WGSIP 22nd session (online)
28-30 October 2020

Coordinating sea ice prediction for the Southern Ocean

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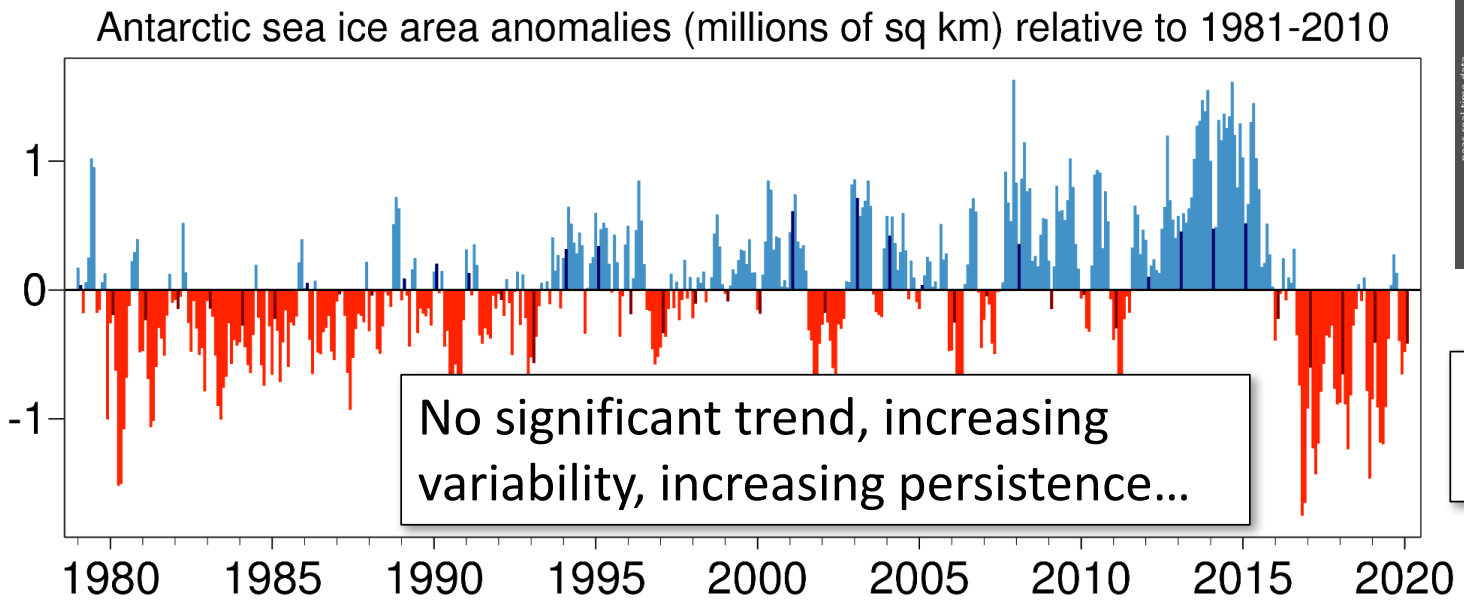
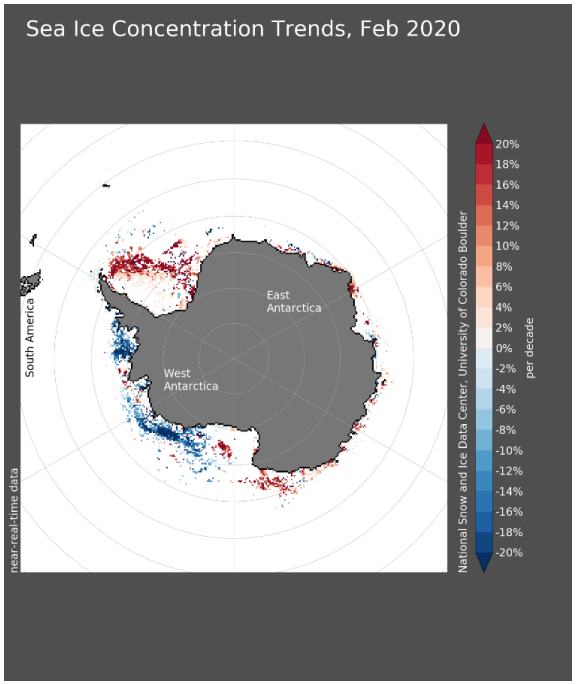
Antarctica, are you trying to tell us something?





https://nsidc.org/data/g02135

… and strong regional expressions

https://climate.copernicus.eu/sea-ice-cover-february-2020

The New York Times

TRENDING

1 January 2020

New Cruise Ships to Set Sail for Antarctica

Interested in the southernmost continent? Here's a roundup of some of the new ships and itineraries planned for the bucket-list destination.

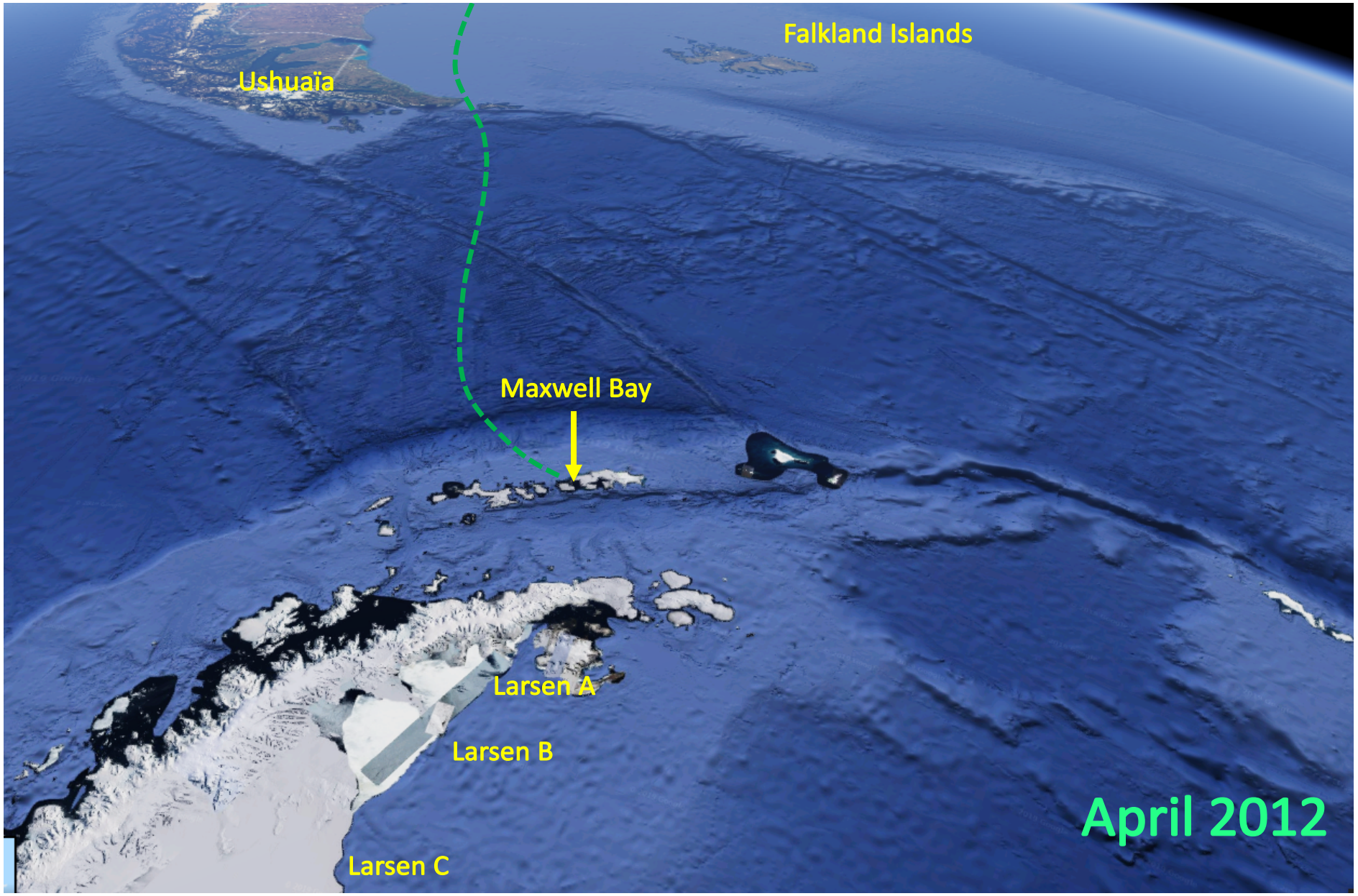
Antarctica21's expedition ship, Ocean Nova, sails through the polar waters in the Antarctic Peninsula.
Sandra Walser and Antarctica21

According to the International Association of Antarctica Tour Operators, approximately 56,000 tourists visited Antarctica in the 2018-2019 season, a 53 percent increase from the 2014-2015 season.

"Climate change is a chief reason for the increased interest in visiting Antarctica," said Mary Curry, a small ship cruise specialist and travel planner at Adventure Life. "We truly don't know if the region will ever be as magnificent as it is now."

https://www.nytimes.com/2020/01/01/travel/antarctica-cruises.html

https://sometimes-interesting.com/2013/03/06/chilling-remains-of-the-mar-sem-fim/


Falkland Islands
Ushuaïa
Maxwell Bay
Larsen A
Larsen B
Larsen C
April 2012

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Polar Prediction Matters

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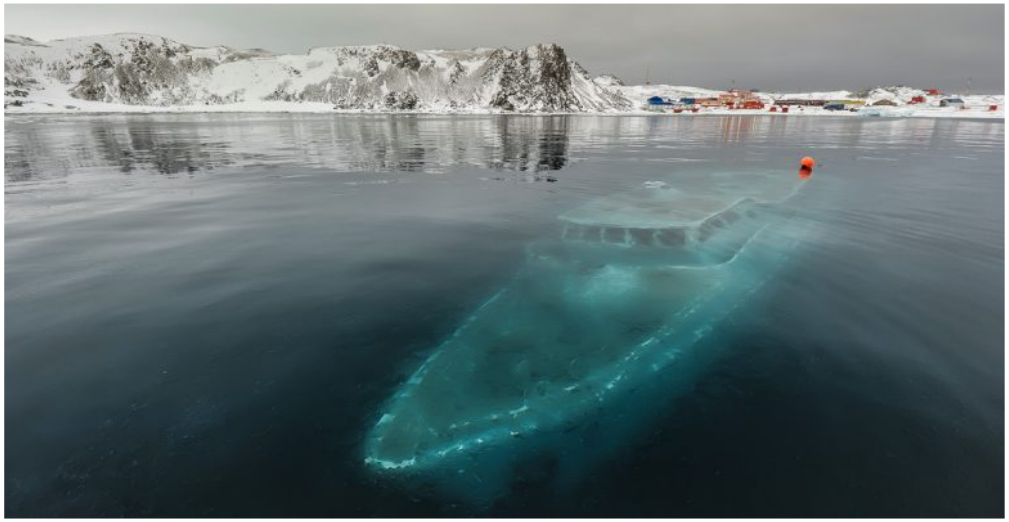


Mar Sem Fin in Ardley Bay, Antarctica. Photograph by Ruslan Eliseev.

To turn or not to turn

https://blogs.helmholtz.de/polarpredictionmatters/2017/11/to-turn-or-not-to-turn/

YOPP
YEAR OF
POLAR
PREDICTION

The Sea Ice Prediction Network South (SIPN South) has three main goals:

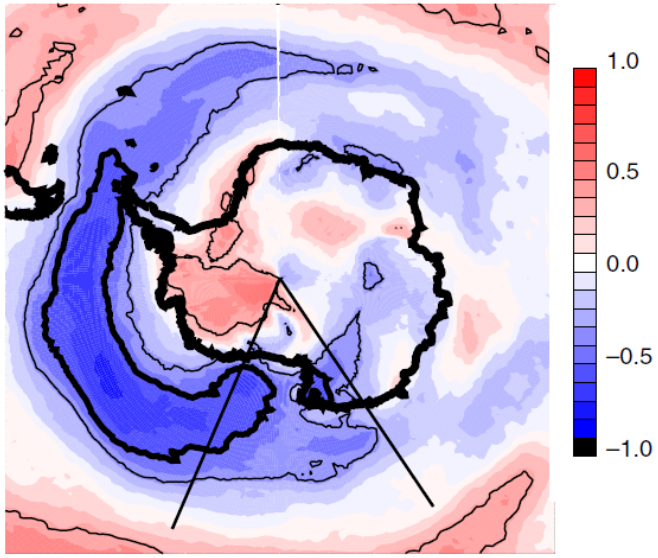
1) Identify existing efforts in Southern Ocean seasonal sea ice forecasting (currently scattered) and build an international network;

2) Coordinate realistic prediction test cases and evaluate the skill of current forecast systems;

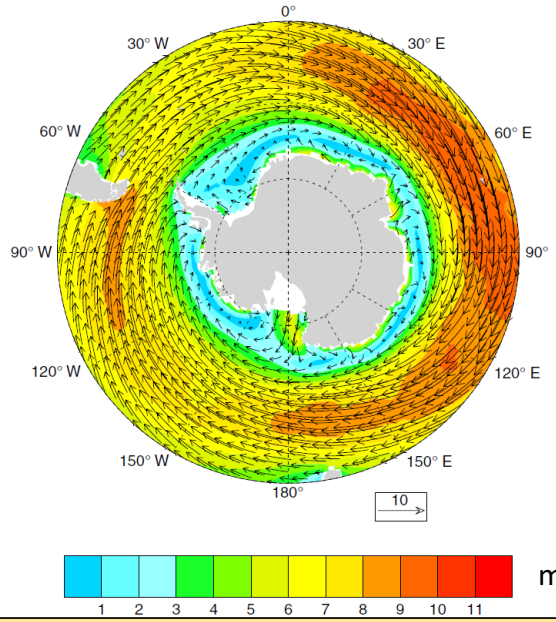
3) Lay the foundations for systematic evaluation of forecasts in the coming years.

A mechanism for summer sea ice predictability in the Southern Ocean

Correlation of October grid-point zonal **wind speed** with following March western Ross Sea **sea ice area** (1979-2015)



Climatology of ERA-Interim winds (1979-2015)



Enhanced October zonal winds → Increased ice divergence → Lower ice concentration → Lower albedo → Enhanced shortwave absorption → Increased oceanic heat storage → Delayed sea ice formation

Holland, Marika M., Edward Blanchard-Wrigglesworth, Jennifer Kay, and Steven Vavrus. "Initial-Value Predictability of Antarctic Sea Ice in the Community Climate System Model 3." *Geophysical Research Letters* 40, no. 10 (May 28, 2013): 2121–24. https://doi.org/10.1002/grl.50410.

A mechanism of reemergence for winter sea ice predictability

Climate Dynamics
https://doi.org/10.1007/s00382-018-4292-2

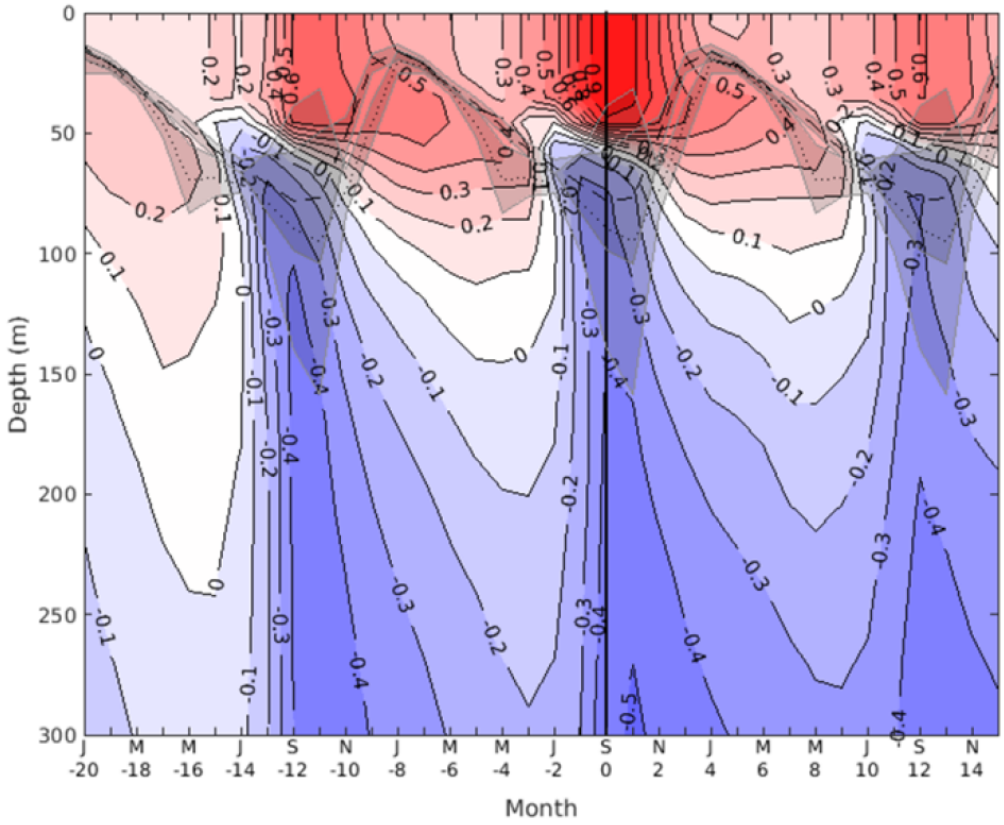
CrossMark

Reemergence of Antarctic sea ice predictability and its link to deep ocean mixing in global climate models

Sylvain Marchi[1] · Thierry Fichefet[1] · Hugues Goosse[1] · Violette Zunz[2] · Steffen Tietsche[3] · Jonathan J. Day[3] · Ed Hawkins[4]

Received: 20 September 2017 / Accepted: 31 May 2018

Correlation of September SST and potential temperature at different lags and depths

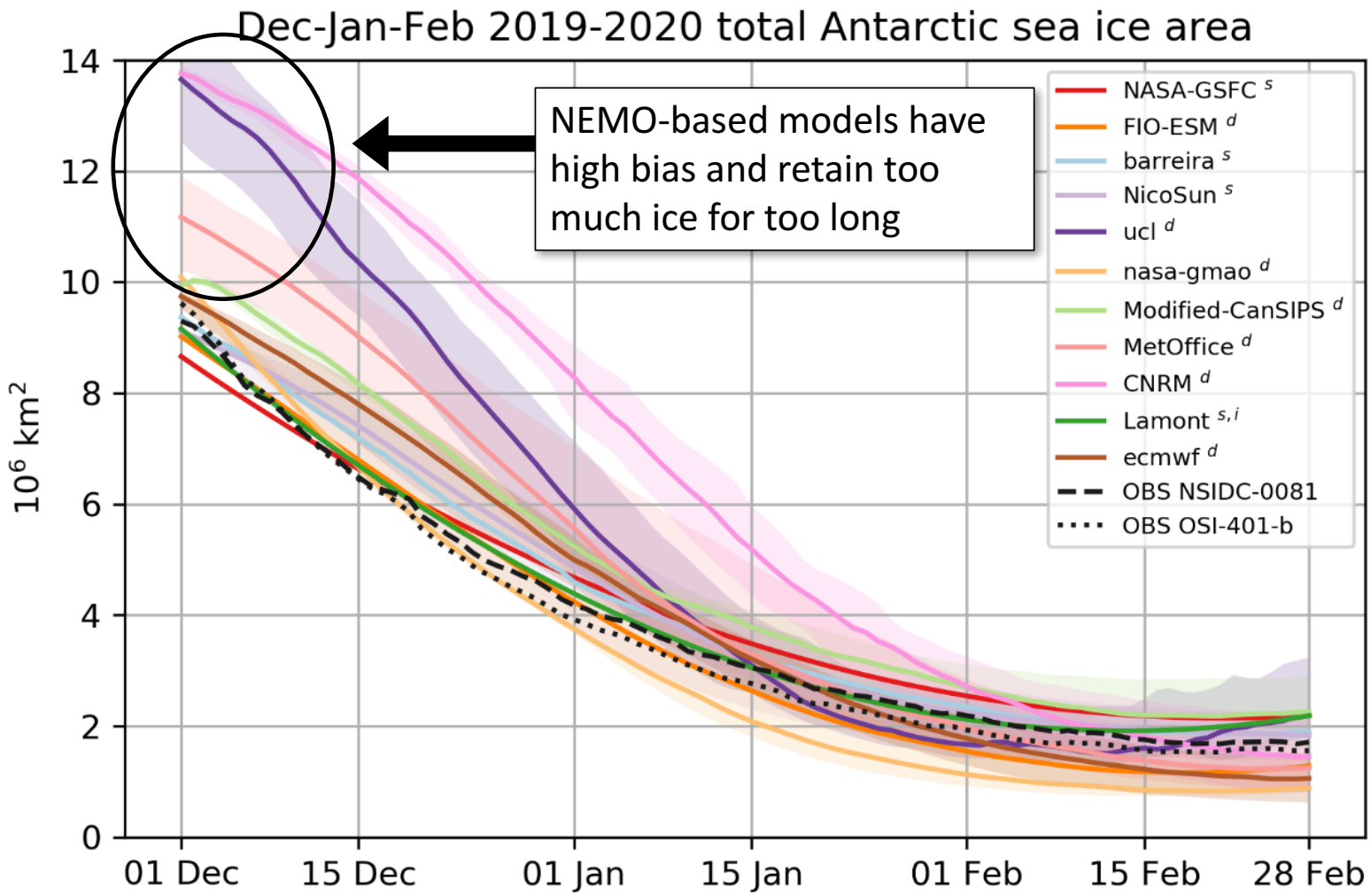


(a) EC-Earth2.2 (340-360 °E)

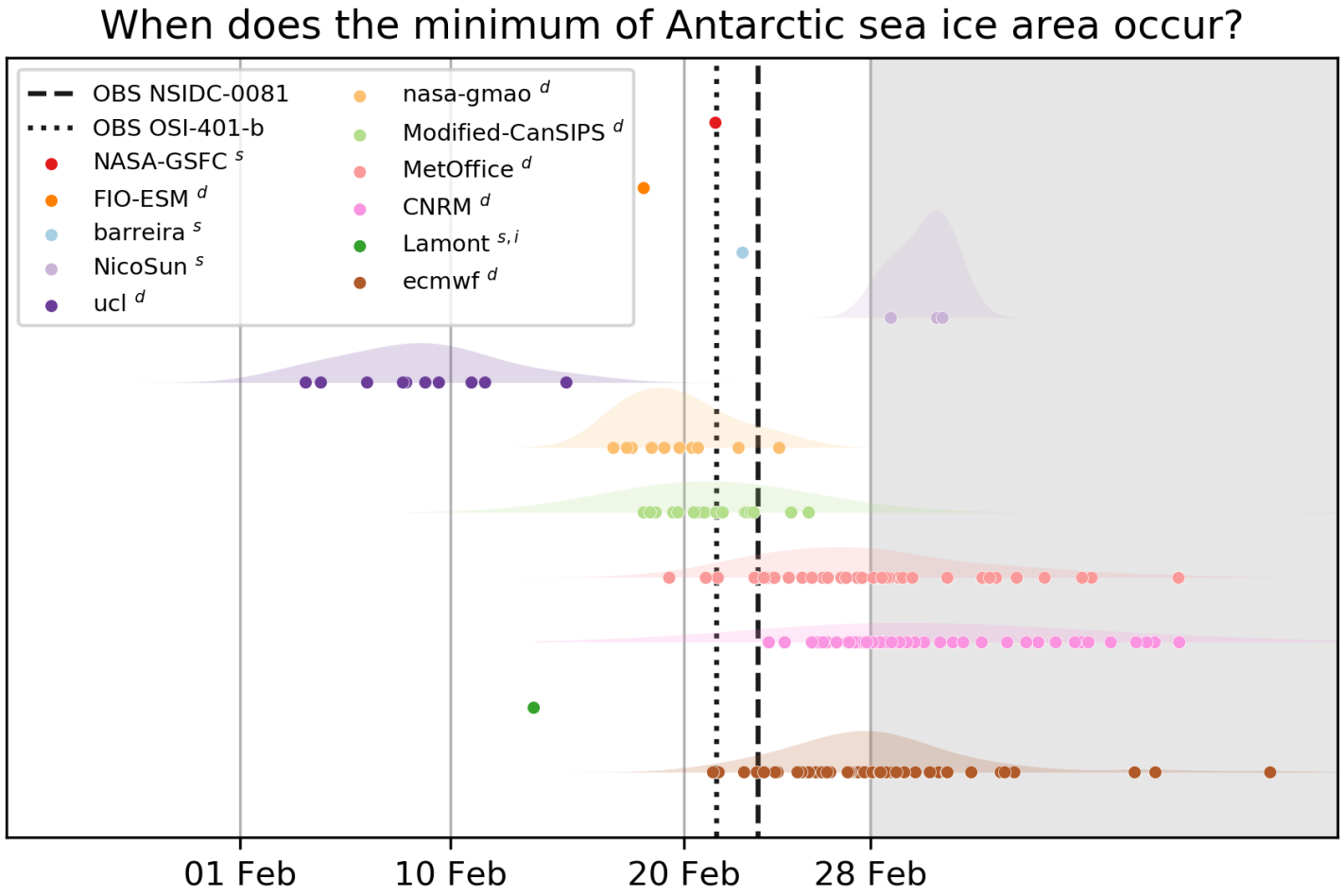
Coordinating 2019-2020 Southern Ocean summer sea ice forecasts

	Contributor name	*Short name (in figures)*	*Forecasting method*	*# of forecasts*	*Initialization date*	*Diagnostics provided*
1	Nico Sun	NicoSun	Statistical model	3	Nov. 30th	SIA + SIC
2	NASA-GMAO	nasa-gmao	Coupled dynamical model	10	Nov. 27th	SIA + SIC
3	FIO-ESM	FIO-ESM	Coupled dynamical model	1	Nov. 15th	SIA
4	ECMWF	ecmwf	Coupled dynamical model	51	Nov. 30th	SIA + rSIA
5	Lamont Sea Ice Group	Lamont	Statistical model	1	Oct. 31st	SIA + rSIA + SIC (monthly, interp. daily)
6	NASA-GSFC	NASA-GSFC	Statistical model	1	Nov. 30th	SIA
7	Modified_ CanSIPS	Modified-CanSIPS	Coupled Dynamical Model	20	Nov. 30th	SIA + rSIA
8	Met Office	MetOffice	Coupled Dynamical Model	42	Nov. 25th	SIA + rSIA + SIC
9	CNRM	CNRM	Coupled Dynamical Model	51	Nov. 30th	SIA + rSIA + SIC
10	UCLouvain	ucl	Ocean—sea ice Dynamical Model	10	July 1st	SIA + rSIA + SIC
11	Sandra Barreira	barreira	Statistical model	1	Nov. 30th	SIA + SIC

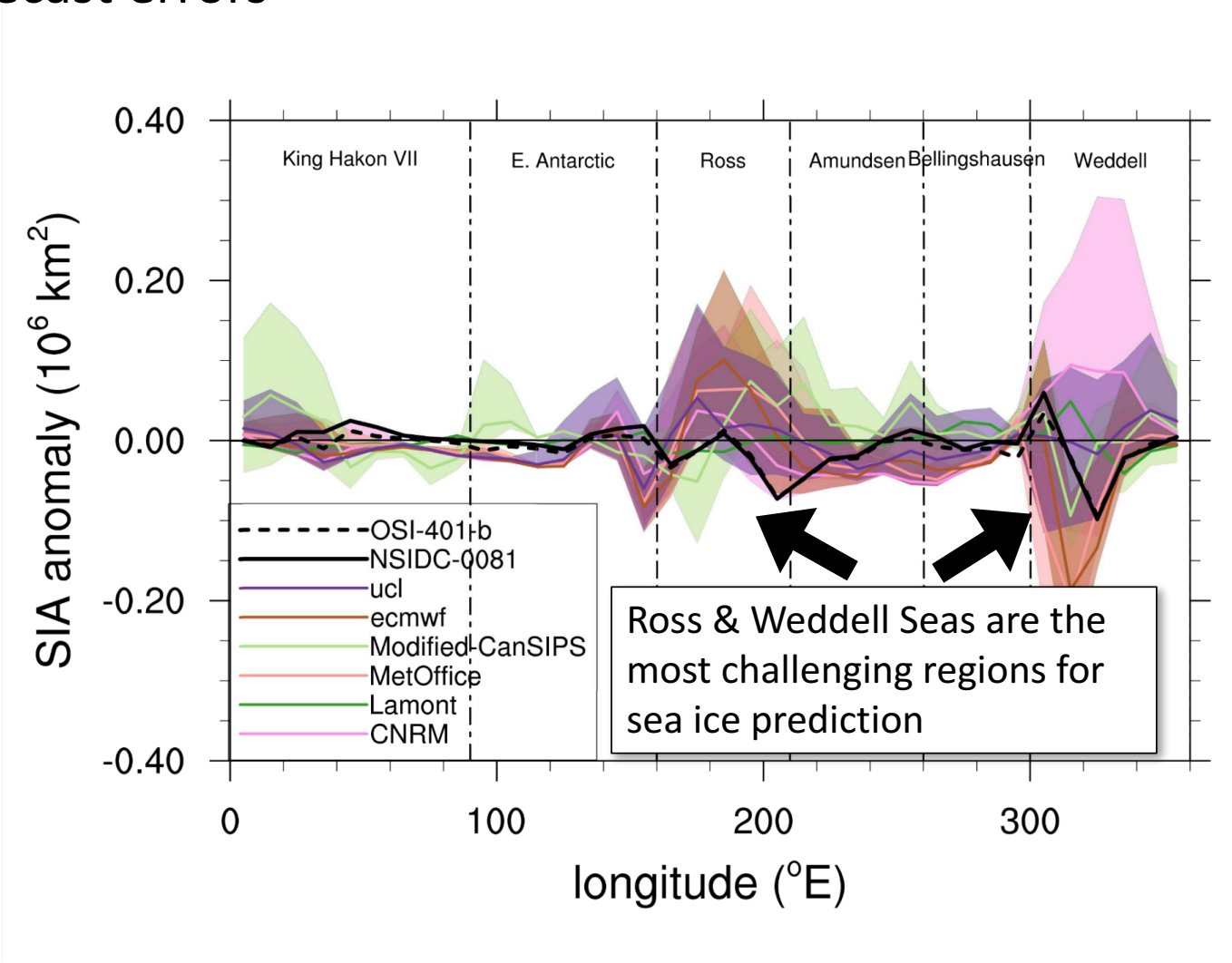
A first glance at predictions: total sea ice area



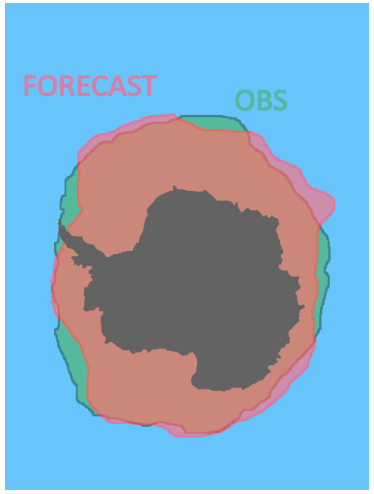
Is the *timing* of the minimum well predicted?



Regional expressions of sea ice area anomalies and forecast errors



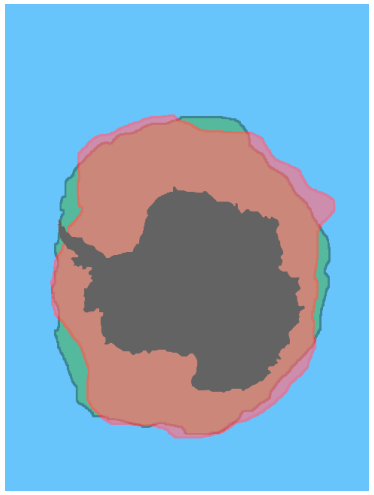
Integrated Ice Edge Error: quantification of spatial errors in forecasted sea ice concentration



Integrated Ice Edge Error =
Area of overestimation
+
Area of underestimation

Goessling, H. F., S. Tietsche, J. J. Day, E. Hawkins, and T. Jung. “Predictability of the Arctic Sea Ice Edge.” *Geophysical Research Letters* 43, no. 4 (2016): 1642–50. https://doi.org/10.1002/2015GL067232.

Statistical model contributions have on average a lower integrated ice edge error



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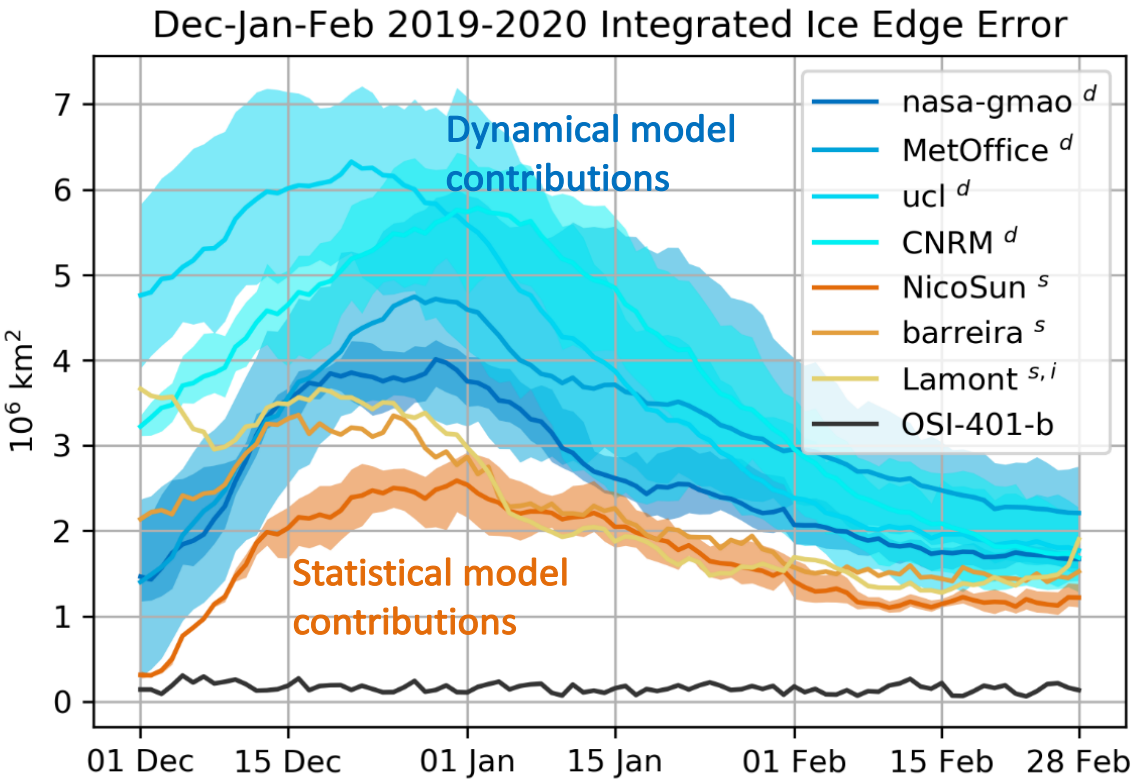
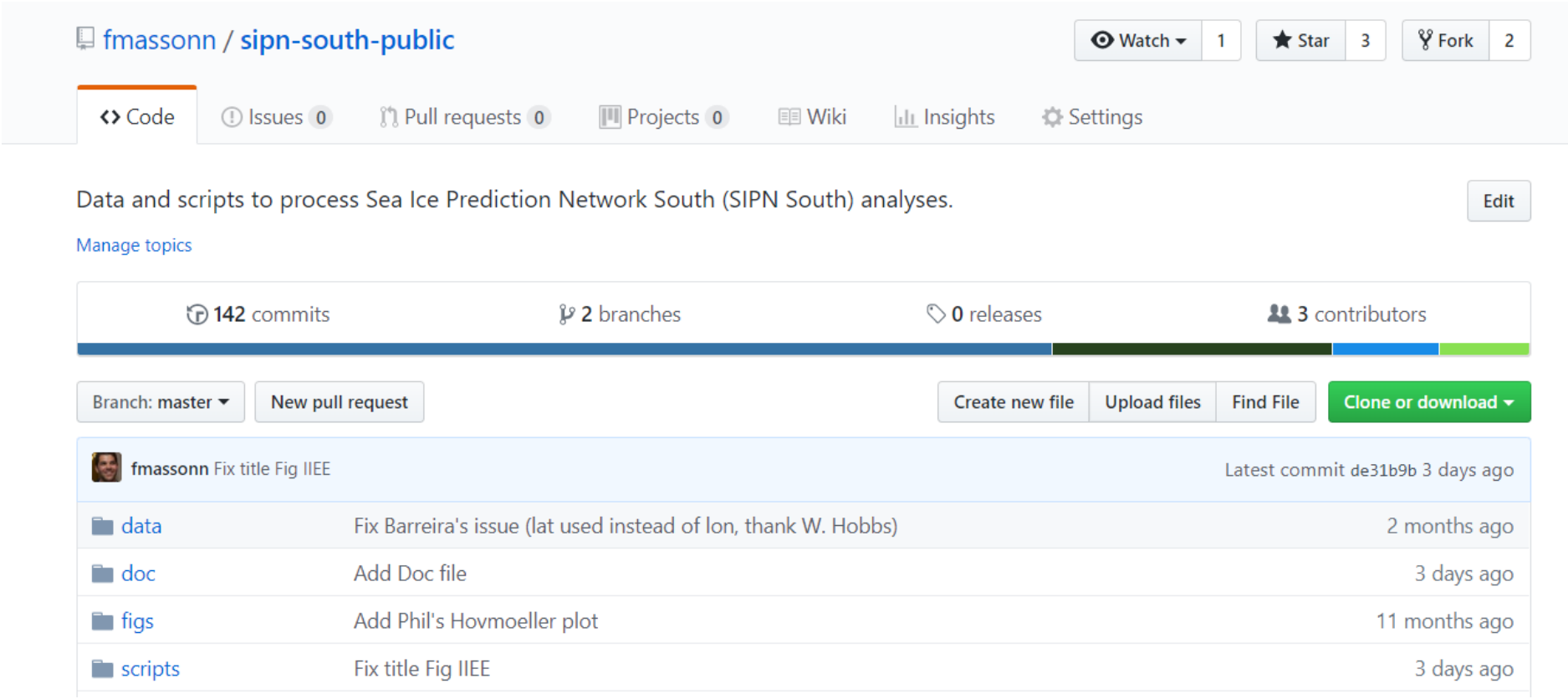


https://github.com/fmassonn/sipn-south-public

https://fmassonn.github.io/sipn-south.github.io/



Conclusions

- As Antarctica becomes a hot spot for research (and tourism) the **need for predictive sea ice information on sub-seasonal to seasonal time scales is greater than ever**
- Modeling and observational studies show **evidence for seasonal Antarctic sea ice predictability**
- Dynamical model contributions have **large biases** even at initial state, and are **outperformed by statistical contributions (different from Arctic)**
- A YOPP-SH planned **winter SOP** (April-July 2022) will be highly beneficial for SIPN South

Thank you

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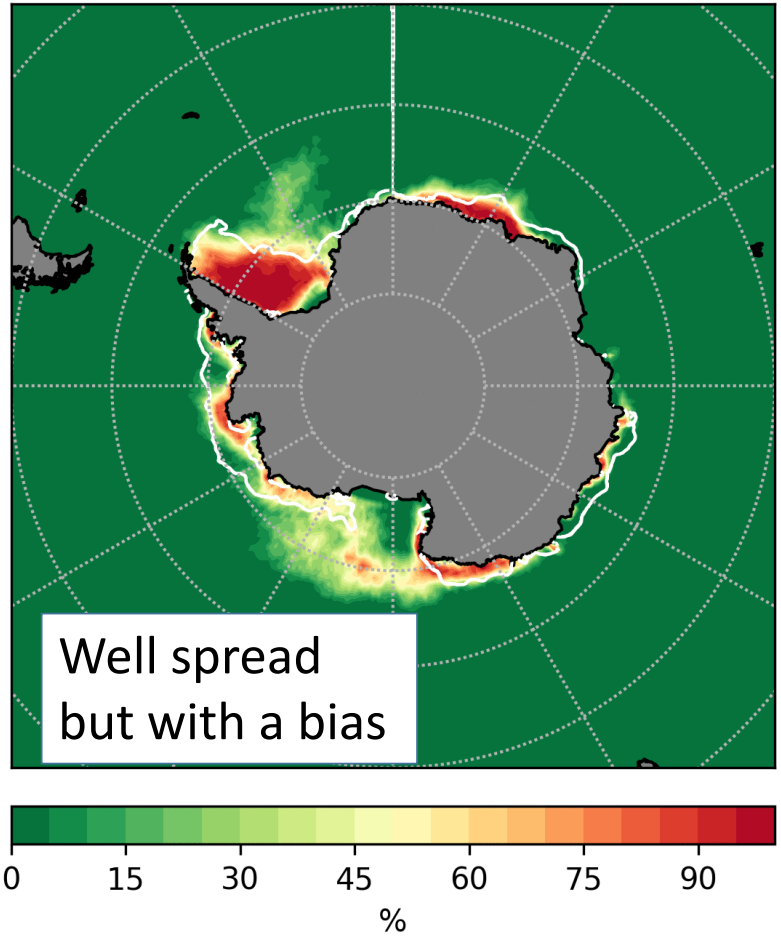
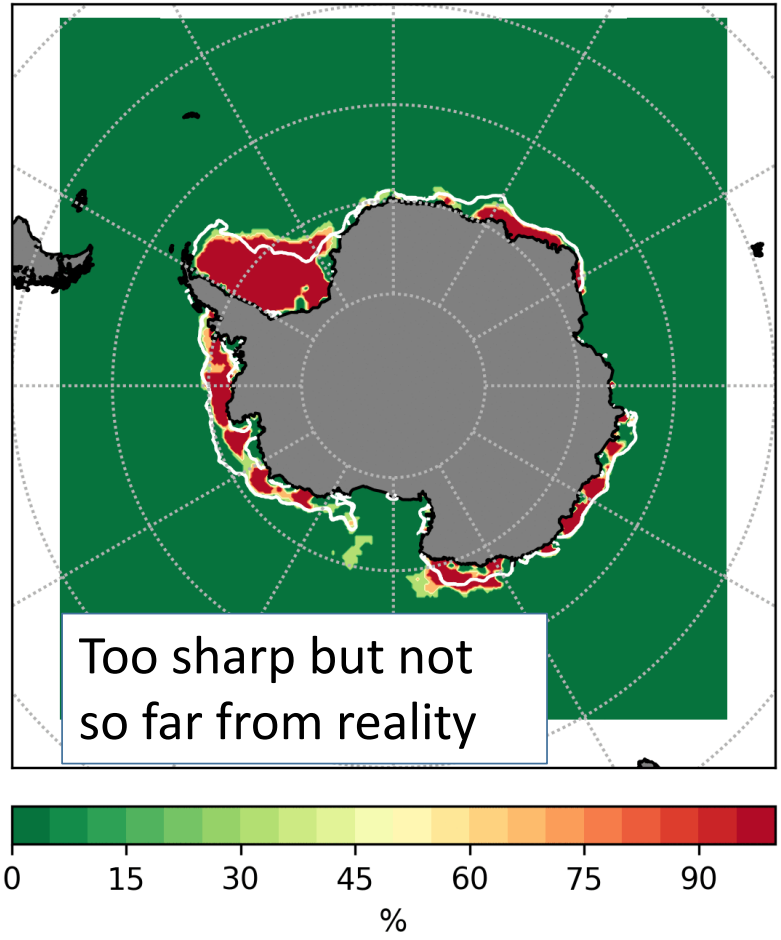
www.climate.be/u/fmasson

Probability of sea ice presence

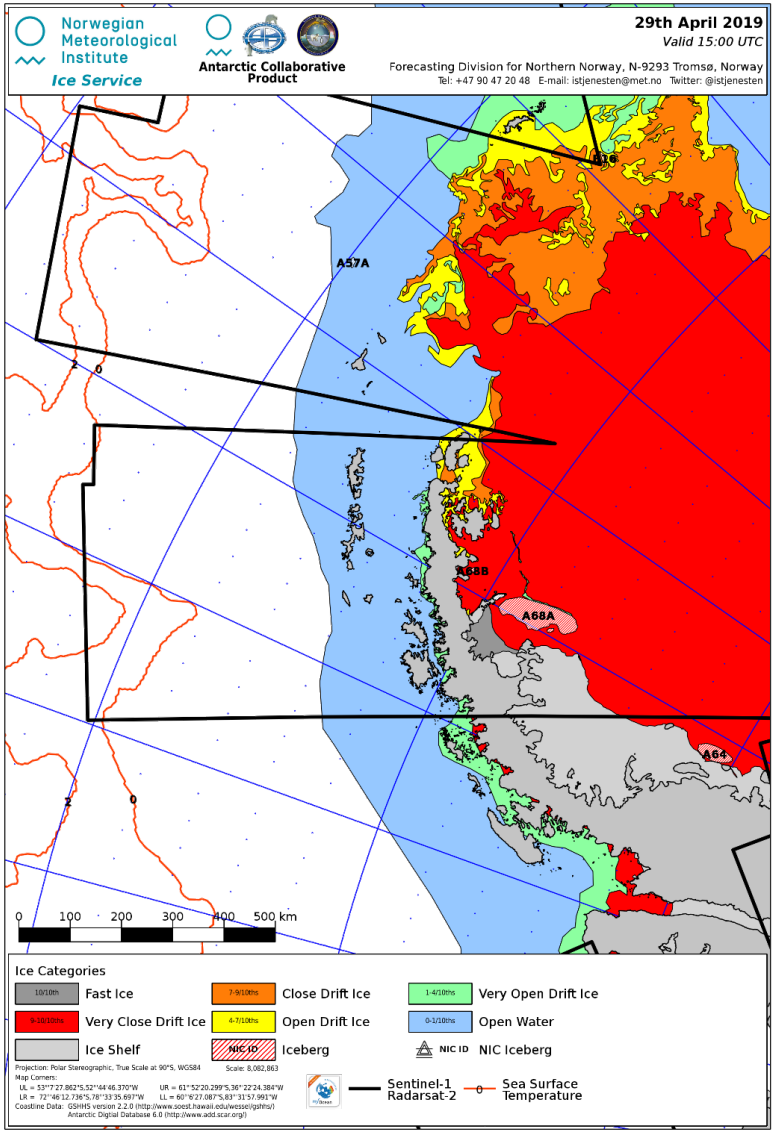
Dynamical model (42 forecasts)
MetOffice | prob > 15% | 01 February 2019



Statistical model (3 forecasts)
Nico-Sun | prob > 15% | 01 February 2019



Ice charts: best available information on current sea ice conditions



http://polarview.met.no/antarctic/peninsula_20190429.png

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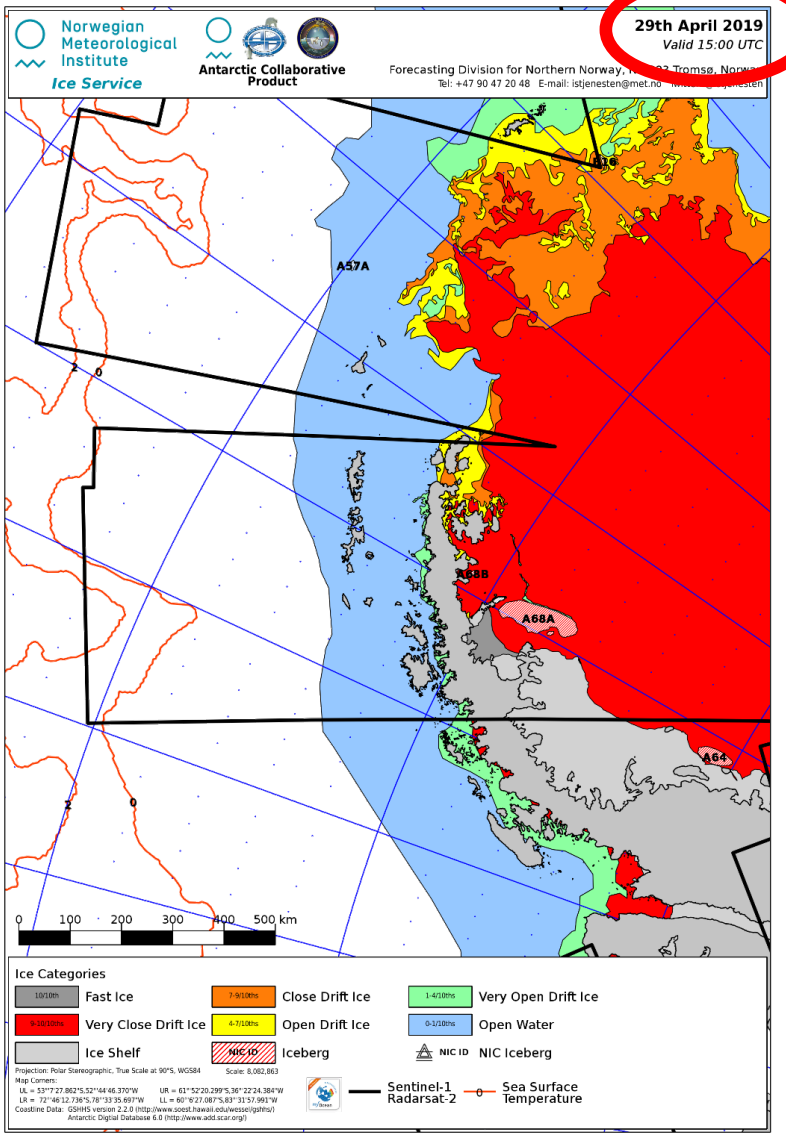
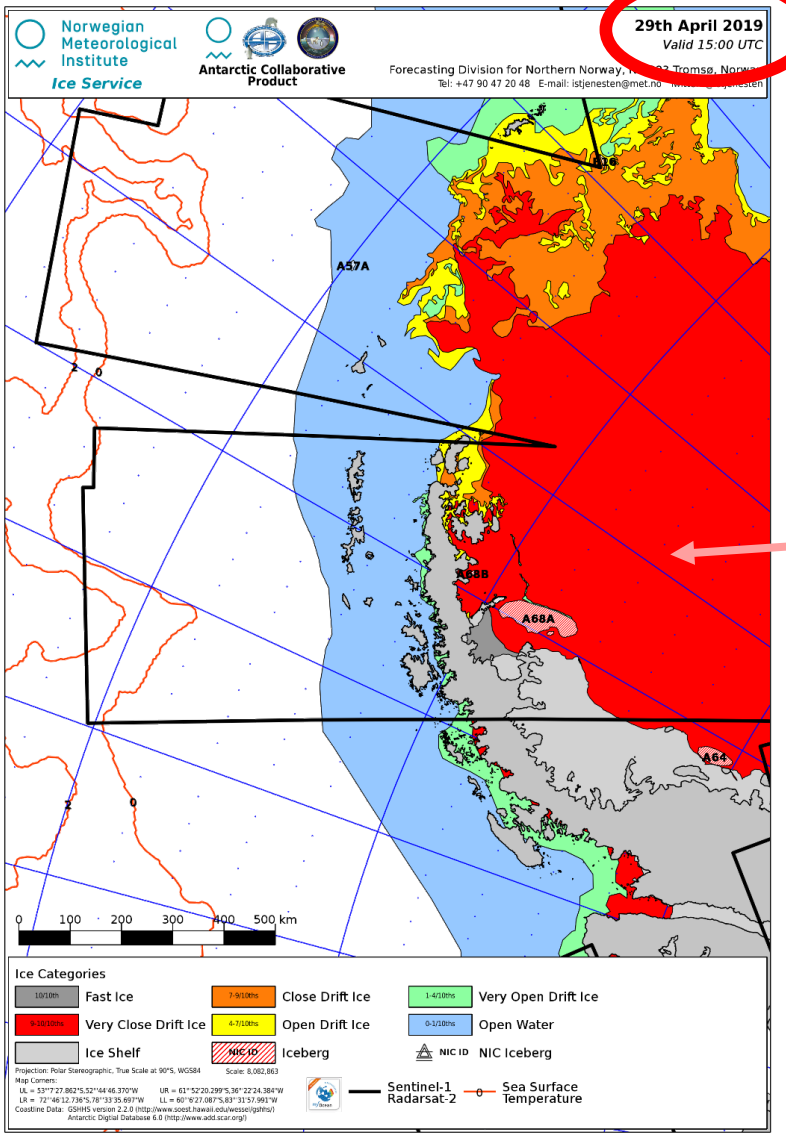


« Now-casting »

http://polarview.met.no/antarctic/peninsula_20190429.png

Ice charts: best available information on current sea ice conditions



« Now-casting »

How about sea ice thickness here?

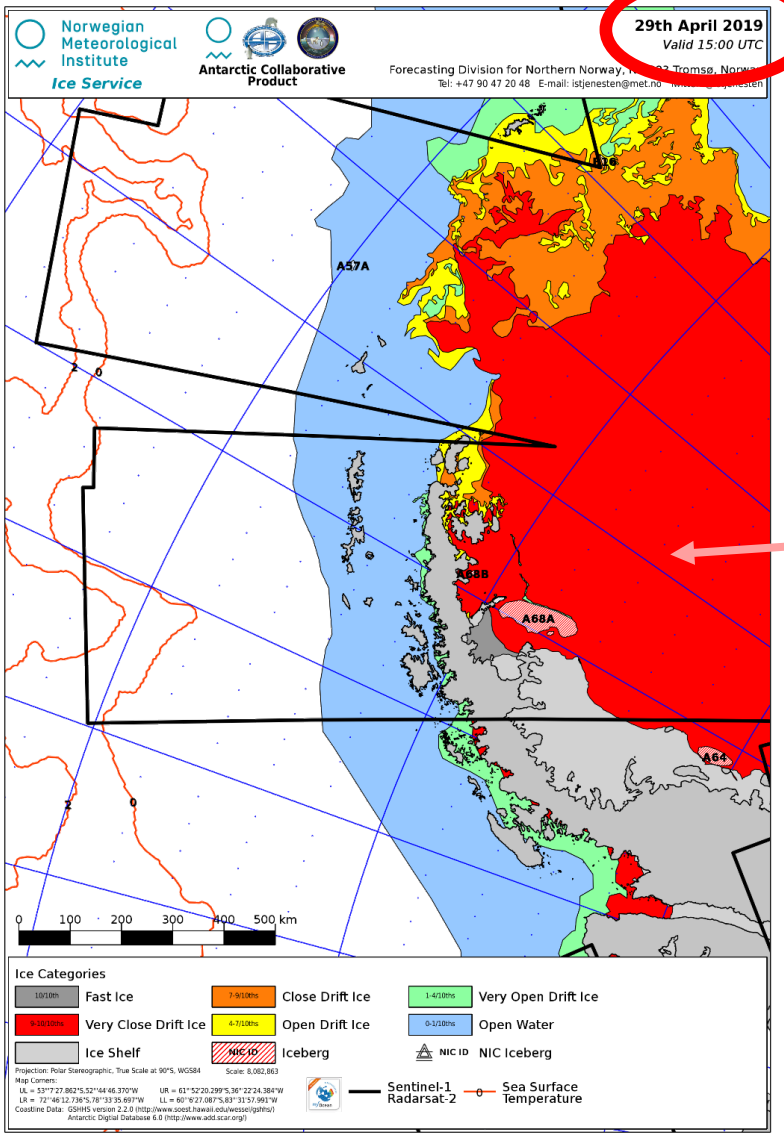
http://polarview.met.no/antarctic/peninsula_20190429.png

Ice charts: best available information on current sea ice conditions

Strong need for

- Information on date of **sea ice edge retreat and advance**
- Information on sea ice **conditions inside the ice pack**

possibly **several weeks/months ahead**



« Now-casting »

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