

**Sea Ice Outlook**  
2021 July Report  
Individual Outlook

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**Name of contributor or name of contributing organization:**

BDAL Group (Sahara 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.**

BDAL Group (Sahara 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.)**

Include this submission in this month's report ONLY

**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.**

4.452

**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.**

It is our goal to predict the 2021 September sea ice extent with a leading time of 3 months (at the end of June) using deep learning methods. The contributing factors are the monthly values of 10 atmospheric and ocean variables for the Pan-Arctic region. The monthly satellite retrieved sea ice data is taken from NSIDC GSFC NASA team, while atmospheric and oceanic variables data is taken from ERA5 global reanalysis product for 42 years, i.e, from January 1979 to June 2021. These atmospheric and ocean variables include surface pressure, 10-meter wind velocity, specific humidity, 2-meter air temperature, shortwave radiation, longwave radiation, rain rate, snowfall rate, sea surface temperature and sea ice extent.

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

We have developed a novel many-to-one Long Short Term Memory (LSTM) model to make monthly mean predictions for pan-Arctic sea ice extent using daily data. We trained our model on the first 37 years of data and evaluated its performance on the last 5 years of data. We forecasted the sea ice extent value for September 2021 with a leading time of 3 months, i.e., June 2021's data sample.

**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).**