

Appendix J

Ice Information Service Delivery in Antarctic Waters Discussion Summary

"(wise) decision-makers base their expectations on a full distribution of outcomes, and then make choices in the face of the resulting – perhaps considerable – uncertainty."

R. Pielke Jr (Room for doubt: Nature 410, 151, March 2001)

Introduction and Background

Scott Carpentier introduced this session which was intended to gather input and opinions on how ice information services could be best delivered in Antarctic waters, recognizing that needs in the Southern Ocean are in different many ways from those in the Arctic.

There are many legitimate reasons why Antarctic decision makers access information from a range of sources. Typical sources of Antarctic sea ice information include:

- Responsible national services for Chile, Argentina, South Africa, Australia and New Zealand servicing their WMO Southern Ocean METAREAs;
- National operational and research institutions who directly service their (and associated) National Antarctic programs and research voyages;
- Commercial Service providers;
- Free internet sites hosted by National operational service providers, various research institutions and/or motivated private persons and organisations; and
- Trusted friends or acquaintances with prior Antarctic experience or knowledge.

With a focus on delivering more impact and value to decision makers for Antarctic waters, the participants of IICWG XVIII were asked to consider:

- the key strengths and weaknesses of the current sources of sea ice information?
- the blocks and pathways to improved customer satisfaction?

Following this introduction, the participants divided into seven breakout groups to discuss these questions. Each group then presented the outcome of their discussions to the plenary

Summary

Following is a summary of the group presentations.

Strengths and Weaknesses

The ice community is relatively small and well integrated. There is good international collaboration and willingness to share knowledge and help develop capacity. There is a passionate enthusiasm within the community that leads to strong engagement and a good cooperative flow of information. As an example, several ice services work together to jointly produce ice charts in areas of overlapping interest. While this practice is well-established among Northern Hemisphere ice services, it is not clear that connections among the Southern Hemisphere ice services are strong. There is a need to develop strategic relationships among them.

Some groups reported that the wide accessibility of ice information from national ice services, academic institutes, and Polar View is a strength. They noted the availability of consistent, high

quality products from ice experts with the ability to interpret sea ice imagery and relate it to current conditions. The Polar View website and the Ice Logistics Portal are both valuable sources of ice information from credible suppliers. However, many more groups reported that the quality of ice information in the Antarctic is limited:

- routine ice charts are only available twice a week and have limited spatial and temporal resolution;
- there are gaps in ice climatologies and seasonal outlooks and long range forecasts are absent;
- there is a lack of sea ice parameters on ice charts, especially ice thickness and snow depth;
- there is no information about data sources on ice charts and no indication of confidence;
- information density varies from region to region and time to time;
- There are no sea ice models that have been validated for general use in the Antarctic and there is a lack of tuning algorithms for models;
- In general, there seems to be little understanding about important Antarctic fast ice processes
- availability of in-situ data, necessary to ground-truth satellite data, is very limited
- the Ice Code itself has a limited ability to communicate ice hazards
- there is a fragmentation of data sources with no single point to access all of the information

Dissemination via the Internet is viewed as strength with a lot of users accessing ice information on-line. However, while there are good communications links available and generally good Inmarsat coverage, there are continuing complaints about low bandwidth data communication to ships. In addition, there are concerns about the reliable availability of ice information on board vessels in the Antarctic. In particular, no ice information is included in Global Maritime Distress and Safety System (GMDSS) broadcasts in the Southern Hemisphere and no service is taking responsibility for providing it.

In some areas, service providers know their users very well. However, this is not generally the case. Many groups reported difficulty knowing who all of their customers are and what their needs are. There is generally little user feedback or follow-on interaction with users. It was noted that the user base is very much broader than just mariners and polar scientists. It also includes training institutes, classification societies, ship builders, policy makers, tour operators, adventurers, insurance companies, fishers, academia, polar communities, routing services, and regulatory agencies.

User understanding of ice products and information is generally deficient. Besides not being able to understand the products available, there is a general lack of awareness by users of what all is available. There can be misuse of ice information as well due to a misunderstanding of what is being presented, especially with satellite imagery. It is a strength that many vessels travelling to the Antarctic carry scientists engaged in ice research. Ships' crews gain valuable experience from having them on board. They learn to interpret satellite imagery themselves.

In those regions where there is good interaction with a small user base, the ice services are highly regarded. There is a trust in the service based on personal relationships and knowledge. Ice services act as brokers to obtain, sift, and tailor information sources. Shore based experts have access to imagery and forecasts and provide products by e-mail, even suggesting routing in difficult ice situations. It is essentially a customized service based on craftsmanship. However, this current practice is very labour intensive and is not scalable if the number of vessels needing support increases. There is limited expertise available and there are only a few ice analysts who are familiar with the Antarctic and understand the unique ice physics in force there. Because the service is dependent on a very small number of experts, there are many single points of failure. While the ice community is starting to talk about ice analyst/forecaster competencies, it was noted that there is no standard of competency for ice analysts – anyone can purport to provide ice information. This

could become a problem if the demand for service starts to exceed the capacity of the limited expertise available.

It is also of note that, outside of some specific regions, relationships between service providers and users may not be as robust.

Concerning satellite data coverage in the Southern Ocean, there are some positives but mostly negatives. While large swath, weather-independent data is available, it is low in spatial resolution. High resolution data is available but is expensive, has gaps in coverage, and can be dependent on weather (e.g. MODIS). The coverage of weather-independent Synthetic Aperture Radar (SAR) data in the Southern Ocean is currently quite poor but with the availability of the second Sentinel-1 satellite in 2018, it should become much better. Users can access satellite images on the Polar View website but they need training to use them appropriately.

Blocks and Pathways

The blockages to improving the availability of ice information in the Southern Ocean are not numerous but they are formidable. Overall, there are shortages of both money and people to provide ice information services. This leads to uncertainties about the future which deter organizations from implementing solutions to identified problems, including:

- a deficiency of ice charting capacity with no one taking ownership of the problem
- no formal structures or processes to provide ice information
- ice models in the Southern Ocean are not mature
- a lack of satellite Synthetic Aperture Radar coverage
- a lack of in situ data
- low communications bandwidth to ships
- no standards for user training and education

On the positive side, there are many national programmes with a long history in Antarctica. This can serve to build public support or, as one group put it, “the Antarctic is sexy”. The international research community relies on quality ice information for maritime safety and security of Antarctic re-supply and are supportive of the ice services.

The implementation of the IMO Polar Code presents an opportunity to develop a new basic level of service that is scalable. Ice services could take the opportunity to create a forum to obtain customer feedback to better understand the needs of users across their whole customer base. The Polar Code could also offer training opportunities for both mariners and ice analysts to break down the barriers between analyst expertise and navigator expertise.

New technologies also offer better ways to provide ice chart information through new formats that are more intuitive to reduce user training needs. Better communication channels to ships, which could be optimized according to technological restrictions, could perhaps offer “on-demand” resolution – the “Google Maps” analogy – with means to communicate uncertainty in the information being supplied. One group proposed a “WAZE-like” app to allow ships to update information in real time so it is available to all other ships in the area. The relatively low level of marine traffic in the Southern Ocean may allow testing and implementation of new service provision approaches more easily than in higher traffic areas.

Addressing resource shortages in a government context requires positioning the benefits of ice information within the strategic goals of the government. The benefits to citizens and tax-payers must be made clear. An accepted basic level of service must be defined upon which to base a service strategy. The closeness of the ice community and the willingness of ice services to share their expertise and technologies provide an opportunity to help overcome resource limitations. The transfer of best practices and knowledge from the Northern to the Southern Hemisphere has already begun and can be further exploited to build capacity. Distance learning technologies could be

employed to train new recruits in ice analysis and image interpretation. As has happened in the Northern Hemisphere, Southern Hemisphere ice services could work together to realize service efficiencies. More sharing of the workload to provide quality ice information across the vastness of the Southern Ocean would be beneficial to all of the ice services involved and, most importantly, to the mariners receiving the best service possible.

Scott's Wrap-up

Strengths:

1. The IICWG is a powerful end-to-end unifier across the Sea Ice service value chain;
2. The generosity and good-will of the "Arctic" services acts as an accelerator for Antarctic service improvements;

Weaknesses:

1. Fragmented delivery of ocean, atmosphere and sea ice information to mariners and the wider community of stakeholders results in:
 - a. Overall, multiplication of cost and effort for both Business as Usual (BAU) and Business Continuity assurance
 - b. Reduction in overall service quality: because detailed water/ice/atmosphere products often don't merge seamlessly into a consolidated view of the environment;
2. Responsible METAREA nations are not "Authentic" service providers in the Antarctic. They are not the "guaranteed" source of sea ice information;
3. Low bandwidth and multiple incompatible visualisation platforms heavily impedes service quality and decision making ability

Pathways to improved customer satisfaction

1. Acknowledging that Antarctic weather service delivery, sea ice service delivery and climate service delivery are all constrained in some way due to resourcing challenges, and that there is a clear direction towards a merging of these services via coupled ocean-ice-atmosphere modelling and via a bridging of the gap between seasonal and sub-seasonal forecasting; and that COMNAP is likely the primary beneficiary of enhancements to all 3 of these service types; and that to the end user there is little appreciation of the distinction between these 3 service types, we should encourage a merging or integration of these efforts (think the WMO Globally Integrated Polar Prediction System (GIPPS)).
2. Following the above point, it is noteworthy that the WMO EC-PHORS Antarctic Task Team drafted the recommendation to the WMO executive council that: *"member nations renew their efforts to coordinate the products and services provided to Antarctic operators by National weather services, build interoperability into existing systems and, where feasible, provide integrated products and services to improve service delivery capabilities of Members to meet end-user needs in the Antarctic."*