

2020 Sea Ice Outlook - June contribution

DovekSIE, a statistical model based on sea ice export through the Fram Strait

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Section 1:

Confirm whether your submission is for this month only, or to be included in other monthly reports:

Include this submission in all three of the monthly reports (June, July, and August)

Section 2:

What is the type of your Outlook projection?

Statistical

Section 3:

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Section 4:

Pan-Arctic September extent prediction:

3.89 million km²

Section 5:

Executive summary of your Outlook contribution:

Our research focuses on seasonal predictability of sea ice in the Arctic Ocean, using observations-based approaches. We are interested in the winter preconditioning effect on the pack ice before the summer melt. Specifically, we investigate how dynamic processes affect preconditioning, in other words, we ask how anomalies in the general circulation of sea ice will influence later conditions of the Arctic Ocean pack ice under a typical melt season. We investigate the skill of different sea ice predictors, including atmospheric forcing parameters that physically connect to wintertime sea ice dynamics.

The dovekSIE method builds on the correlation between winter Fram Strait sea ice export and the following September minimum sea ice extent, presented in Williams et al., 2016. A positive anomaly of the winter Fram Strait sea ice export is associated with enhanced circulation of ice through the Transpolar Drift Stream and positive anomalies of coastal divergence of sea ice along the Eurasian coastlines. Increased coastal divergence late in the winter causes anomalies of younger and thinner ice in the peripheral seas, which is more vulnerable to melting in the summer.

The dovekSIE forecasts are generated using the sea level pressure difference between Greenland and Svalbard as a proxy for area of ice exported through Fram Strait. Sea ice tends to flow parallel to isobars and the pressure difference across Fram Strait correlates with sea ice export ($r=0.44$). Sea level pressure fields are available in near-real-time and therefore enable the continuous update of dovekSIE forecasts during winter via the web app.

We are supporting the activities of the Sea Ice Prediction Network with great enthusiasm. This is our fourth contribution to the Sea Ice Outlook.

Section 6:

[Brief explanation of the outlook method:](#)

The dovekSIE prediction for the 2020 monthly mean September ice extent is 3.89 million km². The dovekSIE prediction is computed as a sum of the linear trend (climatology) and departure from the trend (interannual variability). We take the long-term linear trend in a time series of the monthly mean September sea ice extent over the 1993-2019 period. A negative departure from the trend is projected for the 2020 September monthly mean sea ice extent. We use the integrated sea level pressure difference across Fram Strait from November 1 to May 31 in a linear least squares fit model as a predictor for the anomaly of monthly mean September sea ice extent.

Section 7:

[Initial SIC/SIT datasets:](#)

Sea ice concentration is not used as an initial condition (such as in a dynamical model). However, we use sea ice extent from the NSIDC Sea Ice Index V3 to fit our statistical model.

Section 8:

[a\) Uncertainties / probabilities estimates](#)

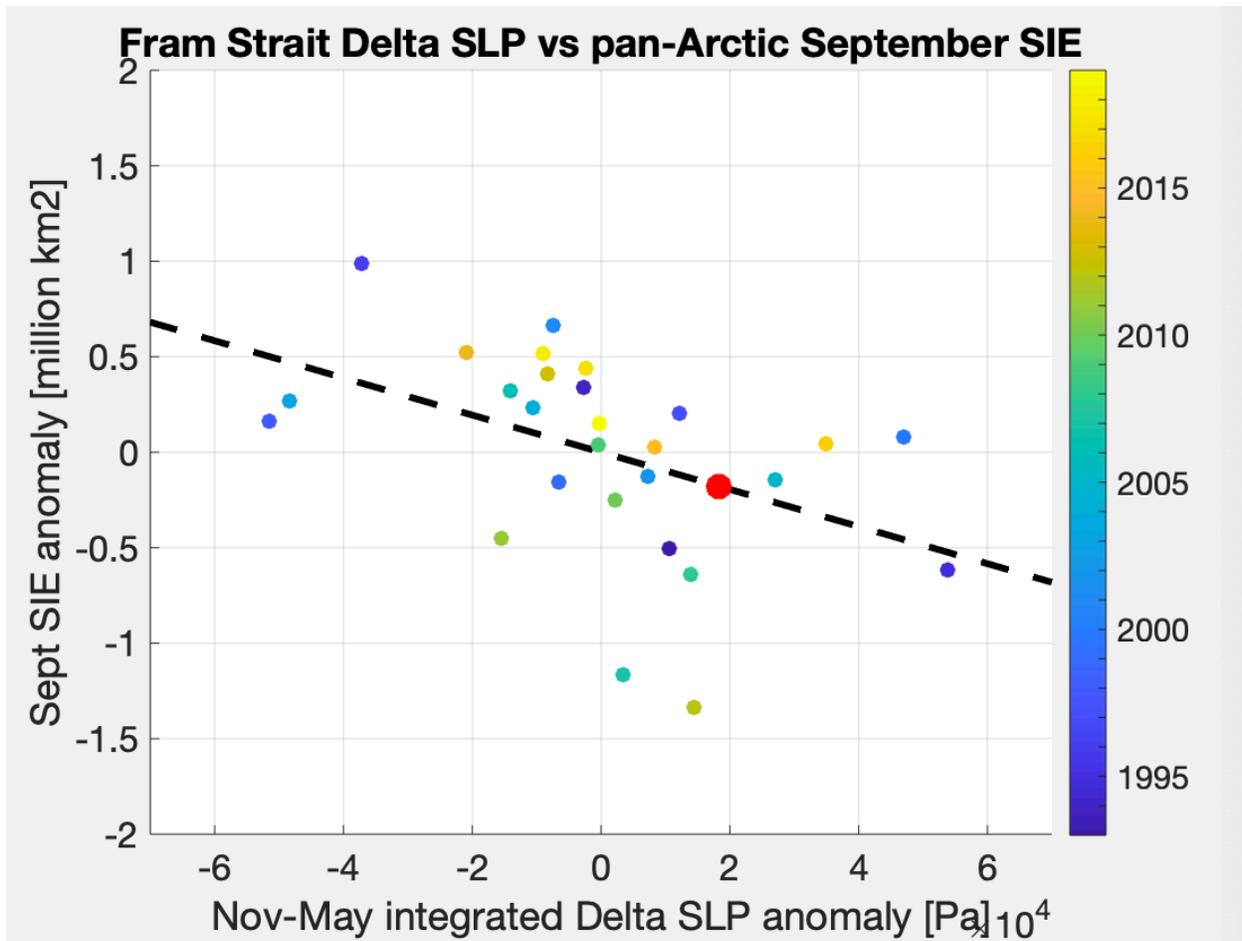
RMSE: 0.46 million km²

[b\) Assessment of basis for the uncertainty estimate](#)

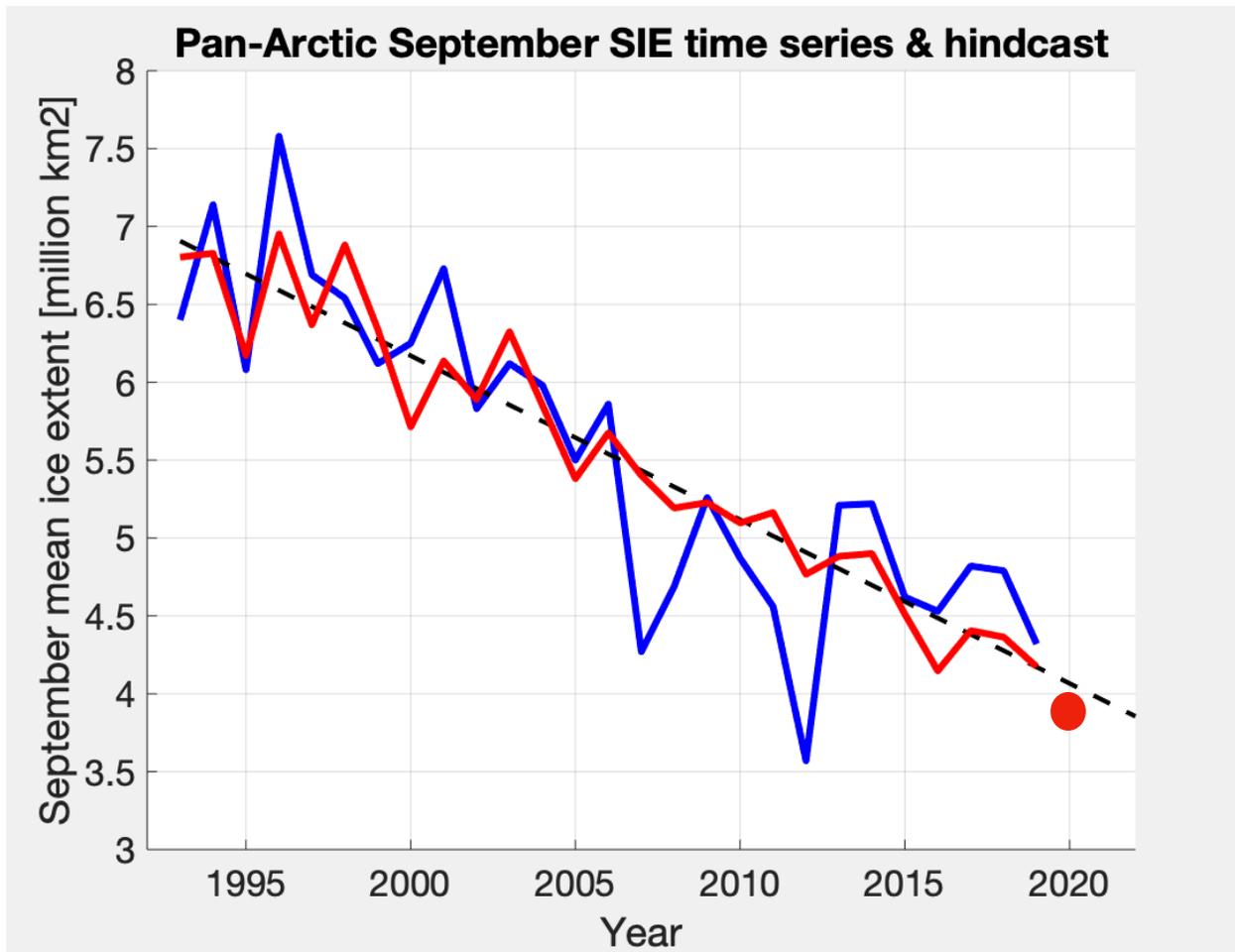
We compare hindcasts to the observed mean September sea ice extent for the 1993-2019 period and calculate the root mean squared error.

References:

Williams, J., Tremblay, B., Newton, R., & Allard, R. (2016). Dynamic preconditioning of the minimum September sea-ice extent. *Journal of Climate*, 29(16), 5879-5891, doi: 10.1175/JCLI-D-15-0515.1



Scatter plot of the anomaly of the time integrated sea level pressure difference between Greenland and Svalbard and the anomaly of the mean pan-Arctic September sea ice extent. The coefficient of correlation between the two is $r=-0.45$. The dashed line represents the best linear fit going through zero. The red dot indicates the sea level pressure difference anomaly for 2020.



Time series of observed mean September sea ice extent (blue) and dovekSIE hindcasts (red) over the 1993-2018 period. The dashed black line indicates the 1993-2018 mean September sea ice extent trend based on the observations. The red dot represents the September 2020 forecast (3.89 million km²).