An initial outlook at the austral summer 2019-2020 sea-ice forecasts in the Southern Ocean

Coordinating Seasonal Predictions of Sea Ice
in the Southern Ocean for 2017-2019

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The Sea Ice Prediction Network South

The Sea Ice Prediction Network South (SIPN South) is an international project endorsed by the Year of Polar Prediction (YOPP). Its goal is to make an initial assessment of the ability of current systems to predict Antarctic sea ice globally and regionally, with a focus on the summer season. The project has three strategic objectives:

1. Provide a focal point for seasonal outlooks of Antarctic sea ice (winter and summer), where the results are exchanged, compared, discussed and put in perspective with those from the Arctic thanks to interactions within the (Arctic) SIPN,
2. Provide news and information on the state of Antarctic sea ice, highlight recent published research, report ongoing observational campaigns and disseminate upcoming events (conferences, workshops, webinars, et cetera),
3. Coordinate realistic prediction exercises, focusing on summer, and possibly aligned with the Year Of Polar Prediction (YOPP)'s Special Observing Periods.

We remind the reader that SIPN South is not an operational forecasting exercise. A brief assessment of forecast skill was performed in Massonnet et al. (2018, 2019) for the predictions of past years.

Forecasting sea ice during austral summer 2019-2020

We issued a call on November 7th, 2019, to collect forecasts covering the period December 1st 2019-February 28th 2020 (the 29th of February 2020 was deliberately excluded from the analyses).

So far, we have **received 7 submissions and would like to thank all contributors for their participation.** We expect one additional submission within the next days. Possible new submissions will be displayed in future reports but, in any case, they will not use data past December 1st.

We asked contributors to provide, in order of descending priority, (1) the total Antarctic sea-ice area ("SIA") for each day of December-February 2019-2020, (2) the sea-ice area per 10° longitude bands ("rSIA") for each day of December-February 2019-2020 and (3) the sea-ice concentration ("SIC") for each day of December-February 2019-2020

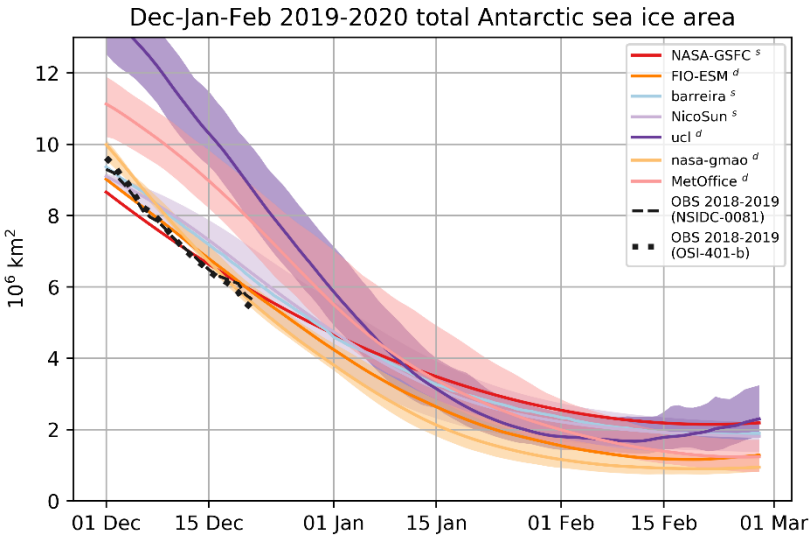

Figure 1. Total (circumpolar) Antarctic sea ice area of the 7 forecasts for each day of December-February 2019-2020. The superscripts in the legend indicate whether the submission is based on a *s*tatistical or a *d*ynamical approach.The black dashed lines are two observational references up to Dec. 21, 2019.

Table 1. Information about contributors to the summer 2019-2020 coordinated sea ice forecast experiment.

	Contributor name	*Short name (in figures)*	*Forecasting method*	*Nb. of forecasts*	*Initialization date*	*Diagnostics provided*
1	Nico Sun	NicoSun	Statistical model	3	Nov. 30th, 2019	SIA + SIC
2	NASA-GMAO	nasa-gmao	Coupled dynamical model	10	Nov. 27th, 2019	SIA + SIC
3	FIO-ESM	FIO-ESM	Coupled dynamical model	1	Nov. 15st, 2019	SIA
4	Barreira	barreira	Statistical model	1	Dec. 1st, 2019	SIA + SIC
5	NASA-GSFC (Alek Petty)	NASA-GSFC	Statistical model	1	Nov. 30th, 2019	SIA
6	Met Office	MetOffice	Coupled Dynamical Model	42	Dec. 1st, 2019	SIA + rSIA + SIC
7	UCLouvain	ucl	Ocean—Sea Ice Model	10	July 1st, 2019	SIA + rSIA + SIC

Circumpolar sea-ice area

Fig. 1 shows the total sea-ice area (SIA) forecasted for each day of December-January-February 2019-2020. We stress that SIA is not a very physical diagnostic, but it gives a first impression on how the forecasts behave. In this figure, we have also plotted for reference the sea-ice area from two observational references, the NSIDC-0081 product (Maslanik and Stroeve, 1999) and the OSI-401-b product (Tonboe et al., 2017). Two SIPN South forecasts based on dynamical coupled models appear to biased high at the time of initialization, similarly to last year.

Spatial information

Four groups submitted the spatial information of daily sea-ice concentration for each day of December-February 2019-2020. Groups provided several members (from 1 to 42) in order to sample uncertainty associated to the (unpredictable) evolution of the climate system, so that each member of a given model could be seen as a possible realization of that model. Fig. 2 displays the ensemble mean of monthly mean sea-ice concentration for February 2020, together with the sea-ice edge lines (15% sea-ice concentration contours) for each member. Sea-ice presence is forecasted in the Weddell Sea along the Antarctic Peninsula in all contributions. This is a region where the ice is climatologically present. There is high inter-model uncertainty regarding the presence of ice in the Ross Sea in February 2020.

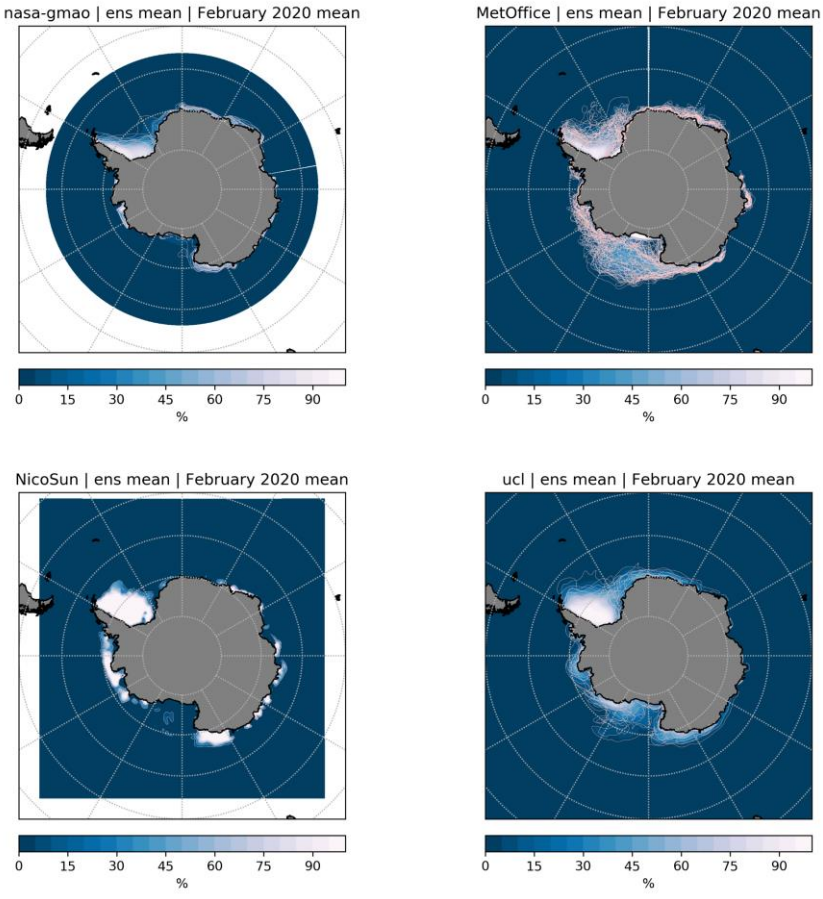

Figure 2. Ensemble mean of February 2020 monthly mean sea ice concentration, as forecasted by the four groups that submitted daily sea ice concentration information. The very thin salmon lines are the ice edge position for each forecast member, determined as the 15% contour line of the monthly mean sea ice concentration for the member.

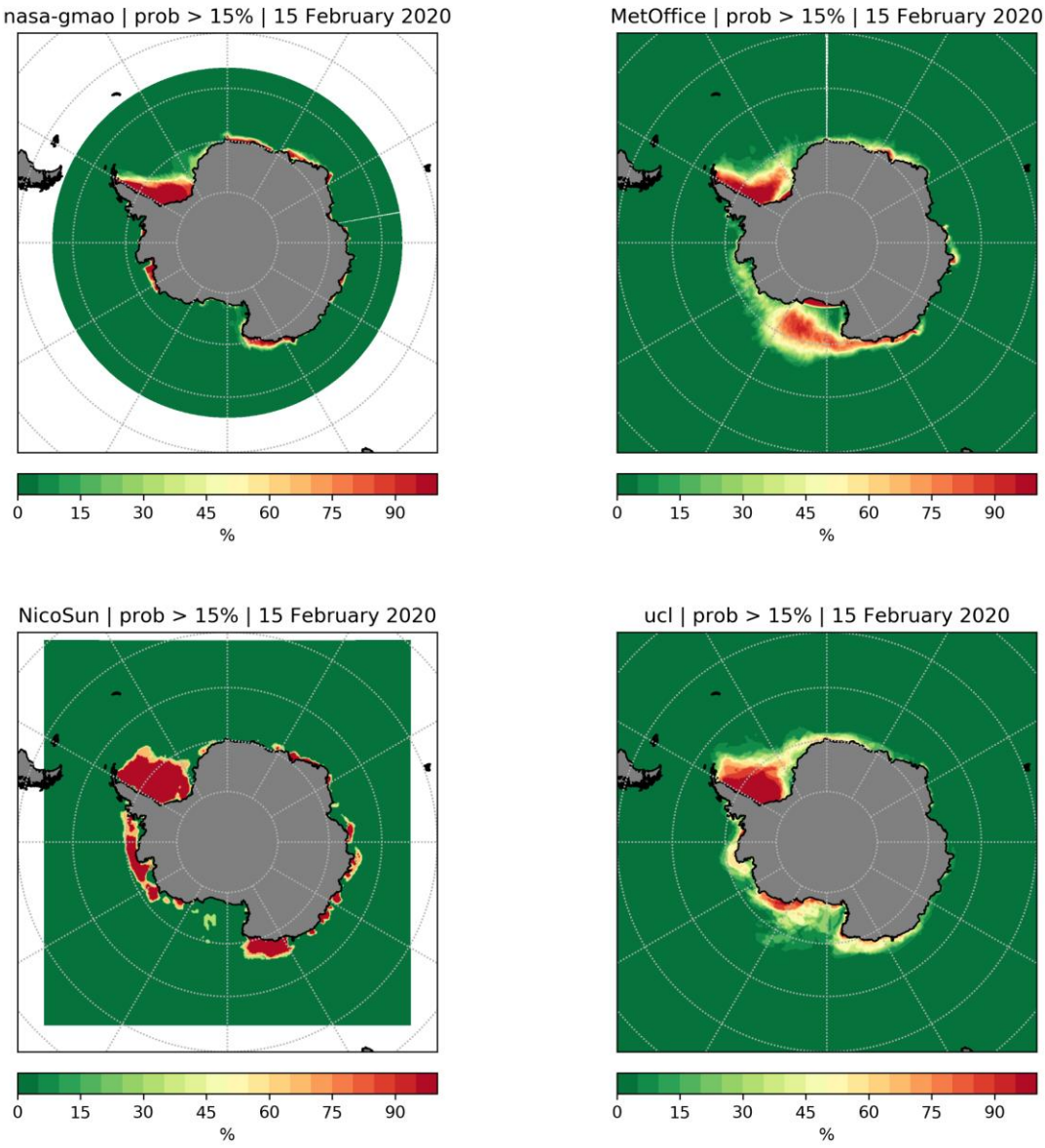

Figure 3. Probability of ice presence for the 15th of February 2020, as forecasted by the four groups that submitted daily sea ice concentration information. The probability of presence corresponds to the fraction of ensemble members that simulate sea ice concentration larger than 15% in a given grid cell, for that day. A dynamic animation of that figure for all 28 days of February is available here

The maps of ensemble February mean sea-ice concentration (Fig. 2) are useful to appreciate the expected average conditions that could prevail in February, but are difficult to interpret for potential final users of the forecasts. Therefore, we also show the daily probability of sea-ice presence (Fig. 3; a dynamic animation of this figure is available here). Green pixels are those where the ice is extremely unlikely to be present, while red ones are those where the ice is extremely likely to be present.

Next steps

After February 2020, we will evaluate the forecasts with two observational references. A more detailed analysis of this first exercise will be published in Spring 2020.

Scripts and data availability

The data presented in this report and the scripts used to generate figures can be retrieved and reproduced by cloning the following Git project:

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

List of contributors

Contributor long name	*Contributor short name*	*Contributors*
Nico Sun	Nico-Sun	Nico Sun
NASA-GMAO	nasa-gmao	Richard Cullather, Anna Borovikov, Eric Hackert, Robin Kovach, Zhao Li, Jelena Marshak, Andrea Molod, Steven Pawson, Yury Vikhliaev, Bin Zhao
FIO-ESM	Qi Shu	Fangli Qiao, Zhenya Song, Xunqiang Yin, Yajuan Song
NASA-GSFC	NASA-GSFC	Alek Petty
Met Office	MetOffice	Ed Blockley, GloSea5 Seasonal Forecast team
UCLouvain	Ucl	Sylvain Marchi, François Massonnet
Sandra Barreira	Barreira	Sandra Barreira, Alvaro Scardilli

References

Maslanik, J., Stroeve, J., 1999. Near-Real-Time DMSP SSMIS Daily Polar Gridded Sea Ice Concentrations, Version 1 [NSIDC-0081]. https://doi.org/10.5067/U8C09DWVX9LM

Massonnet, F., Reid, P., Bitz, C.M., Fyfe, J.C., Hobbs, W.R., 2019. Assessment of summer 2018-2019 sea-ice forecasts for the Southern Ocean.

Massonnet, F., Reid, P., Bitz, C.M., Fyfe, J.C., Hobbs, W.R., 2018. Assessment of February 2018 sea-ice forecasts for the Southern Ocean.

Tonboe, R., Lavelle, J., Pfeiffer, R.H., Howe, E., 2017. Product User Manual for OSI SAF Global Sea Ice Concentration (Product OSI-401-b).

To know more about SIPN South:

Website:

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

EGU Cryosphere blog article on SIPN South:

https://blogs.egu.eu/divisions/cr/tag/sipn/

Video summarizing SIPN South's first experiment:

https://www.youtube.com/watch?v=MUeWapsdSwQ

Full report of the past experiments:

Massonnet, François, Philipp Reid, Cecilia M. Bitz, J. C. Fyfe, and William R. Hobbs. "Assessment of February 2018 Sea-Ice Forecasts for the Southern Ocean," 2018. https://eprints.utas.edu.au/27184/.

Massonnet, François, Philipp Reid, Cecilia M. Bitz, J. C. Fyfe, and William R. Hobbs. "Assessment of Summer 2018-2019 Sea-Ice Forecasts for the Southern Ocean," 2019. https://eprints.utas.edu.au/29984/.