

Tropical and mid-latitude impact on polar predictability in the Community Earth System Model

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If you could make a (quasi) perfect forecast of the tropics/
mid-latitudes... how much does your polar forecast improve?

Polar differences? Seasonal modulation?
Role of model bias?



LETTER

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Tropical forcing of the recent rapid Arctic warming in northeastern Canada and Greenland

Qinghua Ding¹, John M. Wallace², David S. Battisti², Eric J. Steig¹, Ailie J. E. Gallant³, Hyung-Jin Kim⁴ & Lei Geng²

Ding et al, 2014

ARTICLE

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OPEN

Shifting El Niño inhibits summer Arctic warming and Arctic sea-ice melting over the Canada Basin

Chundi Hu^{1,2}, Song Yang^{1,3,4}, Qigang Wu², Zhenning Li^{1,3}, Junwen Chen³, Kaiqiang Deng^{1,3}, Tuantuan Zhang^{1,3} & Chengyang Zhang^{1,5}

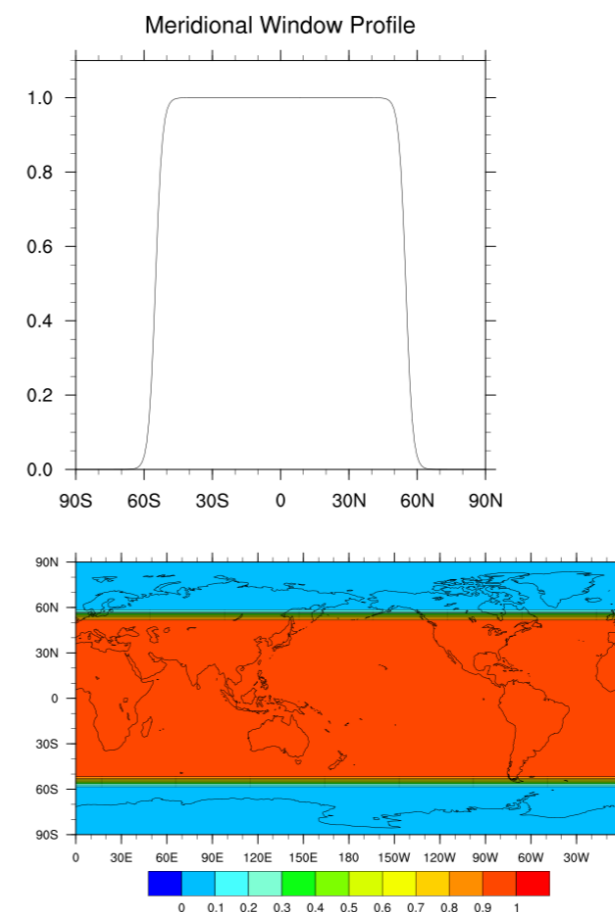
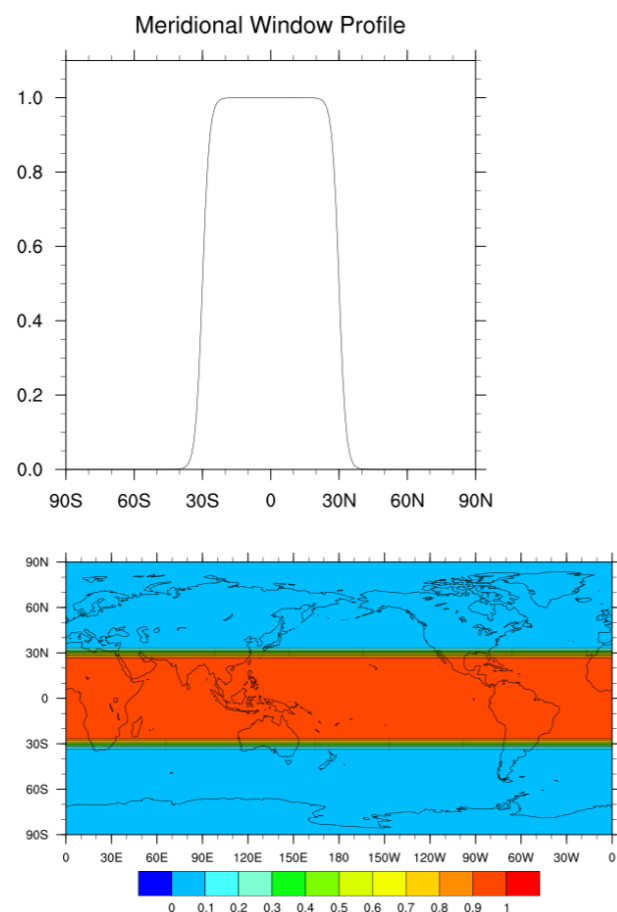
Hu et al, 2016

Methodology

1. Run a free-running forecast ensemble with fully coupled CESM
2. Run a second set of forecast ensembles, nudging regionally **U, V, T, surfQ** to a run from 'parent' ensemble above

Exp 1: nudge 30S-30N

Exp 2: nudge 55S-55N



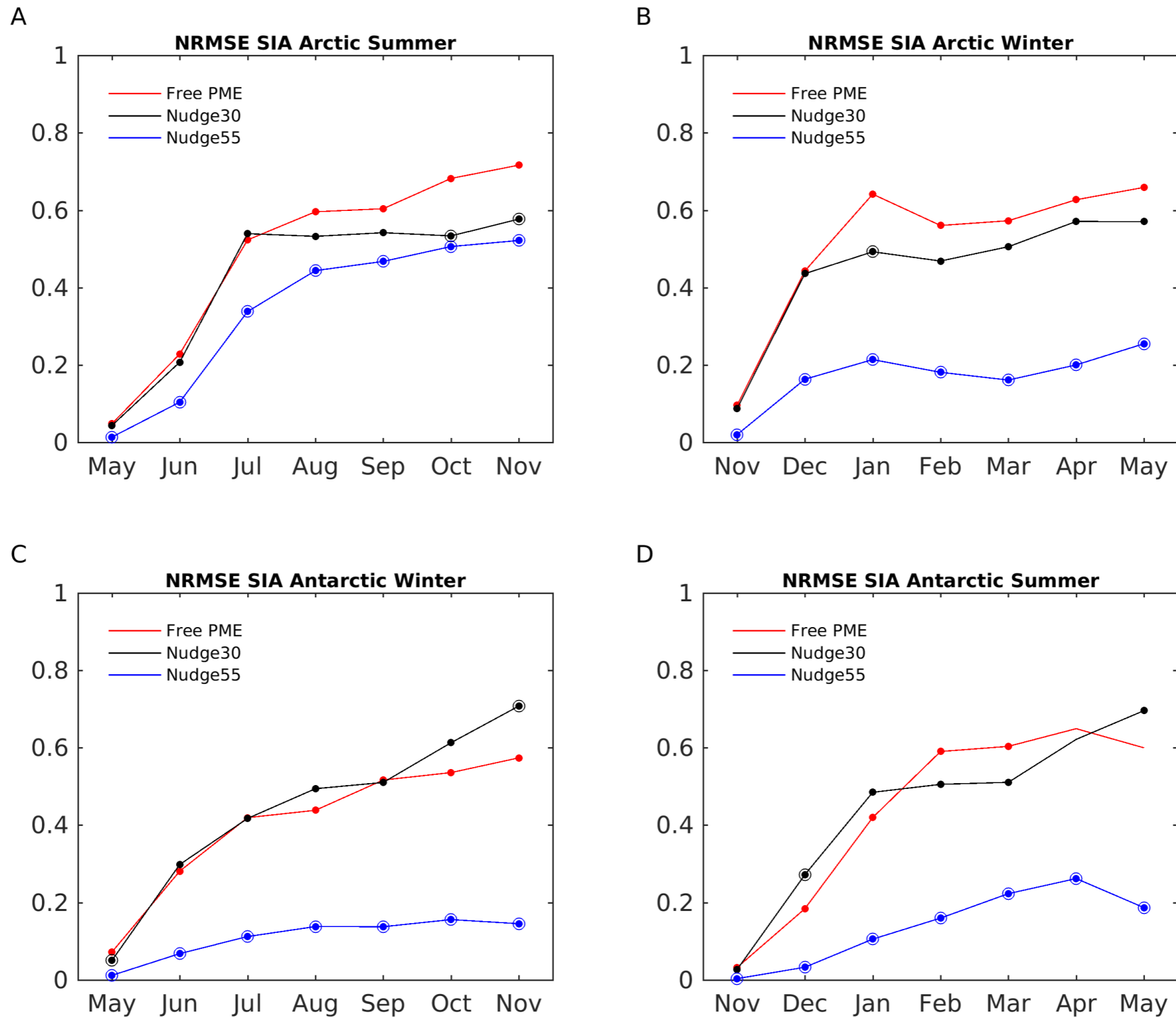
Methodology

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Initialization (forecast cycle)	PME	Nudging	ICs from LENS member:	Size, Start date, Length
May 1 2000	Free	None	5,10,14,22,23,29	6 ensembles 15 runs, 7 months
May 1 2000	Nudge30	30°N-30°S	"	6 ensembles 15 runs, 7 months
May 1 2000	Nudge55	55°N-55°S	"	6 ensembles 15 runs, 7 months
Nov 1 2000	Free	None	10, 23 (May 1 members 2,9,11), 29 (May 1 Members 5,14)	6 ensembles 15 runs, 7 months
Nov 1 2000	Nudge30	30°N-30°S	"	6 ensembles 15 runs, 7 months
Nov 1 2000	Nudge55	55°N-55°S	"	6 ensembles 15 runs, 7 months

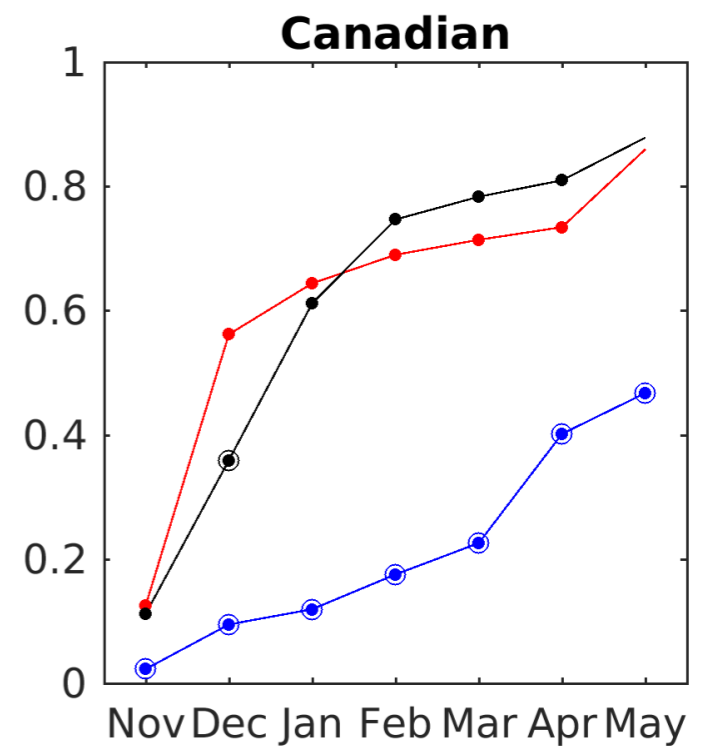
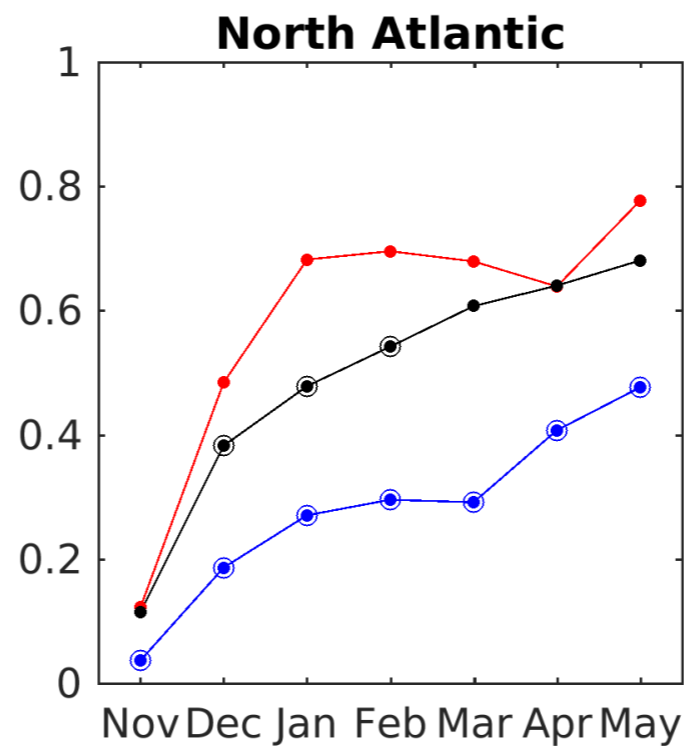
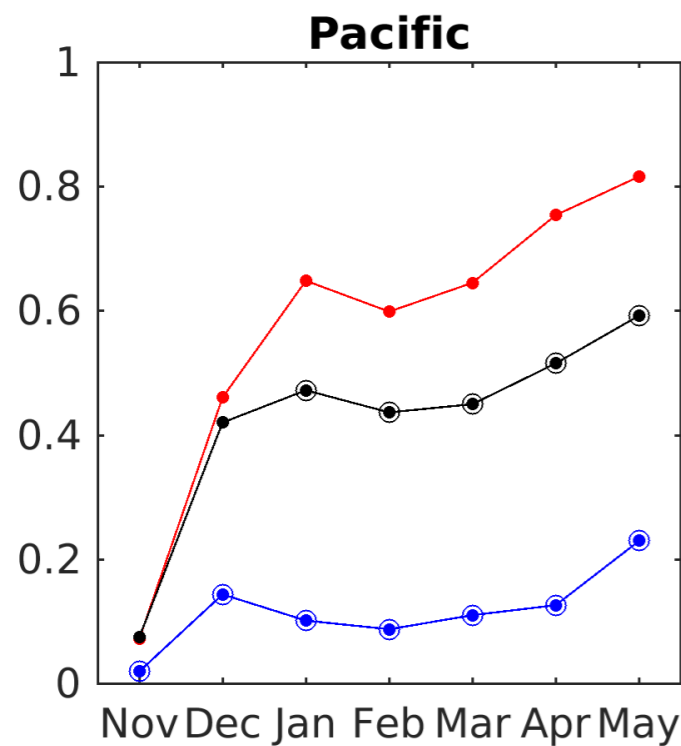
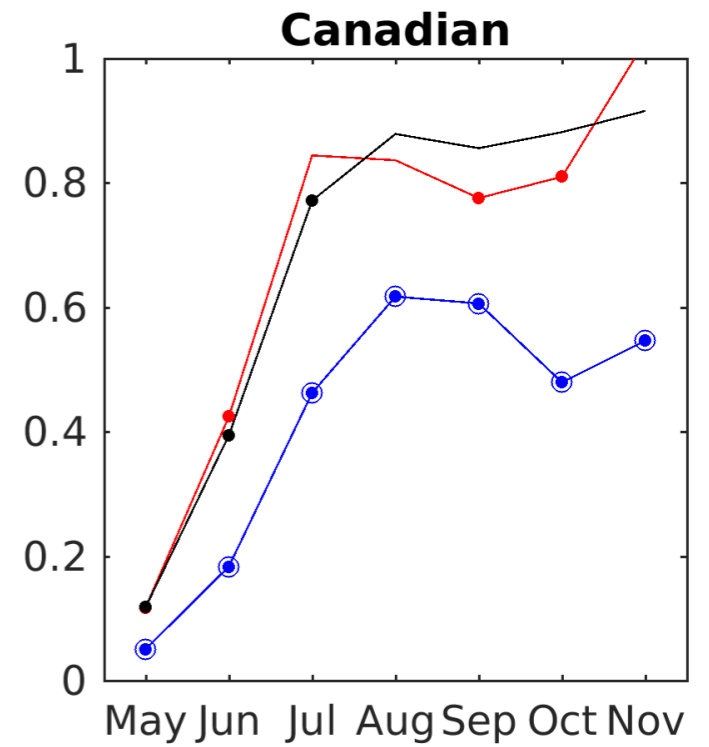
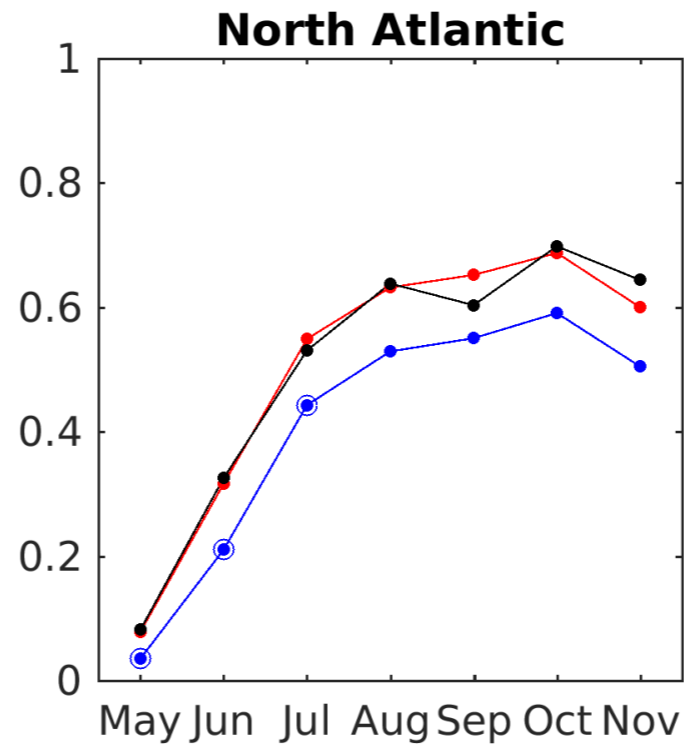
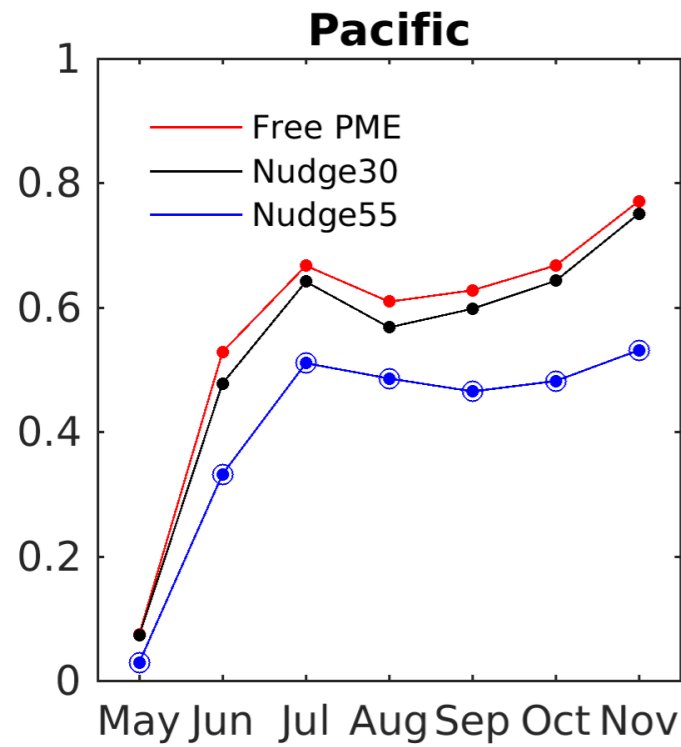
Results

Normalized RMSE Pan-Polar SIA



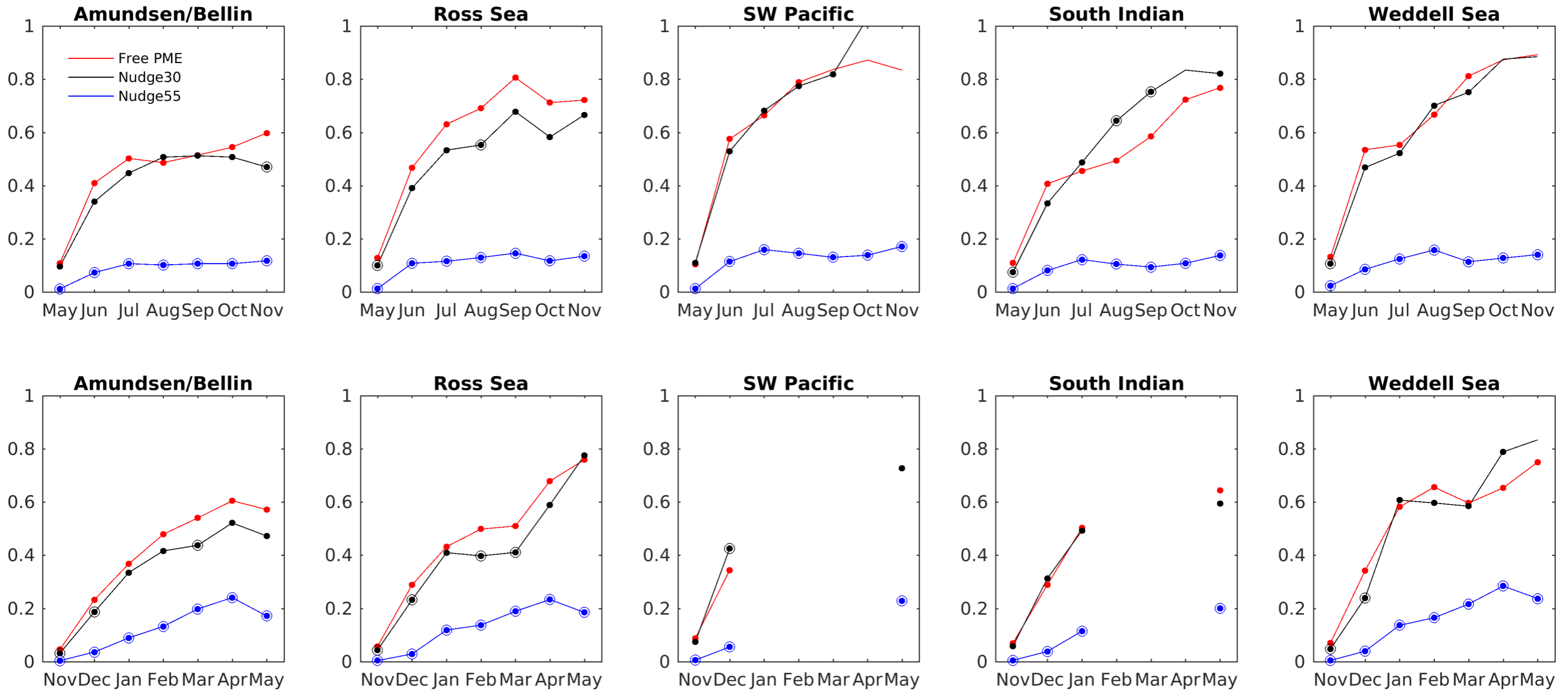
Results

Normalized RMSE Regional NH SIA



Results

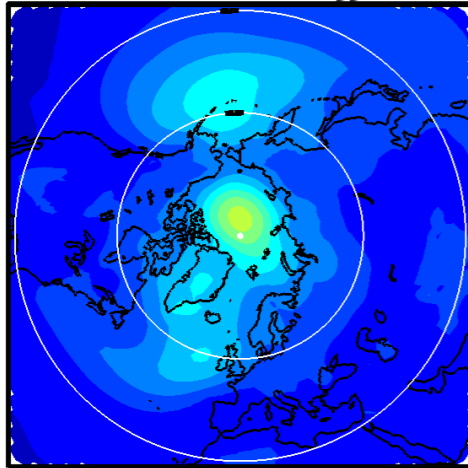
Normalized RMSE Regional SH SIA



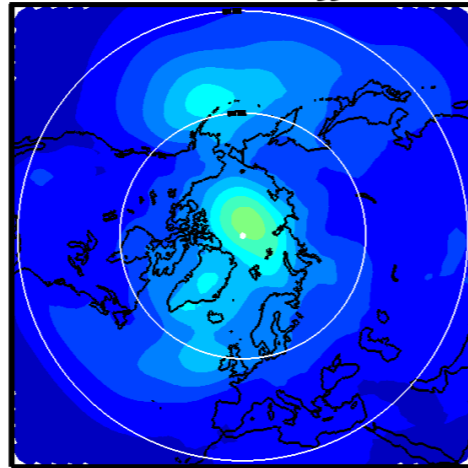
Results

RMSE NH SLP

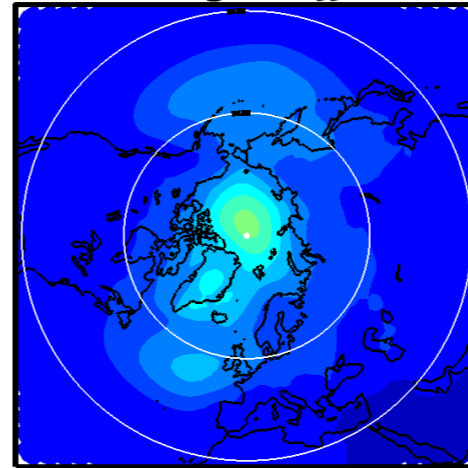
CESM-LENS JJA



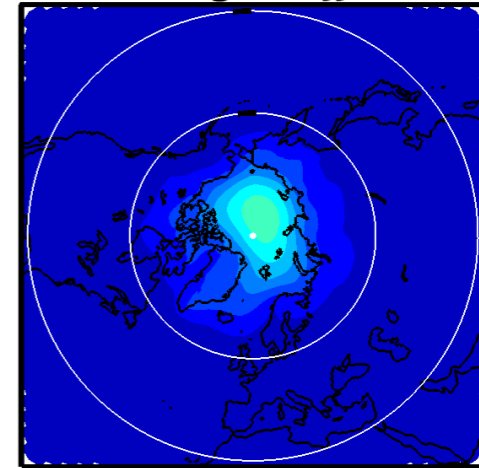
Free PME JJA



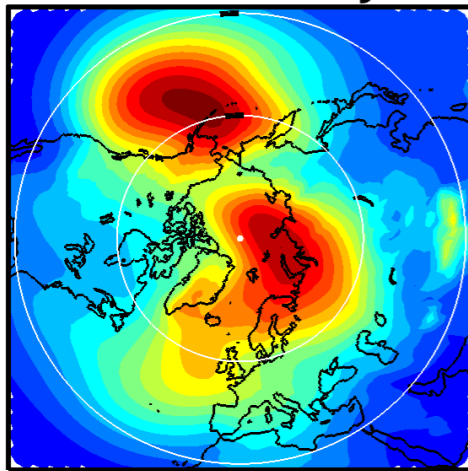
Nudge30 JJA



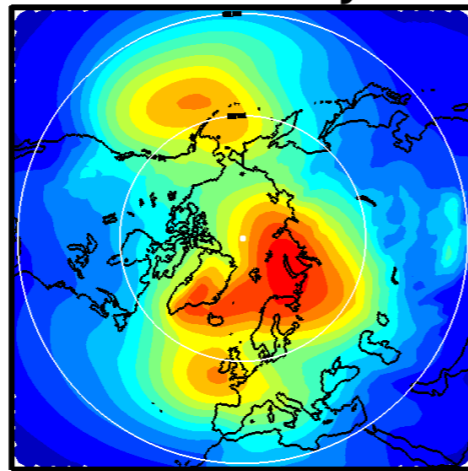
Nudge55 JJA



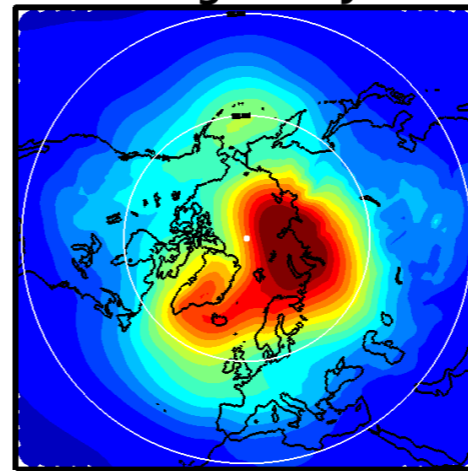
CESM-LENS DJF



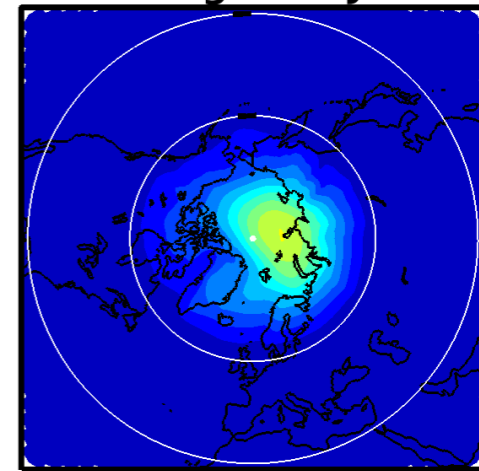
Free PME DJF



Nudge30 DJF



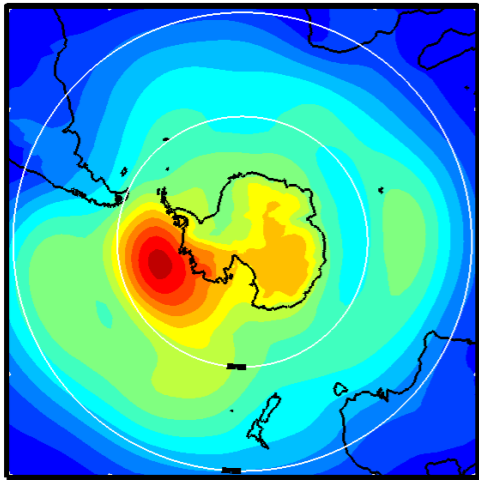
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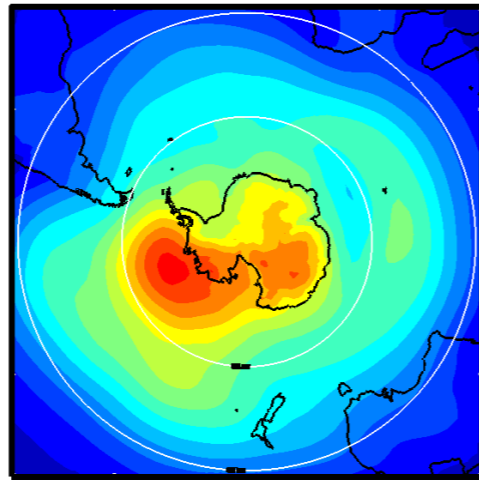
Results

RMSE SH SLP

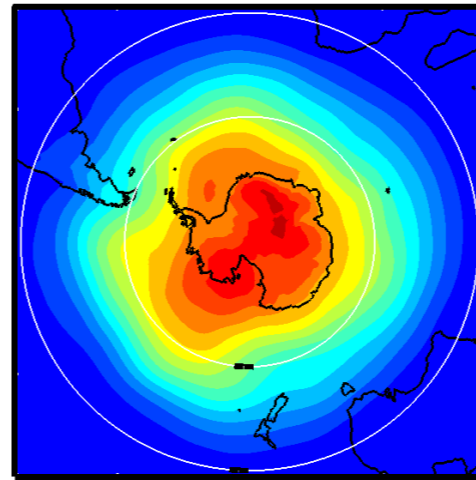
CESM-LENS JJA



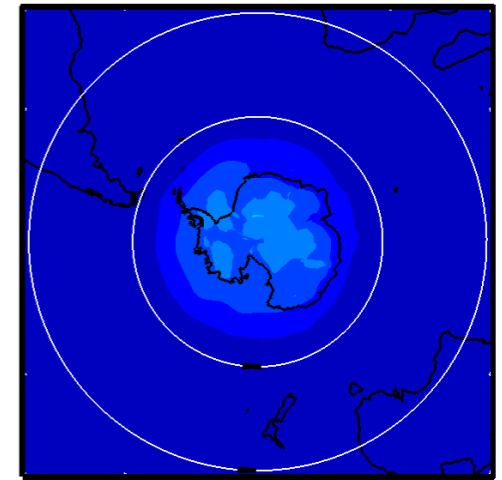
Free PME JJA



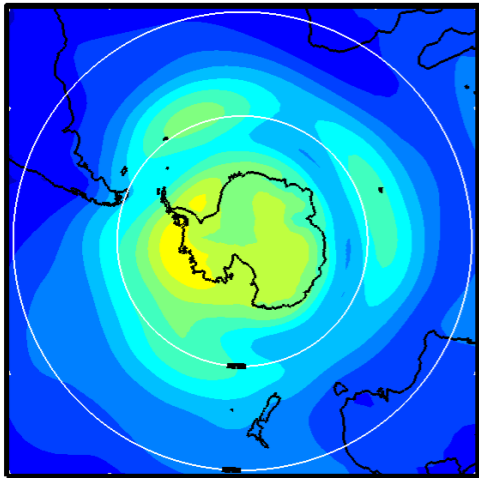
Nudge30 JJA



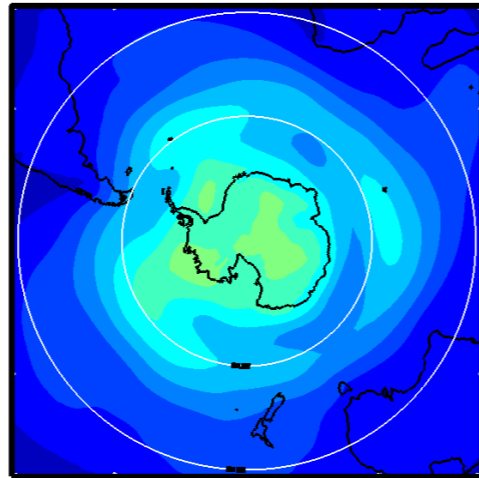
Nudge55 JJA



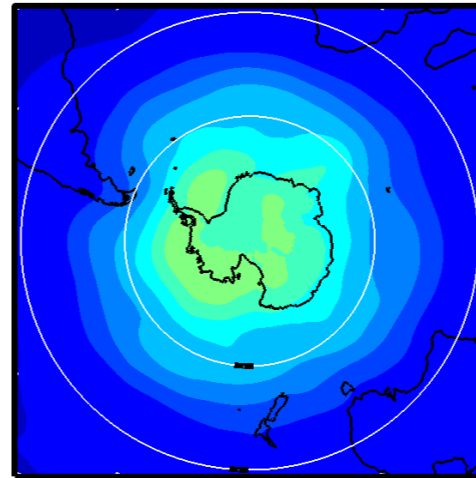
CESM-LENS DJF



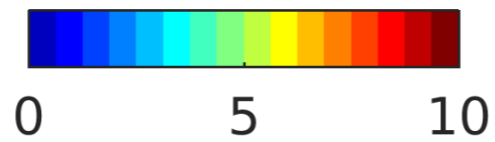
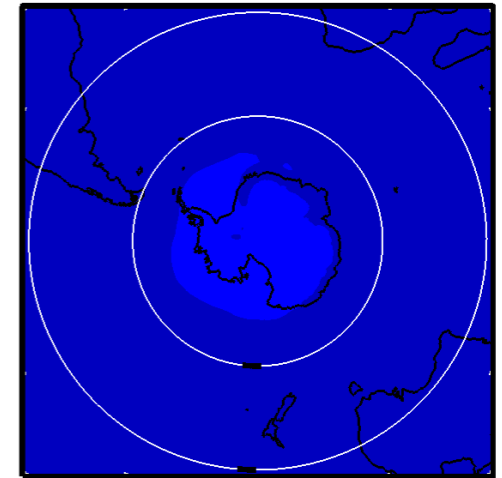
Free PME DJF



Nudge30 DJF

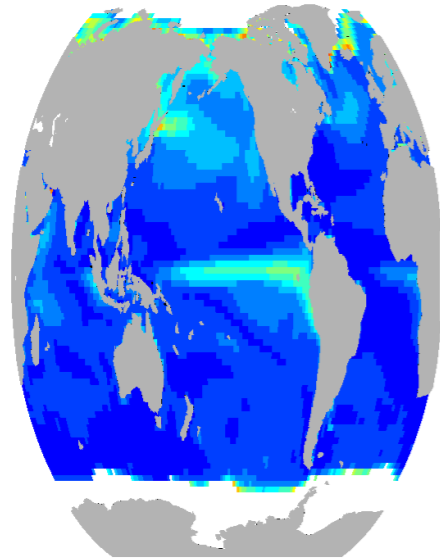


Nudge55 DJF

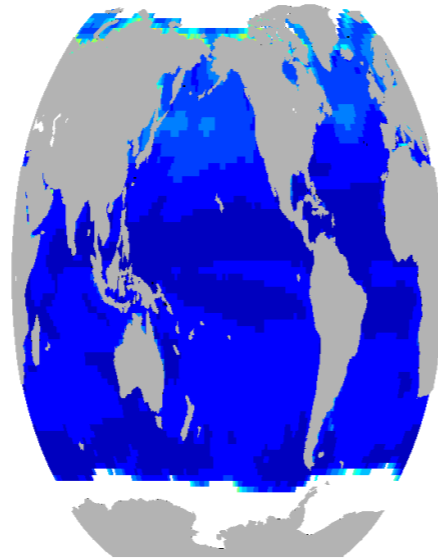


SST predictability

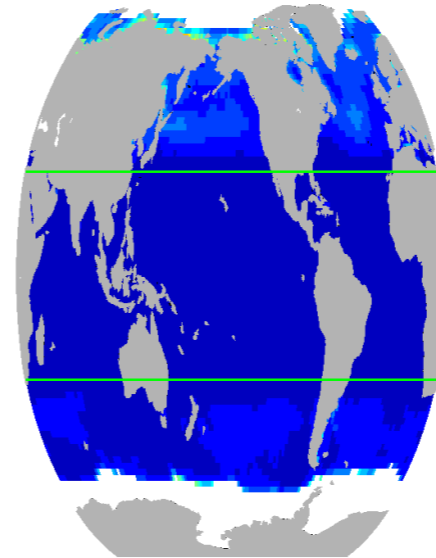
CESM-LENS JJA



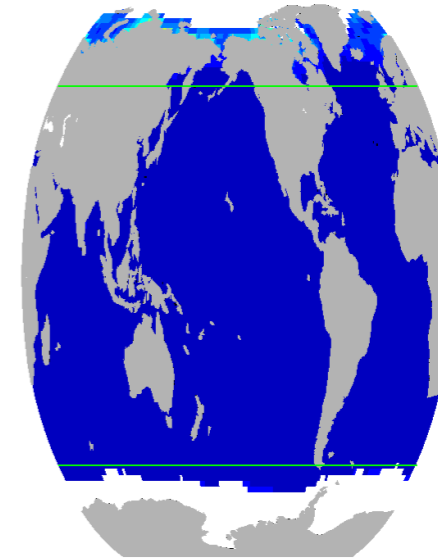
Free PME JJA



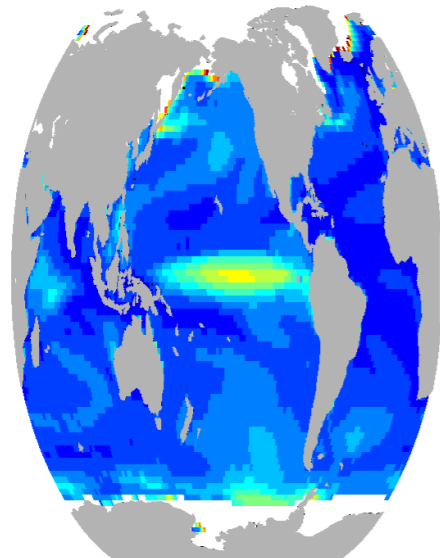
Nudge30 JJA



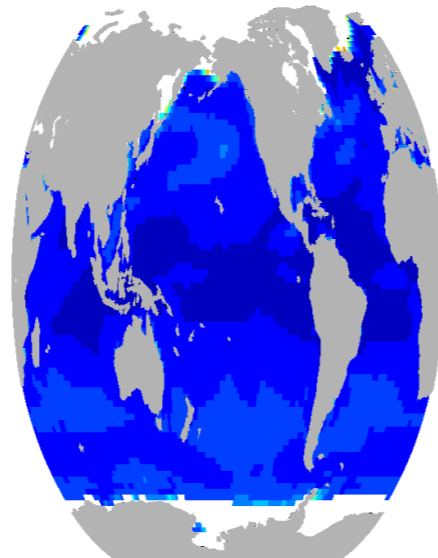
Nudge55 JJA



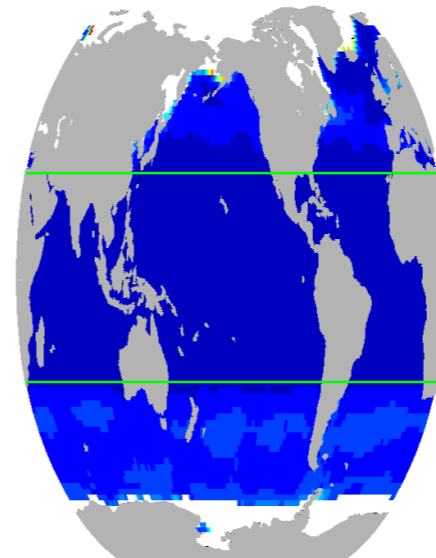
CESM-LENS DJF



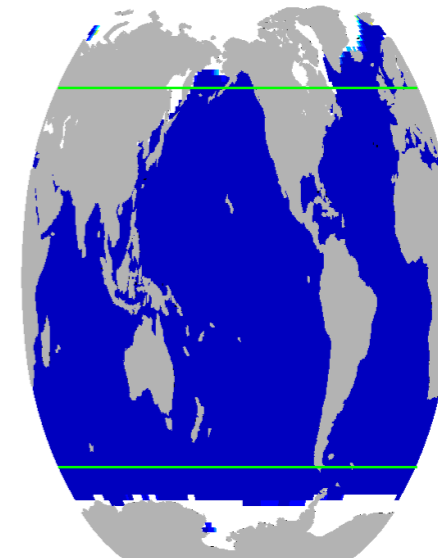
Free PME DJF



Nudge30 DJF



Nudge55 DJF



Summary

Summer Arctic: very little enhanced predictability (either sea ice or atmosphere) from tropics or mid-latitudes.
Forecast error growth mostly local.

Winter Arctic: some enhanced predictability from tropics, especially Pacific, strong from mid-lats

Antarctic: very little enhanced predictability from tropics (only in A&B, Ross), strong from mid-latitudes year round

Tropical SSTs: high seasonal predictability... Does this imply weak seasonal teleconnections to poles?...
(see special issue in 2 hours)