June 2011 Sea Ice Outlook – AWI/FastOpt/OASys contribution

F. Kauker[a,b], R. Gerdes[a], M. Karcher[a,b]

T. Kaminski[c], R. Giering[c], M. Vossbeck[c]

June, 2011

[a] Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany
[b] O.A.Sys - Ocean Atmosphere Systems, Hamburg, Germany
[c] FastOpt, Hamburg, Germany

Experimental setup

For the present outlook the coupled ice-ocean model NAOSIM has been forced with atmospheric surface data from January 1948 to May 18th 2011. This atmospheric forcing has been taken from the NCEP/NCAR reanalysis (Kalnay et al., 1996). We used atmospheric data from the years 1991 to 2010 for the ensemble prediction. The model experiments all start from the same initial conditions on May 18th 2011. We thus obtain 20 different realizations of sea ice development in summer 2011. We use this ensemble to derive probabilities of ice extent minimum values in September 2011.

Mean September Ice Extent 2011

The simulated ice extent for all 20 realizations is shown in Figure 1. Since the forward simulation underestimates the September extent compared with the observed extent minima in 2007, 2008, and 2009 by about 0.49 million km^2 (in the mean), we added this bias to the results of the ensemble. It is not clear whether the bias is caused by a imperfect sea ice-ocean model or by imperfect initial or boundary conditions.
The mean September value of the ensemble mean is 5.43 million km² (bias corrected). The standard deviation of the ensemble is 0.58 million km^2 (2008: 0.55; 2009: 0.40; 2010: 0.41). The highest value is generated by the forcing of the year 1996 (6.85 million km^2) and the lowest by the forcing of the year 2008 (4.44 million km^2).
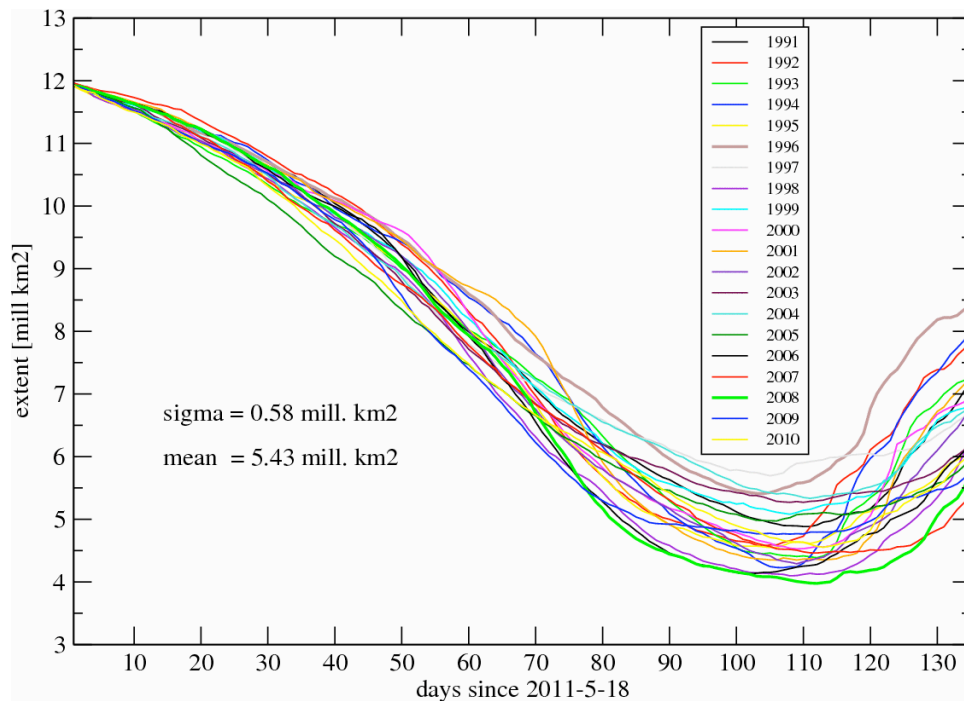
Figure 1: Simulated evolution of the ice extent [million km^2] when forced with atmospheric data from 1991 to 2010 until end of September. The the abscissa gives the days since the initialization of the forecast on May 18th 2011. The range from day 106 to 135 is used for the calculation of the September mean. Model-derived ice extents have been adjusted assuming a systematic bias (see text).

Assuming a Gaussian distribution we are able to state probabilities (percentiles) that the sea ice extent in September 2011 will fall below a certain value.

The probability deduced from the ensemble that in 2011 the ice extent will fall below the three lowest September minima:

probability to fall below 2007 (4.28 mill. km^2 - record minimum) is about 2%,
probability to fall below 2008 (4.67 mill. km^2 - second lowest)   is about 10%,
probability to fall below 2009 (4.90 mill. km^2 - third lowest)   is about 18%.

With a probability of 80% the mean September ice extent in 2011 will be in the range between 4.7 and 6.2 million km^2.

References:

Kalnay et al. (1996), The NCEP/NCAR 40-year reanalysis project, Bull. Amer. Meteor. Soc., 77, 437-470.