ICE COLD (RE)ANALYSIS – HOW DO ERA5/JRA55-do COMPARE IN THE FROZEN SOUTHERN OCEAN

Will Hobbs, (Andrew Kiss, Ryan Holmes)

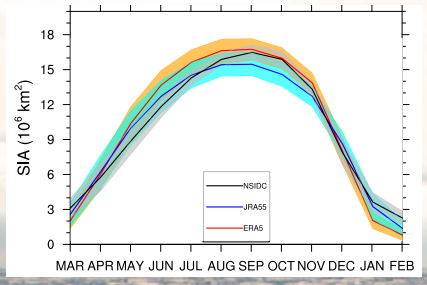
Sea ice (and especially sea ice area) is strongly constrained by surface forcing in ocean-sea ice models. So what's the best forcing dataset? Here I'm comparing Antarctic sea ice in ACCESS-OM2-025 forced by JRA55 and ERA5 reanalyses, with a focus on recent extreme events.

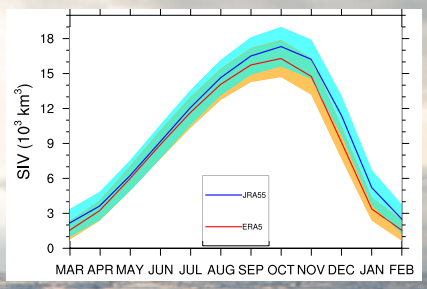
CLIMATOLOGY

1980-2009 climatologies of sea ice area (SIA) and volume (SIV); shading = 2σ range.

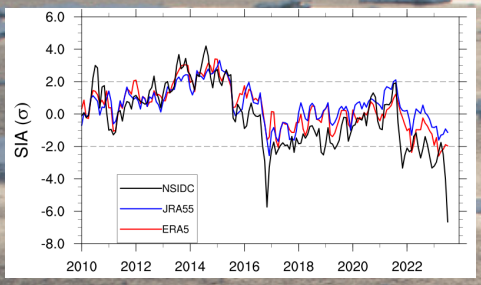
Compared to the obs (NSIDC), both are biased low in summer; ERA5 better matches the winter maximum extent.

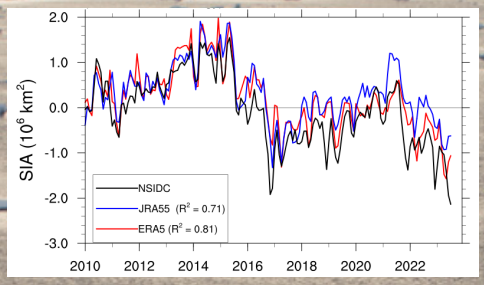
Both give a too rapid/early autumn growth





VARIABILITY





The last decade has been pretty 'interesting' for Antarctic sea ice... Here we have the absolute and normalized SIA anomalies (compared to 1980-2009).
Both products get the interannual variability well, but neither capture the recent extremes (2016, 2022 and 2023). ERA5 is a bit better, but the simulations are closer to each other than the obs.

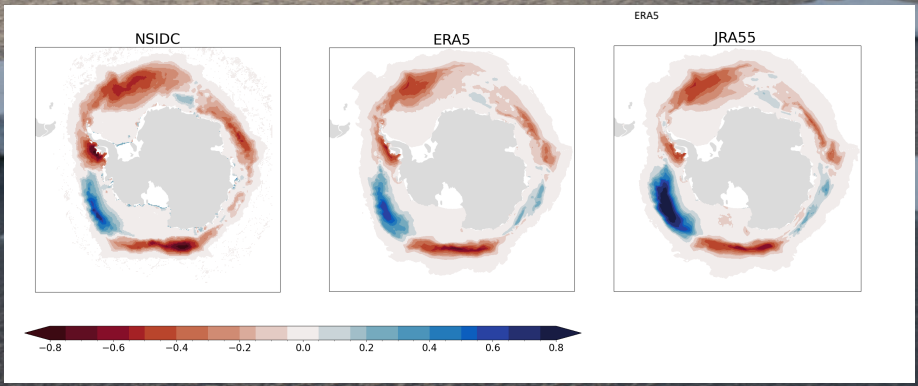
BUT HOW ABOUT THAT 7σ..?

Is Antarctic sea ice keeping you awake at nights? Yeah, me too.

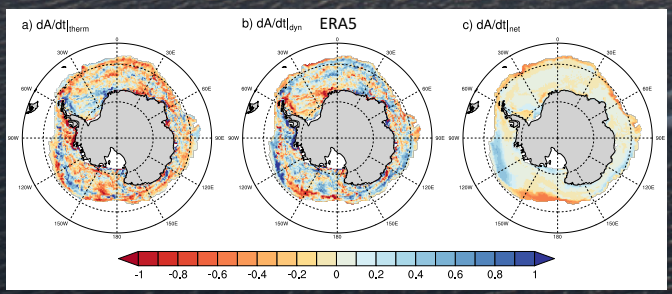
According to the variability plots, the simulations don't seem to be that worried though. To pick apart why, let's look at the March-July 2023 sea ice concentration (SIC) anomalies. JRA55 has way too much ice in the Amundsen Sea (side note, that was also why it didn't capture Feb 2022), but ERA5 looks OK.

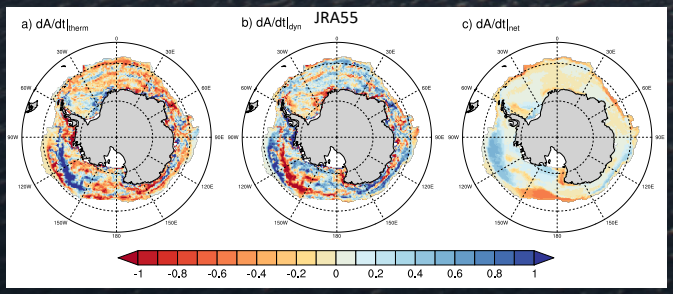
Both have too much ice in the Weddell and Bellingshausen Seas, and interestingly have a *positive* anomaly in East Antarctica.

It's almost as if there's something other than the atmosphere driving this....



HOT AND DYNAMIC





Sea ice anomalies for a given month are a combination of ice/ocean conditions in the previous month (persistence), and dynamic and thermodynamic tendencies that are dominated by the atmosphere. Here we look at the SIC-tendencies (anomalies with respect to 1980-2009 for March-July 2023.

Thermal and dynamic effects are closely coupled so we see a compensation between the 2, with the net being a residual of these terms.

In the Amundsen Sea, JRA55 gives too much freezing which is transported northwards by the winds – possibly a surface air temperature bias? The East Antarctic bias for both products looks dynamic.

Both products have reduced freeze in the Bellingshausen and Weddell Seas, compensated by dynamics. That compensation is a bit weird for the Bellingshausen, because there wasn't really any ice to move around until June....