How Do Intense Summer Cyclones Impact the Arctic Marginal Ice Zone in the CESM2 Large Ensemble?

5 August 2017

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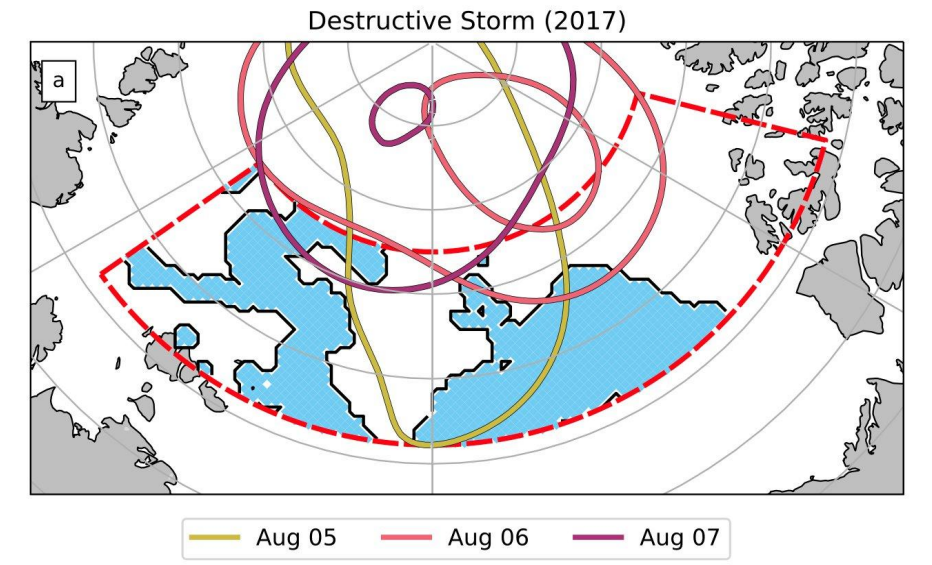
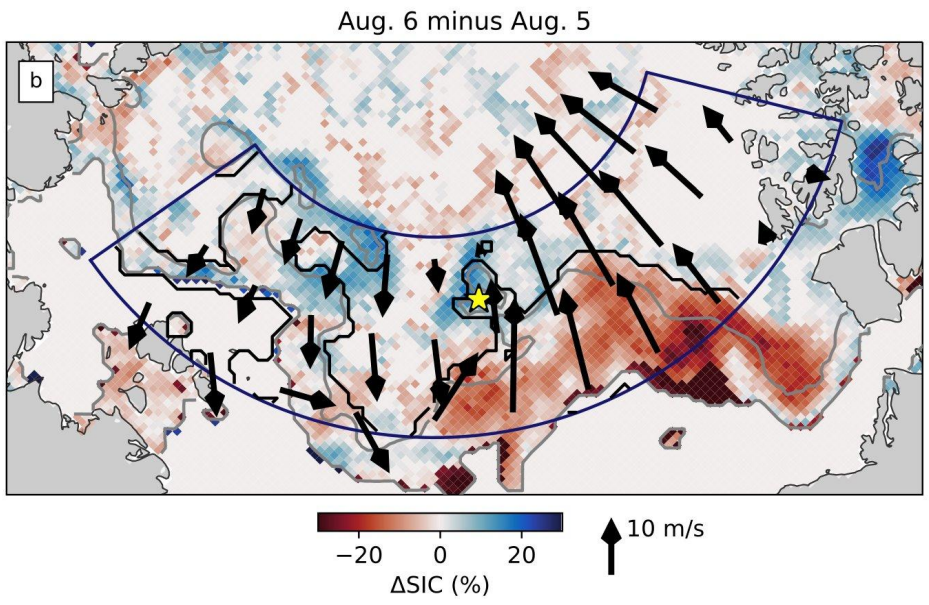
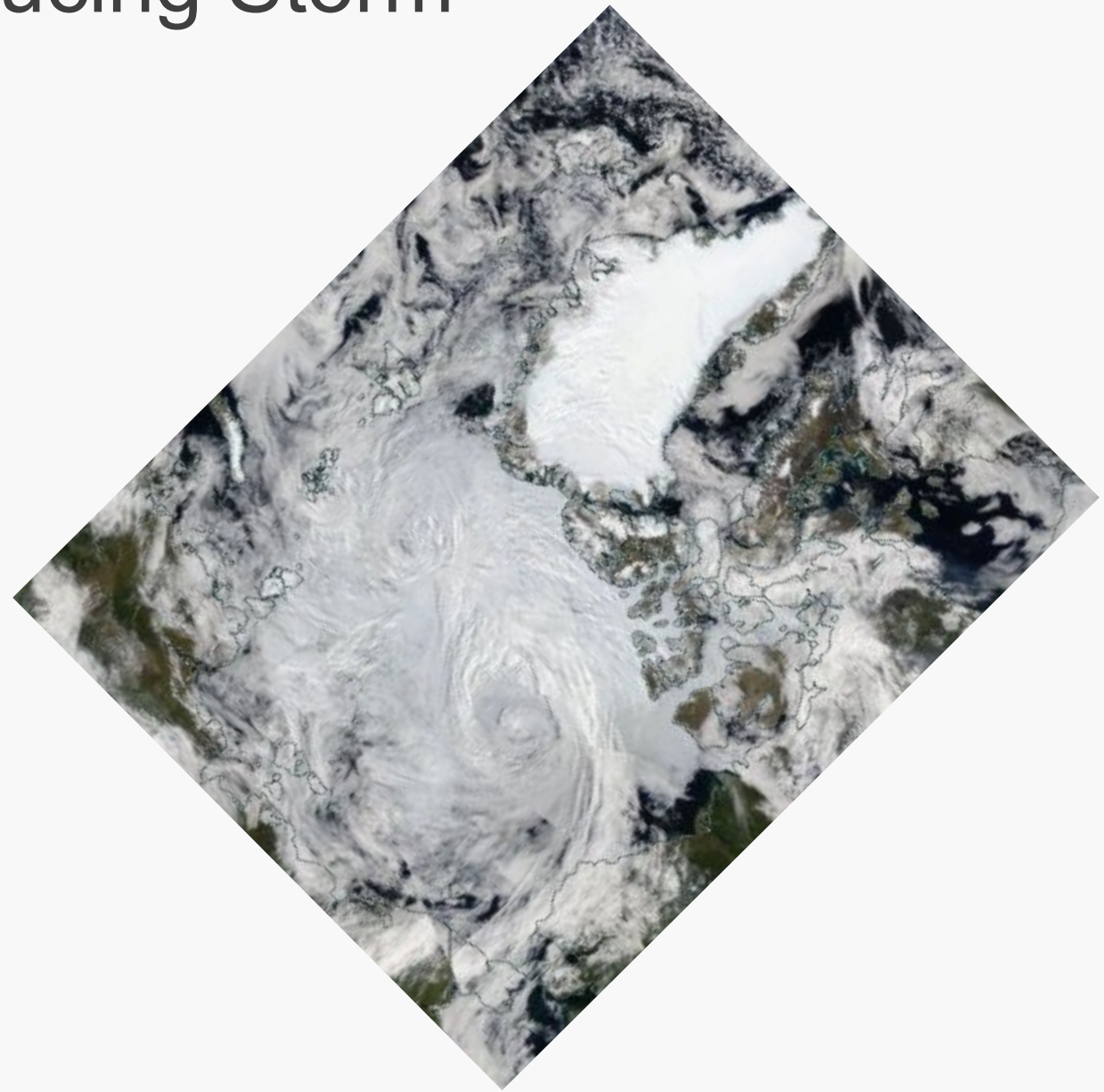
Polar Climate Working Group Meeting
March 3, 2024

A Sample MIZ Ice-Area Reducing Storm







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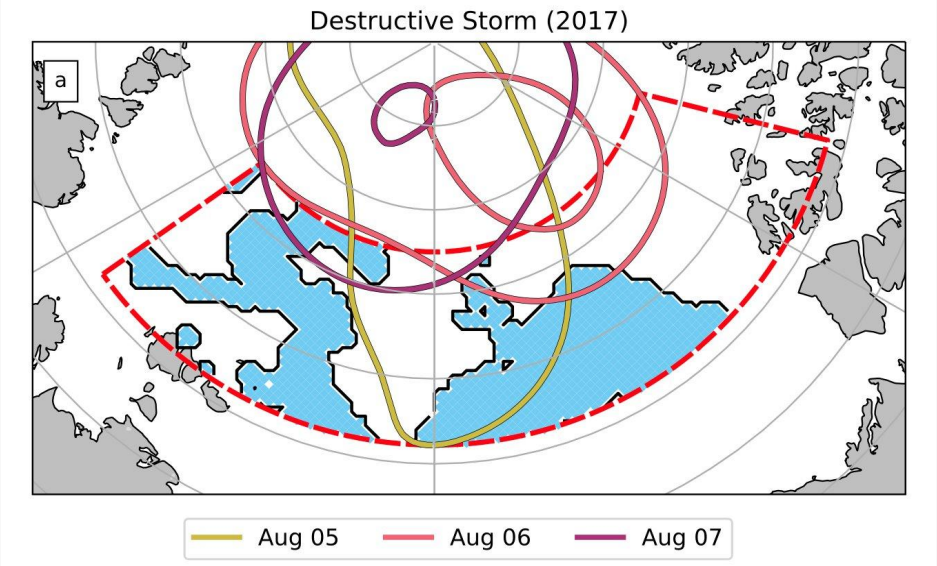
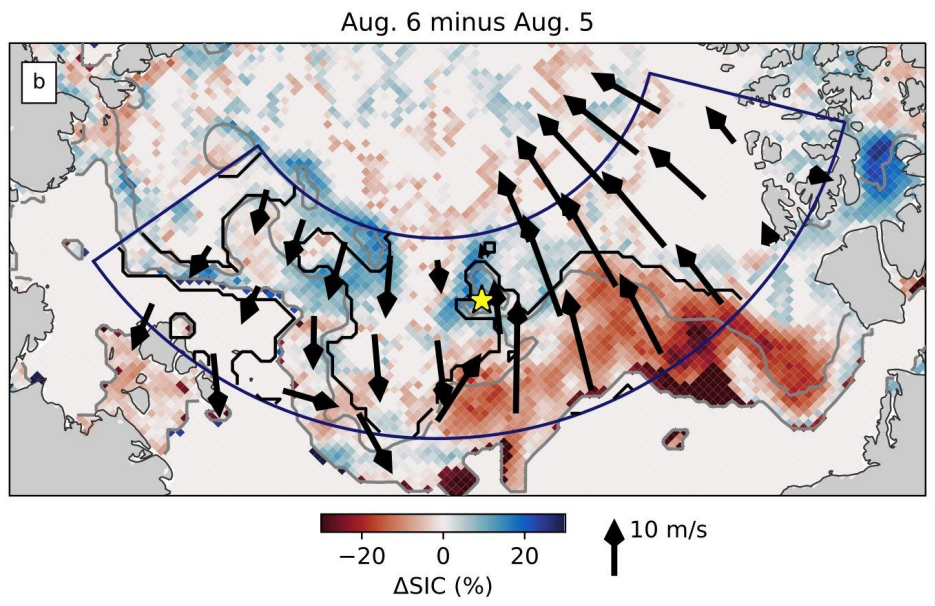
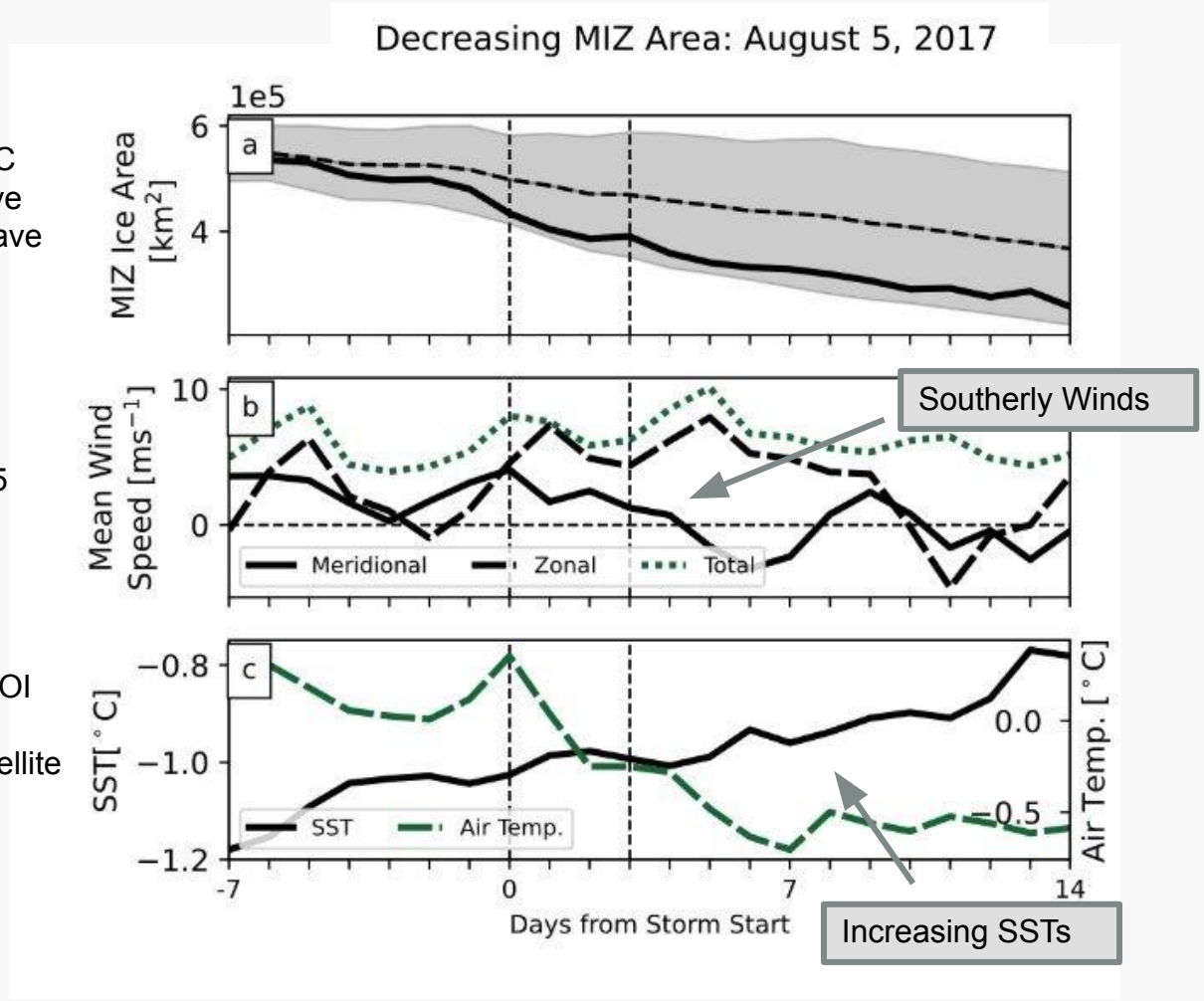




NSIDC Passive Microwave SIC

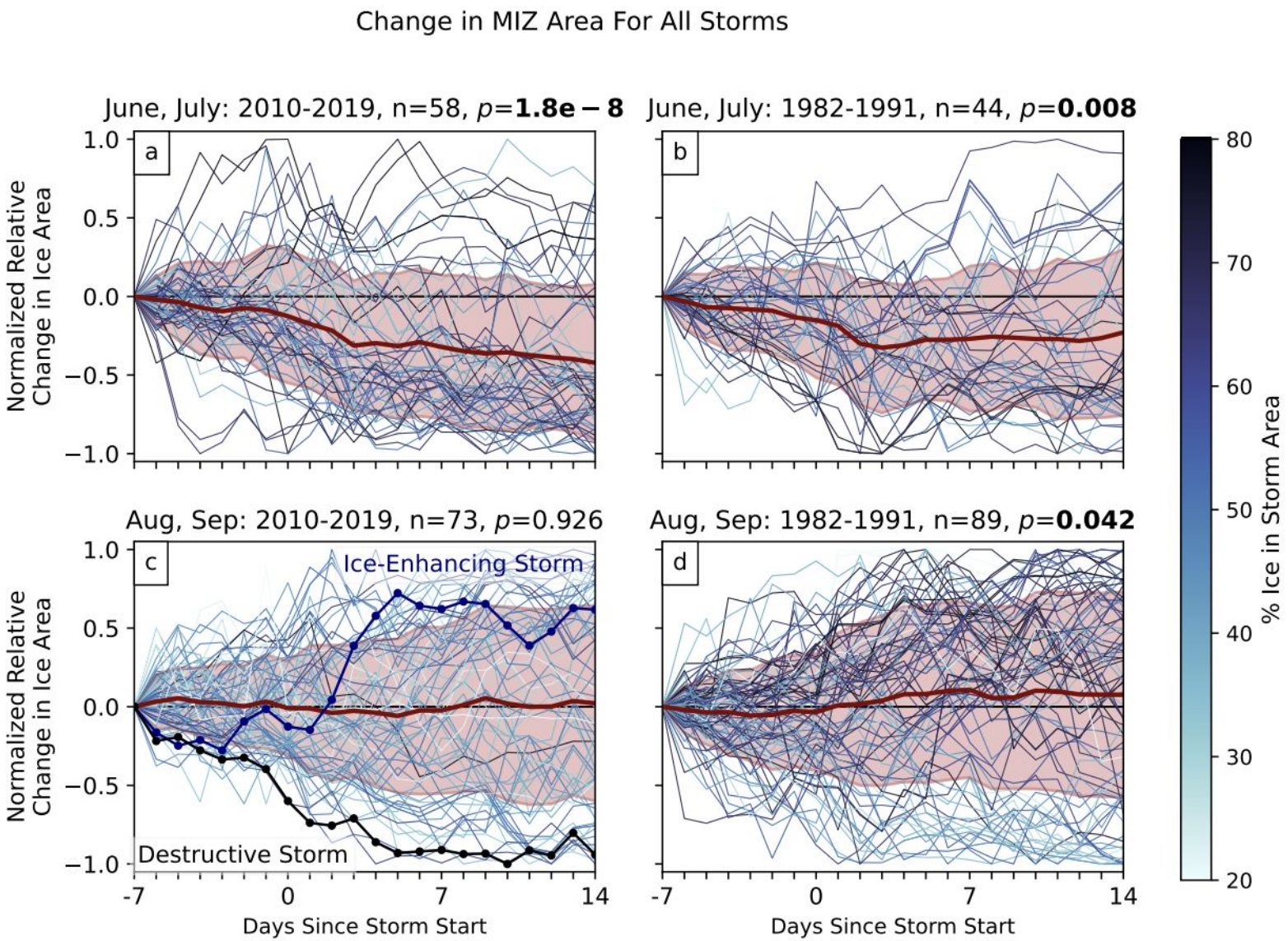
ERA5

NOAA OI SST Multi-Satellite



(Mundi and L'Ecuyer, 2025)

There’s a lot of variability in storm impacts…



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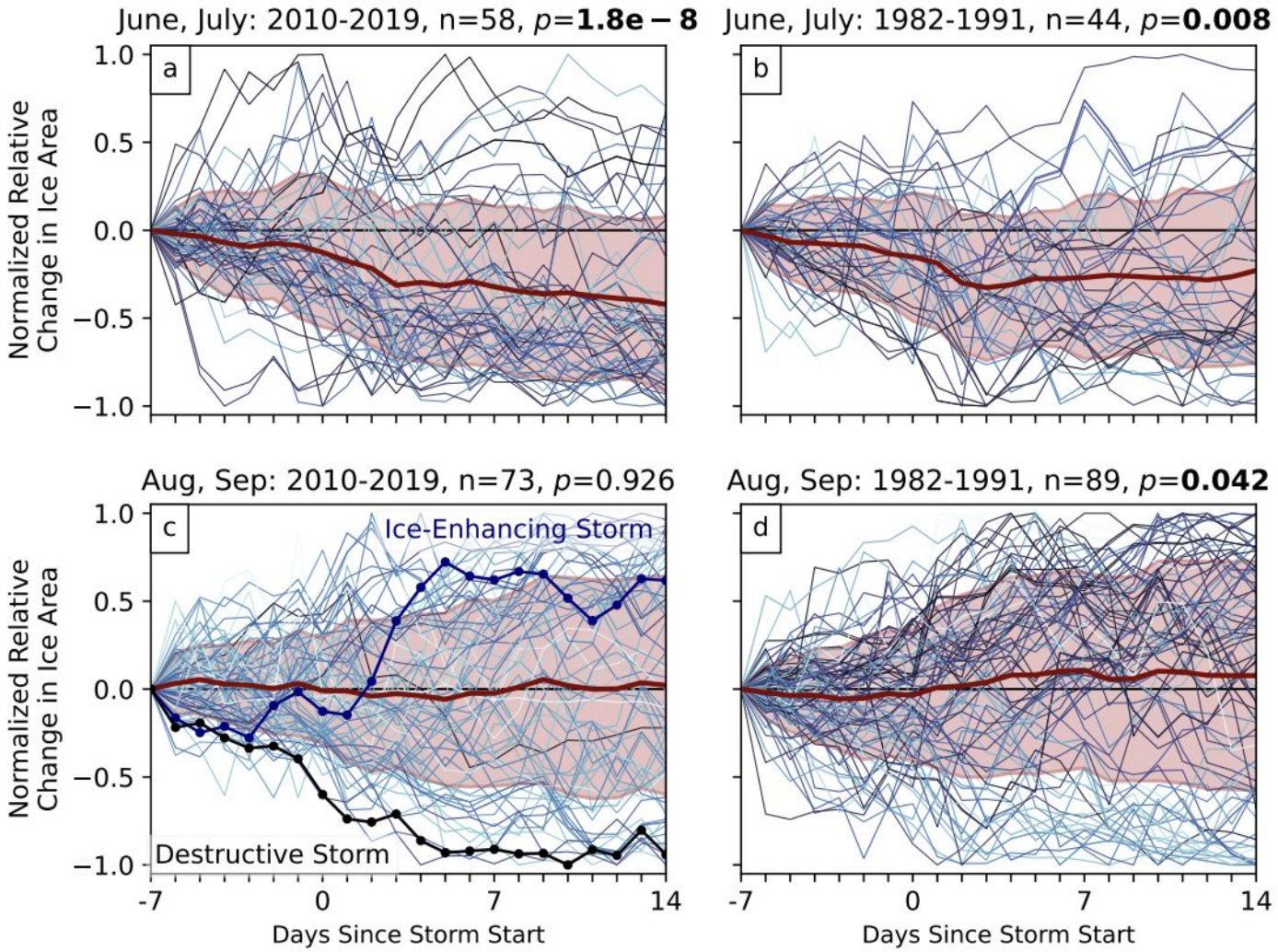
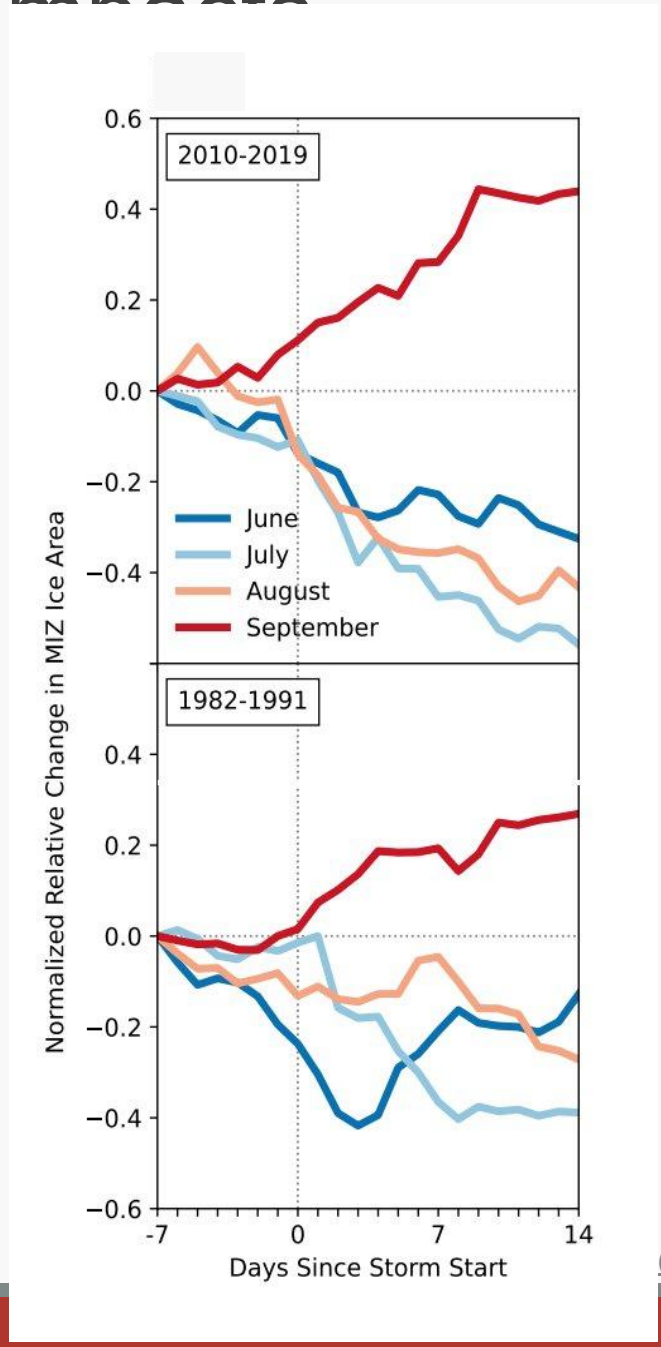
But mean tendencies emerge





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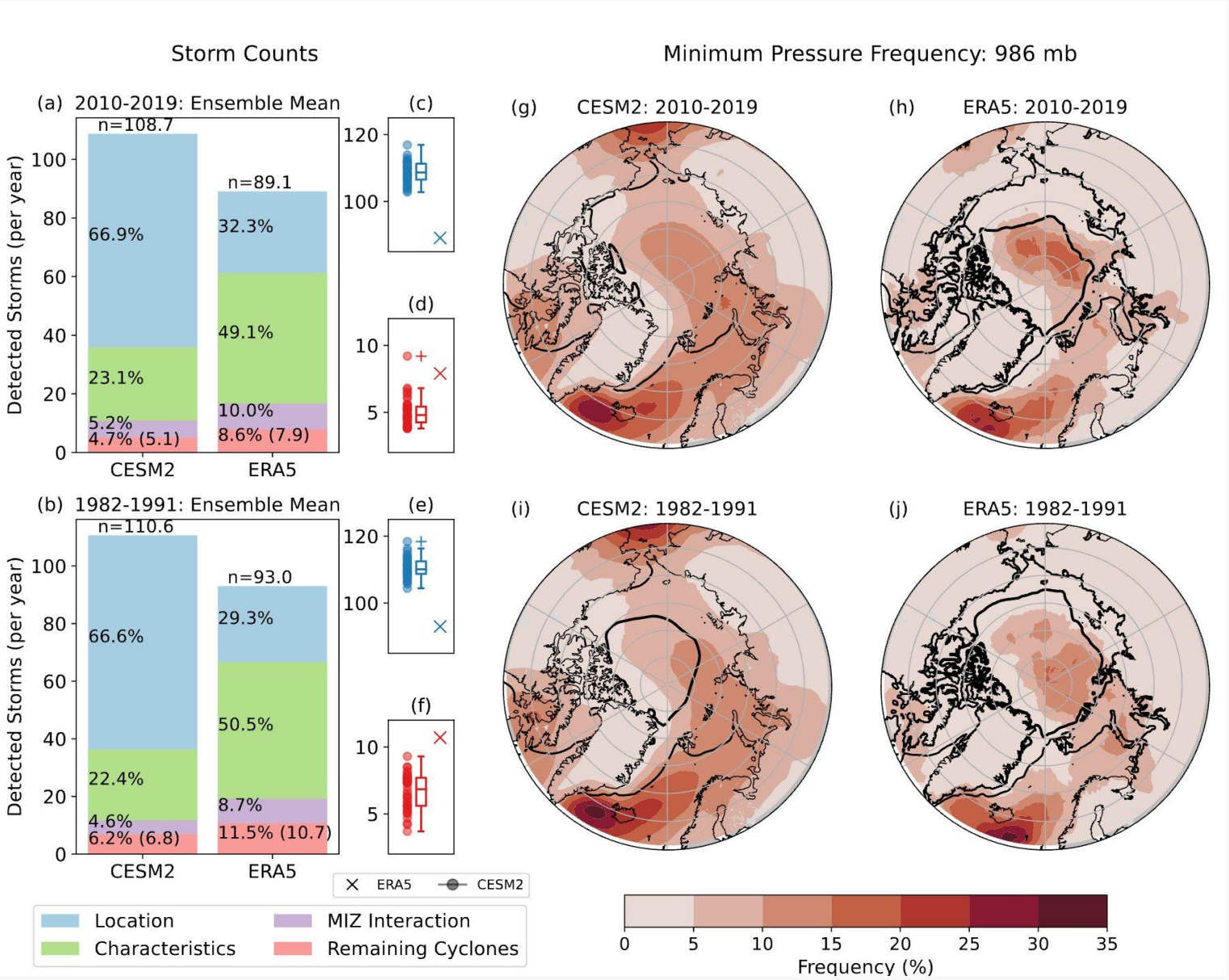
How are cyclone impacts represented in the CESM2 Large Ensemble and how do they vary in the future?

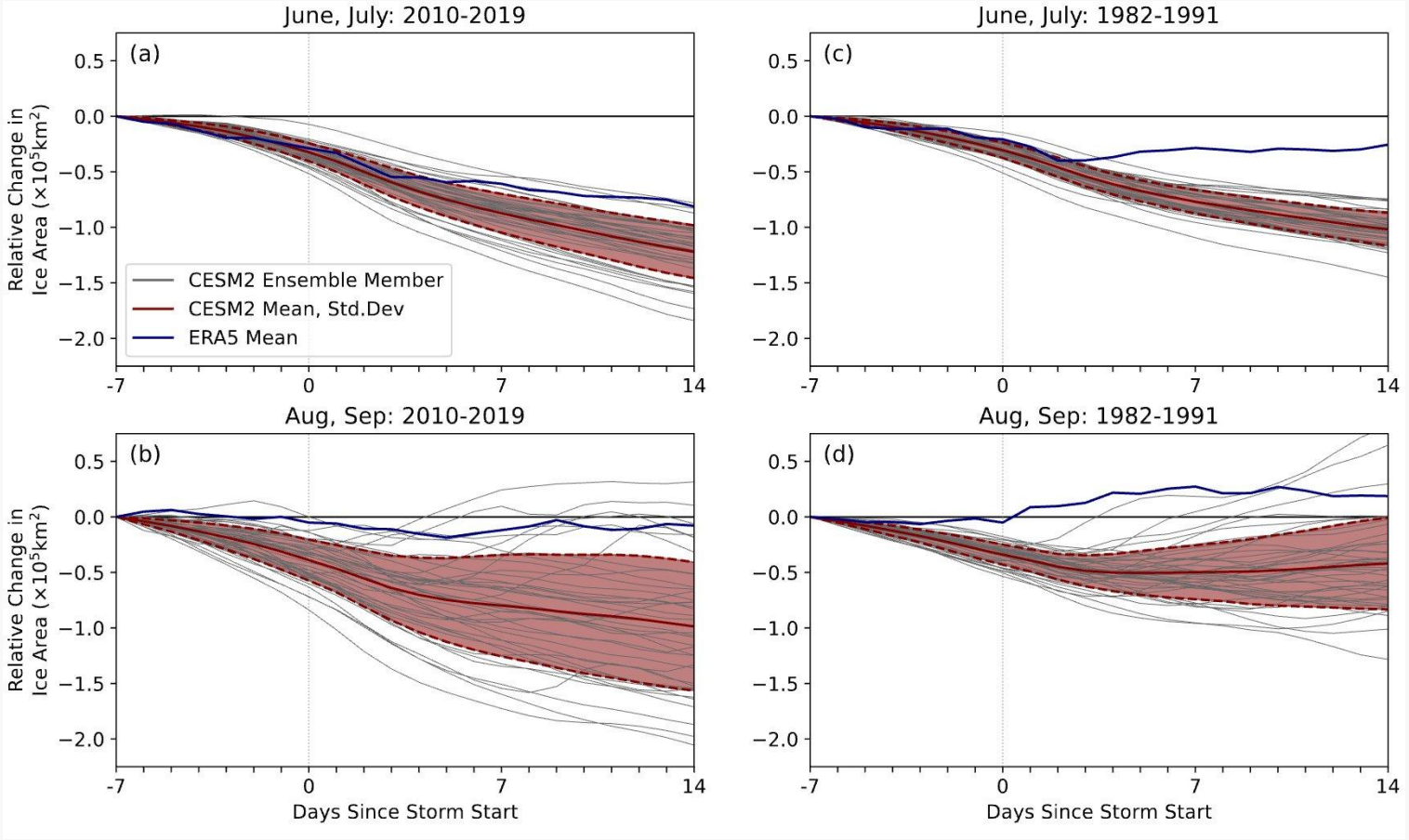
Differences in Storm Count



- Intense cyclones are defined by a pressure threshold
  - (scaled for CESM resolution)
- Despite having more cyclones overall, CESM2-LE has fewer storms that reach the ice edge

Differences in Ice Impact

- CESM2-LE tends to produce too large of a cyclone impact compared with satellite observations



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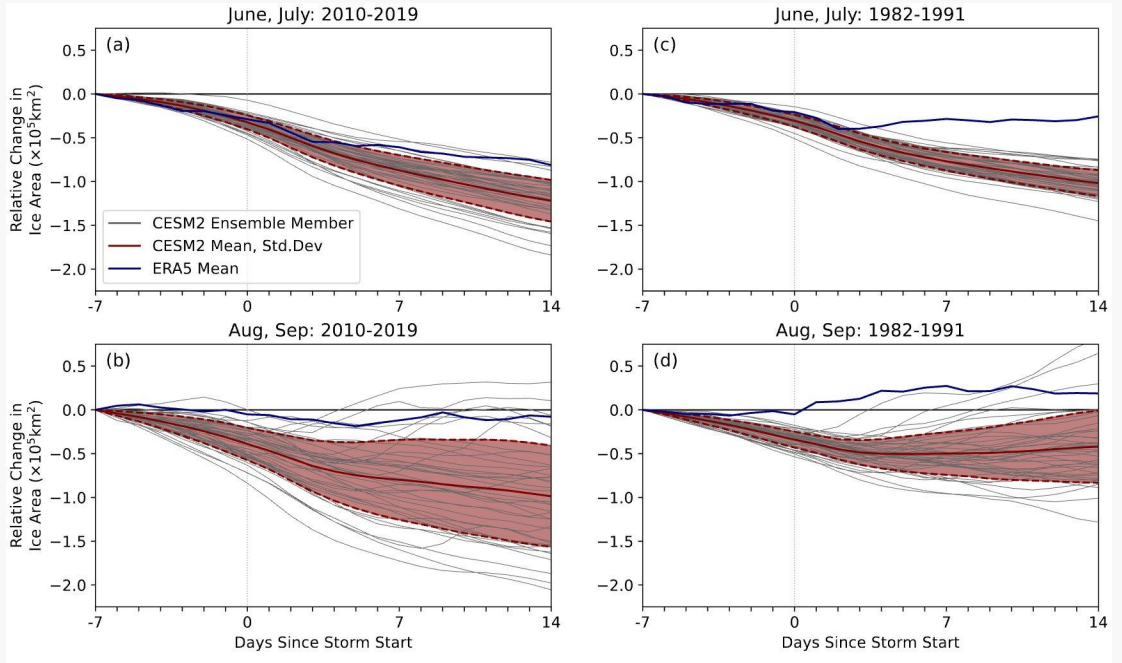
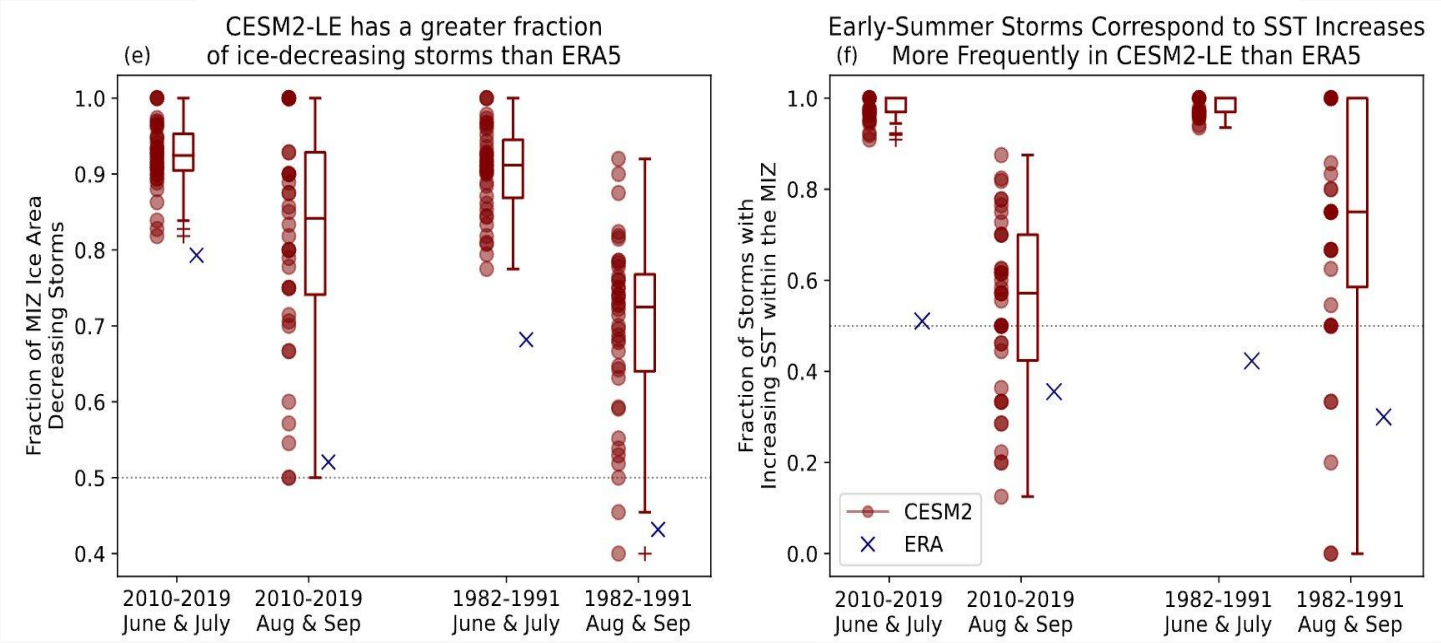
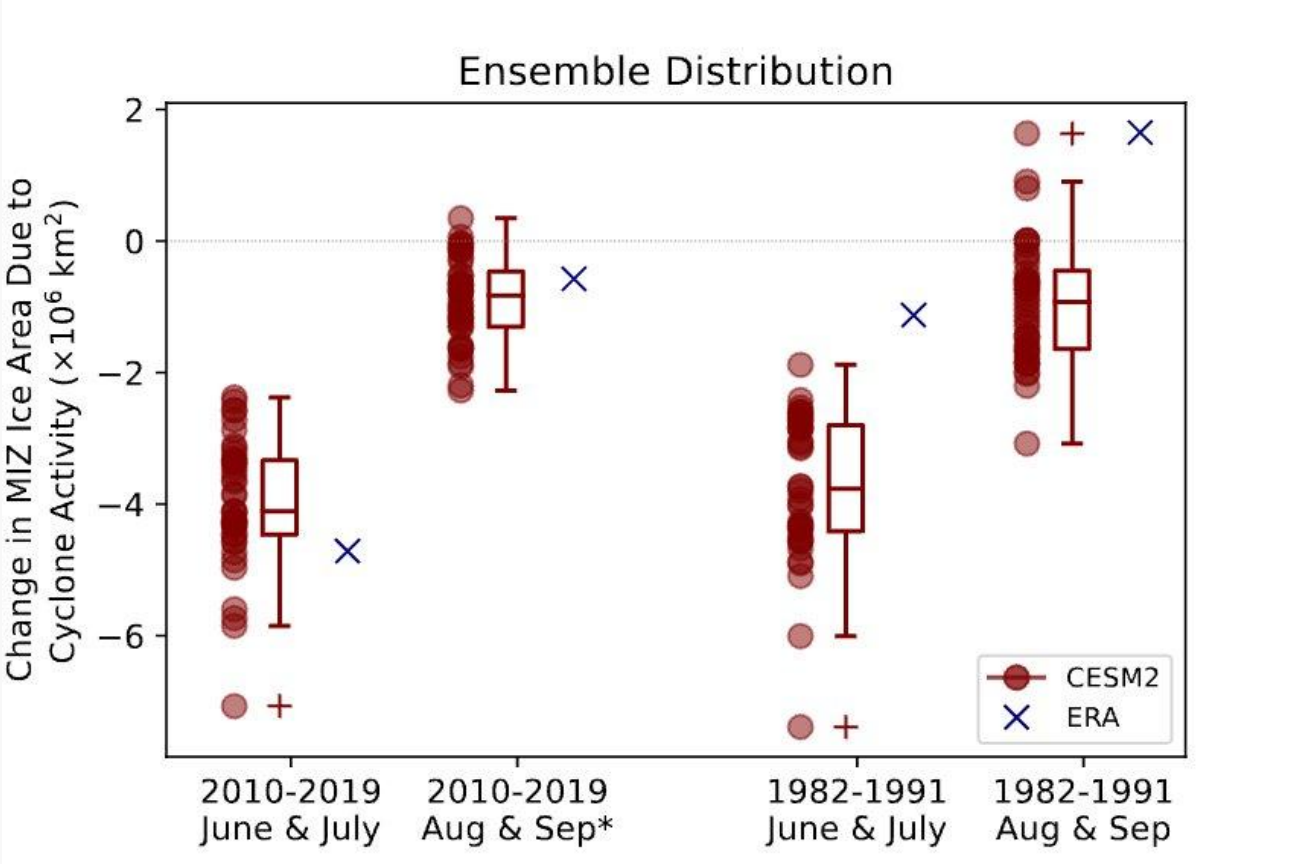


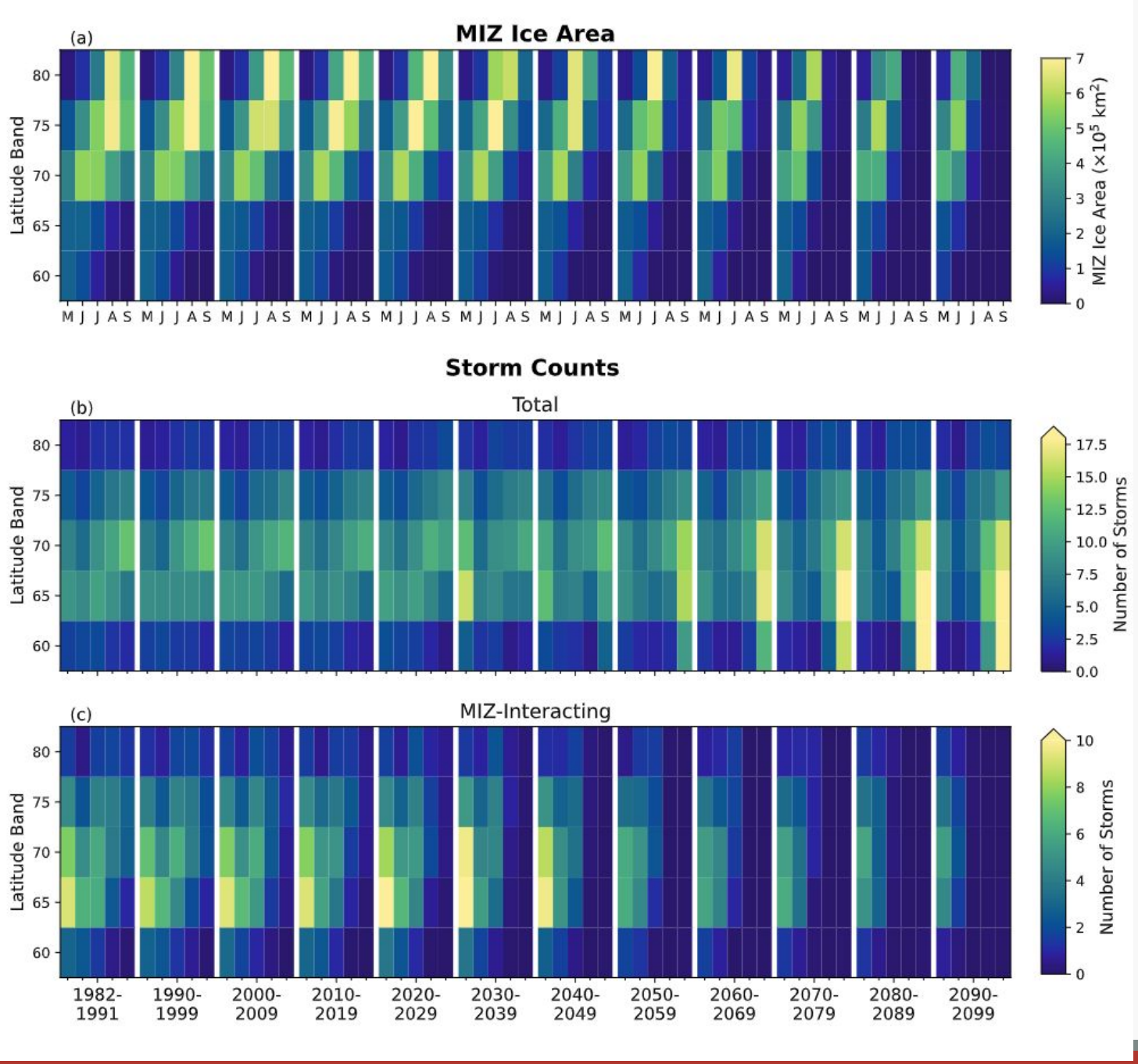


Putting these two biases together…

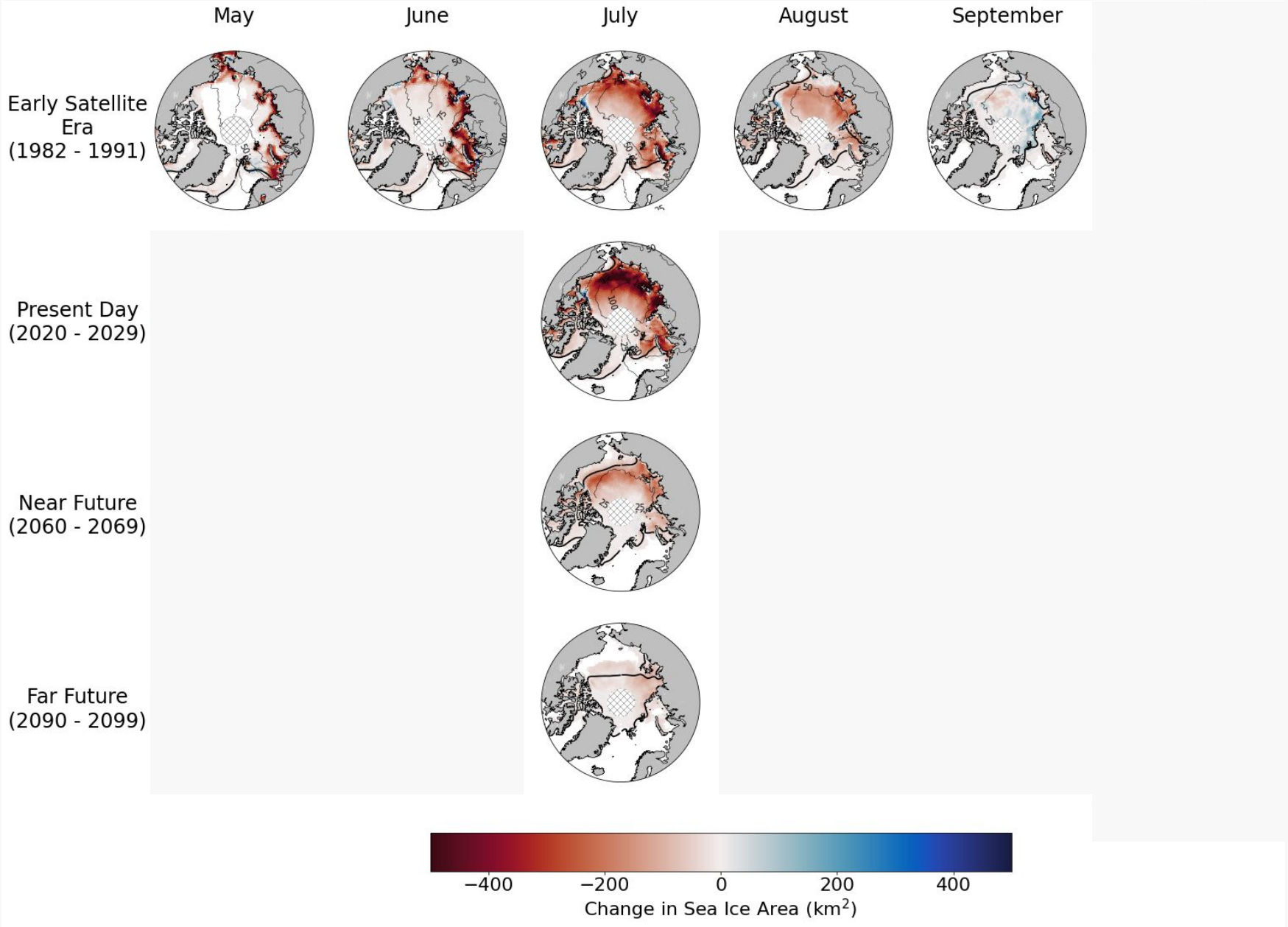


- The two competing biases produce similar net ice effects.

Cyclone Counts in Future Decades



Cyclone Impacts in Future Decades



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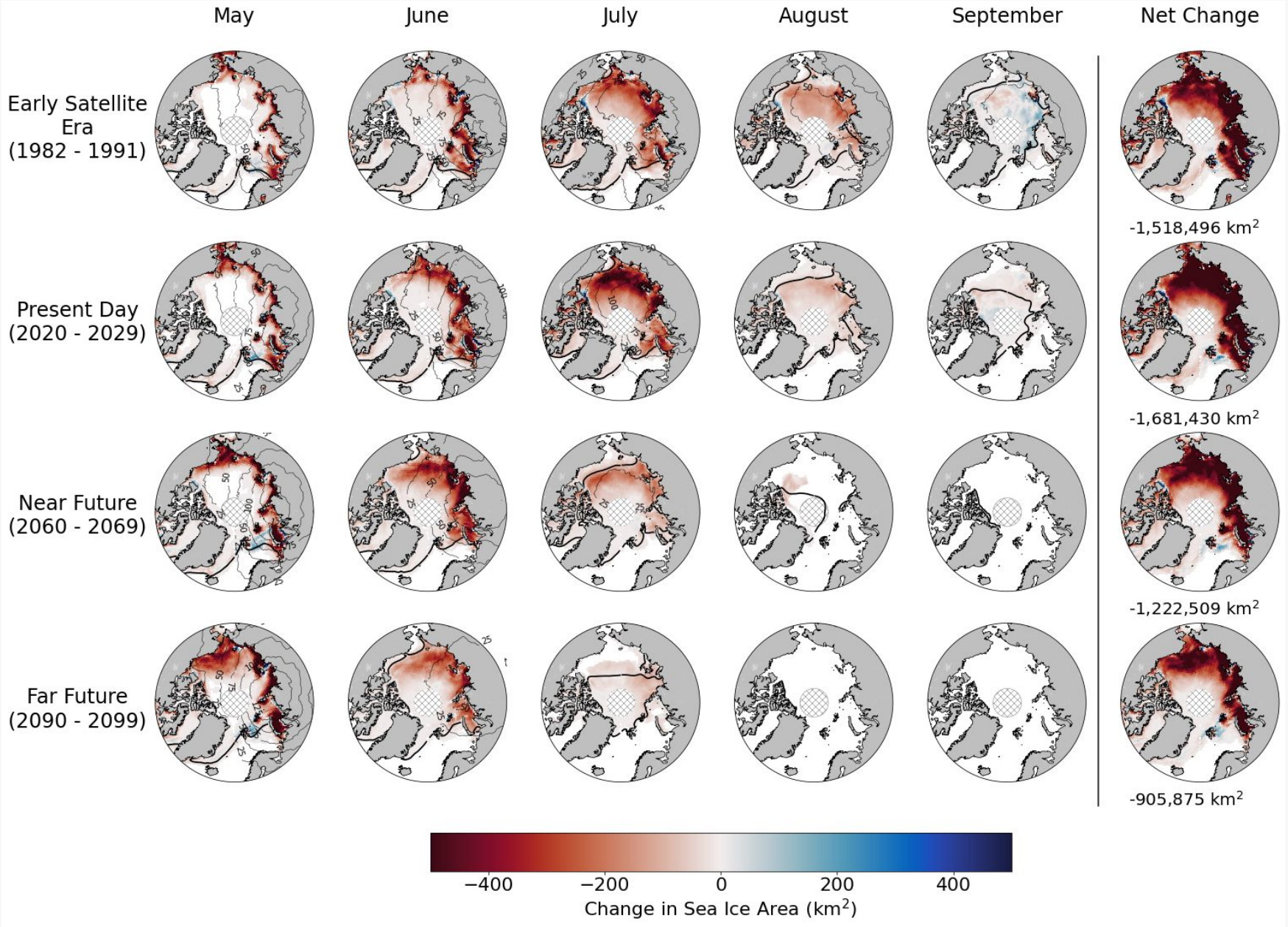

Summary

- Fewer intense storms reach the ice edge in CESM2-LE and their impact on the MIZ is greater than observed
- As summer sea ice recedes in the future, fewer storms interact with the MIZ, particularly in late summer
- The greatest decreases in MIZ ice area due to cyclones occur earlier in the summer in future years

Questions?

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