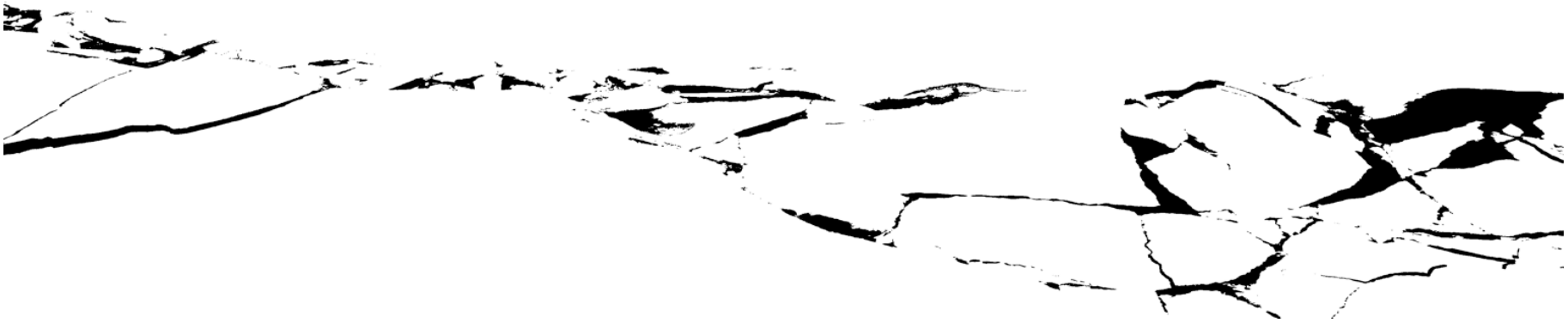
Skillful seasonal sea ice forecasts using satellite derived ice-ocean observations:

Results for September Arctic sea ice and beyond



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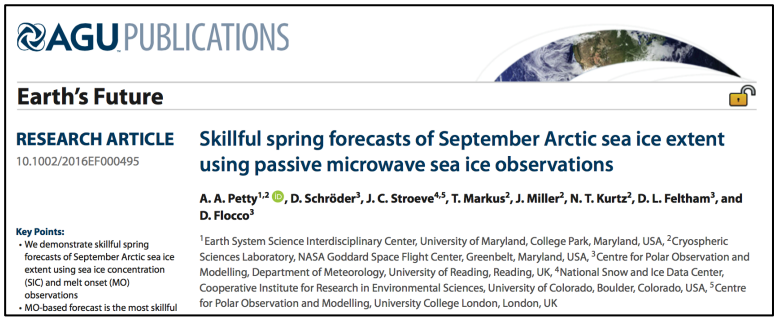
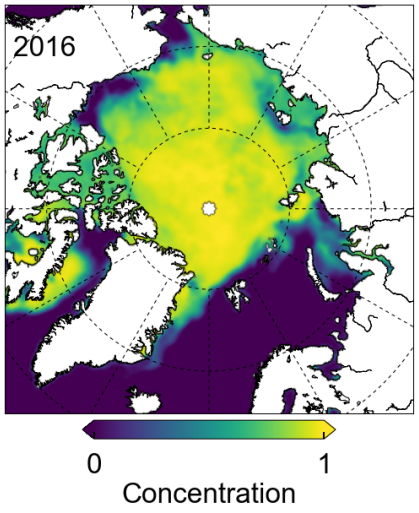
Skillful forecasts of September Arctic sea ice extent

- Simple/nuanced? linear regression framework using spring pan-Arctic data.

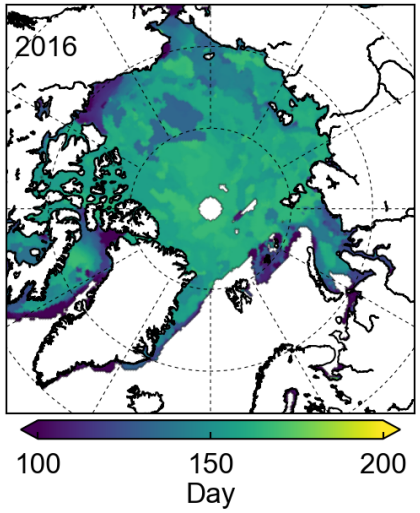


https://github.com/akpetty/ArcticSeaIcePrediction2017

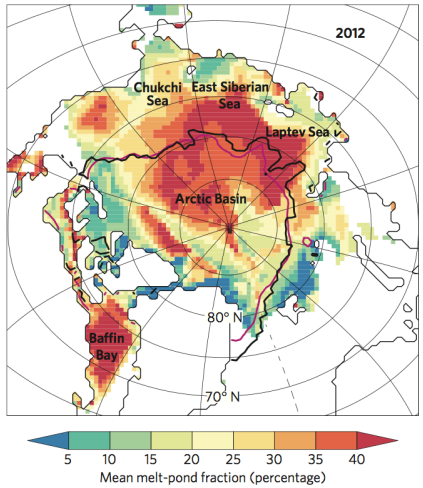
Passive microwave ice concentration



Passive microwave melt onset

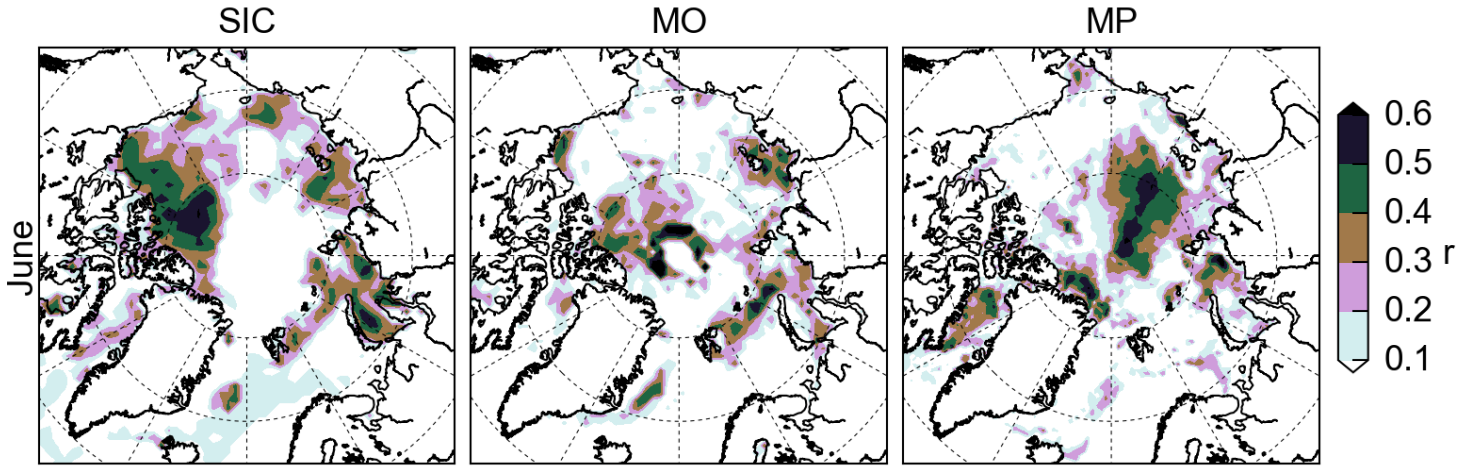


CICE simulated mend pond coverage (from Schroeder et al., 2014)



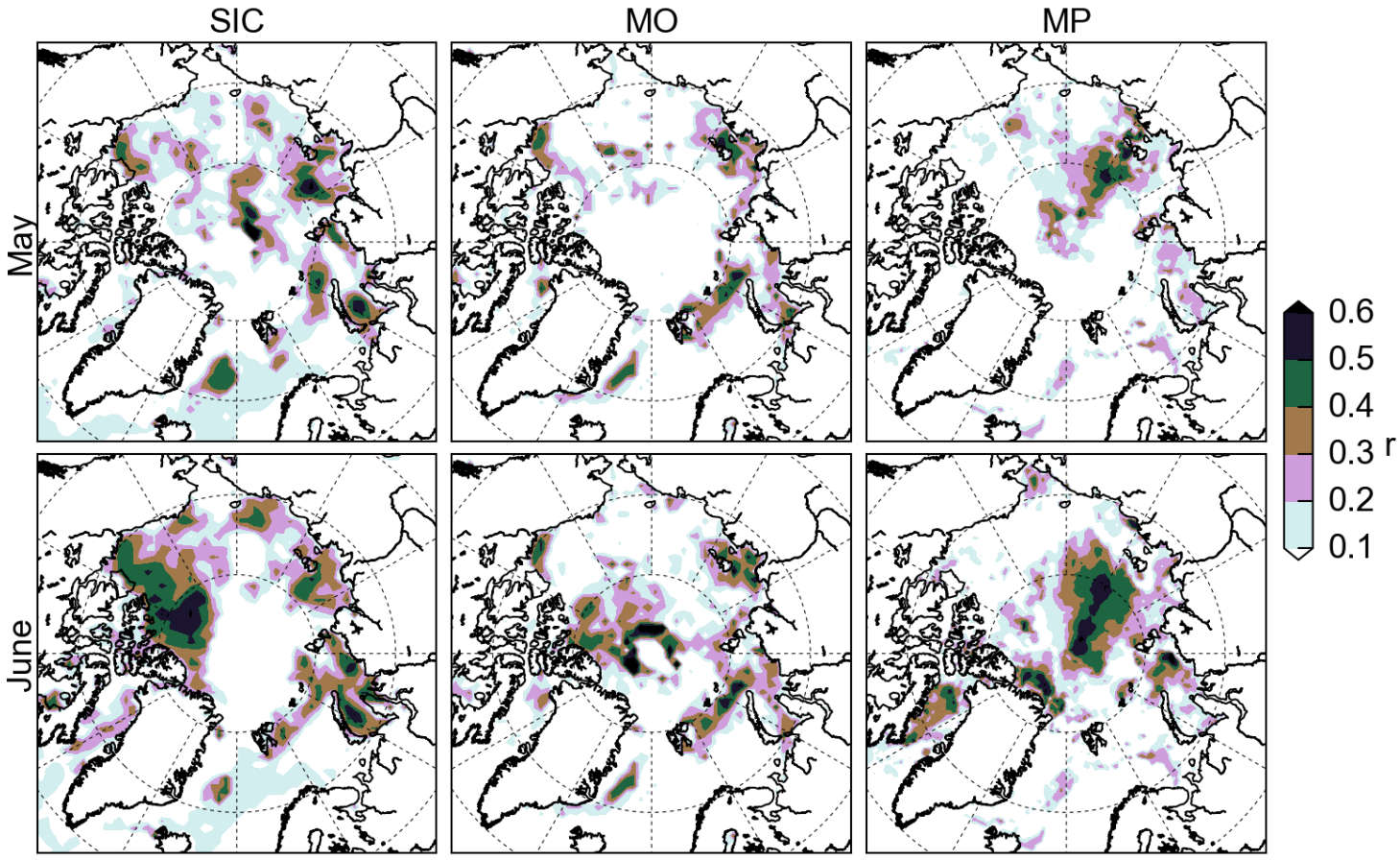
Quick methods slide..

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. Detrend current year's data, weight, then apply to the model and produce a forecast.

Regional/spatial weightings

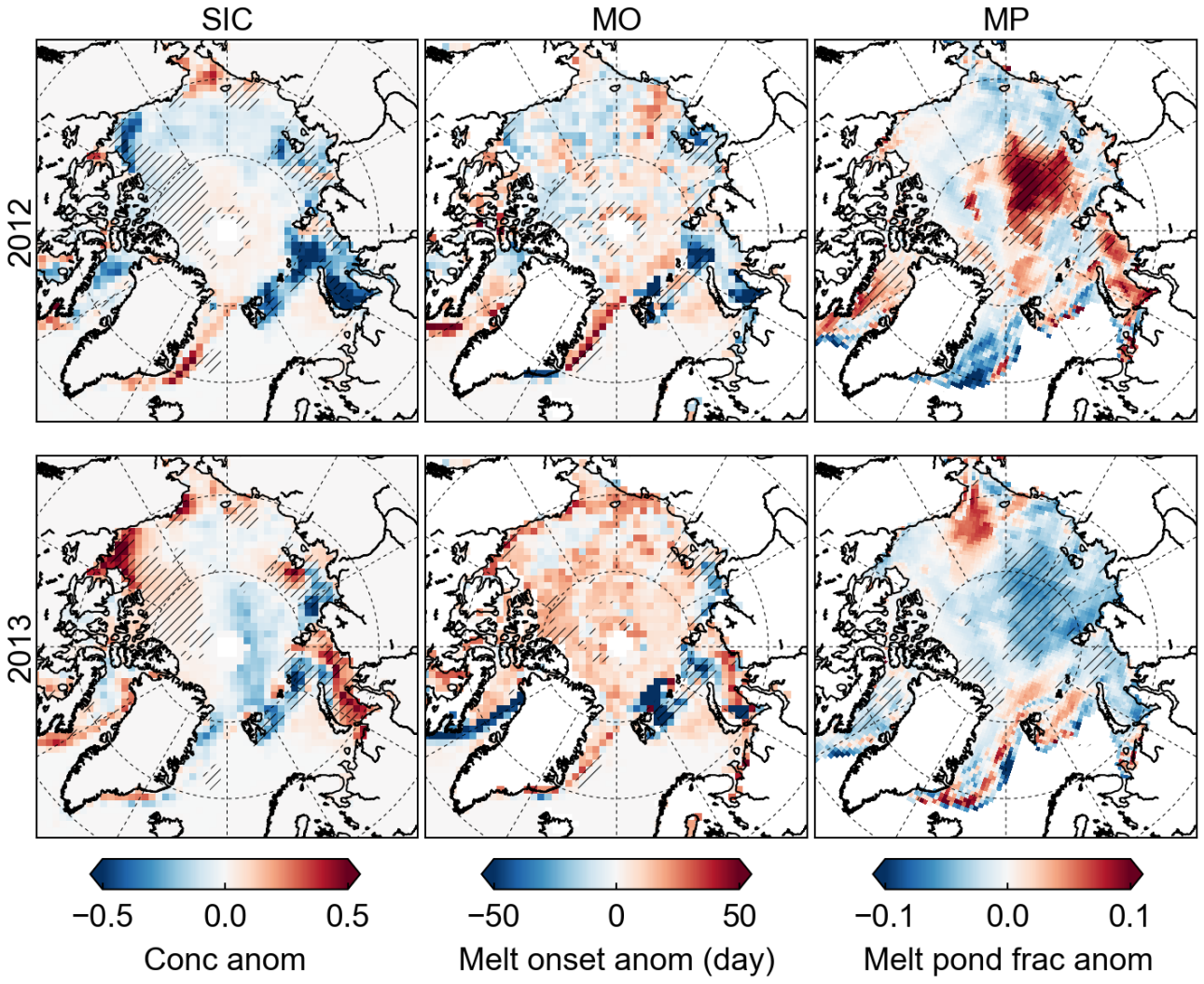


Based on 1979-2015 data

Regional drivers of pan-Arctic forecasts

Detrended variables (hatchings = spatial weightings).

Based on June data

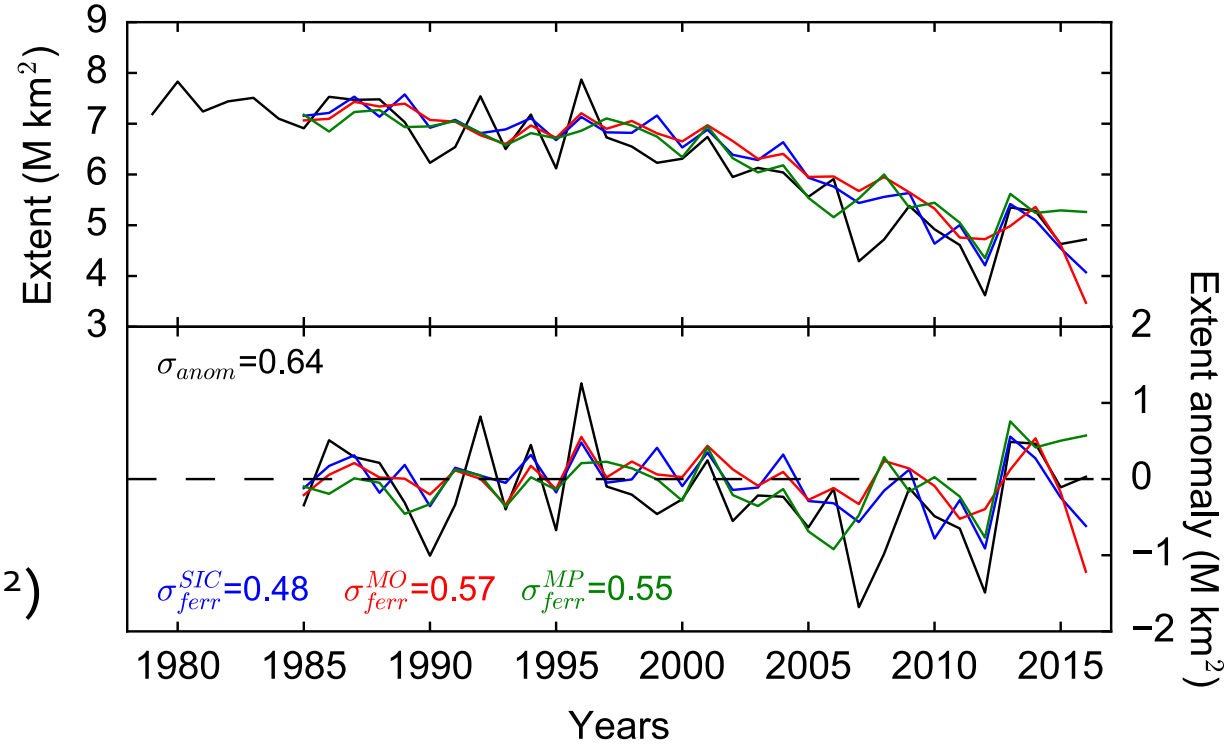


Skillful forecasts of September sea ice extent

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

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

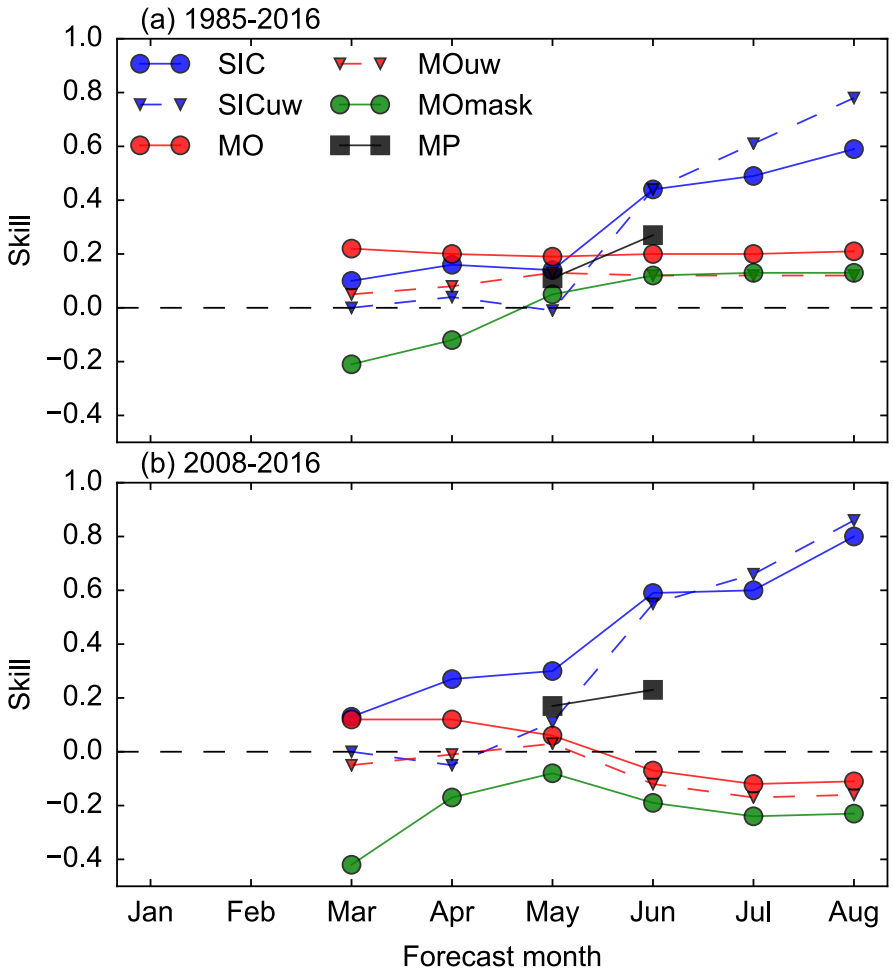
- Is this the best metric?



*Forecasts using June data

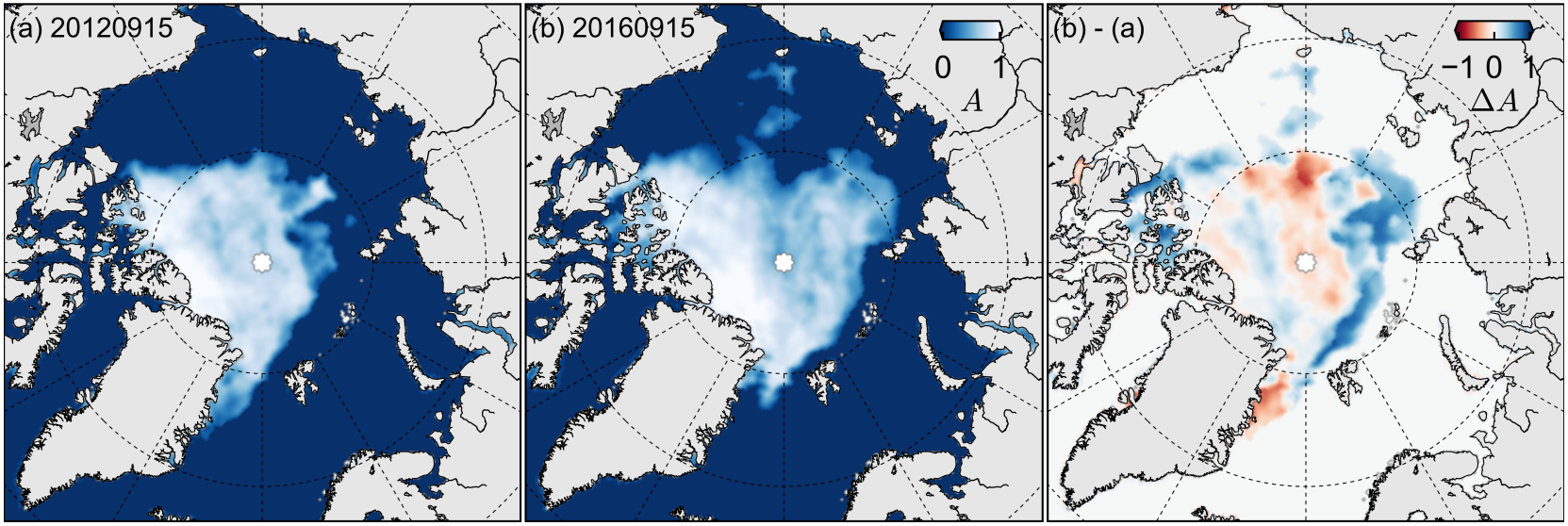
Skillful forecasts of September sea ice

- 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!)

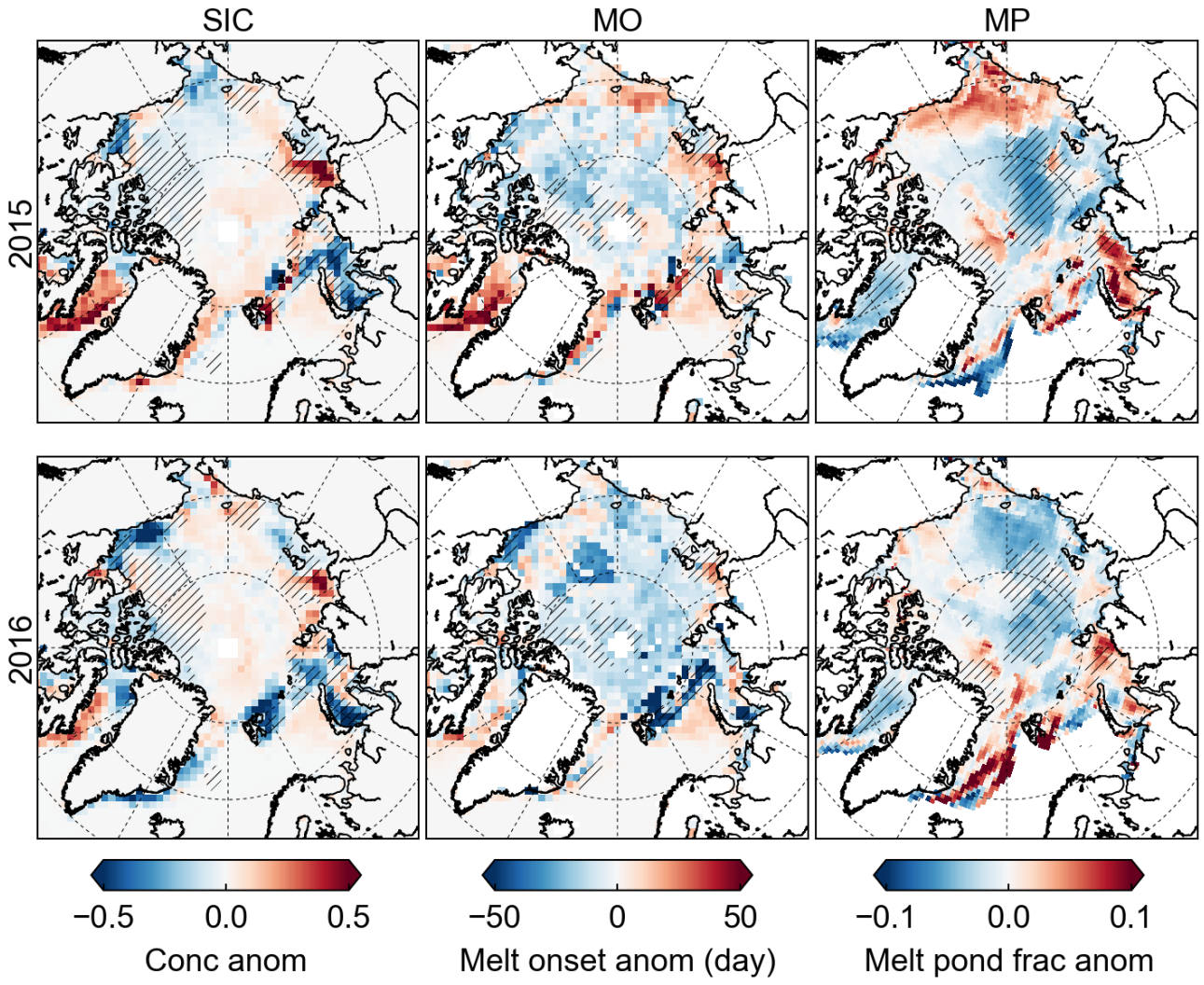


Sea ice extent/area forecasting

- 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.

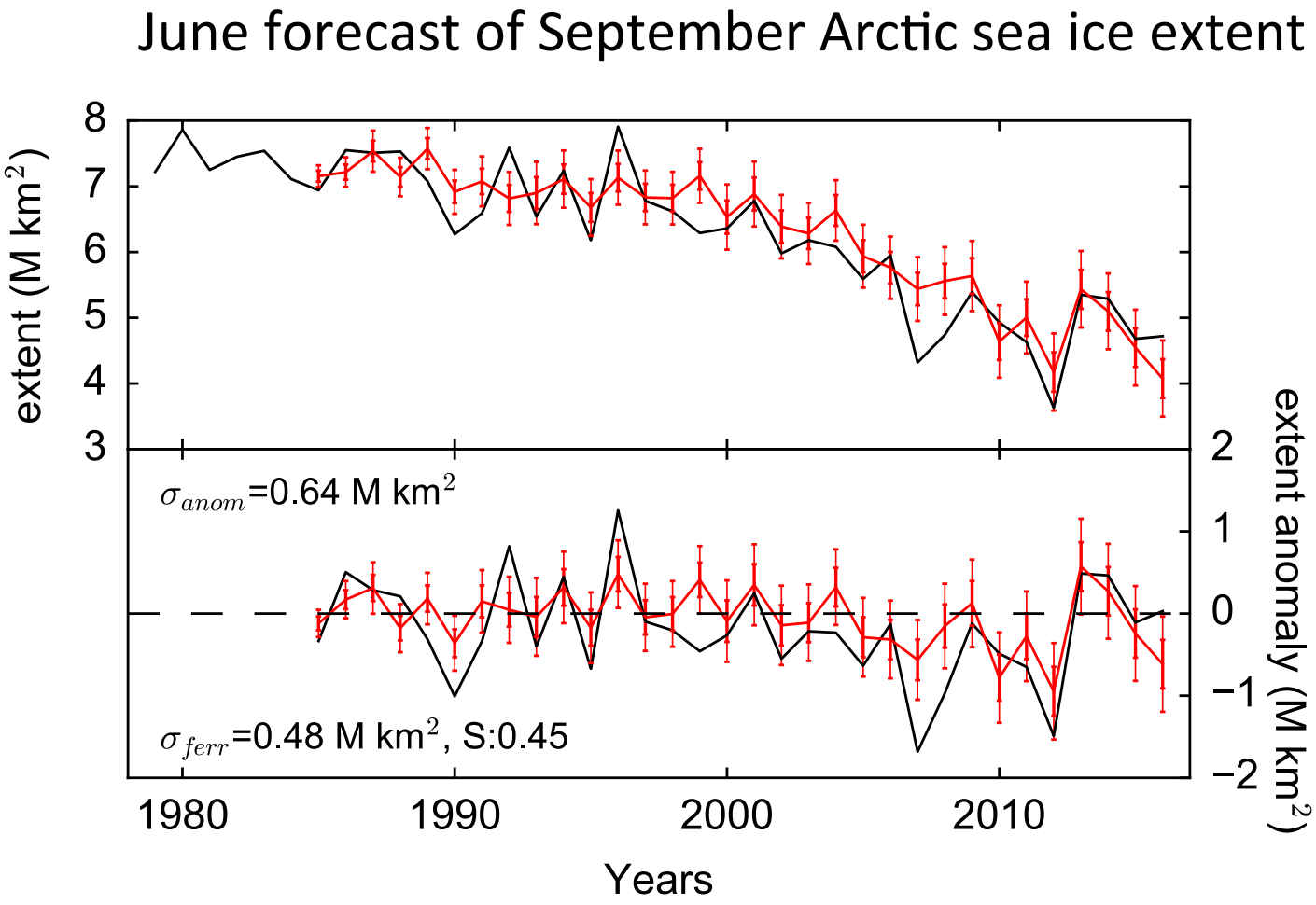


Regional drivers of forecast skill



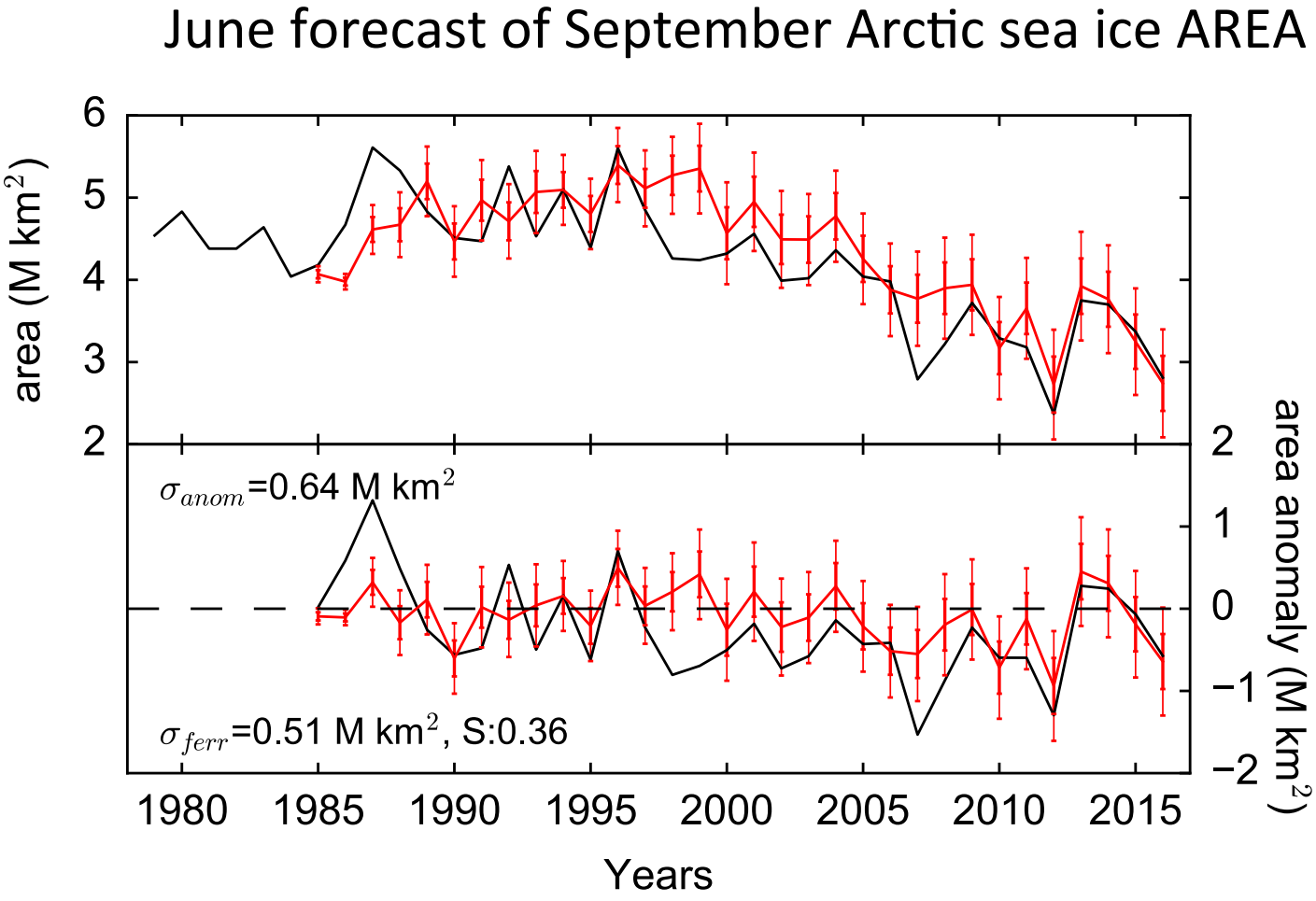
Based on June data

September Arctic sea ice extent



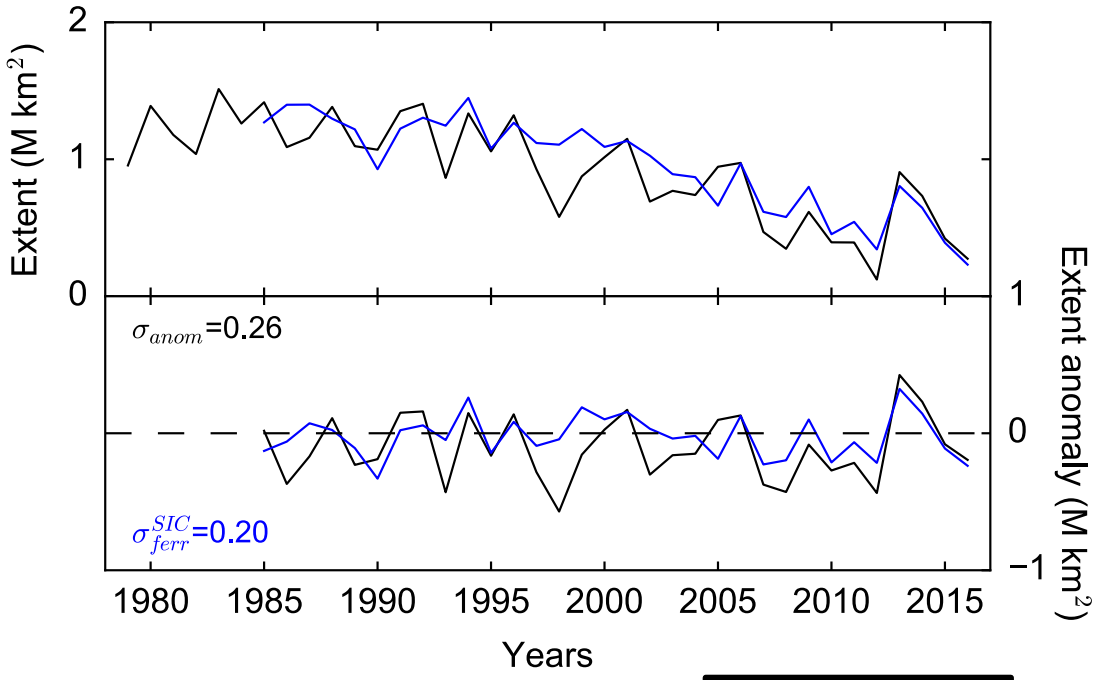
September Arctic sea ice area

Lower skill, but more accurate in recent years!



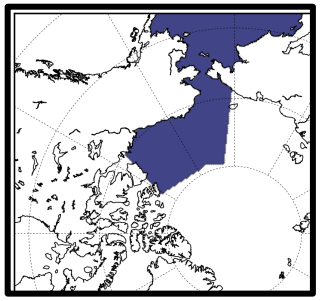
Skillful Alaskan sea ice forecasts

- SIPN suggested region of interest.
- We have other regions we can predict skillfully too.
- Can we apply this model on a grid-cell level? More computing time but definitely possible if desired.



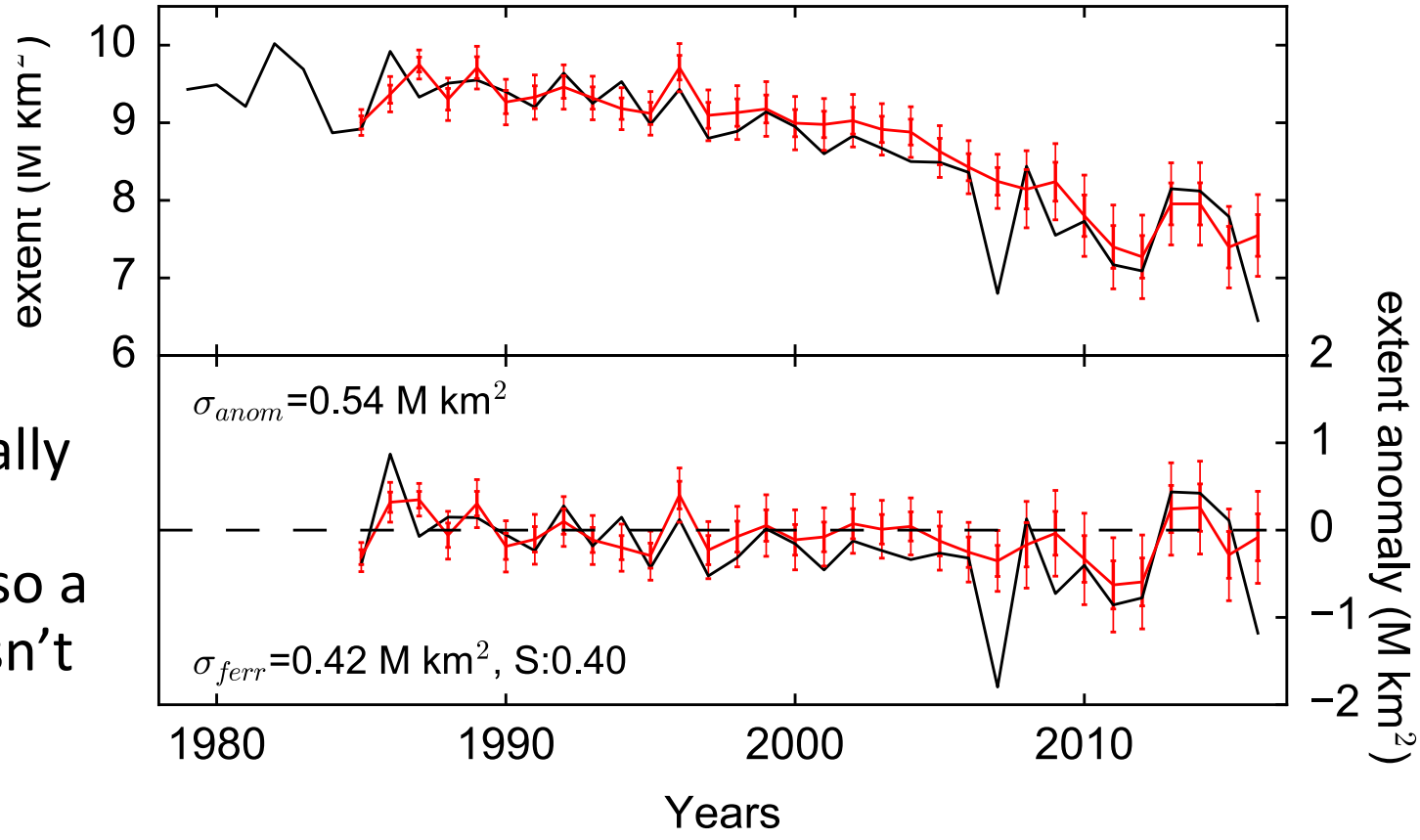
June forecast using SIC data (top)

Uses the NSIDC Arctic Ocean region mask (right)



Beyond September?

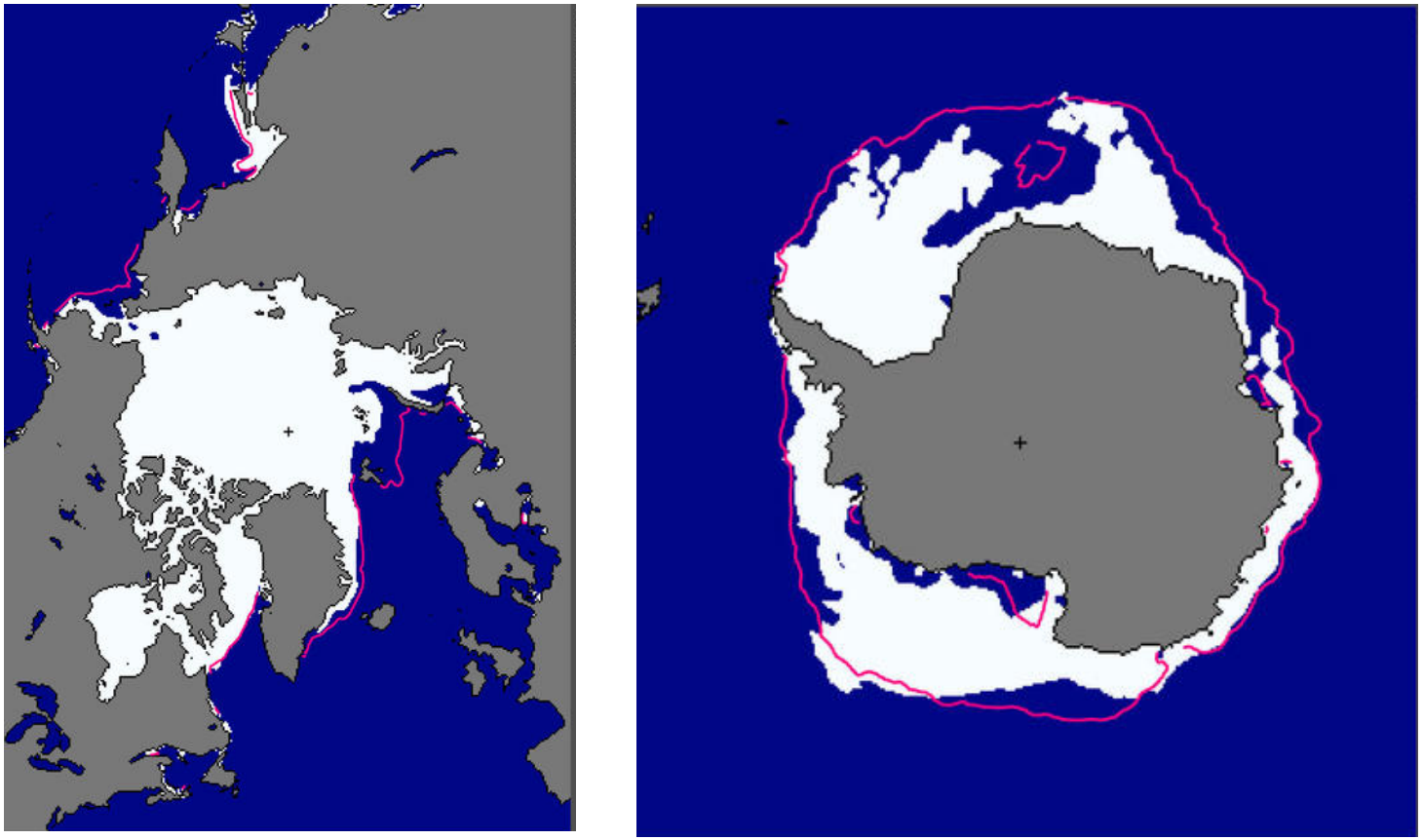
July forecast of October Arctic sea ice extent



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

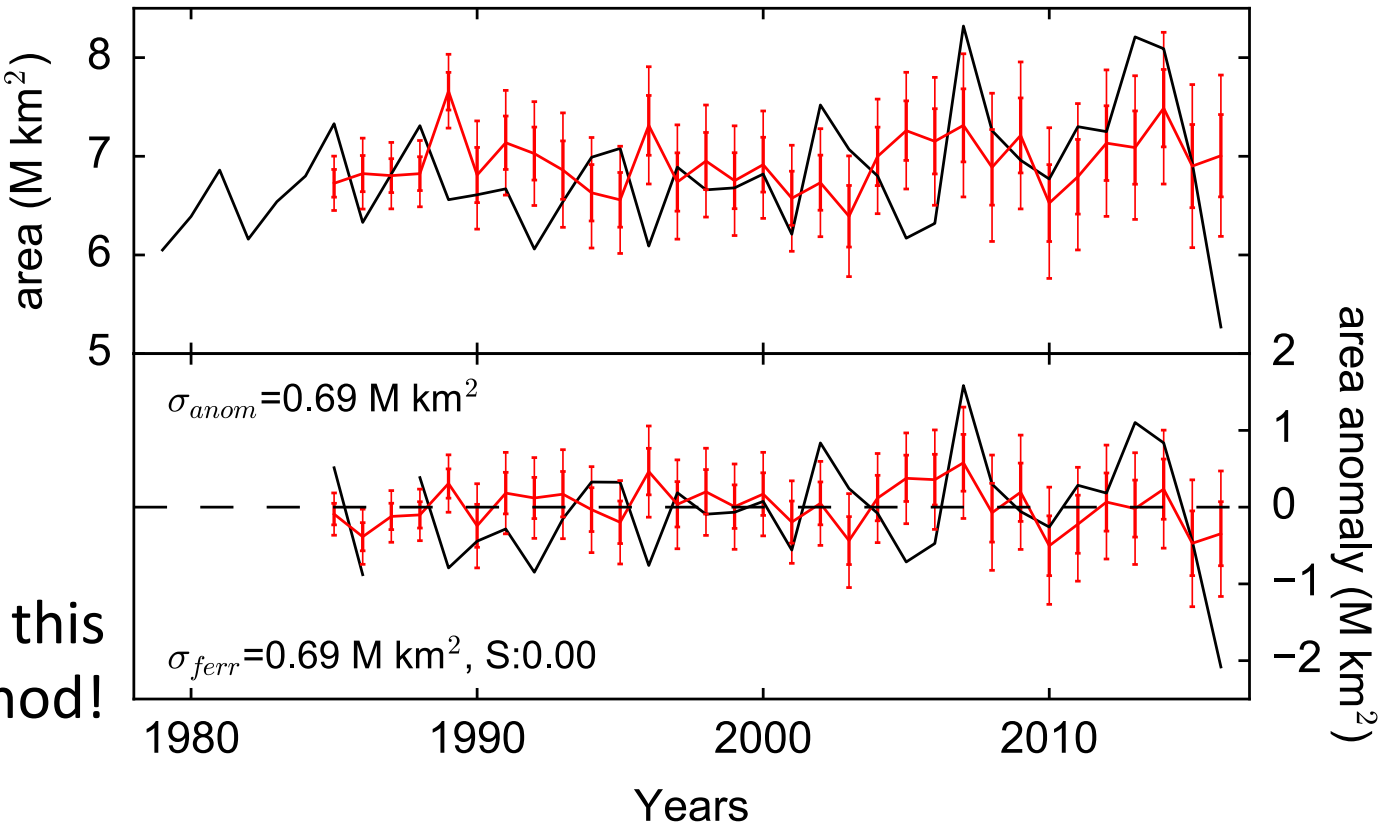
Beyond the Arctic?

December 2016 sea ice



Could we have predicted the low December Antarctic sea ice?*

July forecast of December Antarctic sea ice area

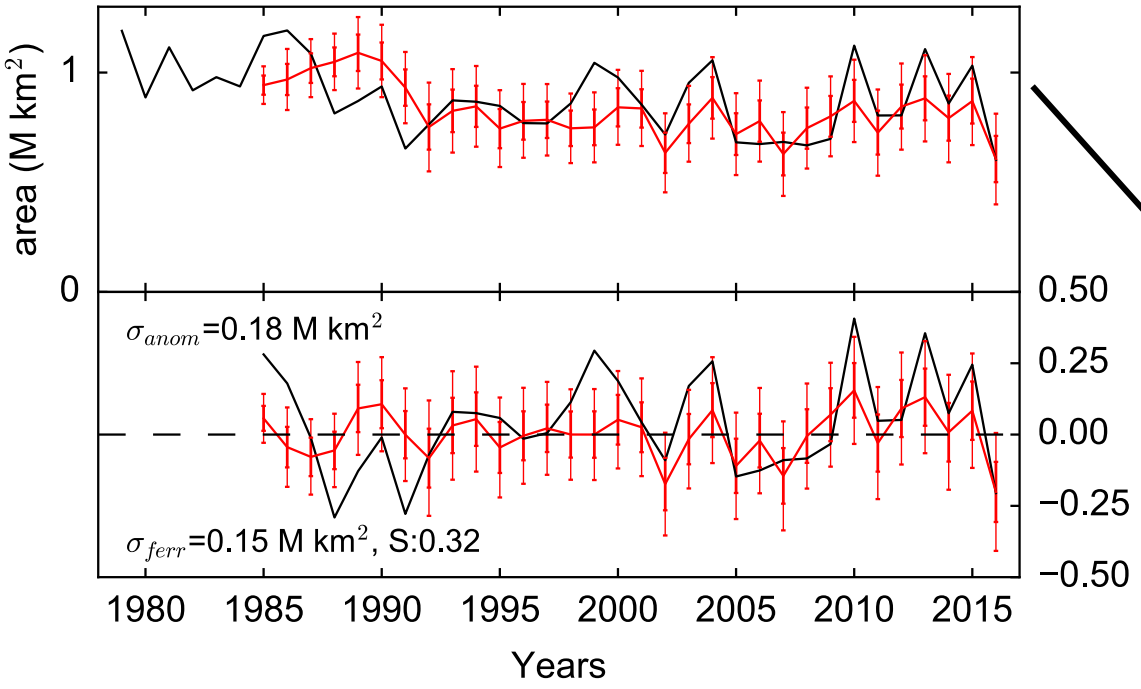


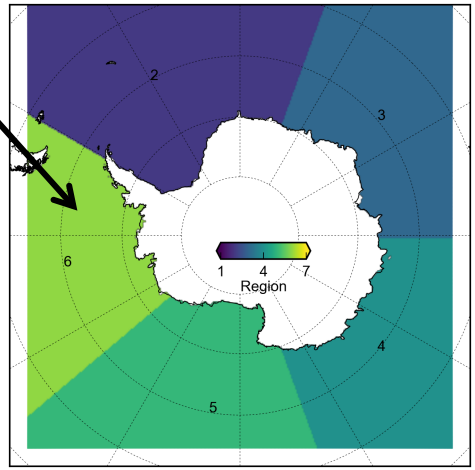
*No? Obviously this is only one method!

What about a regional Antarctic forecast?

Arguably more needed than the Arctic in our search for forecast skill?

July forecast of December Amundsen/Bellingshausen sea ice area





How to bring this all together? Lots of possible sea ice forecasts to generate…

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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