July 2012 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]

July, 2012

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

1. Extent Projection

We estimate a monthly mean September sea-ice extent of 4.67 +- 0.53 million km^2.

2. Methods/Techniques

Sea ice-ocean model ensemble run

3. Rationale

For the present outlook the coupled ice-ocean model NAOSIM has been forced with atmospheric surface data from January 1948 to June 29th 2012. This atmospheric forcing has been taken from the NCEP/NCAR reanalysis (Kalnay et al., 1996). The ensemble model experiments all start from the same initial conditions on May 29th 2012. The modelled initial sea ice thickness is shown in Figure 1. In contrast to the last SIO NAOSIM has been modified with respect to the representation of ice classes for the calculation of the heat transfer through the ice and some parameters. The former uniform PDF of the ice classes is now replaced by a more realistic PDF estimated from EM bird measurements (Hendricks, pers. comm., 2012). This implies also a modification of the sea-ice concentration equation resulting in a more realistic summer sea ice distribution. The simulated monthly September sea-ice extent for 1990 to 2011 is shown in Figure 2 together with an estimate based on OSI SAF (EUMETSAT Ocean and Sea Ice Satellite Application Facility, 2011) ice concentration and the extent provided by the NSIDC (Meier et al, 2005). Compared to the NSIDC ice extent the simulated extent in underestimated in the mean by about 0.18 million km^2. This bias is added to the ensemble prediction. The bias is properly caused by an imperfect sea ice-ocean model and by imperfect boundary conditions.

We use atmospheric data from the years 1992 to 2011 for the ensemble prediction (NCEP/NCAR) and thus obtain 20 different realizations of sea ice development in summer 2012. This ensemble allows to derive probabilities of sea-ice extent minimum values in September 2012. The simulated ice extent for all 20 realizations is shown in Figure 3 from the initialization until end of September.

The mean September value of the ensemble mean is 4.67 million km² (bias corrected). The standard deviation of the ensemble is 0.53 million km² which we provide as uncertainty estimate of the prediction.

References:

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

Meier, W., J. Stroeve, F. Fetterer, K. Knowles. (2005), Reductions in Arctic sea ice cover no longer limited to summer. *Eos: Transactions of the American Geophysical Society* 86, 326.

EUMETSAT Ocean and Sea Ice Satellite Application Facility (2011), Global sea ice concentration reprocessing dataset 1978-2009 (v2, 2011), [Online]. Norwegian and Danish Meteorological Institutes. Available from osisaf.met.no.
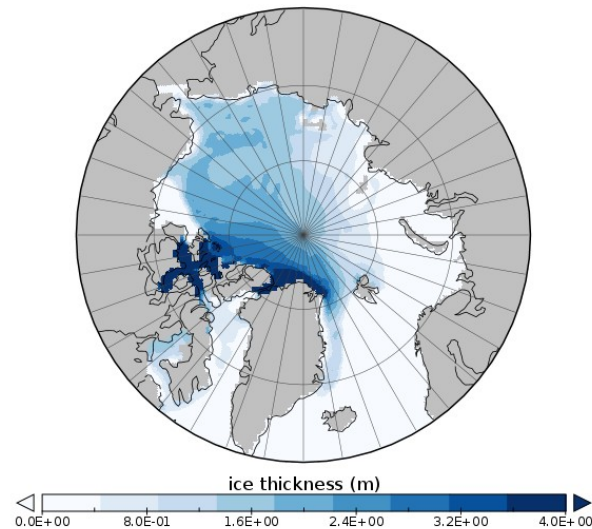
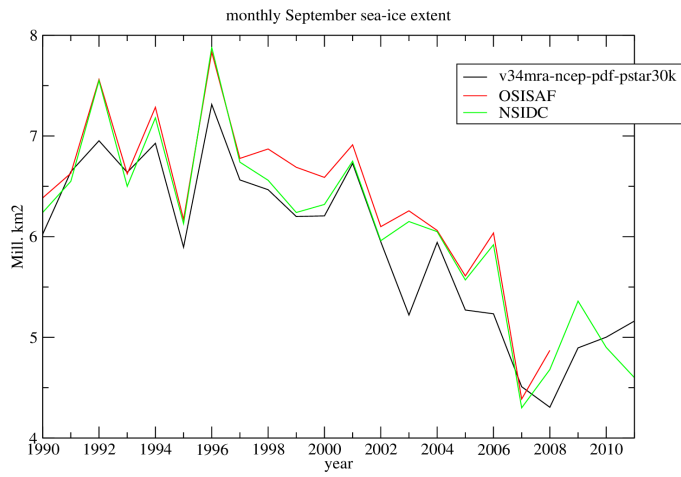*Figure 1: Simulated initial ice thickness on 29th of June 2012.*

Figure 2: Simulated monthly September sea-ice extent (black) for 1990 to 2011 and two observation based estimates.
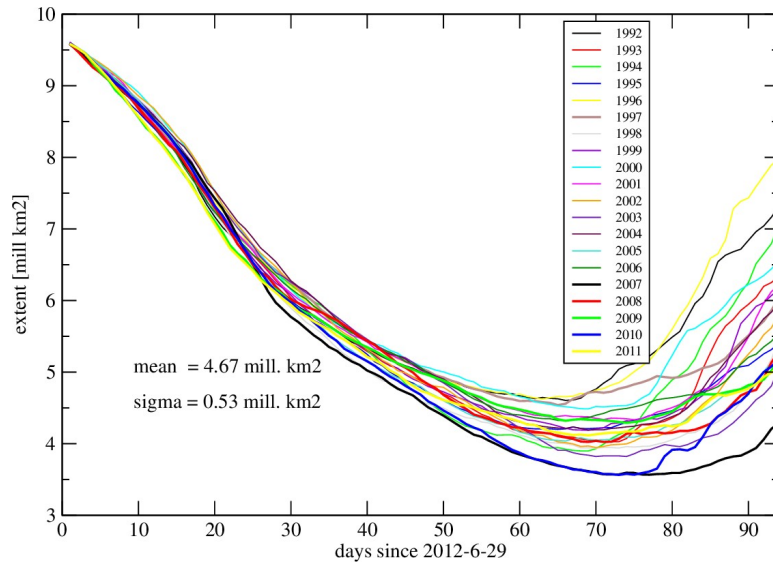

Figure 3: Simulated evolution of the ice extent [million km2] when forced with atmospheric data from 1992 to 2012 until end of September. The abscissa gives the days since the initialization of the forecast on June 29th 2012. Model-derived ice extents are averaged over day 65 to 94 and have been adjusted assuming a bias (see text).