Sea Ice Outlook

Executive Summary

The outlook for the September sea ice extent (SIE) for the year 2019 is based on the mean Arctic Oscillation (AO) index during the previous winter. The AO index was -0.4 for the September sea-ice extent anomaly. This is a purely statistical method (related to Krigging) to extrapolate the long-term trend from previous observations of September Arctic sea ice extent over the 1993-2018 period. A negative departure from the trend is projected for the September sea ice extent over the 1993-2018 period. In 2019, there is likely to be anomalously thin sea ice.

Method Summary

The sea ice extent is calculated from sea ice concentration data using a universal thresholding method. The Thwaites et al. (2012) sea ice concentration data is used for the September sea ice extent anomaly. Sea ice extent anomaly is defined as the difference between the September mean sea ice extent and the long-term mean sea ice extent.

Sea Ice Concentration Rate

None

Sea Ice Concentration Rate

None

Baseline

Title: Sea Ice Outlook

Type: Report

Source: University of East Anglia (Cawley) / McGill Team / LASG-IAP / Nevada

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Summary

The sea ice extent for the month of September 2019 is expected to be about 3.06 million square kilometers. This is based on the mean Arctic Oscillation (AO) index during the previous winter. The AO index was -0.4 for the September sea-ice extent anomaly. This is a purely statistical method (related to Krigging) to extrapolate the long-term trend from previous observations of September Arctic sea ice extent over the 1993-2018 period. A negative departure from the trend is projected for the September sea ice extent over the 1993-2018 period. In 2019, there is likely to be anomalously thin sea ice.

Method

The sea ice extent is calculated from sea ice concentration data using a universal thresholding method. The Thwaites et al. (2012) sea ice concentration data is used for the September sea ice extent anomaly. Sea ice extent anomaly is defined as the difference between the September mean sea ice extent and the long-term mean sea ice extent.
The given uncertainty is the standard deviation of the 10 member ensemble. The projected Arctic minimum sea ice extent from the NCEP CFSv2 model is derived ice thickness predicts a September average Arctic ice extent of 4.41 million square kilometers with a standard deviation of 0.42 million square kilometers. For 2019 the model was upgraded with a bottom-melt model and a radiation of near real-time atmospheric analysis that is similar to MERRA-2, and uses the Local Volume model (v1.5 https://cryospherecomputing.tk/SIT). For each day the model assimilates sea ice concentration and thickness data from a predicted Sea Ice Volume model (v1.5 https://nsidc.org/data/RDEFT4/) from ships, coasters and sea ice buoys. This method applies daily ice loss rates to extrapolate from the start date to the end of the model period. We estimate a weighted model. The forecast is based on a statistical prediction based on the correlation between the ice area extent linear trend and the September extent. The uncertainty estimate is based on results from ensemble runs with the global ocean-sea ice wave radiation and sea ice albedo derived from a predicted Sea Ice Volume model (v1.5 https://cryospherecomputing.tk/SIT). For each day the model assimilates sea ice concentration and thickness data from a predicted Sea Ice Volume model (v1.5 https://nsidc.org/data/RDEFT4/), which in turn obtains sea ice from the EUMETSAT Satellite Ocean Data Service (GES DISC). The MERRA-2 sea ice concentration is derived from MODIS (MOD09A1) daily products at 1 kilometer spatial resolution. The forecast is based on a statistical prediction based on the correlation between the ice area extent linear trend and the September extent. The uncertainty estimate is based on results from ensemble runs with the global ocean-sea ice wave radiation and sea ice albedo derived from a predicted Sea Ice Volume model (v1.5 https://nsidc.org/data/RDEFT4/), which in turn obtains sea ice from the EUMETSAT Satellite Ocean Data Service (GES DISC). The MERRA-2 sea ice concentration is derived from MODIS (MOD09A1) daily products at 1 kilometer spatial resolution. The forecast is based on a statistical prediction based on the correlation between the ice area extent linear trend and the September extent. The uncertainty estimate is based on results from ensemble runs with the global ocean-sea ice wave radiation and sea ice albedo derived from a predicted Sea Ice Volume model (v1.5 https://nsidc.org/data/RDEFT4/), which in turn obtains sea ice from the EUMETSAT Satellite Ocean Data Service (GES DISC). The MERRA-2 sea ice concentration is derived from MODIS (MOD09A1) daily products at 1 kilometer spatial resolution. The forecast is based on a statistical prediction based on the correlation between the ice area extent linear trend and the September extent. The uncertainty estimate is based on results from ensemble runs with the global ocean-sea ice wave radiation and sea ice albedo derived from a predicted Sea Ice Volume model (v1.5 https://nsidc.org/data/RDEFT4/), which in turn obtains sea ice from the EUMETSAT Satellite Ocean Data Service (GES DISC). The MERRA-2 sea ice concentration is derived from MODIS (MOD09A1) daily products at 1 kilometer spatial resolution. The forecast is based on a statistical prediction based on the correlation between the ice area extent linear trend and the September extent. The uncertainty estimate is based on results from ensemble runs with the global ocean-sea ice wave radiation and sea ice albedo derived from a predicted Sea Ice Volume model (v1.5 https://nsidc.org/data/RDEFT4/), which in turn obtains sea ice from the EUMETSAT Satellite Ocean Data Service (GES DISC). The MERRA-2 sea ice concentration is derived from MODIS (MOD09A1) daily products at 1 kilometer spatial resolution. The forecast is based on a statistical prediction based on the correlation between the ice area extent linear trend and the September extent. The uncertainty estimate is based on results from ensemble runs with the global ocean-sea ice wave radiation and sea ice albedo derived from a predicted Sea Ice Volume model (v1.5 https://nsidc.org/data/RDEFT4/), which in turn obtains sea ice from the EUMETSAT Satellite Ocean Data Service (GES DISC). The MERRA-2 sea ice concentration is derived from MODIS (MOD09A1) daily products at 1 kilometer spatial resolution.
A simple statistical model is used to predict September average Arctic sea ice extent. The model is based on monthly mean ice extent from September 1979 to 2018, a total of 40 years, and can be updated with new data as it becomes available. The model is based on the following assumptions:

1. The September mean pan-Arctic SIE is predicted to be 18.64 million square kilometers at the four-month lead. It is 0.2 mskm below September SIE in the sea ice-atmosphere system. The September pan-Arctic sea ice extent (SIE) is calculated from predicted SIC. The model predicts SIC at all grid points in the pan-Arctic region, which is 0.77 mskm, at the four-month lead, 1.32 mskm, at the four-month lead, and 1.68 mskm, at the four-month lead, respectively.

2. The skill of the model is assessed by comparing the model predictions to observations. The model skill is expressed in terms of root mean square error (RMSE), which is a measure of the difference between the model predictions and the observations. The RMSE is calculated as the square root of the mean of the squared differences between the model predictions and the observations. The RMSE is calculated for each model run and for each grid point in the pan-Arctic region.

3. The model predictions are compared to observed SIE data from the National Snow and Ice Data Center (NSIDC). The NSIDC provides SIE data for the pan-Arctic region, which is updated daily. The SIE data are available for the period 1979 to 2018. The NSIDC SIE data are used to evaluate the model predictions.

4. The model skill is expressed in terms of anomaly correlation coefficient (ACC), which is a measure of the agreement between the model predictions and the observations. The ACC is calculated as the ratio of the covariance between the model predictions and the observations to the product of the standard deviations of the model predictions and the observations. The ACC is calculated for each model run and for each grid point in the pan-Arctic region.

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A statistical model computes the probability that sea ice will be present (concentration above 15%) for each grid cell in NSIDC's polar stereographic forecasting system (GloSea). GloSea is a fully coupled Atmosphere-Ocean-Sea Ice-Land (AOIL) model that produces a small 2-member ensemble of sea ice predictions. Here we use the regional coupled ocean-sea ice model to make the September sea ice cover projection. We initialize the model with remote sensing sea ice concentration data and reanalysis ocean data from the EU Copernicus Marine Service. The seasonal forecast atmospheric fields of ocean surface temperatures, sea ice thickness, and freshening are also used together to create a 42-member lagged ensemble or forecasts of Arctic sea ice extent.

The ensemble spread was used to create a range of the 10 measure of uncertainty. The uncertainty estimate is the range of the 10 measure of uncertainty. The range of the ensemble spread was used to create a range of the 10 measure of uncertainty.

The projected Arctic September sea ice extent is 5.2 to 6.3 million km². The projected Antarctic September sea ice extent is 20.5 million km² with an ensemble range from 19.5 to 21.5 million km².

Sea ice concentration data was obtained from NSIDC's Sea Ice Index V3 (Data Set ID: G02135), all other variables are from NASA's MERRA2 dataset.