

Representation of Antarctic climate in CESM2- Sea ice variability

MN Raphael¹, MS Handcock¹, MM Holland² L Landrum²

¹University of California, Los Angeles

²National Center for Atmospheric Research



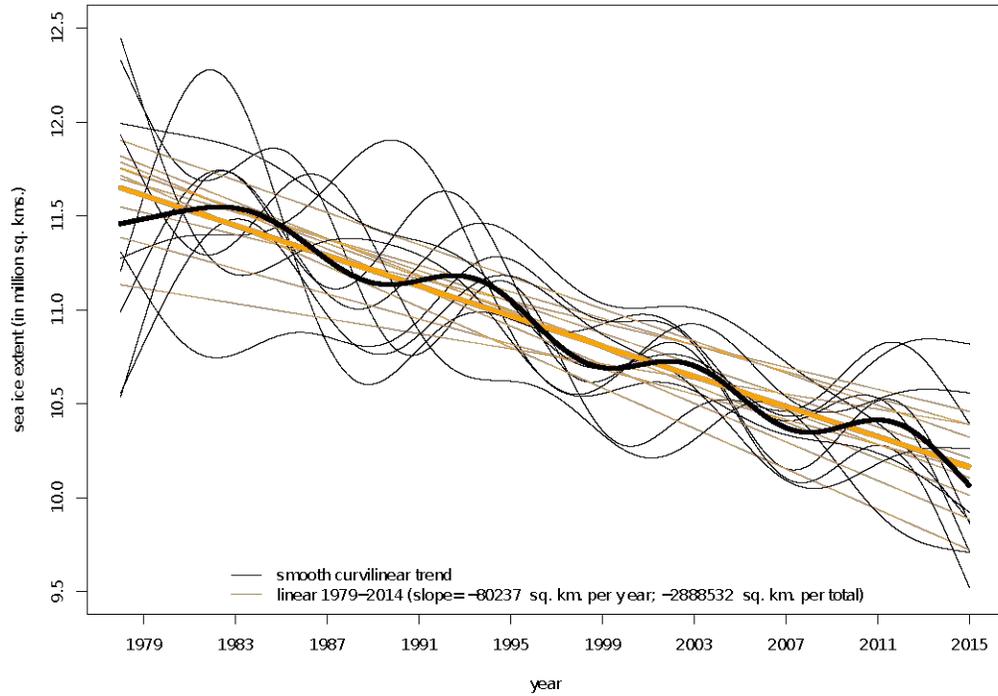
This study takes an initial look at the simulated Daily Sea ice Extent (SIE) focusing on:

- Trend
- Annual Cycle
- Day to day change in SIE
- Volatility

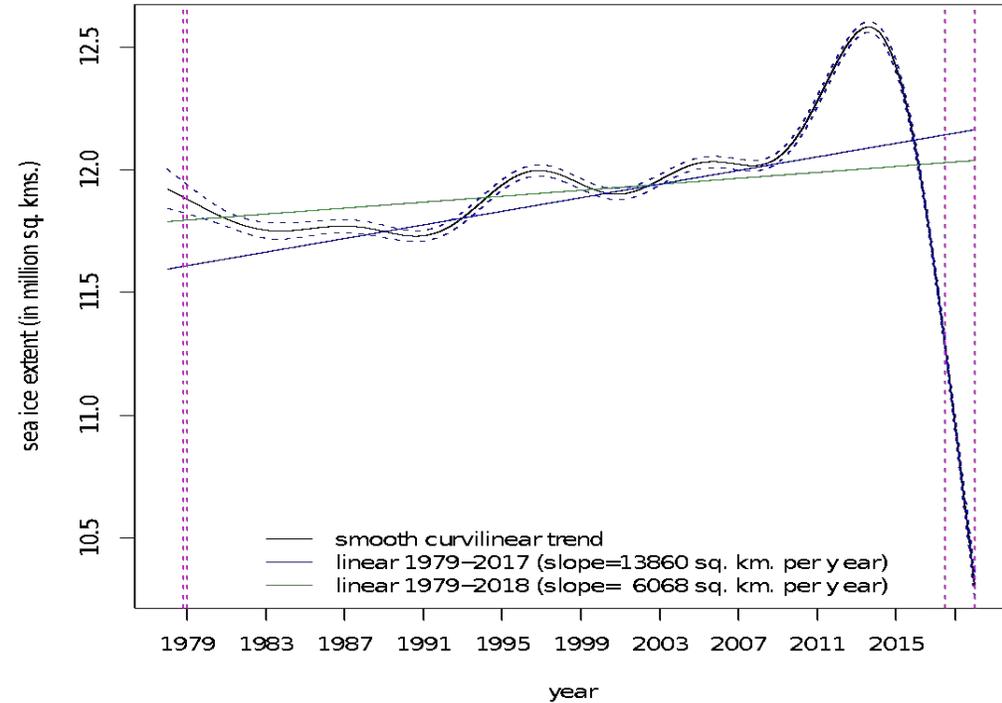
It also examines the **regional representation** as well as the **total sea ice**. Antarctic sea ice has very strong regional expression.

We use the daily sea ice largely because much of the variability in the ice is lost when we do monthly aggregations – e.g much of the recent Antarctic sea ice variations are occurring at the sub-monthly level.

Comparison of the trends in total SIE



SIE timeseries for each of 10 CESM2 runs plus the ensemble means for the period 1979-2014

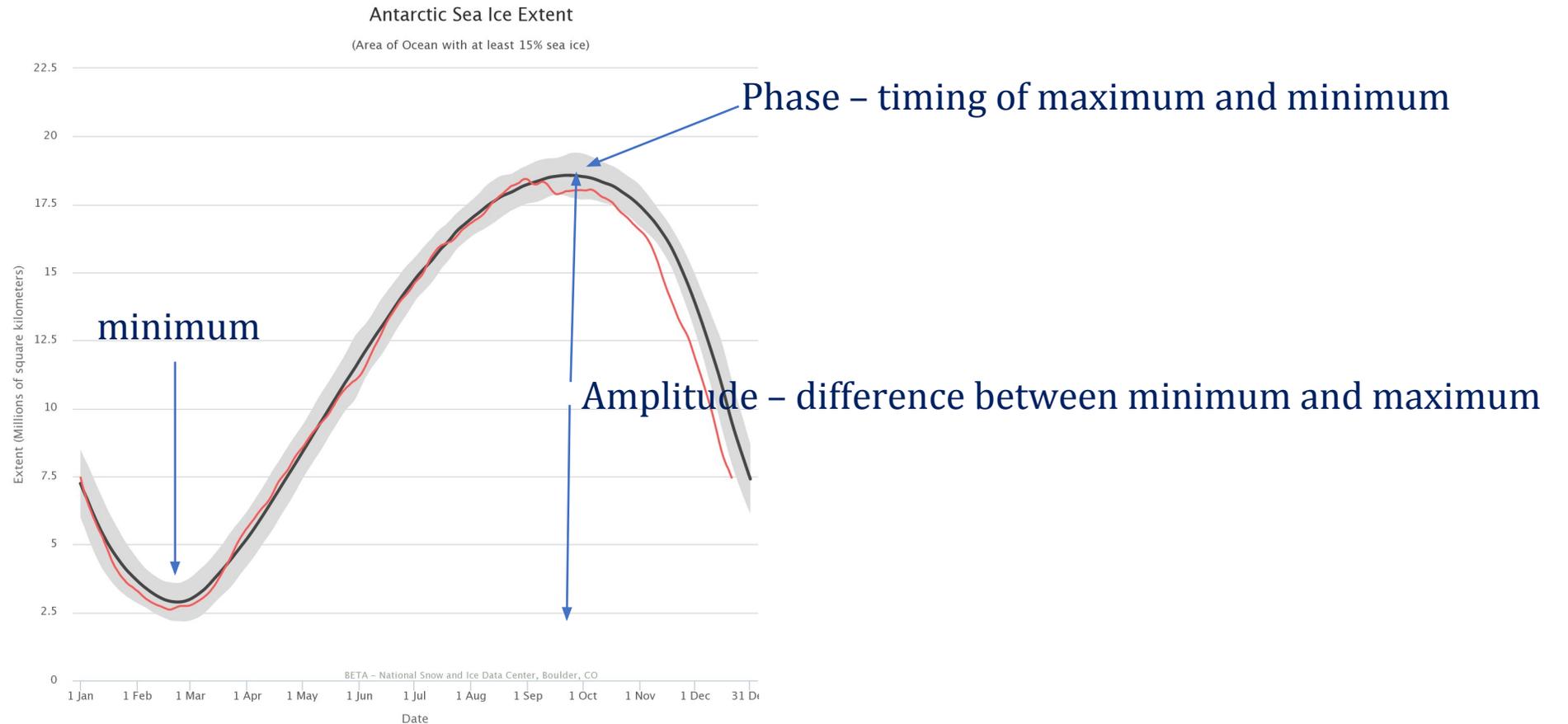


SIE timeseries for the recorded (SSM/I) SIE 1979 - 2018

- CESM2 simulates a negative trend while the recorded is positive.
- Trends are strongly curvilinear rather than linear
- CESM2 captures the sub-decadal variation that is apparent in the recorded.

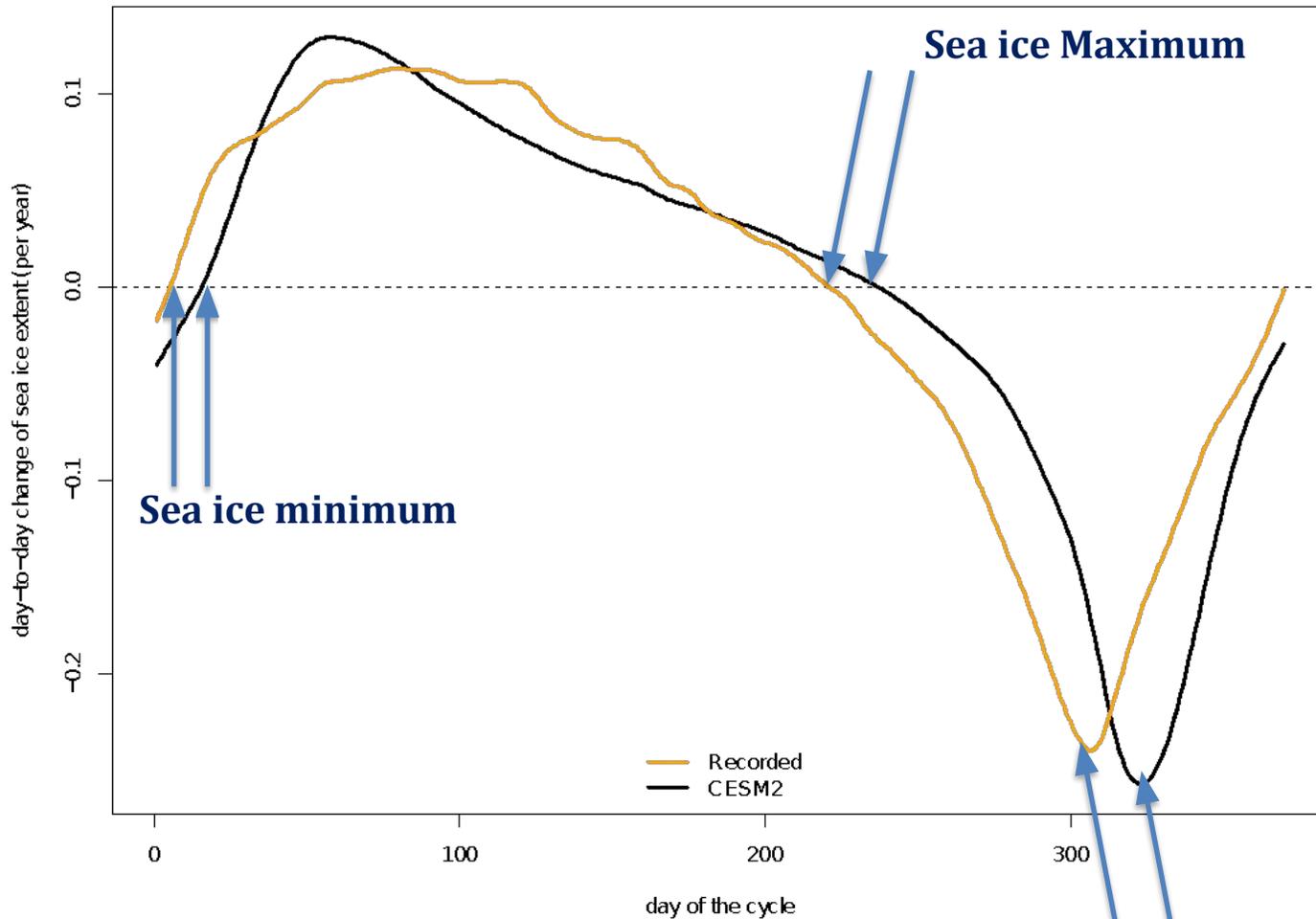
-What is responsible for the subdecadal variation? A question that CESM2 might be able to answer.

Key characteristics of the annual cycle of Antarctic sea ice extent



Day to Day change of sea ice in the Amplitude and Phase adjusted Annual cycle.

Day-to-day Change



SIE in the CESM2

- starts advancing later,
- Achieves its peak growth rate earlier, and that is higher
- But then grows more slowly for the rest of the Advance period of the ice.
- It begins Retreat later, achieving its fastest rate of retreat later than the recorded. That high rate of retreat may be why the ice is so much lower at minimum.

SUMMARY/CONCLUSIONS

◆ **Trend** - As was the case for the CMIP5 models, CESM2 simulates a negative trend in SIE. However CESM2 captures the sub-decadal variability in the total SIE and at the regional levels.

To what can we attribute this sub-decadal variability?

◆ **Annual Cycle** -

The amplitude of the SIE in the CESM2 is lower than in the recorded data. *This might be due to the negative trend in SIE.*

The shape of the annual cycle is very similar between modelled and recorded SIE *however* there is a clear difference in the phase – the timing of the start of retreat.

The CESM2 SIE reaches maximum later than the Recorded data – this is apparent in the total SIE and at the regional level.

◆ **Day to Day change** -

While the rates of change are generally similar (except for the peak rate of retreat), sea ice advances later and retreats later in the CESM2. *What controls the speed of retreat of the sea ice?*