# JCOMM Expert Team on Sea Ice

## Sweden Member Report

## 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 Interpolarization) 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 oceanographical 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**

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