

Sea Ice Outlook
2021 September Report
Individual Outlook

Name of contributor or name of contributing organization:

NASA GMAO

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.

NASA GMAO

**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?

Dynamic Model

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.

4.09

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.

0.41

"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.

An experiment of the new GMAO seasonal forecasting system version 3 predicts a September average Arctic ice extent of 4.09 ± 0.33 million km². The experiment is a test of the new MERRA2-Ocean ODAS and forecast ensemble sub-setting method in a near-real time setting. The forecast suggests a September-averaged ice cover that is similar in extent to the previous year.

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

The forecast uses a prototype the GEOS_S2S version 3 coupled system that was modified for this forecast. The model has an approximate grid spacing of $\frac{1}{2}^\circ$ in the atmosphere and $\frac{1}{4}^\circ$ in the ocean. The ocean data assimilation system is driven by MERRA-2 atmospheric reanalysis and assimilates available observations and along-track ocean altimetry. The ODAS was integrated from November 2020 through May 2021. For this experiment, AWI CryoSat-2/SMOS ice thicknesses were incorporated for the first two months of the integration only. The version 3 ensemble uses a staggered initialization of five atmosphere-perturbed ensemble members starting on every fifth day beginning 01-May. Five atmosphere-perturbed and ten ocean-perturbed ensemble members are started on the last day of the month. A total of 45 ensemble members were run through July, at which point the ensemble is sub-sampled based on error growth, with 10 ensemble members continuing the forecast integration through September.

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

MERRA-2 (<https://doi.org/10.5067/7MCPBJ41Y0K6>)(the MERRA-2 sea ice and SST are obtained from OSTIA; the OSTIA sea ice concentration originates with OSI SAF).

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

NA. (The ODAS was initialized using AWI CryoSat-2/SMOS Data Fusion for November and December 2020, <https://doi.org/10.5194/tc-11-1607-2017>. The ODAS then continued to integrate through to the starting dates in May 2021 without external ice thickness data.)

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:

GEOS S2S_v3 model.

Atmosphere: Goddard Earth Observing System model (GEOS), version Icarus3.3p2 (modified for coupled model); MERRA-2 (atmospheric reanalysis).

Ocean: GFDL Modular Ocean Model version 5 (MOM5); modified version of GMAO MERRA2-Ocean ODAS.

Sea Ice: modified version of the Los Alamos Community Ice Code version 4.1 (CICE4.1); MERRA-2/OSTIA (the OSTIA sea ice concentration originates with OSI SAF).

If available from your method.

a) Uncertainty/probability estimates:

Median

4.13

Lower error bound

3.77

Lower error bound

4.42

Standard Deviation

0.33

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

The indicated uncertainty is based on the standard deviation of 10 ensemble members, which were selected based on an automated sub-sampling procedure used in the forecast system. Other

sources of uncertainty may result from factors associated with the numerical model and its initial conditions.

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

The output monthly mean fields were re-gridded to determine values for the Alaska domain.