JCOMM Expert Team on Sea Ice

Norway Member Report

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Introduction

1. The Norwegian Meteorological Institute (met.no), Norwegian Ice Service (NIS), is responsible for operational monitoring and charting of sea ice in the European sector of the Arctic, with a focus on the waters around the Svalbard archipelago, the Barents Sea, and Fram Strait. This information is distributed to ships primarily in the form of ice charts. The purpose of the sea ice service is to aid navigation and provide tactical and strategic support for the shipping community. The present ice service was established at met.no's Oslo headquarters in 1970 with weekly ice chart production but sea ice reporting has been conducted by the Norwegian Polar Institute (NPI) and met.no sporadically since 1930. In June 1997 the ice service was relocated to the Forecasting Division for Northern Norway (VNN) in Tromsø with weekday ice chart production.

Operational Support

Drivers and Users

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2.1. The maritime users of operational ice information are vessels, icebreakers, pilots, maritime authorities, shipping companies, and export and import companies operating in European Arctic waters. For Norway these include the Coast Guard and the Coastal Administration and the ice service also has a large number of international users. These include fishing boats, yachts, cruise ships, and research vessels.

2.2. Other users interested in the state of the sea ice in the NIS area include helicopter and fixed-wing aircraft operators, for landings on ice both for logistical and search and rescue purposes, insurance companies, oil and gas companies, and mining companies for access to the mines of Svalbard. NIS also handles requests for data to be used in academic research and supplies ice chart information for validation of the satellite products and climate models being developed by met.no R&D Department in Oslo.

2.3. Ice charts and reports have been available free-of-charge on the Internet since the second half of 1997. In 2009 there were ~73,000 requests for ice charts through the static met.no and Polar View web pages. This does not include delivery through the Web Mapping Service (WMS) and FTP. Demand has roughly doubled since the start of 2010 and the severe ice season in the Baltic. Ice charts are also distributed daily by the German Weather Service (DWD) as radio faxes from their station at Pinneberg, and ice edge positions are transmitted in VHF/SSB text from Bodo Radio. Ice charts can also be accessed through other web sites including the Polar View IPY Ice Logistics Portal and from February 2010 the Norwegian Coastal Administration web pages. The high resolution Svalbard ice chart is published in the weekly Svalbardposten newspaper.

Coverage, products and services

2.4. The ice monitoring area covers the European Arctic sector, including Hudson Bay and the Labrador Sea/Baffin Bay in the west and the Kara Sea in the east, with a focus on detailed mapping of the ice conditions around Svalbard. The ice season is therefore all year, with greatest user activity occurring in the summer months. In January 2010 ice development in the Skagerrak area between Norway, Sweden and Denmark resulted in the creation of an additional area of focus.

2.5. In addition the ice service is developing an Antarctic ice chart product, in association with the EC/ESA GMES Polar View project, that covers the Weddell Sea sector from the Bellinghausen Sea and Antarctic Peninsula in the west to the King Haakon VII Sea and the Fimbul Ice Shelf approaches in the east. This will initially be a weekly product (Mondays) for the Antarctic summer.

2.6. Throughout the intersessional period, the NIS provided operational sea ice charting on weekdays, excepting Norwegian public holidays, throughout the year.

2.7. Products and services are available free-of-charge.

2.8. Arctic ice charts can be viewed at the following web addresses:
http://retro.met.no/kyst_og_hav/iskart.html
http://polarview.met.no/
ftp://ftp.met.no/pub/icecharts/

2.9. The latest Antarctic ice chart can be found at:
http://polarview.met.no/antarctic/antarctic.jpg

2.10. Ice charts as Web Mapping Service (WMS):
http://wms.met.no/icechart/
http://kart.kystverket.no/ and select “Sjøis”

2.11. Other services and products are available on request.

Sea Ice Climatology

3. Ice chart data is available in the form of ESRI Shapefile format files back to 1967. These can be used to generate custom analyses of the sea ice climatology in the area covered by NIS. Data prior to 2003 has been supplied to the ACSYS Historical Ice Chart Archive (1553-2002) (http://acsys.npolar.no/ahica/intro.htm).

4. NIS has provided climatological ice information updates to the UK Hydrographic Office for the Bering Sea and Strait Pilot, the Southern Barents Sea and Beloye More Pilot, and analysed ice limit information for the Arctic and Antarctic for Admiralty Routing Charts.

Data Sources

5. NIS uses a mix of satellite, aircraft and surface observations. The most important single data source are dual-polarization ScanSAR Wide images (500 km swath, 100 metre resolution) from the Canadian RADARSAT-2 satellite which NIS started using in November 2008, having previously used images from RADARSAT-1 beginning in 2005. During 2008 and 2009 approximately 300 images per year were acquired through the Norwegian Space Center. Starting in September 2009 NIS is also able to acquire ~600 images per year through the ESA GMES MyOcean project. RADARSAT-2 images are acquired by the Kongsberg Satellite Services (KSAT) ground stations in Tromsø and Longyearbyen and are normally available to the ice service less than one hour after the satellite overpass.
6. ESA ENVISAT ASAR wide swath medium resolution (WSM) images (400 km swath, 125 metre resolution) are also used regularly with NIS having access to the ESA Rolling Archives at Kiruna, Sweden and ESRIN, Italy. In addition MODIS and AVHRR imagery provide optical information but use is limited by winter darkness and cloud cover. Passive microwave from SSM/I, SSMIS and AMSR-E is provided by the Ocean and Sea Ice Satellite Application Facility (OSISAF) at met.no R&D in Oslo, and AMSR-E from the University of Bremen and is used for background mapping at lower resolution.
7. The ice service, in collaboration with NPI, acquires ground truth observations from the weather stations at Hopen and Bear Island. This consist of ice situation reports, photographs, and thickness measurements. In addition NIS solicits reports from ships, aircraft, and ground observers operating in the ice chart area.

Ice Charting System

8. NIS continues to use the ice charting system based on ESRI ArcView which was developed for the 1997 change over from manual drawing of ice charts to GIS production.
9. Under the European Ice Service (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.

Medium Range Forecasting

10. Reorganization of resources within met.no in December 2009 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.

Training

11. Training has been conducted in-house on an as required basis. Ice analysts from NIS have attended the International Ice Chart Working Group (IICWG) Ice Analysts Workshops (IAW) held in Rostock, Germany in 2008 and hosted by the NIS in Tromsø in 2009. This has enabled them to swap ideas and learn new techniques with analysts from the other ice services.

Science

12. Dual-polarization SAR for sea ice operations. NIS is now actively archiving all its orders of RADARSAT-2 ScanSAR Wide scenes. These will be used to evaluate how this data could be used for ice classification and its temporal performance over the annual cycle. Studies will be conducted in collaboration with national and international partners, including the University of Tromsø which has a strong remote sensing group interested in multi-polarization, multi-frequency SAR:
13. Iceberg detection with SAR. In 2008 NIS employed a French intern student for 3 months who performed an initial study of iceberg detection using a morphological filtering technique. With increasing quantities of SAR data data becoming available since then, the ice service intends to look again at how maps of iceberg occurrence could be developed. However ground truth data for the Svalbard area is lacking and the ice service is actively seeking research funding that could provide for a project to acquire this. Lack of ground truth data is also a problem for the met.no R&D working on ice and iceberg drift models.
14. Multi-sensor sea ice algorithms. Studies are being conducted in collaborations with the University of Edinburgh, University of Cambridge (DAMTP), and Scottish Association of Marine Science (SAMS) in the United Kingdom. The focus is on how to combine disparate data from passive microwave, optical and SAR sensors into a robust classification algorithm.
15. Sea ice thickness. Collaboration with the University of Cambridge (DAMTP) provides access to an extensive sea ice thickness dataset covering the past 40 years. The most recent data acquisitions in 2004 and 2007 provided some ground truth of Envisat ASAR, Radarsat-1 and ALOS PALSAR.
16. Ice chart information for forecast and climate models. met.no runs a number of different models that incorporate sea ice parameters. Presently the ice chart information is used for validation. The intention is to work more with data assimilation in the future, particularly with the implementation of the high resolution models for the Svalbard and Skagerrak areas.

International Activities

17. NIS is part of the European Ice Service (EIS), a collaboration with the Danish Meteorological Institute (DMI), Finnish Ice Service (FMI), and Swedish Ice Service (SMHI), that is the equivalent to the North American Ice Service (NAIS).
18. NIS has been active through international cooperation within the International Ice Chart Working Group (IICWG) which has now had ten annual meetings.
19. WMO JCOMM Expert Team on Sea Ice (ETSI).
20. Scientific activities are conducted in collaboration with numerous national and international partners through funding applications to the Research Council of Norway (NFR), the European Union (EU), and European Space Agency (ESA).

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