

SEA ICE PREDICTION NETWORK (SIPN)

Template for Pan-Arctic Sea Ice Outlook Core Contributions

June Report (Using May Data)

**Required*

1. *Contributor Name(s)/Group: Xiaojun Yuan, Dake Chen and Cuihua Li/Lamont-Doherty Earth Observatory of Columbia University

2. *Type of Outlook projection
___model ___x_statistical ___heuristic

If you use a model, please specify:

Model Name ___Linear Markov Model___

Components of the model: Atmosphere___, Ocean___, Ice___, Land___, Coupler___

For non-coupled model: Ice ___x___, Ocean___x___, Forcing___x___

3. *September monthly average projection (in million square kilometers) 5.20

4. *Short explanation of Outlook method (1-3 sentences)

The montprediction

If this is a model contribution, please include method of method of initialization and variable used. In addition, we encourage you to submit a more detailed Outlook, including discussions of uncertainties/probabilities, including any relevant figures, imagery, and references.

A Linear Markov model is used to predict monthly Arctic sea ice concentration at all grid points in the pan Arctic region. The model is a stochastic linear inverse model that is built in the multi-EOF space and is capable to capture the co-variability in the ocean-sea ice-atmosphere system. The model employs 6 variables (ice concentration, sea surface temperature, surface air temperature, 300mb height and wind vectors at 300mb) and 11 mEOF modes. Bias correction has been applied to the prediction.

Chen, D. and X. Yuan, A Markov model for seasonal forecast of Antarctic sea ice. *Journal of Climate*, 17(16), 3156-3168, 2004.

Yuan, X., D. Chen, and C. Li, A Markov model for seasonal forecast of Arctic sea ice. In prep.

5. Projection uncertainty/probability estimate (only required if available with the method you are using)

The uncertainty is measured by RMS error (predicted extent – observed extent). Based on cross-validation experiments, EMS error for September ice extent is 1.12 million square kilometers.

6. Short explanation/assessment of basis for the uncertainty estimate in #5 (1-2 sentences)

The uncertainty is estimated based cross-validation experiments for four months lead prediction of September ice extent using 34 years (1979-2012) of time series.

7. * "Executive summary" about your Outlook contribution

1-3 sentences, to be used in Outlook summary: say in a few sentences what your Outlook contribution is and why. To the extent possible, use non-technical language.

The Markov model is capable to capture co-variability in the ocean-sea ice – atmosphere system, which is likely the predictable part of variances in sea ice. The model focuses on predicting this part of variances. Cross-validation skill, measured by correlation between four-month lead prediction and observation of September ice extent, is 0.77.