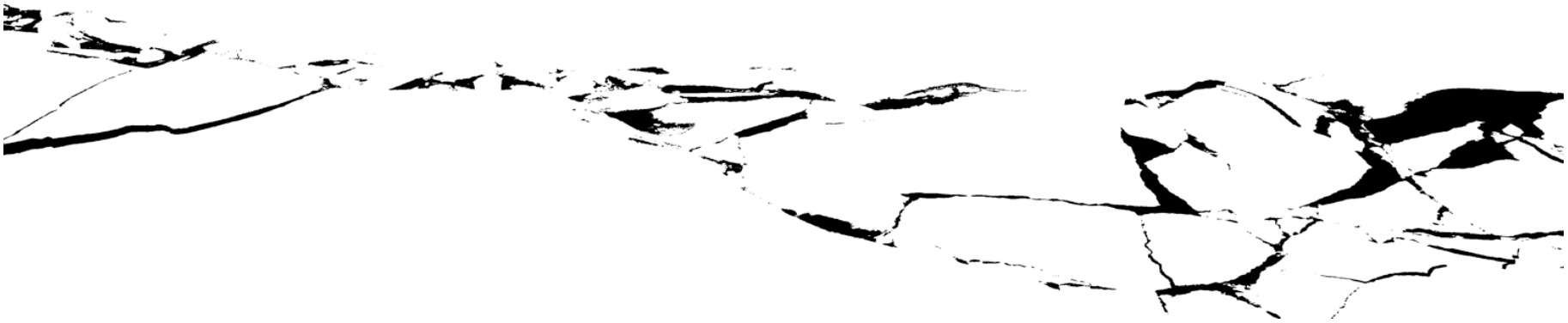
Skillful seasonal sea ice forecasts using satellite derived ice-ocean observations:

Results for September Arctic sea ice and beyond



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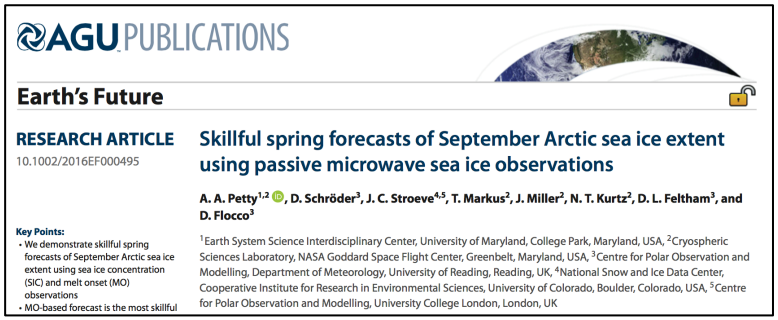
Skillful forecasts of September Arctic sea ice extent

- Simple linear regression framework using spring pan-Arctic data.


AGU PUBLICATIONS

Earth's Future

RESEARCH ARTICLE
10.1002/2016EF000495

Skillful spring forecasts of September Arctic sea ice extent using passive microwave sea ice observations

A. A. Petty[1,2], D. Schröder[3], J. C. Stroeve[4,5], T. Markus[2], J. Miller[2], N. T. Kurtz[2], D. L. Feltham[3], and D. Flocco[3]

Key Points:
- We demonstrate skillful spring forecasts of September Arctic sea ice extent using sea ice concentration (SIC) and melt onset (MO) observations
- MO-based forecast is the most skillful

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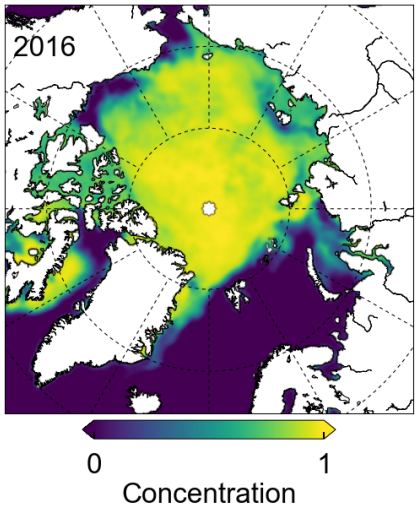
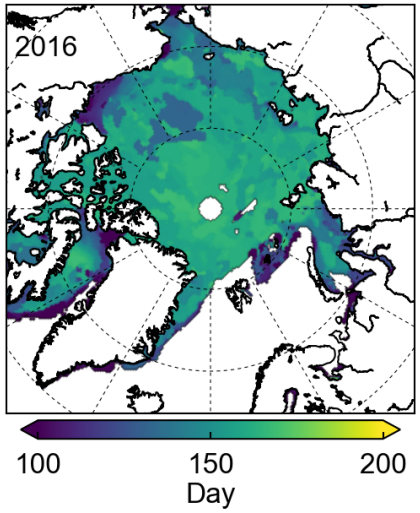
https://github.com/akpetty/ArcticSeaIcePrediction2017

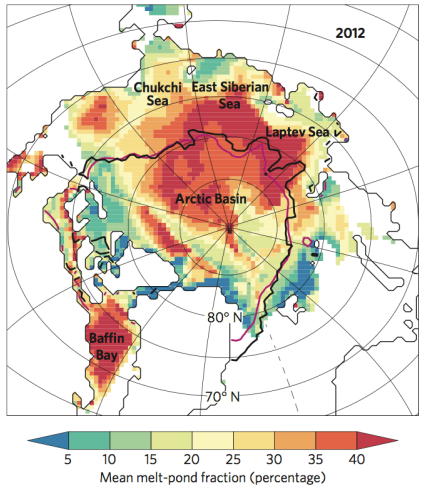
Passive microwave ice concentration



Passive microwave melt onset

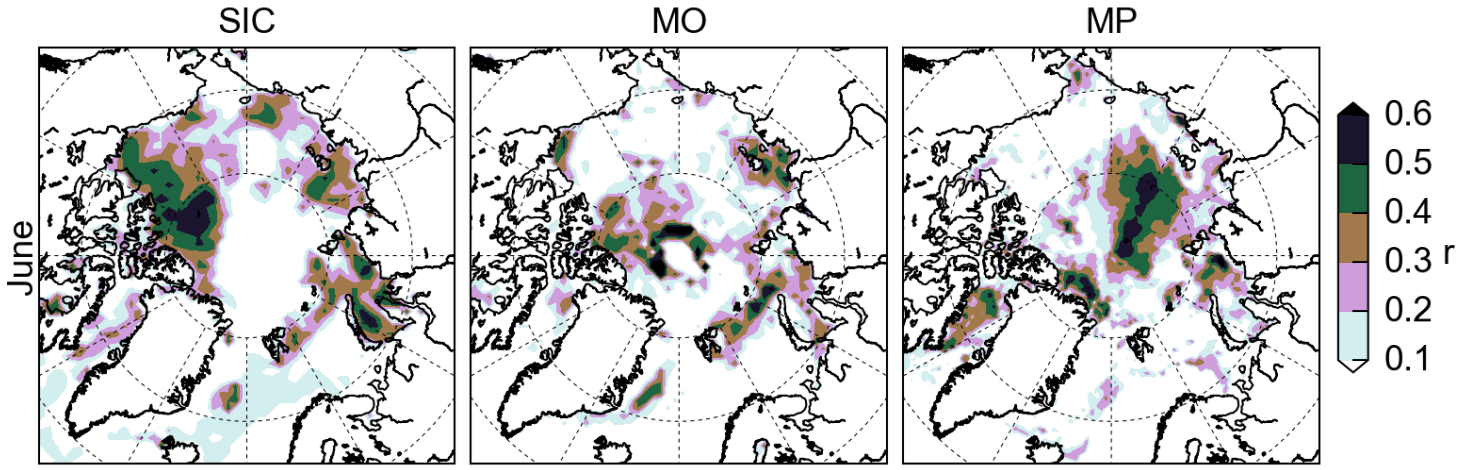


CICE simulated mend pond coverage (from Schroeder et al., 2014)



Quick methods slide..

1. Detrend the ice extent and forecast grid cells for all years prior to the forecast year. Correlate.

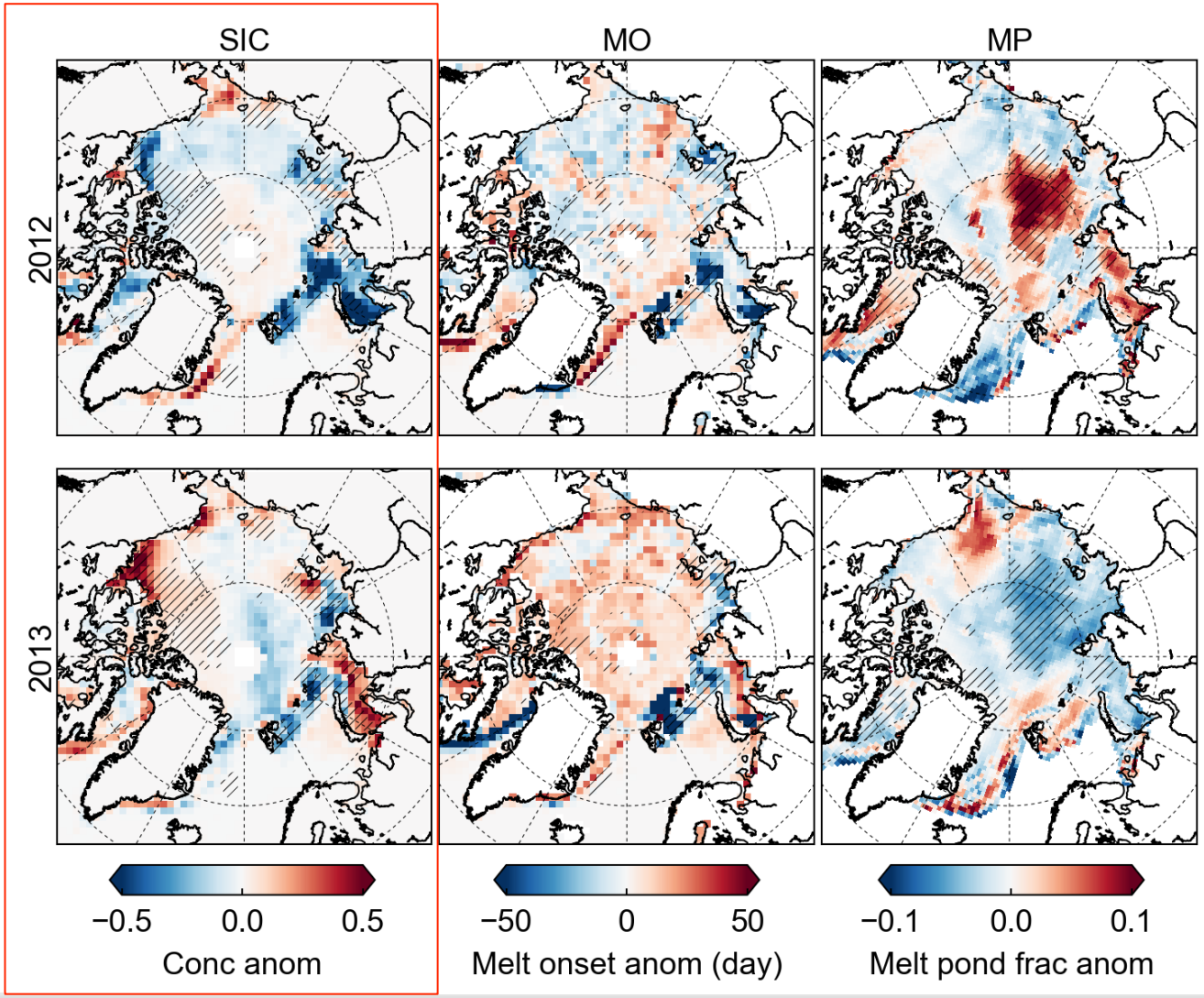


2. Use the correlations as weightings, apply to spring variables and average to generate a weighted/averaged time series.
3. Generate a linear regression model from the two time series'.
4. Detrend current year's data, weight, then apply to the model and produce a forecast.

Regional drivers of pan-Arctic forecasts

Detrended variables (hatchings = spatial weightings).

Based on June data



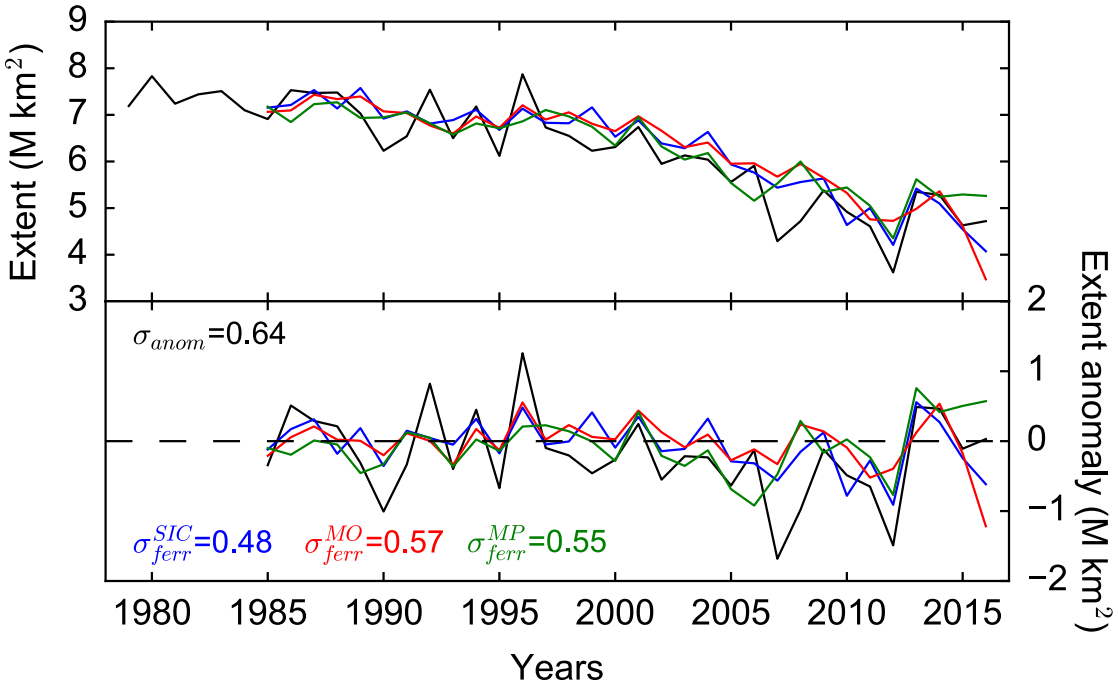
Skillful forecasts of September sea ice extent

- Firstly, how do we define skill?
- We choose linear trend persistence and compare RMS errors.

$$S=1-(rms_{forr}^2/rms_{ltp}^2)$$

- Another is a lagged 'auto-correlation' approach, but this misses the accuracy.

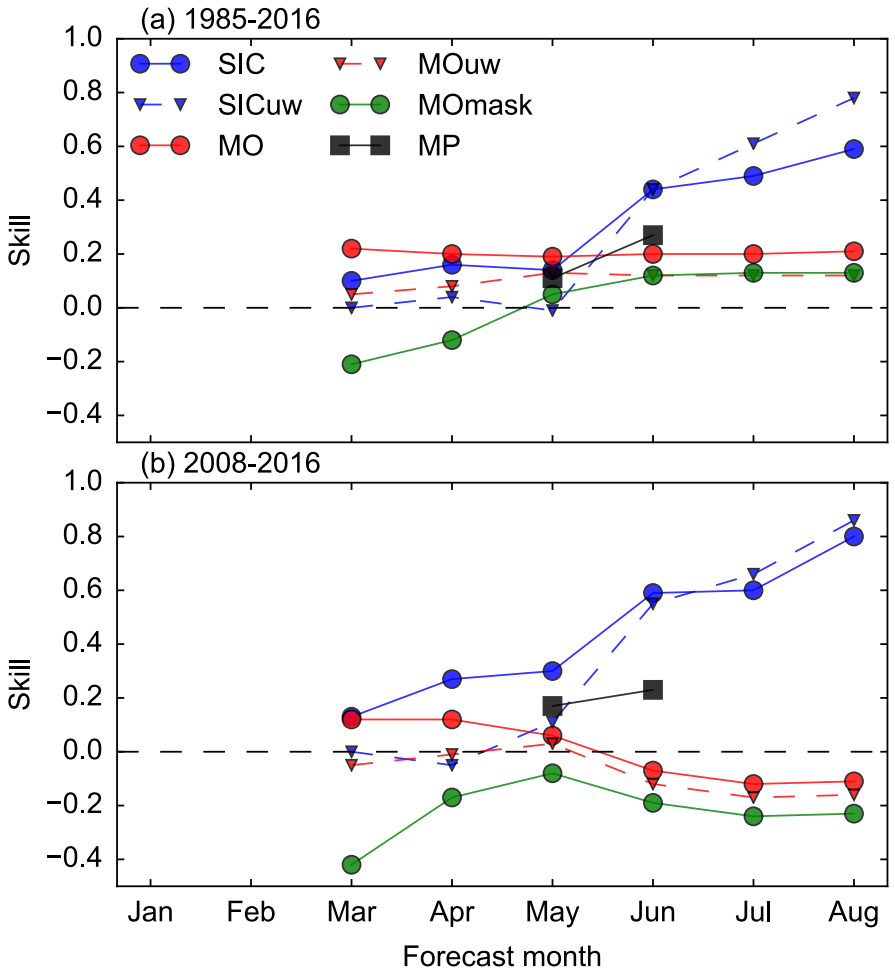
- Which is this the best metric?



*Forecasts using June data

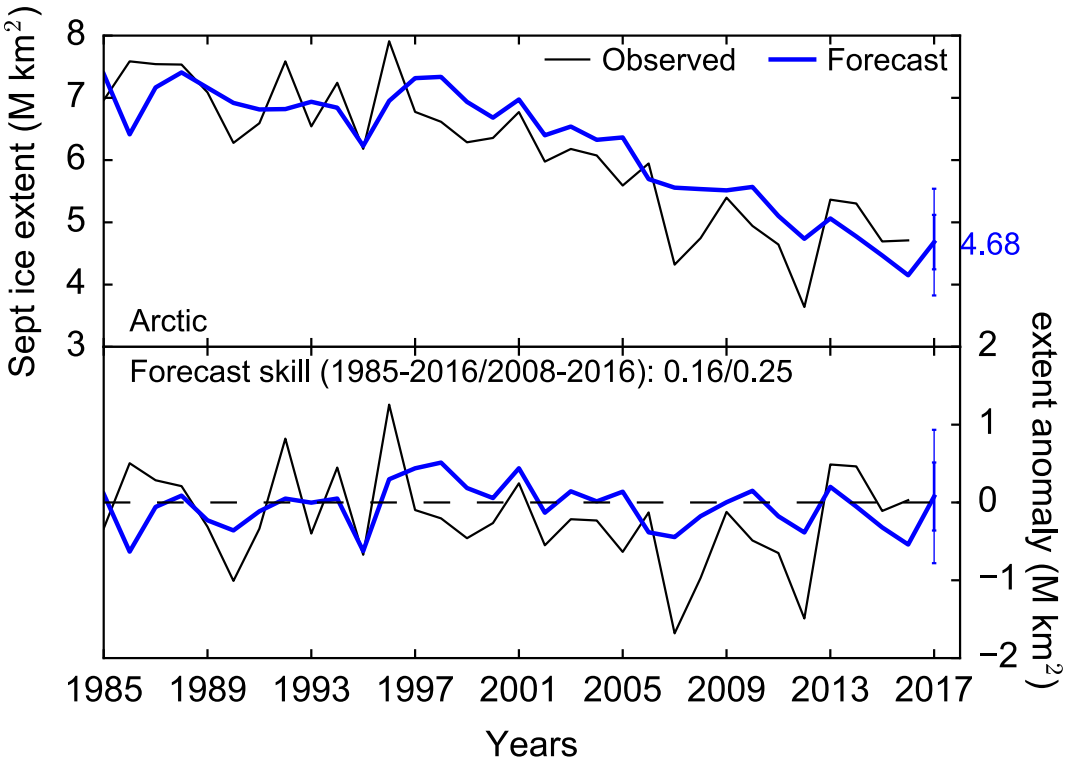
Skillful forecasts of September sea ice

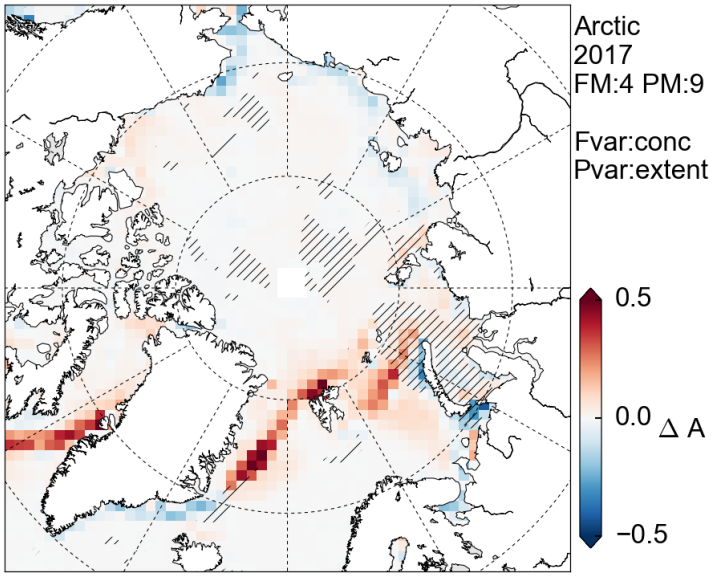
- Ice concentration best, especially at lower lead times.
- Some skill in the melt onset at early lead times (open water timing).
- NB Not much improvement for multivariate regressions (not shown!)



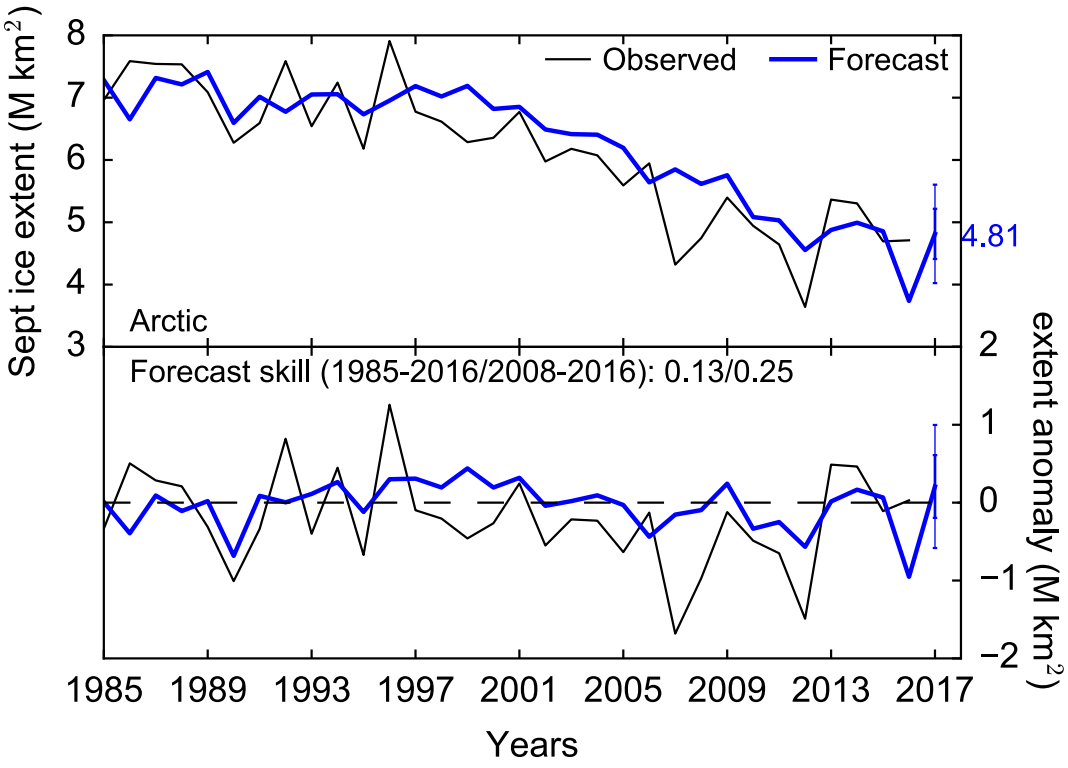
What about the 2017 forecasts?..

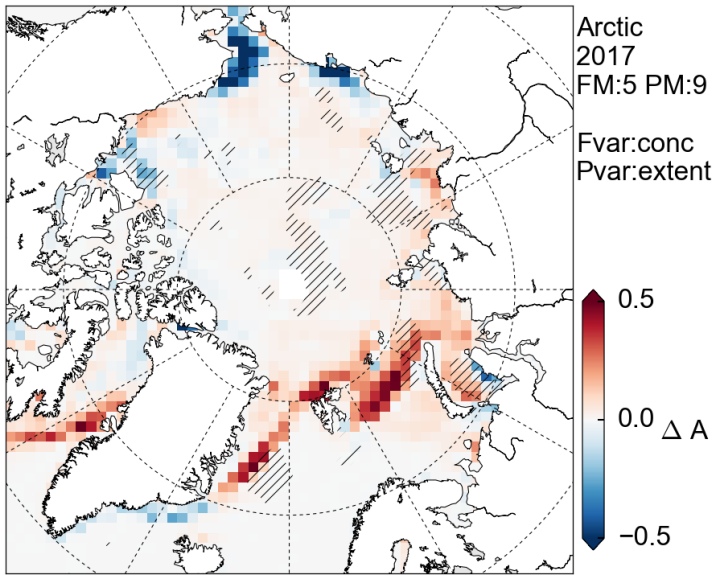
April forecast of September 2017 SIE



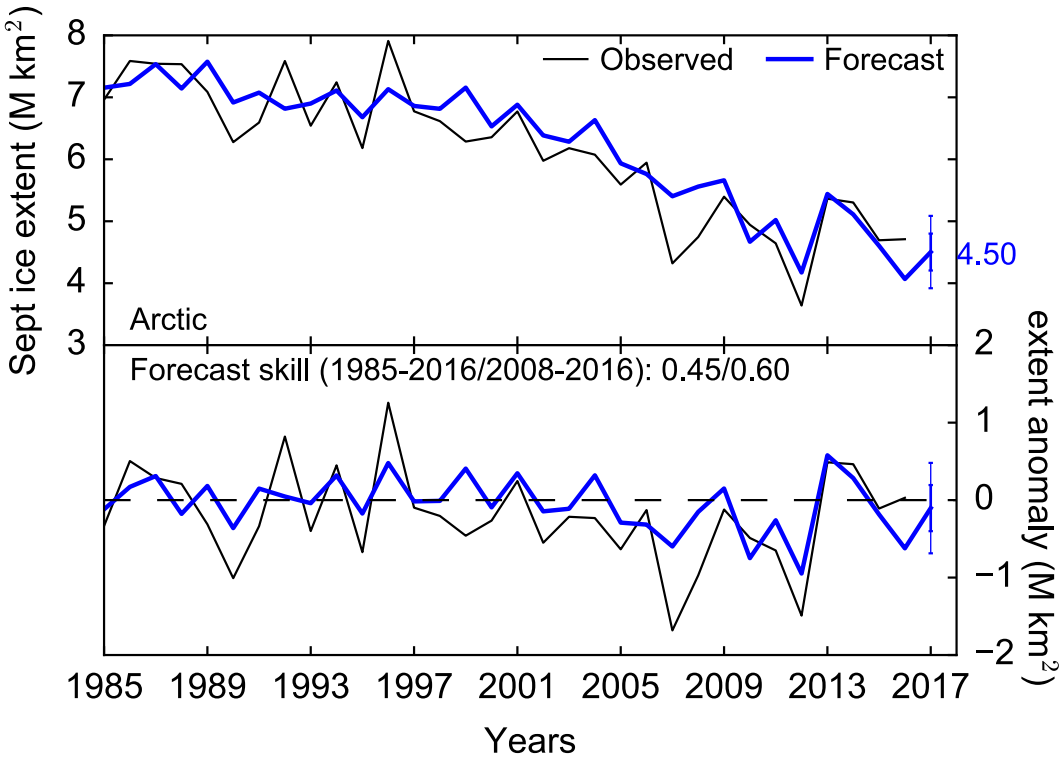


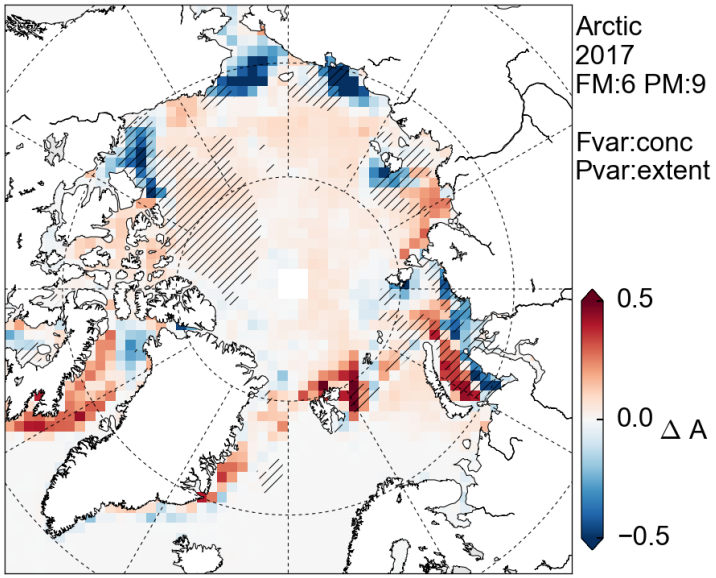
May forecast of September 2017 SIE





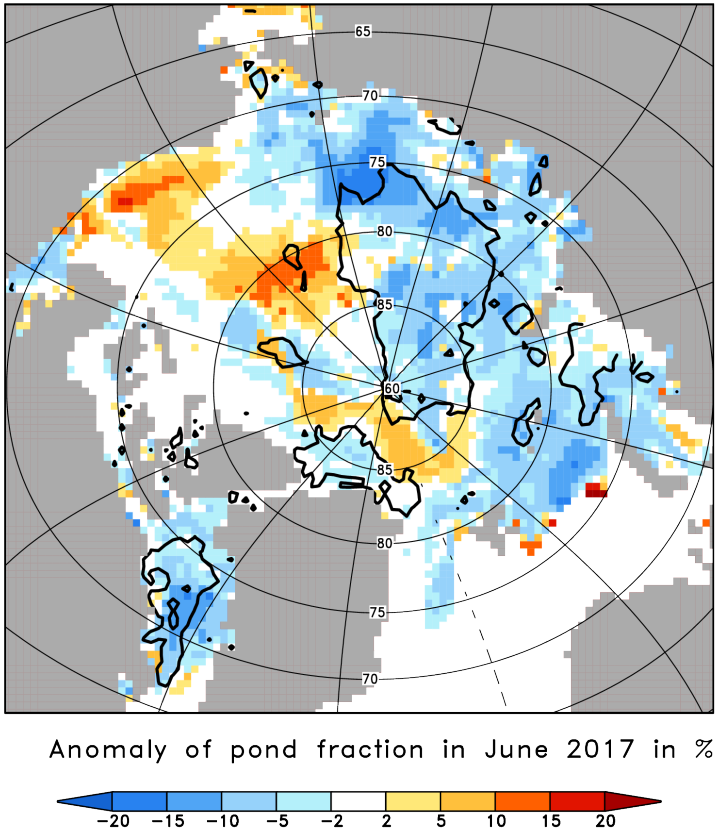
June forecast of September 2017 SIE





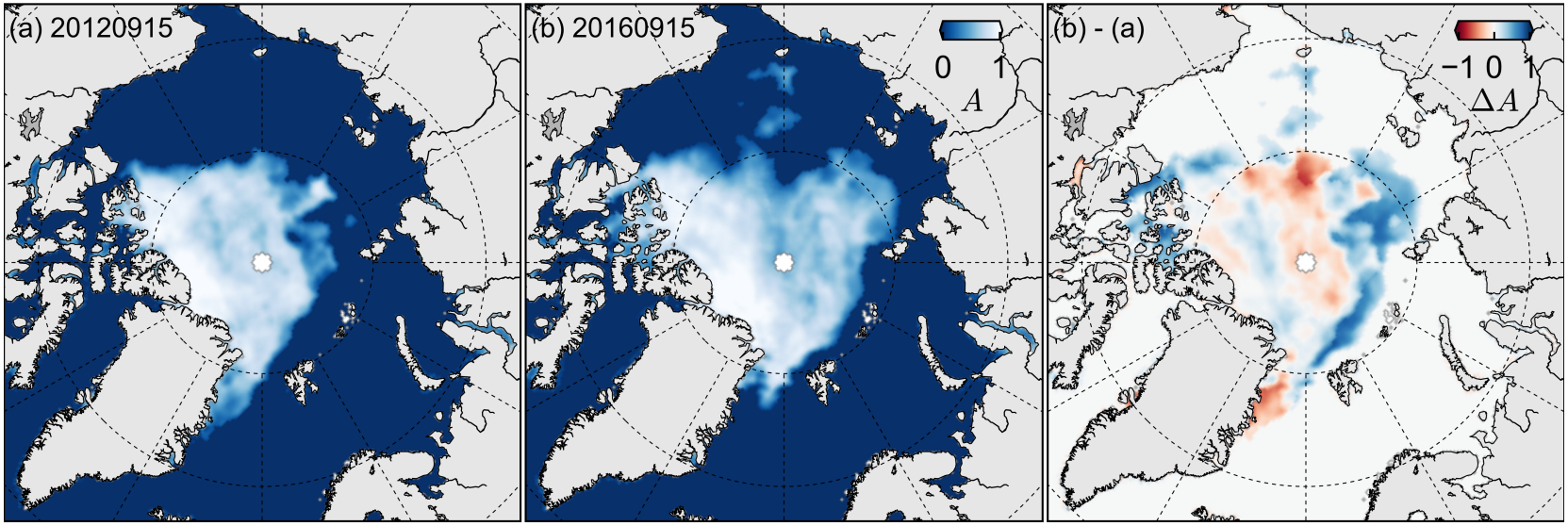
June forecast of September 2017 SIE with simulated melt pond coverage

- The CPOM (Schroeder et al.,) melt pond model is forecasting 5.1 M km^2 (using May + June data)
- Driven in general by less ponding in the Eastern Arctic this spring.

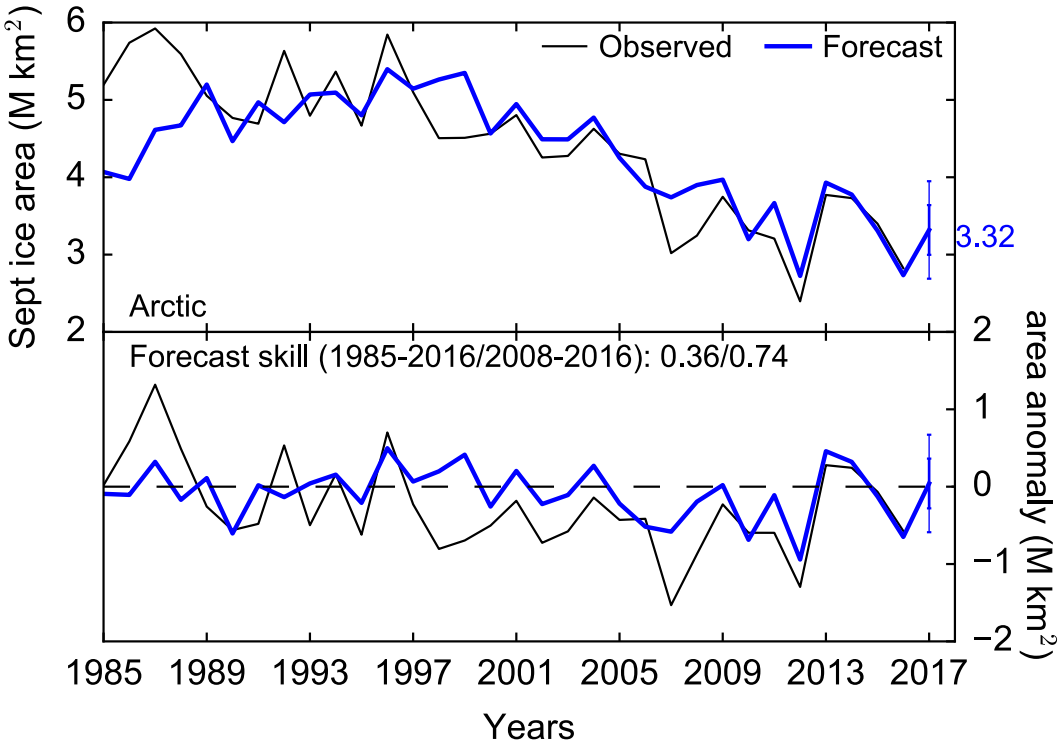


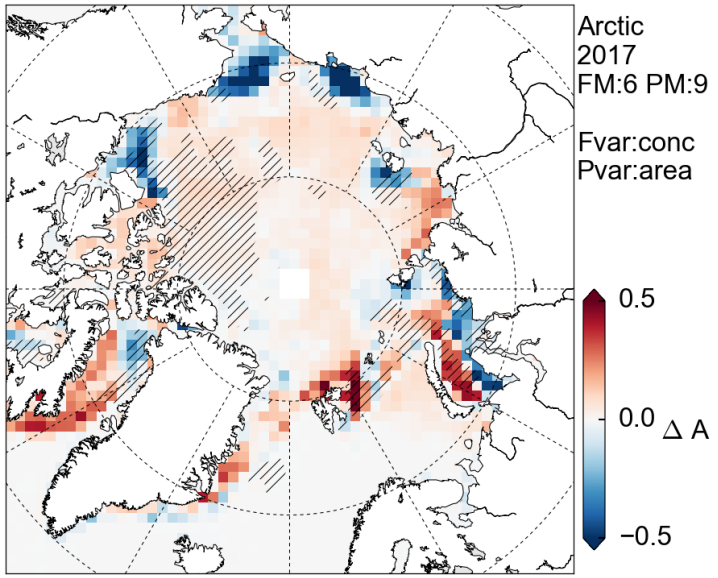
Sea ice extent/area forecasting

- Sea ice extent arguably not the best (most physical?) metric
- Satellite record of sea ice area has a variable pole hole though, so isn't as easily defined.
- Seemed to cause problems for forecasts (ours at least!) in 2016.



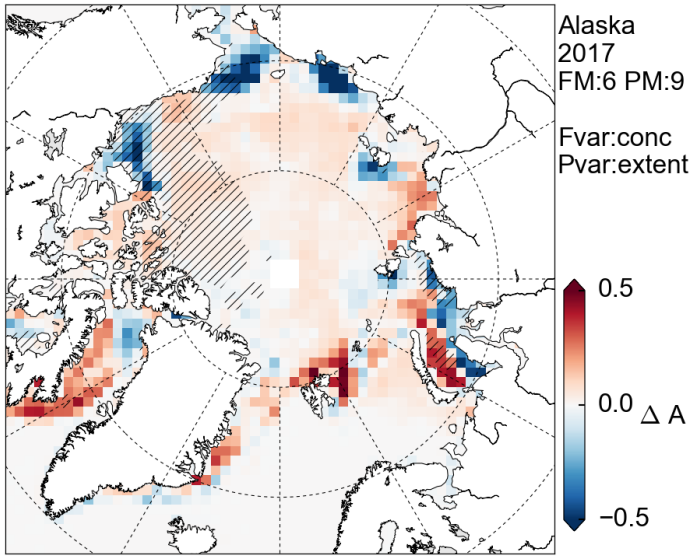
June forecast of September 2017 SIA



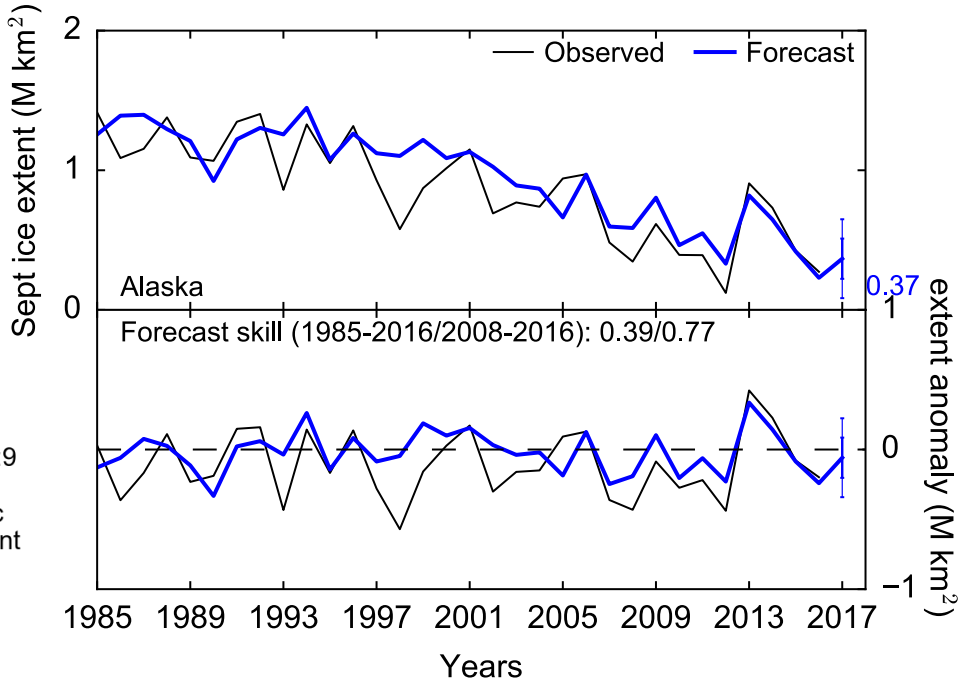


Skillful Alaskan sea ice forecasts

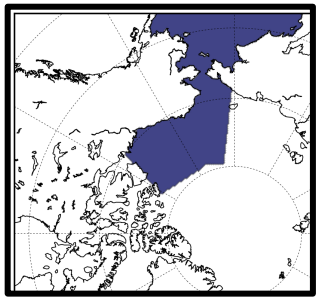
- SIPN suggested region of interest.
- We have other regions we can predict skillfully too.



June forecast using SIC data

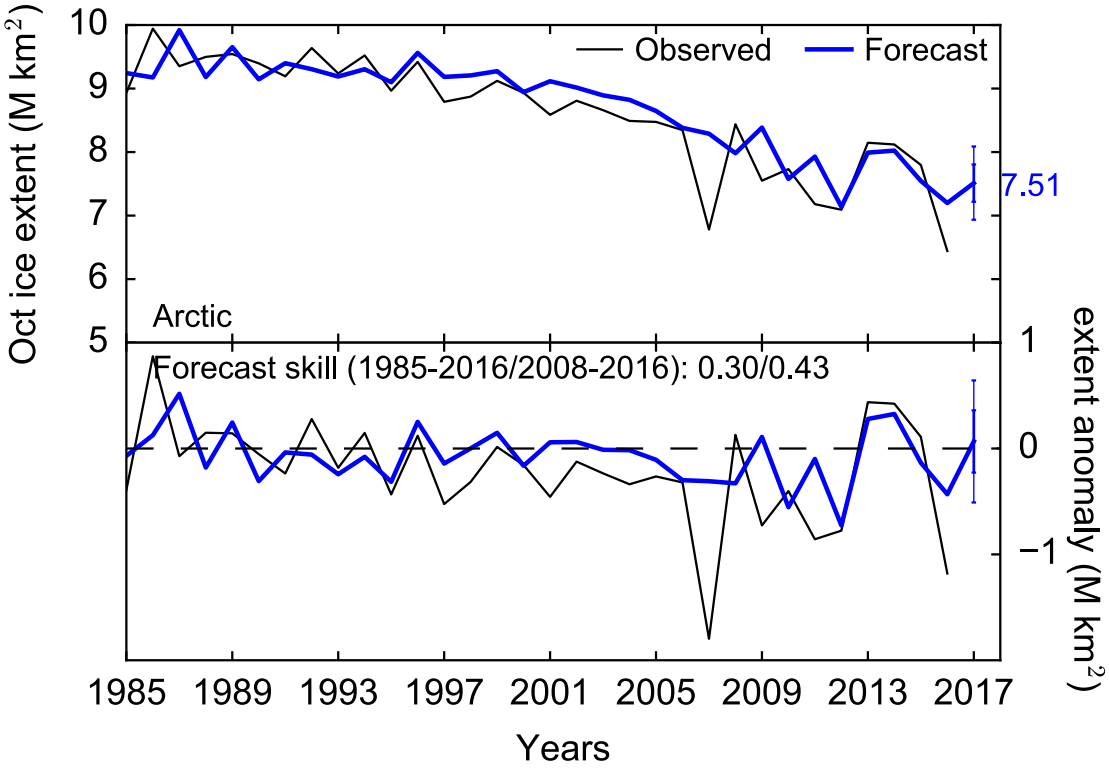


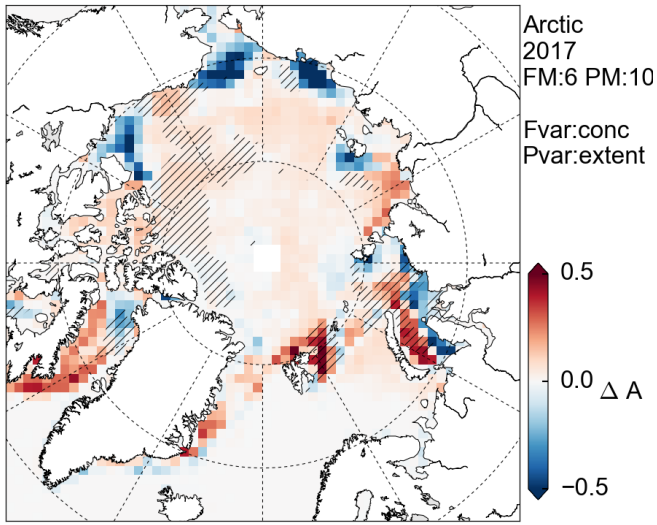
Based on the NSIDC Arctic Ocean region mask (right)



Beyond September?

June forecast of October Arctic sea ice extent





Area actually looks very similar
(also a low that isn't forecast).

What next?

Hopes for an open source prediction portal

- User interface (UI) to select hemisphere, region, forecasted month, initial forecast month, weighted/unweighted? Show forecast (with confidence intervals) and weighted drivers.
- Provide a simple, observational based forecast using NRT data, offer this as a baseline?
- Help encourage an improved, community developed, forecast framework.

Summary

- Demonstrated skillful September Arctic sea ice forecasts.
- Moving towards regional/seasonal forecasts.
- Exciting prospects for Antarctic forecasting!
- Plans for an open UI.

Questions?

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