Pan-Arctic September 2014 Sea Ice Outlook

August report (based on July data)

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1. Core information

Contributors

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Type of projection

Sea ice-ocean model NEMO-LIM3:

- ocean model: NEMO (Madec, 2012);
- sea ice component: LIM3 (Vancoppenolle et al., 2009);
- atmospheric forcing: NCEP/NCAR (Kalnay et al., 1996).

The method is based on atmospheric reanalysis data up to July 31, 2014.

The method does not use any data assimilation.

September monthly average Arctic sea ice extent projection

5.1 million square kilometers.

Method

Our estimate is based on results from ensemble runs with the global ocean-sea ice coupled model NEMO-LIM3. The ensemble members are expected to sample the atmospheric variability that may prevail this summer.

In practice, the model is forced with NCEP/NCAR atmospheric reanalysis data from 1948 to July 31, 2014. No data are assimilated during this simulation. Ten ensemble members are then started from the obtained model state, each using atmospheric forcing from one year between 2004 and 2013. This choice is a compromise between a sufficiently large ensemble and the rapidly changing Arctic atmospheric conditions in recent decades. The estimate given above corresponds to the ensemble median monthly September extent, corrected by the mean bias between simulated and observed values reported in the NSIDC sea ice index.

The model configuration is exactly the same as in our contribution from last year, where additional details can be found.
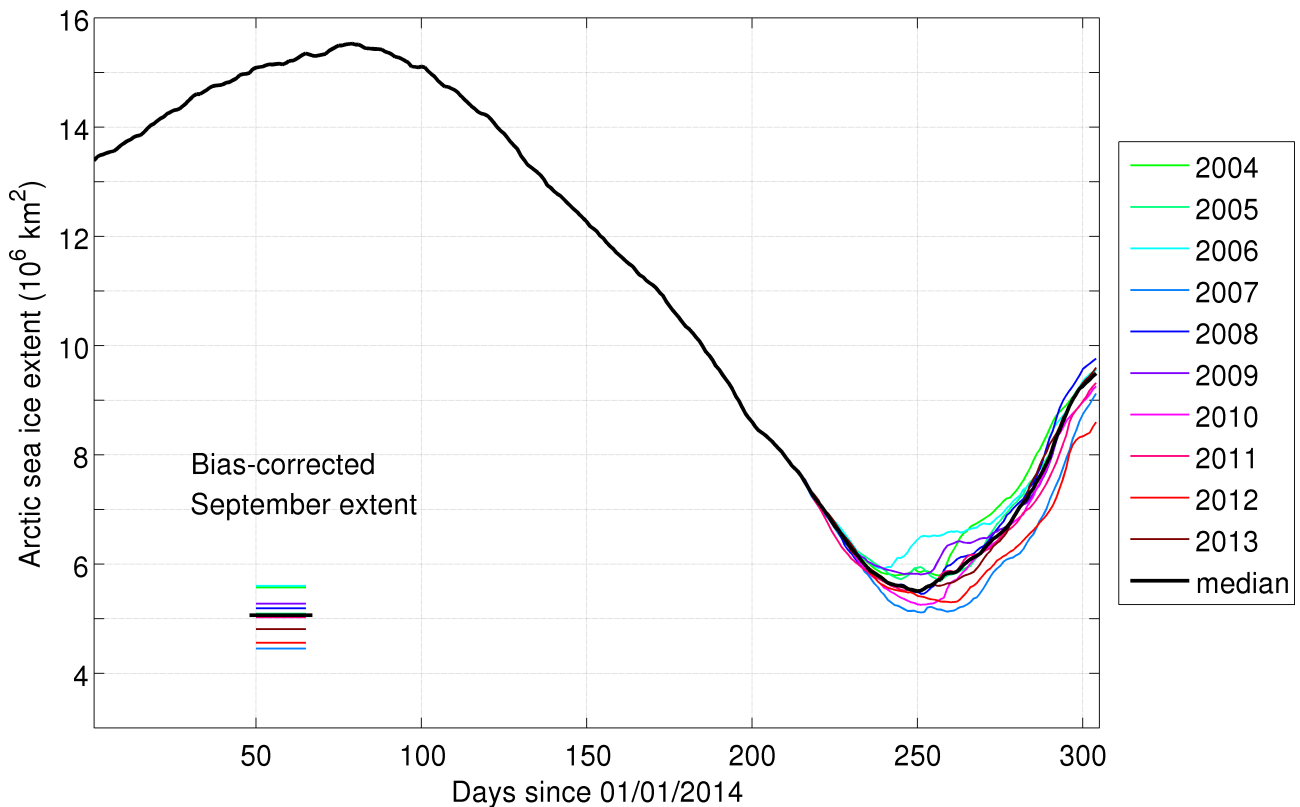
Figure 1: ensemble members and median 2014 daily Arctic sea ice extents. The bias-corrected September monthly mean extents for each members and their median (which is our final estimate) are also plotted as an inset.

Projection uncertainty

From 4.5 to 5.6 million square kilometers.

Basis for the uncertainty estimate

The projection uncertainty is given as the range between minimum and maximum extents in the ensemble. Although relatively wide, this neglects potential erroneous initial state and model errors not accounted for through the mean bias correction. It is based solely on the uncertainties arising from atmospheric variability, and on the hypothesis that the 2014 atmospheric summer conditions will be similar to the ones observed during the last decade.

Executive summary

Our estimate is based on results from ensemble runs with the global ocean-sea ice coupled model NEMO-LIM3. Each member is initialized from a reference run on July 31, 2014, then forced with the NCEP/NCAR atmospheric reanalysis from one year between 2004 to 2013. Our estimate is the ensemble median, and the given range corresponds to the lowest and highest extents in the ensemble.

2. Additional information

Hindcast validation

Our contribution is based on the known model skill in reproducing the monthly Arctic sea ice extent anomalies over the last 30 years, as well as the observed long-term downward trend. However, apart from our successful last year contributions, the projection method has not been tested in hindcast mode.
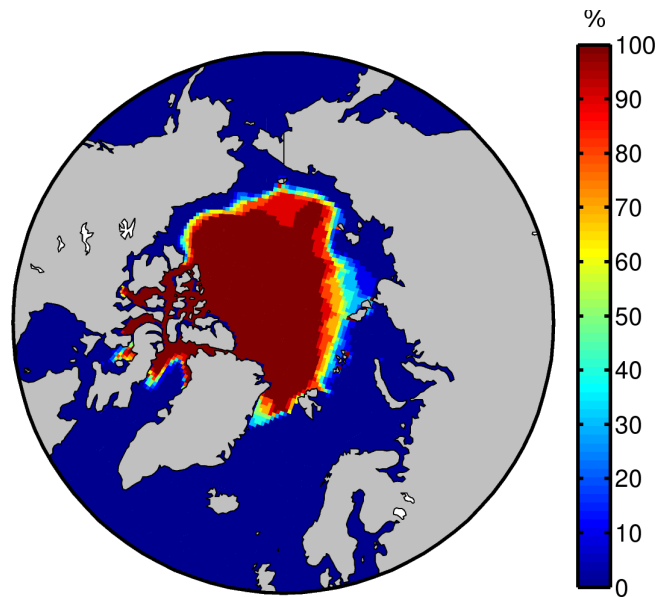
Maps

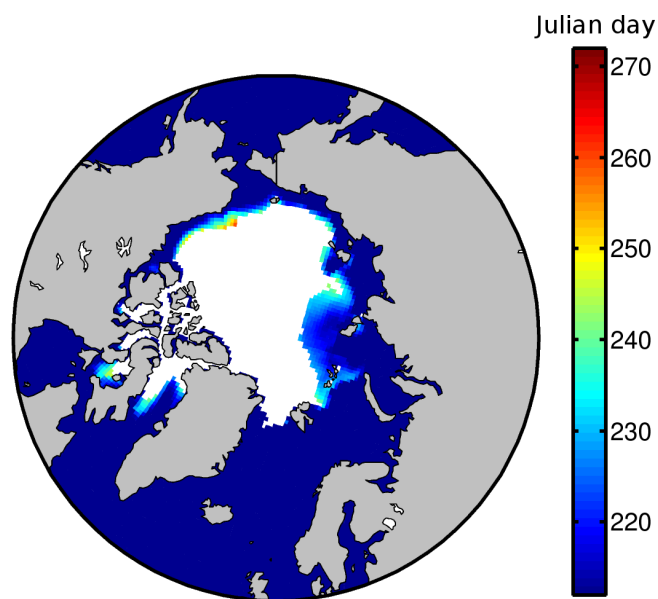Figure 2: sea ice probability (SIP) in September 2014.
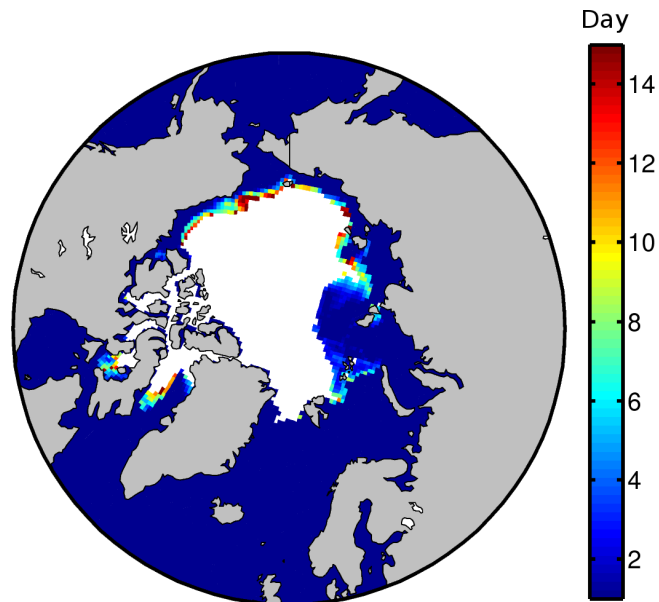

Figure 3: ice-free date (IFD) in 2014.

Figure 4: standard deviation in ice-free date (IFD) in 2014.

References

Madec, G. (2012), NEMO ocean engine, Note du Pôle de modélisation, Institut Pierre-Simon Laplace (IPSL), France, No 27.

Vancoppenolle, M., T. Fichefet, H. Goosse, S. Bouillon, G. Madec and M. A. Morales Maqueda (2009), Simulating the mass balance and salinity of Arctic and Antarctic sea ice. 1. Model description and validation, Ocean Model., 27, 1–2, 33–53, doi: 10.1016/j.ocemod.2008.10.005.

Kalnay, E. and coauthors (1996), The NCEP/NCAR 40-Year Reanalysis Project, Bull. Amer. Meteor. Soc., 77, 3, 437–471, doi: 10.1175/1520-0477(1996)077<0437:TNYRP> 2.0.CO;2.