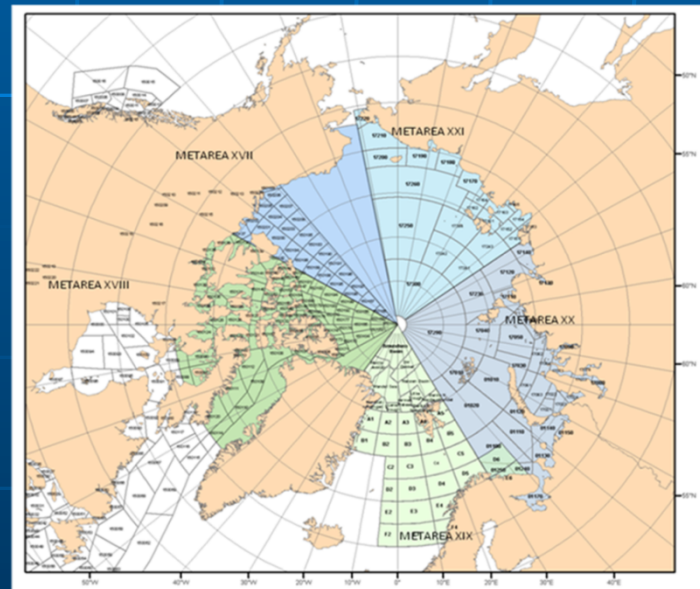
ICE E TO 7941N 02031E, 7941N 02000E,
7942N 01831E,
7922N 01914E, 7911N 01919E.

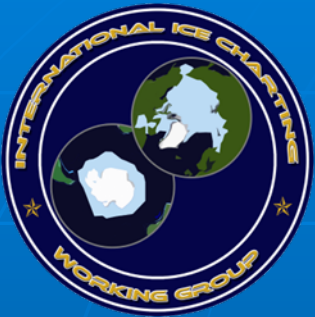
A5

ICE E TO 7838N 02104E, 7835N 02107E.

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ICE E TO 7815N 02207E, 7812N 02220E.





Recommendation I(B) re: IMO Polar Code

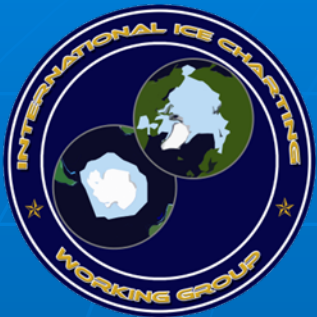
- IICWG Task Group contributed to development of ice information and ice navigator training requirements of the mandatory Polar Code
- IICWG is contributing to the development of the "POLARIS" ice regime system as a risk reduction tool for ships operating in Polar waters

Increasing ice thickness
(severity)

		WINTER RISK VALUES (RVs)											
POLAR SHIP CATEGORY	ICE CLASS	ICE FREE	NEW ICE	GREY ICE	GREY WHITE ICE	THIN FIRST YEAR 1ST STAGE	THIN FIRST YEAR 2ND STAGE	MEDIUM FIRST YEAR 1ST STAGE	MEDIUM FIRST YEAR 2ND STAGE	THICK FIRST YEAR	SECOND YEAR	LIGHT MULTI YEAR	HEAVY MULTI YEAR
		-	0-10 cm	10-15 cm	15-30 cm	30-50 cm	50-70 cm	70-95 cm	95-120 cm	120-200 cm	200-250 cm	250-300 cm	300+ cm
A	PC 1	3	3	3	3	2	2	2	2	2	2	1	1
	PC 2	3	3	3	3	2	2	2	2	2	1	1	0
	PC 3	3	3	3	3	2	2	2	2	2	1	0	-1
	PC 4	3	3	3	3	2	2	2	2	1	0	-1	-2
	PC 5	3	3	3	3	2	2	2	1	0	-1	-2	-2
B	PC 6	3	2	2	2	2	1	0	0	-1	-2	-3	-3
	PC 7	3	2	2	2	1	1	0	0	-2	-3	-3	-3
C	IA Super	3	2	2	2	2	1	0	0	-2	-3	-4	-4
	1A	3	2	2	2	1	0	-1	-1	-3	-4	-4	-4
	1B	3	2	2	1	0	-1	-2	-3	-3	-4	-5	-5
	1C	3	2	1	0	-1	-2	-2	-3	-4	-4	-5	-6
	NO ICE CLASS	3	1	0	-1	-2	-2	-3	-3	-4	-5	-6	-6

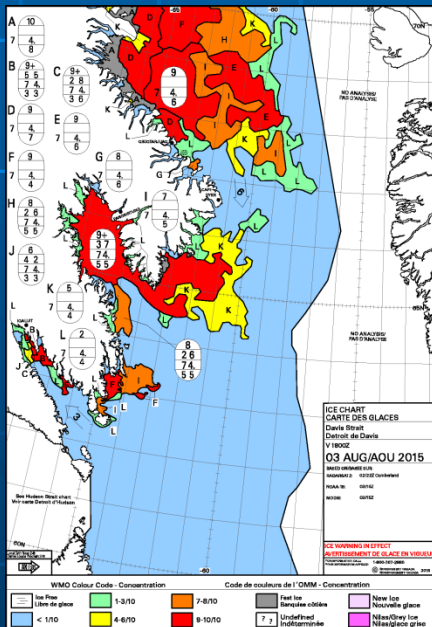
Increasing ice class

Increased Risk

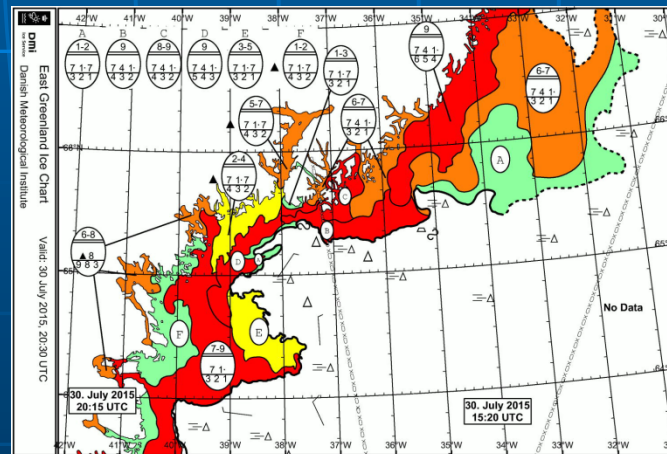


Recommendation I(C) re: Harmonizing Shipping Regimes

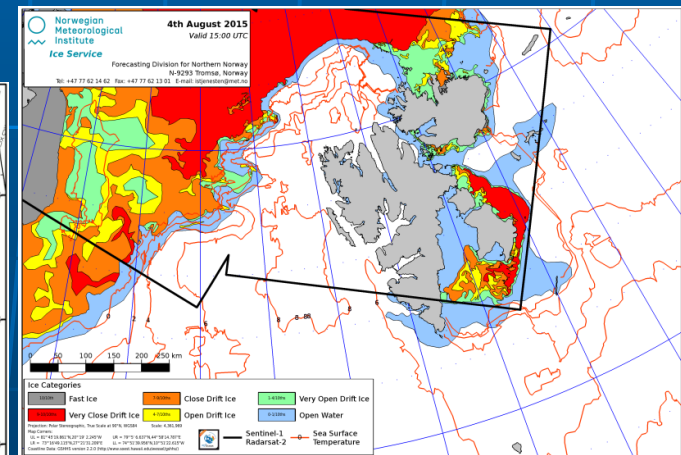
- IICWG's earlier work to harmonize ice chart symbology and colour schemes has resulted in (nearly) common "look and feel" of ice charts internationally
- IICWG work with IHO resulted in adoption of S-411 – the international standard for exchange and display of ice information for Electronic Chart Display and Information Systems (ECDIS)



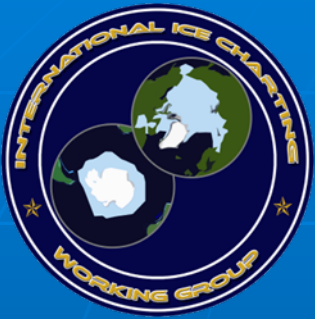
Canada



Denmark

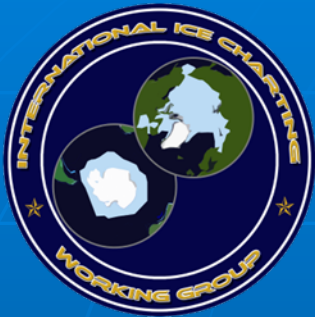


Norway



Recommendations I(E) - Arctic SAR & II(F) – Oil Spill Prevention

- Emergency incident response is a continuing theme at IICWG meetings
 - Following the 2013 meeting in Reykjavik, actions were adopted to establish the U.S. National Ice Center as a central place where response organizations could go to be directed to the most capable ice information source in the vicinity of the emergency and for individual ice service to implement procedures to respond accordingly
 - IICWG has an open action item to map how routine Ice Service products overlay on the SAR and MPERSS areas to identify gaps in the provision of weather and ice information
 - Oil Spill Response Ltd. and the International Tanker Owners Pollution Federation Ltd. will be giving presentations and participating in discussions at the IICWG in October 2015



Recommendations III(A&D) Infrastructure Investments

- Contributions to IMO Polar Code
- Ice Information for Arctic METAREAs
- All national ice services are attempting to respond to demands for more and better information on ice conditions in the Arctic
 - Historical
 - Current
 - Short and long term forecasts
- IICWG has been identifying needs and supporting actions to promote monitoring and research into a better understanding of the Arctic that is essential to improving ice forecasts



PAME and IICWG Collaboration



Challenges

- Most national ice services are having difficulties maintaining their levels of service in the face of increased demands as a result of greater Arctic maritime activity
 - Encourage PAME member states to ensure adequate funding for ice services
- Arctic observing network – atmosphere, ice, ocean – is extremely sparse
 - Support efforts to improve the Arctic Observing Network
- Physical processes affecting Arctic ice are not well understood or modelled
 - Support continued Arctic research with applicability to operational services
- Some ships – particularly cruise ships – are sailing in Arctic waters with inadequate ice information and training
 - Enhance training standards for Arctic ice navigators
 - Clarify ice information requirements in the Polar Code – perhaps through insurance industry requirements



Opportunities

- IICWG could regularly brief PAME to maintain an accurate awareness of changes in sea ice and iceberg conditions in the Arctic
 - So PAME can ensure its policies and activities are appropriate for the changing Arctic environment
- PAME could regular update IICWG on evolving needs for ice information in the Arctic
 - Arising from PAME areas of expertise (e.g. ecosystem sustainability, threats to mammals, impacts on indigenous communities)
- PAME could assist IICWG in its relations with other international organizations
 - e.g. IICWG is seeking clarification on whether the International Charter on Space and Disasters can be activated to prevent disasters – as in the case of vessels trapped in dangerous ice conditions
- IICWG will keep PAME updated on its activities related to AMSA recommendations
 - Emergency incident response, availability of pan-Arctic ice information



Thank you

<http://nsidc.org/noaa/iicwg>