Sea Ice Outlook
2017 July Report
Individual Outlook

Name of contributor or name of contributing organization:

GFDL/NOAA, Bushuk 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.

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Do you want your June contribution to automatically be included in subsequent reports? (If yes, you may still update your contribution via the Google form.)

No do not use my prediction this month in later months

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.

4.21

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.

0.10

Maximum possible extent: 3.80 million square kilometers

"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.

Our July 1 prediction for the September-averaged Arctic sea-ice extent is 4.21 million square kilometers, with an uncertainty range of 3.58-4.61 million square kilometers. Our prediction is based on the GFDL-FLOR ensemble forecast system, which is a fully-coupled atmosphere-land-ocean-sea ice model initialized using a coupled data assimilation system. Our prediction is the bias-corrected ensemble mean, and the uncertainty range reflects the lowest and highest sea ice extents in the 12-member ensemble.

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

Our forecast is based on the GFDL Forecast-oriented Low Ocean Resolution (FLOR) model (Vecchi et al., 2014), which is a coupled atmosphere-land-ocean-sea ice model. The model is initialized from an Ensemble Kalman Filter coupled data assimilation system (ECDA; Zhang et al., 2007), which assimilates observational surface and subsurface ocean data and atmospheric reanalysis data. The system does not assimilate any sea ice concentration or thickness data. The FLOR atmospheric initial conditions are produced from an AMIP run forced by observed SST and sea ice. Historical radiative forcing is used prior to 2005 and the RCP4.5 scenario is used for

predictions after 2005. For the predictions initialized after 2004, the aerosols are fixed at the RCP4.5 scenario year of 2004. The performance of this model in seasonal prediction of Arctic sea ice extent has been documented in Msadek et al. (2014) and Bushuk et al. (2017). For an evaluation of the model's September sea ice extent prediction skill from a July 1 initialization, see Section 2 below.

References:

Bushuk, M., R. Msadek, M. Winton, G. Vecchi, R. Gudgel, A. Rosati, and X. Yang, 2017: Skillful regional prediction of Arctic sea ice on seasonal timescales. Geophys. Res. Lett., 44.

Msadek, R., G. Vecchi, M. Winton, and R. Gudgel, 2014: Importance of initial conditions in seasonal predictions of Arctic sea ice extent. Geophys. Res. Lett., 41 (14), 5208-5215.

Vecchi, G. A., et al., 2014: On the seasonal forecasting of regional tropical cyclone activity. J. Climate, 27 (21), 7994-8016.

Zhang, S., M. Harrison, A. Rosati, and A. Wittenberg, 2007: System design and evaluation of coupled ensemble data assimilation for global oceanic climate studies. Mon. Wea. Rev., 135 (10), 3541-3564.

Tell us the dataset used for your initial Sea Ice Concentration (SIC). Include name and date (e.g., "NASA Team, May 2017"). We also encourage you to submit initial fields to the dropbox, see https://www.arcus.org/sipn/sea-ice-outlook/2017/june/call in the section on "Submitting Figures and Gridded Data of Full Spatial Fields (Optional) of Forecasts and Initial Conditions" for detailed instructions. Required if sea Ice concentration is used.

None

Dataset of initial Sea Ice Thickness (SIT) used (include name and date):

None

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:

Model: GFDL-FLOR

Component Name Initialization (e.g., describe Data Assimilation)

Atmosphere	AM2.5	AMIP run forced with observed SST/sea ice
Ocean	MOM4	EnKF coupled data assimilation
Sea Ice	SIS1	EnKF coupled data assimilation (no ice data)

If available from your method for pan-Arctic extent prediction, please provide

a) Uncertainty/probability estimate such as median, ranges, and/or standard deviations (specify what you are providing).

Median: 4.21
Range: 3.58-4.61
St. dev.: 0.26

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

These statistics are computed using our 12 member prediction ensemble.

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

These forecasts are bias corrected based on an additive correction using a suite of retrospective forecasts spanning 1980-2016. The bias is defined as the September sea ice extent difference between NSIDC NASA team observations and forecasts initialized on July 1.