Sea Ice Outlook

2023 June Report

Individual Outlook

Name of contributor or name of contributing organization:

SYSU/SML-LSTM

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.

SYSU/SML-LSTM

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.

4.77

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.

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.

"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 deep learning model long short-term memory network (LSTM) is used to predict the monthly sea ice concentration and the sea ice extent of September 2023 in pan-Arctic. Monthly averaged sea ice concentration fields between 1982/01 and 2020/12 were used to train. And the monthly sea ice concentration from 2022/06 to 2023/05 with total 12 months was used to predict the September sea ice extent in 2023. The model predicts a pan-Arctic sea ice extent of 4.77(±0.31) million square kilometers and has a positive anomaly of 0.59.

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

Deep learning model long short-term memory network (LSTM) with encoder-decoder structure is used in this prediction. This structure includes two inputs: encoder input and decoder input. Based on sea ice concentration annual patterns, the LSTM use 12 previous monthly sea ice concentration (t-12~t-1) as encoder input and 1 previous monthly sea ice concentration as decoder input (t-1). The LSTM in encoder generates the context vectors which aggregate the sea ice concentration information from the previous 12 months. The LSTM in decoder utils the previous information in the context vectors to predict sea ice concentration over the next 12 months. The training period is from 1982/01 to 2020/12.

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

“NSIDC NASA Team, https://nsidc.org/data/nsidc-0081/versions/2, https://doi.org/10.5067/YTTHO2FJQ97K, data from 2022/06 to 2023/05 with total 12 months.

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

NA

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

4.77

Lower error bound

4.37

Lower error bound

5.17

Standard Deviation

0.4

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

We estimate our uncertainty with root-mean-square-error(RMSE) of sea ice extent calculated from 2021-2022 hindcast.

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

NA