Regional sea ice outlook for Greenland Sea and Barents Sea - based on data until the end of May 2010

Sebastian Gerland[1], Harvey Goodwin[1], and Nick Hughes[2]

1: Norwegian Polar Institute, 9296 Tromsø, Norway (E-mail: gerland@npolar.no; goodwin@npolar.no)

2: Norwegian Ice Service, Norwegian Meteorological Institute, 9293 Tromsø (E-mail: nick.hughes@met.no)

The monthly mean sea ice extent for May 2010 based on Norwegian ice charts produced primarily from passive microwave satellite data, supplemented with high resolution SAR imagery from 2007, is compared with the corresponding monthly mean for May for the previous years 2007-09 (Fig. 1), and with 30, 20, and 10 year averages for monthly means for the periods 79-08, 80-99 and 99-08 (Fig. 2).

The sea ice systems in the Greenland Sea and Barents Sea are substantially different. Sea ice in the Greenland Sea is (see e.g. Vinje et al. 1998) dominated by ice drifting with the transpolar drift and the East Greenland current out of the Arctic Basin southwards, whereas sea ice in the Barents Sea (see e.g. Vinje and Kvambekk 1991) consists to a high degree of seasonal ice formed in the same area during the past winter.

In the **Greenland Sea** ice extent in May for 2010 was slightly larger in the southwest and smaller in the northeast, compared with previous years 2007-2009 (Fig. 1). In the southwest, the extent appears roughly similar for May 2010 compared with all May means calculated for 10-30 year periods (Fig. 2). However, in the northeast (northwest of Spitsbergen), the ice edge for May 2010 is located further north than ice extent for the previous three years and for all monthly averages (10 to 30 year means). The 2010 ice edge suggests already open water towards the Hinlopen Strait (between Spitsbergen and Nordaustlandet); however, the resolution of passive microwave satellite data is not sufficient and the near coast reduces data quality, meaning the local ice situation there cannot be assessed in detail. One can speculate that the influence of Atlantic water could be the reason for change in the ice edge position. To discuss this more one would need to look into more individual monthly mean data for that region, in addition to in situ oceanographic and atmospheric data. It should also be noted that in May 2010 there was ice seen in passive microwave data off southwest Spitsbergen, where in 10-30 year May means and Mays in the previous three years no significant amounts of ice were seen. Ice in this region usually is advected from the Barents Sea.

Compared with the Greenland Sea, the sea ice extent in the **Barents Sea** shows more variability between individual years and also between the 10, 20 and 30 year averages for June, especially for the eastern part (Fig. 1 and 2). As known from Barents Sea monitoring studies (Gerland et al. 2010a, b), the inter-annual variability of the position of the ice edge in spring and autumn is high, but shows a clear negative trend since 1979. In

May 2010, ice extent was substantially less than the May 2009 extent and the 10, 20 and 30 year averages in the north eastern Barents Sea (area between Franz Josef Land and Novaya Zemlya). The ice edge in May in the eastern Barents Sea was further south in 2007 and 2008, but the Arctic minimum extent record year 2007 come close to the 2010 May extent in this area (blue and red lines in Fig. 2). Towards Svalbard, the differences between different years/means become less. It is remarkable that in the May mean for 2010, the entire west coast of Novaja Semlja appears ice free, as was also the case in 2007. In May 2010, more ice is visible in the south-eastern Barents Sea as in the same month in the years 2007-2009 and as in the 10-30 year May means.

The Norwegian ice chart data provides a record extending back to 1967 (44 years), for the area around **Svalbard** (box extending from 72 to 85ºN and 0 to 40ºE). The ice charts use 6 categories for ice concentration: open water (0-10%), very open drift ice (10-40%), open drift ice (40-70%), close drift ice (70-90%), very close drift ice (90-100%), and fast ice (100%). The sum of these values was taken to be the overall mean ice extent. May 2010 was the third lowest mean extent on record at 476,038 km^2. The record low for this area was 379,835 km^2 in 2006, followed by 469,682 km^2 in 2004. 2007, 2008, 2009 were 7th, 15th, and 13th lowest respectively, and is 175,663 km^2 lower than last year (2009, 555,497 $km^{2|}$). A reason for the low extent in 2010 could be a higher sea surface temperature (SST) in the West Spitsbergen Current. SST data from the NOAA Extended Reconstructed Sea Surface Temperature (SST) V3b (http://www.esrl.noaa.gov/psd/data/gridded/data.noaa.ersst.html) reports the May 2010 average of this to be 2.74 ºC, the second highest in that record and only exceeded by 2.84 ºC in 1984.

Using the monthly ice chart data, SST and Arctic Oscillation (AO) values from NOAA (http://www.esrl.noaa.gov/psd/data/gridded/data.noaa.ersst.html) it is possible to attempt a simple **forecast for the Svalbard area,** based on statistical regression**.** From the data for 1967 to 2009, we find a relationship for the September ice extent:

$$Ice_{September} = 443665 + (13893.36 \times AO_{March}) + (0.22654 \times Ice_{April}) + (-112854 \times SST_{May})$$

This gives an initial predicted ice chart mean ice extent in September 2010 of 255,788 $km^{2|}$ (with an error of ±50,000 km^2), at 9th in the record of September ice extents. We will attempt to refine this further over the next few months. It should be noted that we do not say this is a minimum ice extent for the Svalbard area, simply because the regional ice extent minimum is highly variable and can occur any time between July and November.

References

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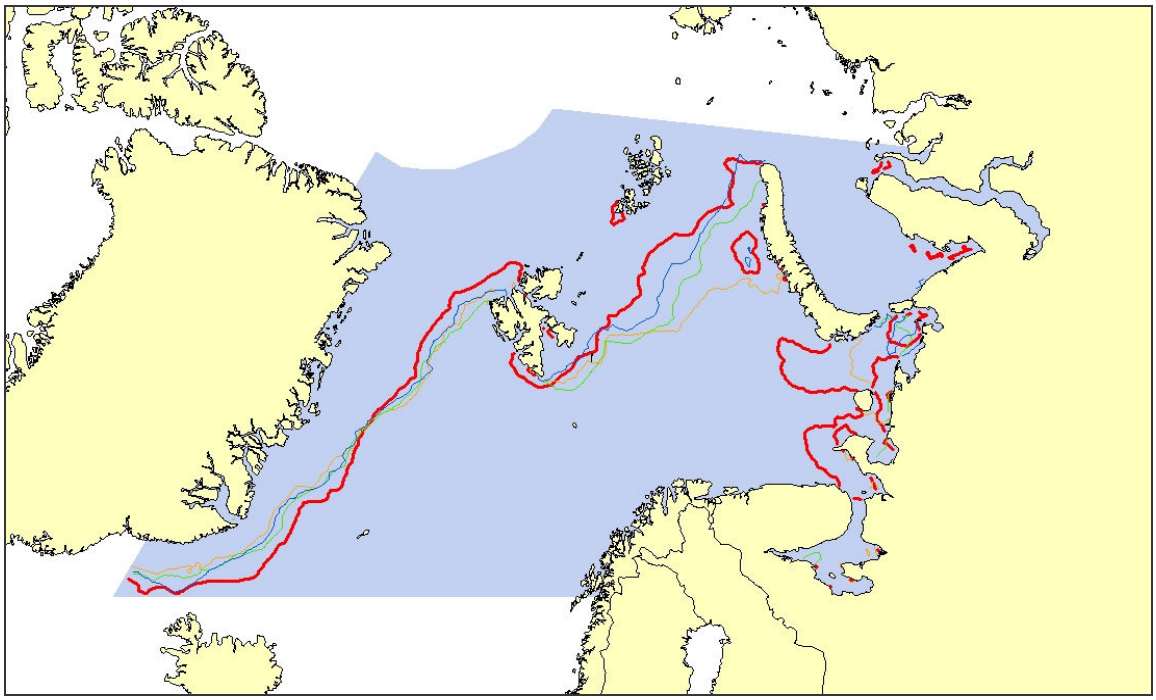

Fig. 1: Ice extent (monthly means, May) southern border of 30% ice concentration, in the Greenland Sea / Fram Strait and Barents Sea, based on passive microwave satellite data (red = May 2010, orange = May 2009, green = May 2008, blue = May 2007).

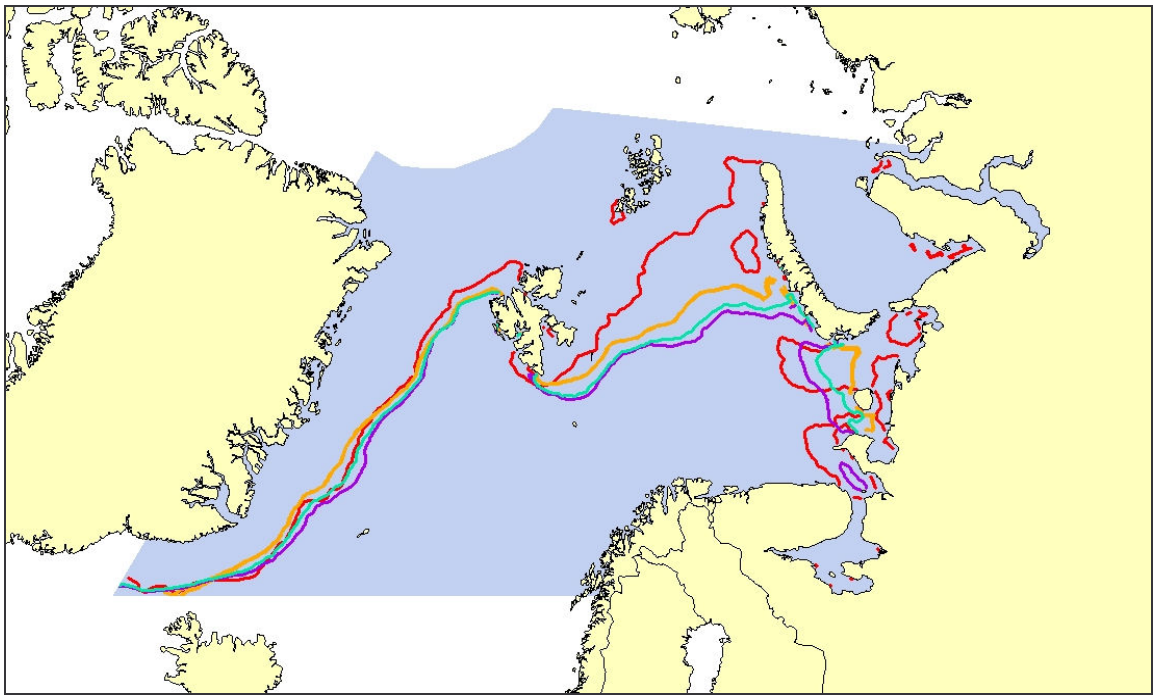

Fig. 2: Ice extent (monthly means, May) southern border of 30% ice concentration, in the Greenland Sea / Fram Strait and Barents Sea, based on passive microwave satellite data (red = May 2010, orange = mean May 1999-2008, green = mean May 1979-2008, purple = mean May 1980-1999).