Sea Ice Outlook

2021 September Report

Individual Outlook

Name of contributor or name of contributing organization:

Big Data REU Team 1 @ UMBC

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.

Big Data REU Team 1 @ UMBC

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.)

Repeat this submission in all future monthly reports

What is the type of your Outlook projection?

ML/Other

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.

4.358

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.

We produced our Outlook as part of a project to predict both Arctic sea ice concentration and extent using the latest deep learning techniques. The following predictors were used to obtain our Outlook: Surface pressure, Wind speed, Specific humidity, Surface temperature, Shortwave radiation, Longwave radiation, Rainfall rate, Snowfall rate, Sea surface temperature, and Sea ice concentration. Sea ice concentration data was obtained from the National Sea Ice Data Center, and data for all other variables was sourced from the ERA-5 re-analysis conducted by the European Center for Medium-range Weather Forecasts. All data was provided at a daily resolution from January 1979 to June 2021 with a value for each grid cell in the 448 by 304 pixel domain. For our deep learning models, the daily data was averaged to the monthly scale.

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

A multi-task convLSTM neural network was used to produce our Outlook. Convolutional neural networks (CNN) are particularly useful for inputs in a spatio-temporal format. We considered our dataset as an image with 10 channels corresponding to the 10 predictors. The model was trained on data from January 1979 to December 2029, and tested from January 2020 to June 2021. When given three month-lagged values for each of the 10 input variables, the model predicts sea ice concentration for each of the 448 * 304 pixels in the spatial domain and a single value represent SIE for the month. The three month-lag of the data enabled us to use June 2021 data to produce the September 2021 Outlook. We calculated overall sea ice extent by selecting pixels with a predicted ice concentration of greater than 15%, multiplying each of these pixels by their specific area, then summing each area.

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

NA

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

Lower error bound

Lower error bound

Standard Deviation

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

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