Name of contributor or name of contributing organization:

IceTFT (Bin Mu et al.)

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.

IceTFT(Bin Mu, et al.)

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?

Mixed/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.

4.85

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.

IceTFT is a SIE forecasting AI system which predicts 12-month SIE up to 12 months ahead at Sea Ice Index from NSIDC NASA Team. IceTFT is based on a deep learning Temporal Fusion Transformer model which was proposed for multi-step forcasting directly instead of recursive approach., and has been trained and tested on SIE dataset from 1982-2021. IceTFT's monthly inputs include SIE, 11 climate variables(2m air temperature, 2m specific humidity, downward shortwave and longwave radiation flux, river and glacier runoff, precipitation, sea surface temperature, snow fall, clear sky downward solar flux, clear sky downward longwave flux and upward solar radiation flux) and time-step static metadata.

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

IceTFT's inputs include three types dataset, and each type of they is selected by separate variable selection network to filter unnecessary noises. The first input type is static metadata which are calculated by counting the days from start(1982-01-01). Gated Residual Network (GRN) in IceTFT generates different context vectors which are linked to the different location, and static covariate encorder condition temporal dynamics through these context vectors. The second input is SIE and three inputs are several physical variables which are used to provide atmospheric, oceanographic features for prediction. IceTFT use an LSTM encoder-decoder to enhance locality information of these time series. In addition, IceTFT uses a interpretable multi-head self-attentive mechanism to learn long-term features at different time steps. Note that IceTFT use SIE as input instead of SIC, and the output of IceTFT are 12-month SIE.

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

NSIDC NASA Team,Sea Ice Index, Version 3(https://doi.org/10.7265/N5K072F8)

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

0.15

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).