Sea Ice Outlook

2023 June Report

Individual Outlook

Name of contributor or name of contributing organization:

Lamont (Yuan and Li)

Is this contribution from a person or group not affiliated with a research organization?

Name and organization for all contributors. Indicate primary contact and total number of people who may have contributed to your Outlook, even if not included on the author list.

Lamont (Yuan & Li)

Do you want your June contribution to automatically be included in subsequent reports? (If yes, you may still update your contribution via the submission form.)

[Do you want your contribution for this month to automatically be included in subsequent reports?]

What is the type of your Outlook projection?

Statistical/ML

Starting in 2017 we are accepting both pan-Arctic and pan-Antarctic sea ice extent (either one or both) of the September monthly mean. As in 2016, we are also collecting Alaskan regional sea ice extent. To be consistent with the validating sea ice extent index from NSIDC, if possible, please first compute the average sea ice concentration for the month and then compute the extent as the sum of cell areas > 15%.

a) Pan-Arctic September extent prediction in million square kilometers.

5.14

b) same as in (a) but for pan-Antarctic. If your method differs substantially from that for the Arctic, please enter it as a separate submission.

17.89

c) same as in (b) but for the Alaskan region. Please also tell us maximum possible extent if every ocean cell in your region were ice covered.

0.66

"Executive summary" of your Outlook contribution (using 300 words or less) describe how and why your contribution was formulated. To the extent possible, use non-technical language.

A linear Markov model is used to predict monthly Arctic sea ice concentration (SIC) at all grid points in the pan-Arctic region (Yuan et al., 2016). The model was retrained last year using the data from 1979 to 2021. The model is capable of capturing the co-variability in the ocean-sea ice-atmosphere system. The September pan-Arctic sea ice extent (SIE) is calculated from predicted SIC. The model predicts negative SIC anomalies throughout the pan-Arctic region, with negative anomalies exceeded 24% in the Kara, Leptev and East Siberian Seas. These anomalies are relative to the 1979-2021 climatology. The September mean pan-Arctic SIE is predicted to be 5.14 million square kilometers (mskm) with an RMSE of 0.50 mskm, at the four-month lead. Predicted Arctic SIE anomaly is 1.02 mskm. The Alaskan regional SIE is predicted to be 0.66 mskm, higher than the observation in 2022. A Similar statistical model was also developed to predict the SIE in the Antarctic (Chen and Yuan, 2004). The September mean pan Antarctic SIE is predicted to be 17.89 mskm, with an RMSE of 0.57 mskm based on model cross-validation experiments.

Brief explanation of Outlook method (using 300 words or less).

The linear Markov model has been developed to predict sea ice concentrations in the pan Arctic region at the seasonal time scale. The model employs 6 variables: NASA Team sea ice concentration, sea surface temperature (ERSST), surface air temperature, GH300, vector winds at GH300 (NCEP/NCAR reanalysis) for the period of 1979 to 2021. It is built in multi-variate EOF space. The model utilizes first 11 mEOF modes and uses a Markov process to predict these principal components forward one month at a time. The pan Arctic sea ice extent forecast is calculated by summarizing all cell areas where predicted sea ice concentration exceeds 15%.

Tell us the dataset used for your initial Sea Ice Concentration (SIC).

Sea ice concentration: NSIDC NASA Team, https://nsidc.org/data/nsidc-0081, https://doi.org/10.5067/U8C09DWVX9LM.

Tell us the dataset used for your initial Sea Ice Thickness (SIT) used. Include name and date.

N/A

If you use a dynamic model, please specify the name of the model as a whole and each component including version numbers and how the component is initialized:

If available from your method.
a) Uncertainty/probability estimates:

Median

Lower error bound

4.64

Lower error bound

5.64

Standard Deviation

0.5

b) Brief explanation/assessment of basis for the uncertainty estimate (1-2 sentences).

Our SIE uncertainty is measured by root-mean-square errors (RMSE) between prediction and observation based on cross-validation experiments.

c) Brief description of any post-processing you have done (1-2 sentences).

First, a constant bias correction was applied to Arctic SIC prediction at each grid point. Then a constant SIE bias also derived from the cross-validation experiments from 1979 to 2021 was corrected from the September SIE prediction. Finally, a resolution bias is corrected in the final Arctic SIE prediction.