Veðurstofa Íslands
Report

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Construction of input files for the sea ice model MCRIM 2.5

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Introduction

In the year 1995 the Head of sea ice department at the Icelandic Meteorological Office, Dr. Þór Jakobsson obtained a sea ice forecast model from Dr. V.R. Neralla at the Atmospheric Environmental Service, Canada. This model was the subject of M.Sc. thesis of Jón Elvar Wallevik at the Physics Department, University of Iceland. The author of this report began working on the model after Jón graduated, in the beginning of 1998. The goal was to automate the work required before model run, i.e. constructing input files for the wind on the forecast period, and the initial conditions of ice, distribution and state of development, so a model run could be performed with short notice when needed. That could be for example when sea ice is close to shores of Iceland, endangering navigators in Icelandic seas.

Data

Wind data

The model's forecast period is seven days, and it requires information on wind in the beginning of that period and every six hours after that. The only wind forecast the Icelandic Meteorological Office has direct access to for so long time period is the ECMWF forecast (European Centre for Medium-Range Weather Forecast). It gives all parameters on a grid based on the conventional geographic coordinate system with 1.5-degree resolution.

Ice data

The model allows for defining seven categories of ice.
First year ice:
1 Open sea and slush.
2 Grey-white ice.
3 First year medium thick ice.
4 First year thick ice.
Ridged/rafted ice:
1 Ridged/rafted ice 0-0.9 m thick.
2 Ridged/rafted ice 0.9-11.36 m thick.
Multi-year ice:
1 Multi-year ice, 0-5 m thick.

Data on distribution of sea ice is available on a few web sites as ice charts on .GIF format. The Icelandic Meteorological Office also receives a hard copy of charts from the Danish Meteorological Office (DMI), the National Ice Centre, and the Norwegian Meteorological Office. The National Ice Centre has its maps on the web as Arc/Info coverages, available for no fee. That form of data is by far the most preferable. The Danish Meteorological Office now works on constructing a new ice chart system based on satellite imagery, AVHRR, RADARSAT and SSMI. Those will be vector based, i.e. Arc/Info coverages. An additional option is gaining access to them, but they will probably be available for some fee. Last to mention but not least are the ice charts from the Icelandic Coast Guard. They show the ice edge very accurately, but usually they indicate only total concentration of ice on a relatively narrow band along the edge. Sometimes though partial concentration of different thickness categories is indicated by the well-known "egg-code".

Wind file

The problem of constructing the wind files was relatively easy to solve. A program was written that reads the ECMWF forecast on wind at 10 m altitude as input. It then calculates by bilinear interpolation the wind components in each model grid point, brakes them up into new components parallel to the base vectors of the Hirlam coordinate system and writes in a file.

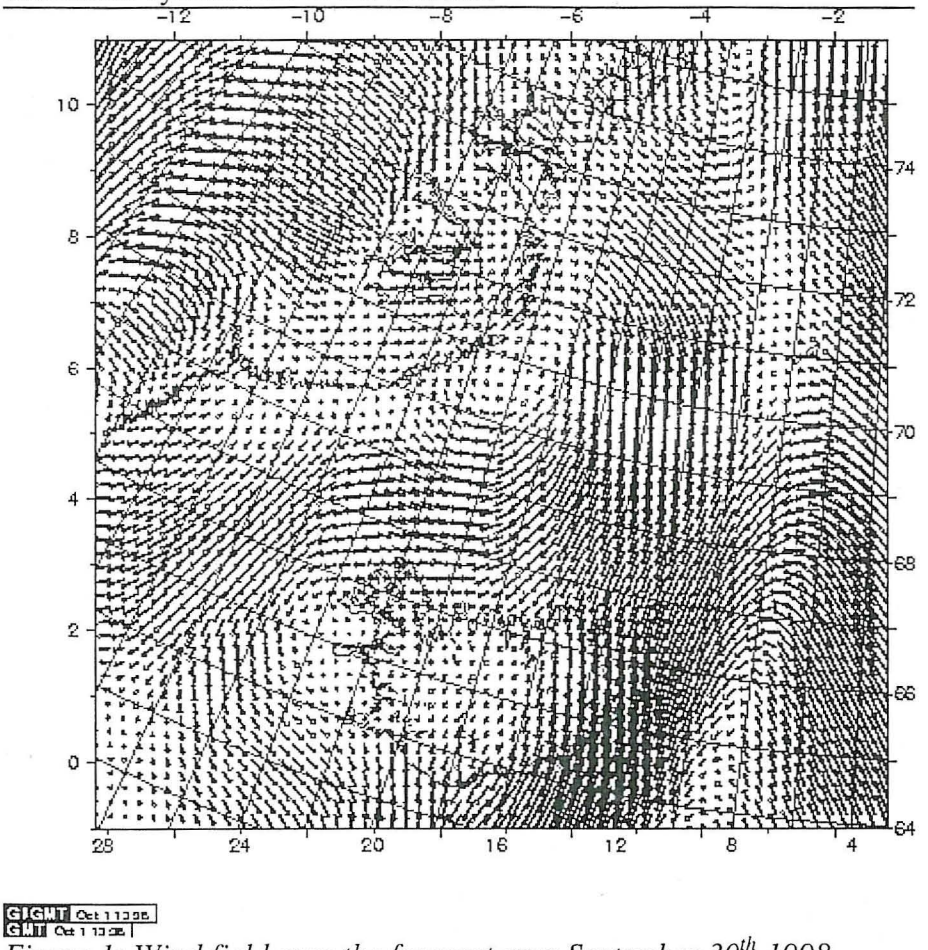

Figure 1: Wind field over the forecast area September 30th 1998.

Ice data file

This problem of creating the ice data file is more complex. When setting up the initial conditions of ice, one has to take into account that the various ice charts are not all as reliable. According to Icelandic navigators the Danish and Icelandic charts are the most accurate, at least regarding the position of the ice edge. Therefore they should be preferred. In order to take advantage of them a program was written that reads as input ASCII file containing points on the boundaries of areas of equal concentration and the concentration inside the regions. Those points the user must pick up from the charts and type in the file. Not though nearly as time consuming as creating this file manually this method requires at least an hour's work before model run. Moreover, a more advanced software for this purpose indeed is available, namely Arc/Info. As mentioned before charts from the National Ice Centre are available on the web as Arc/Info coverages, SIGRID coded. They are based on satellite images, from an

analysis period of 3 or 4 days so they are at least partially out dated when issued. Nevertheless a procedure has been developed for setting up the file for initial conditions through Arc/Info. It is useful because any time a model run is performed these charts have to be used for some portion of the forecast area. None of the other charts covers all of it. Also, Danish charts possibly will be available later as Arc/Info coverages, and maybe a person from the Icelandic Meteorological Office could be trained in digitising Icelandic and Danish charts which then could be used.

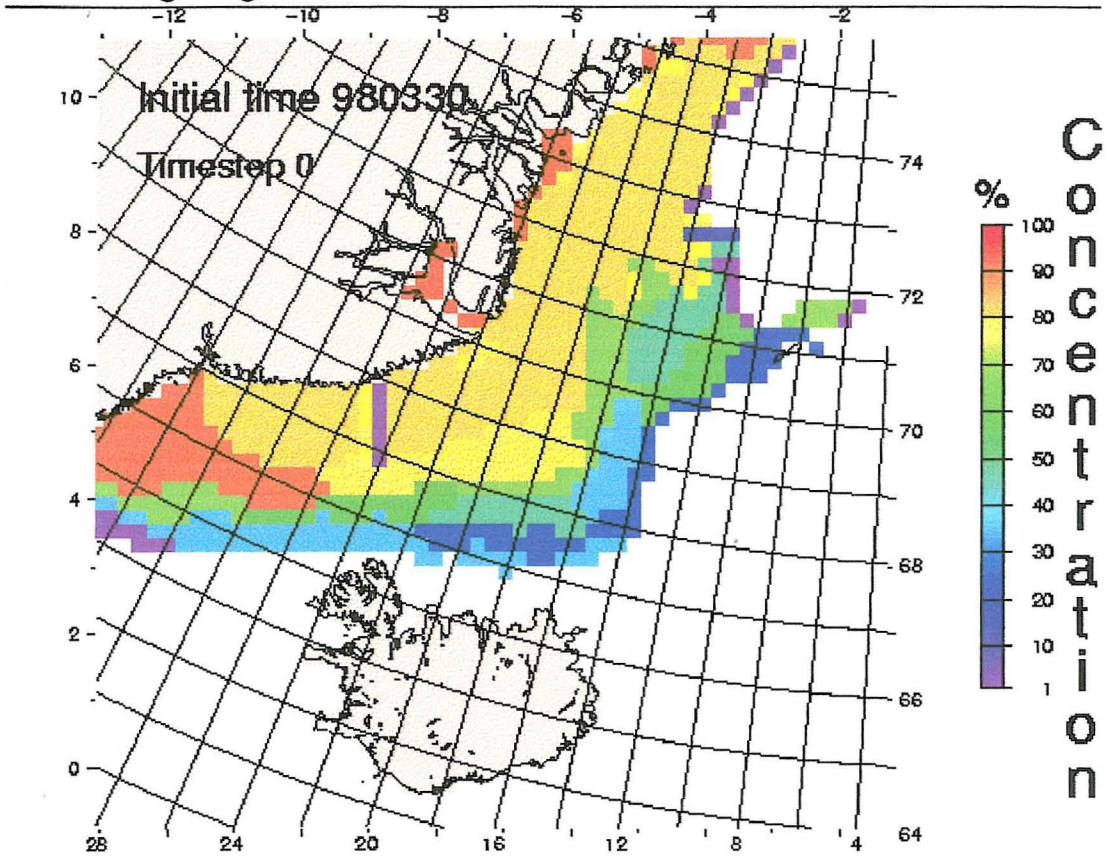

Figure 2: Total concentration of ice March 30th 1998 in each grid cell, according to the Arc/Info cover from National Ice Centre. This was obtained through Arc/Info by an AML program.

Conclusions

Now the wind file is constructed automatically when model run is performed.
A model run can be performed requiring so to say no previous work, using the Arc/Info coverages from the National Ice Centre as input for ice characteristics. Using also Danish or Icelandic charts requires about one hour's work for one person picking up points from the charts and typing them into a file. More preferable solution would be to train one of the staff in digitising the ice charts and constructing Arc/Info coverages which then can be used exactly the same way as the coverages from the National Ice Centre. It would also give an interesting opportunity for data exchange between The Icelandic Meteorological Office and other institutions in the field of sea ice research.

Acknowledgements

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