Arctic sea ice in the large ensemble

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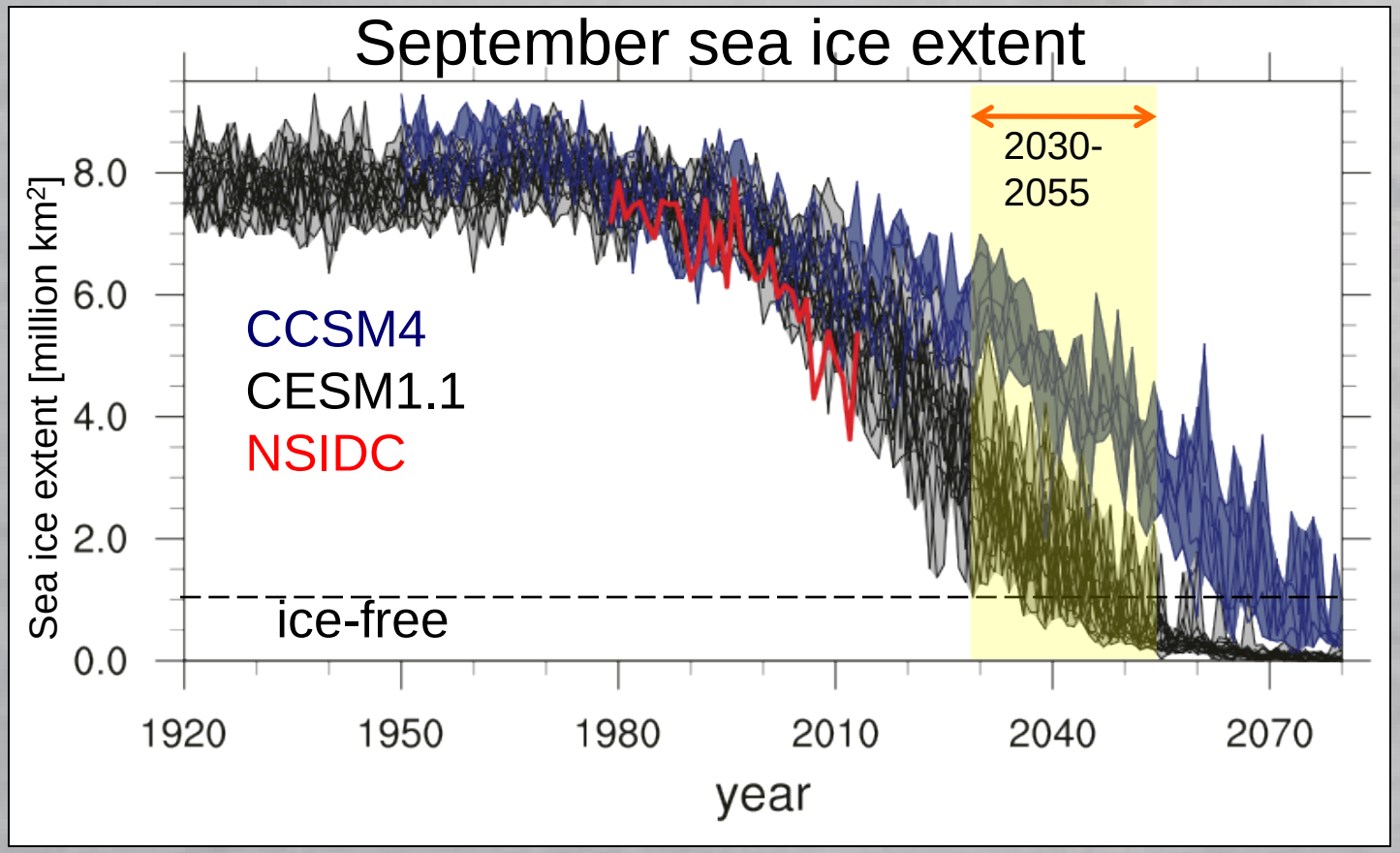
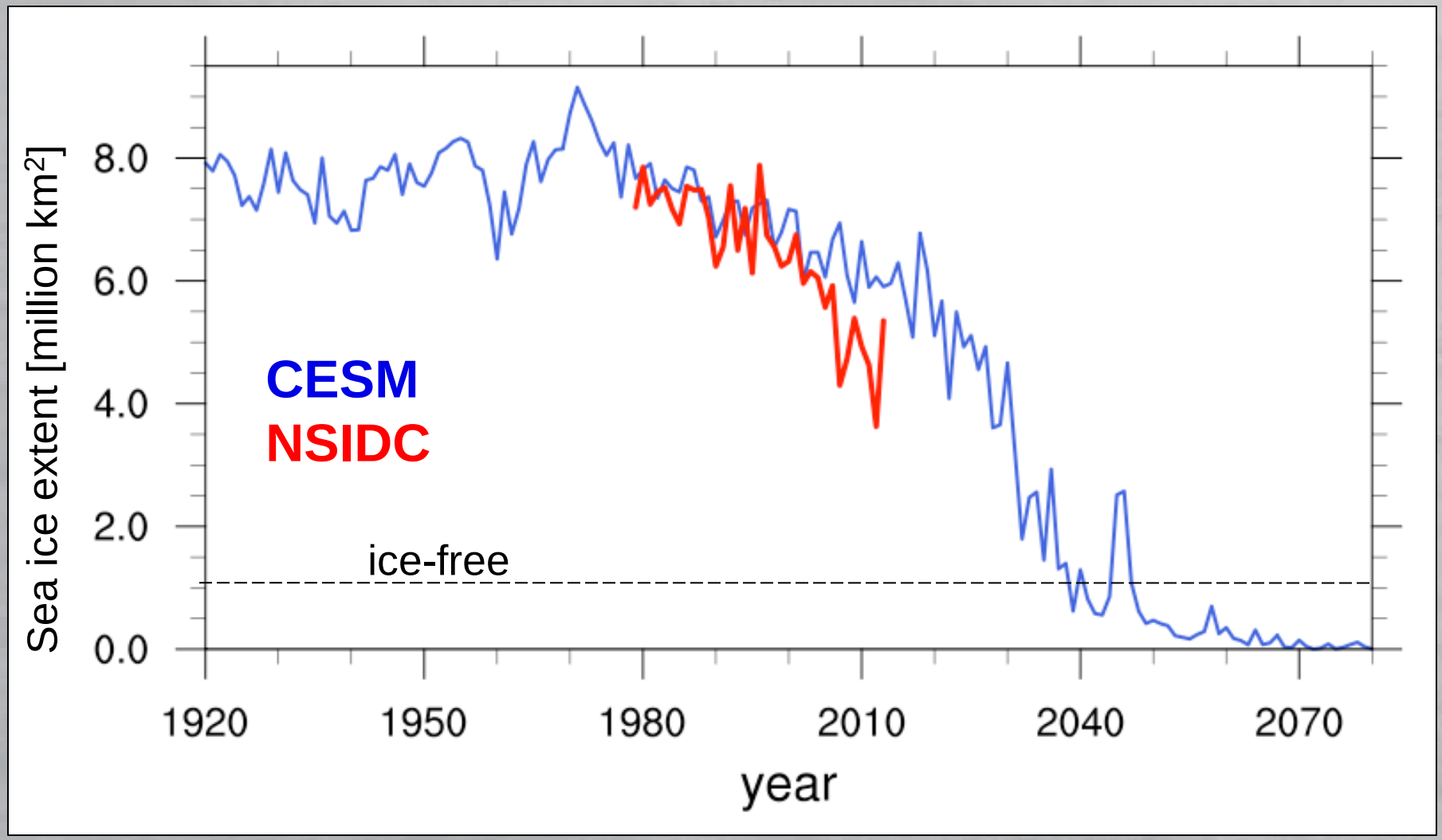
Large Ensemble CESM1.1

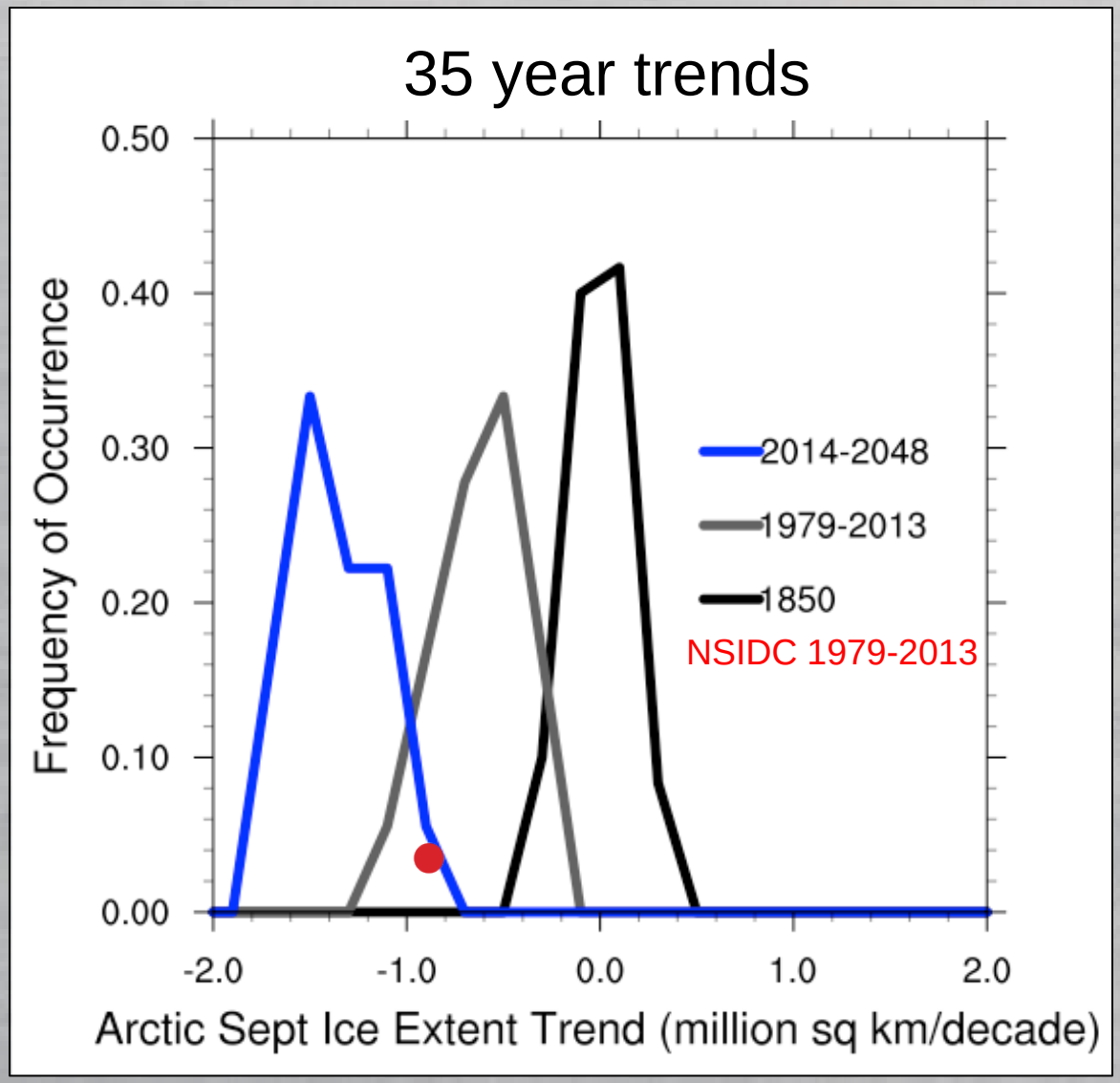
- Analysis with 18 members, RCP8.5



September sea ice extent

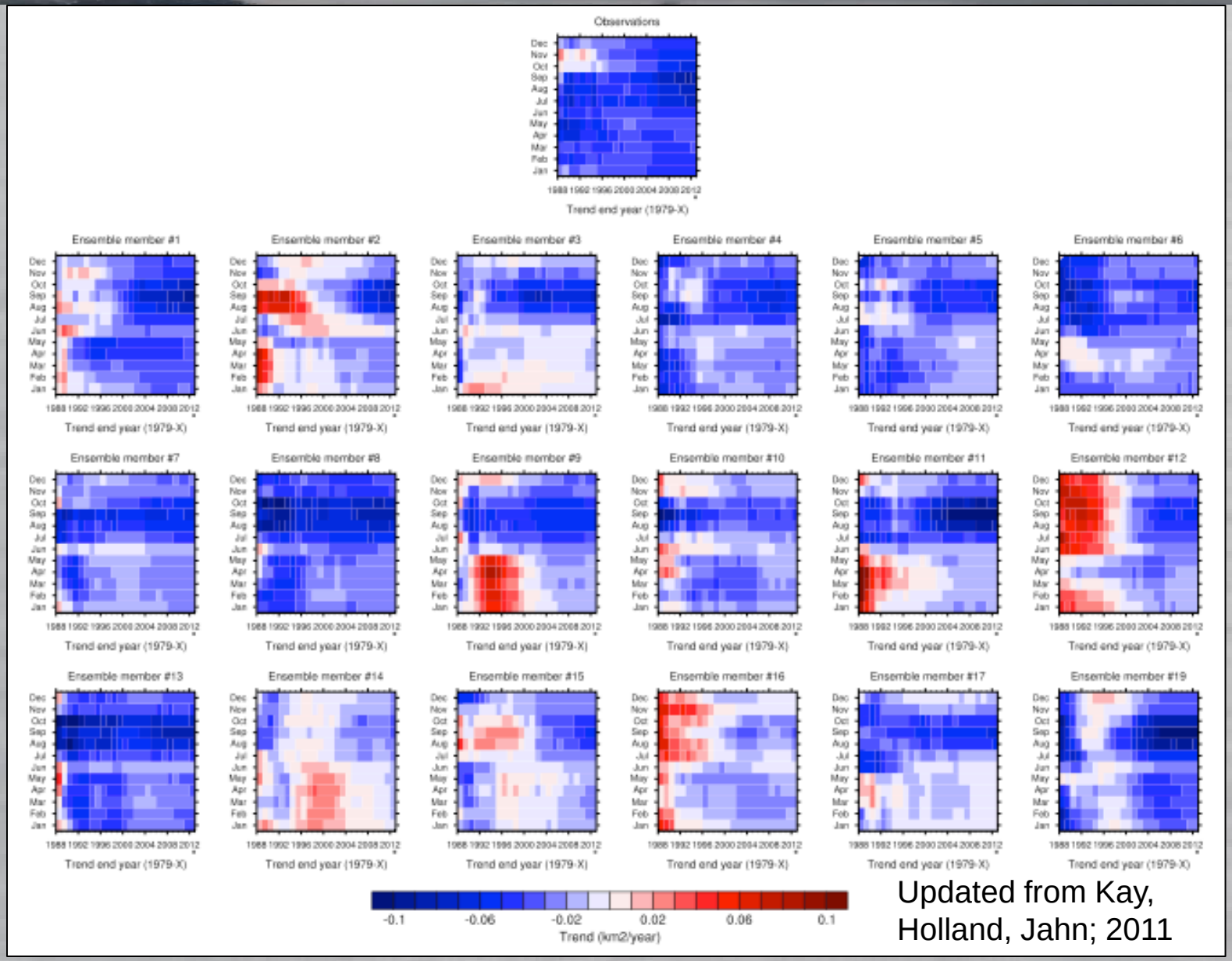


September sea ice extent trends



Updated from Kay, Holland, Jahn; 2011

Sea ice extent trends 1979-X



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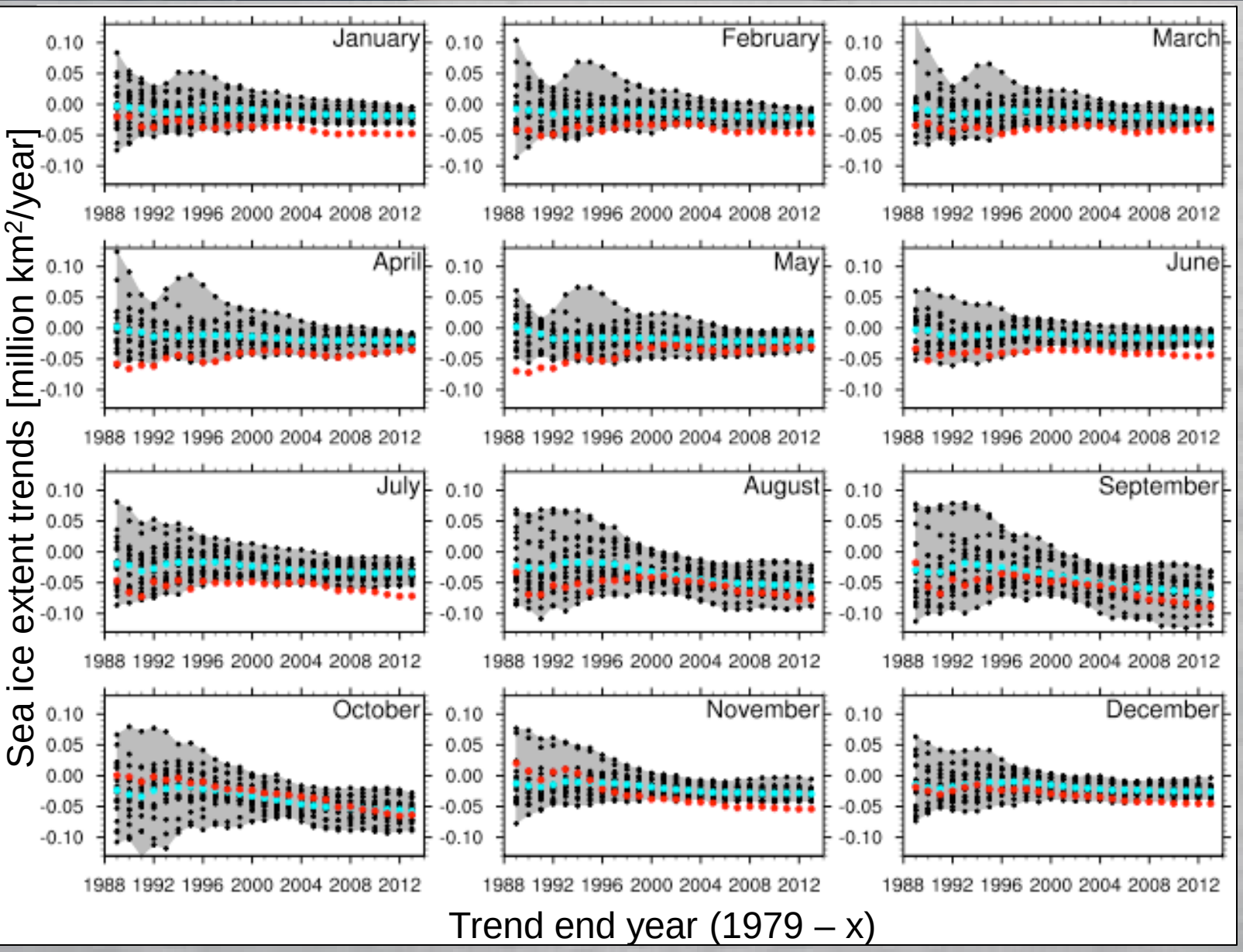
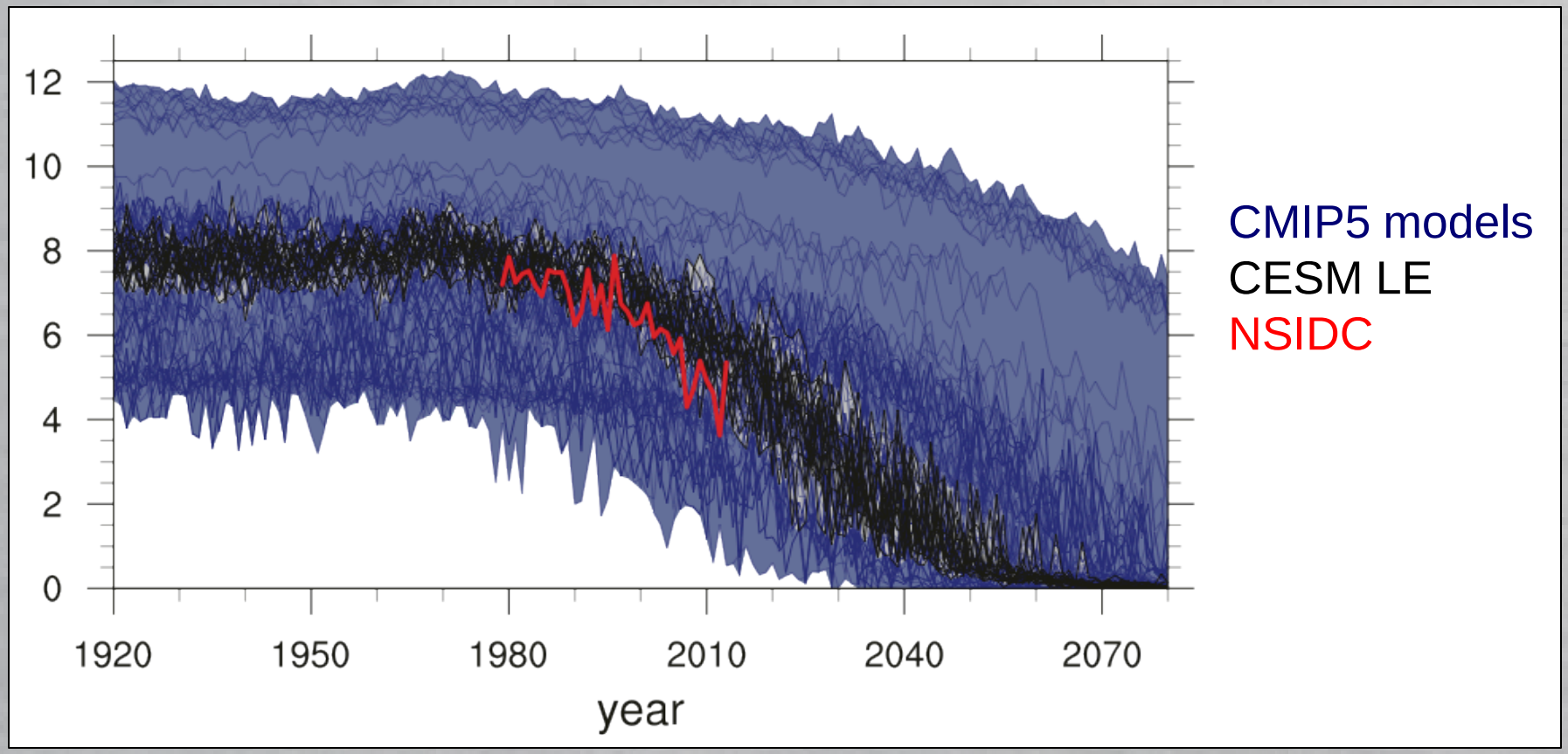
Sea ice extent trends 1979-X



CESM members
Ensemble Mean
NSIDC

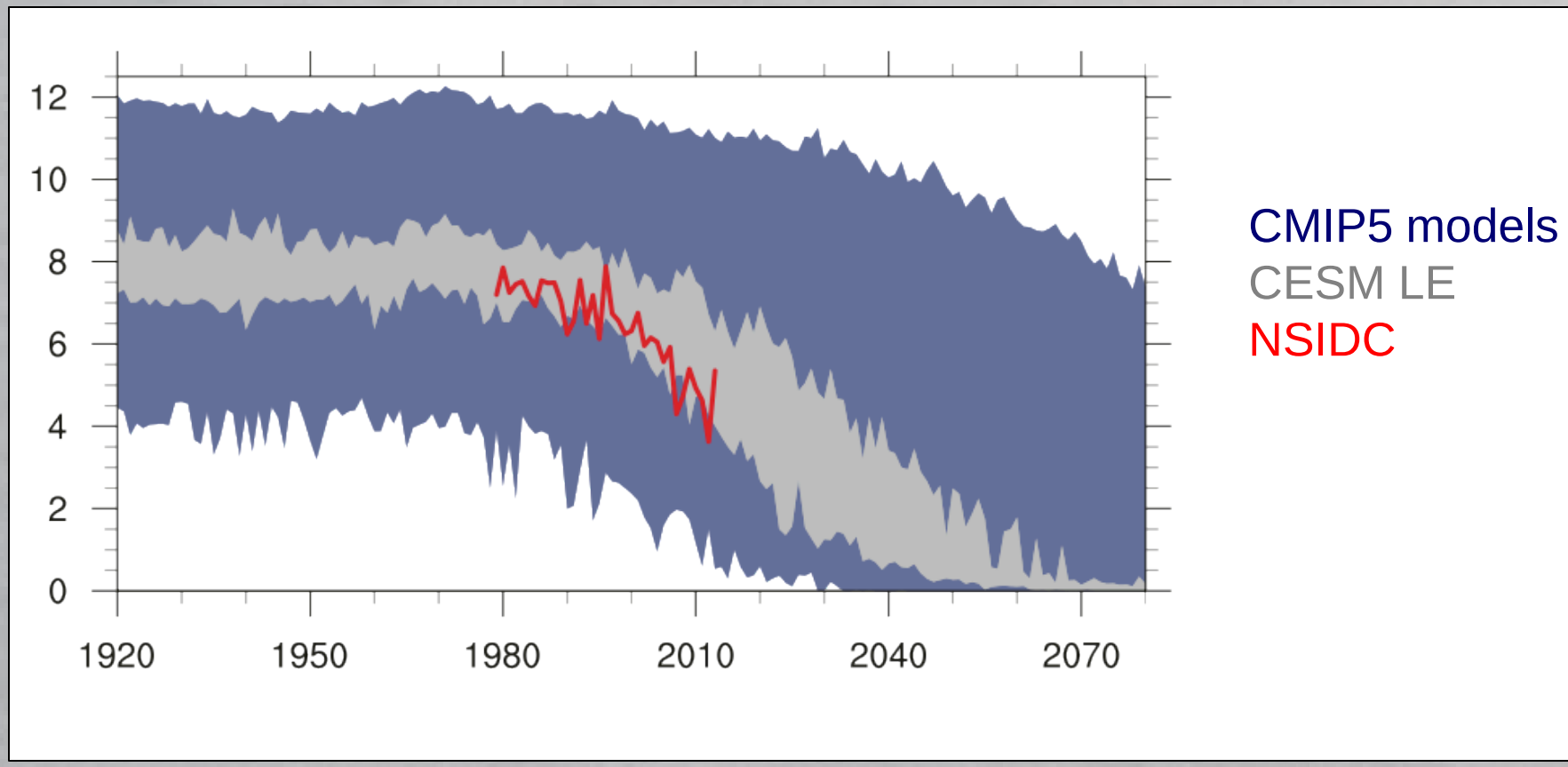
CESM LE and CMIP5

September sea ice extent



CMIP5 data courtesy of Andy Barrett and Julienne Stroeve (NSIDC)

September sea ice extent



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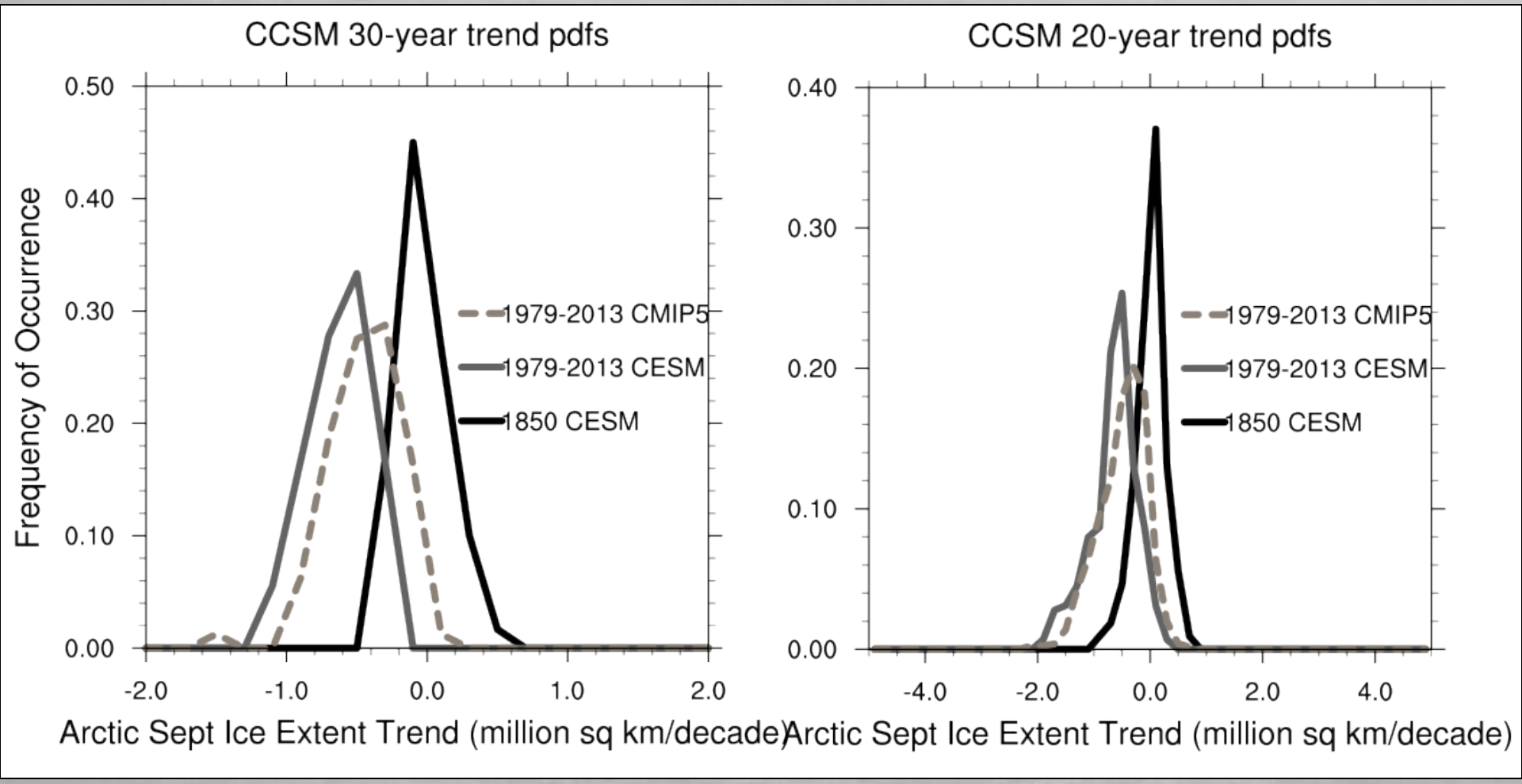
September sea ice extent trends



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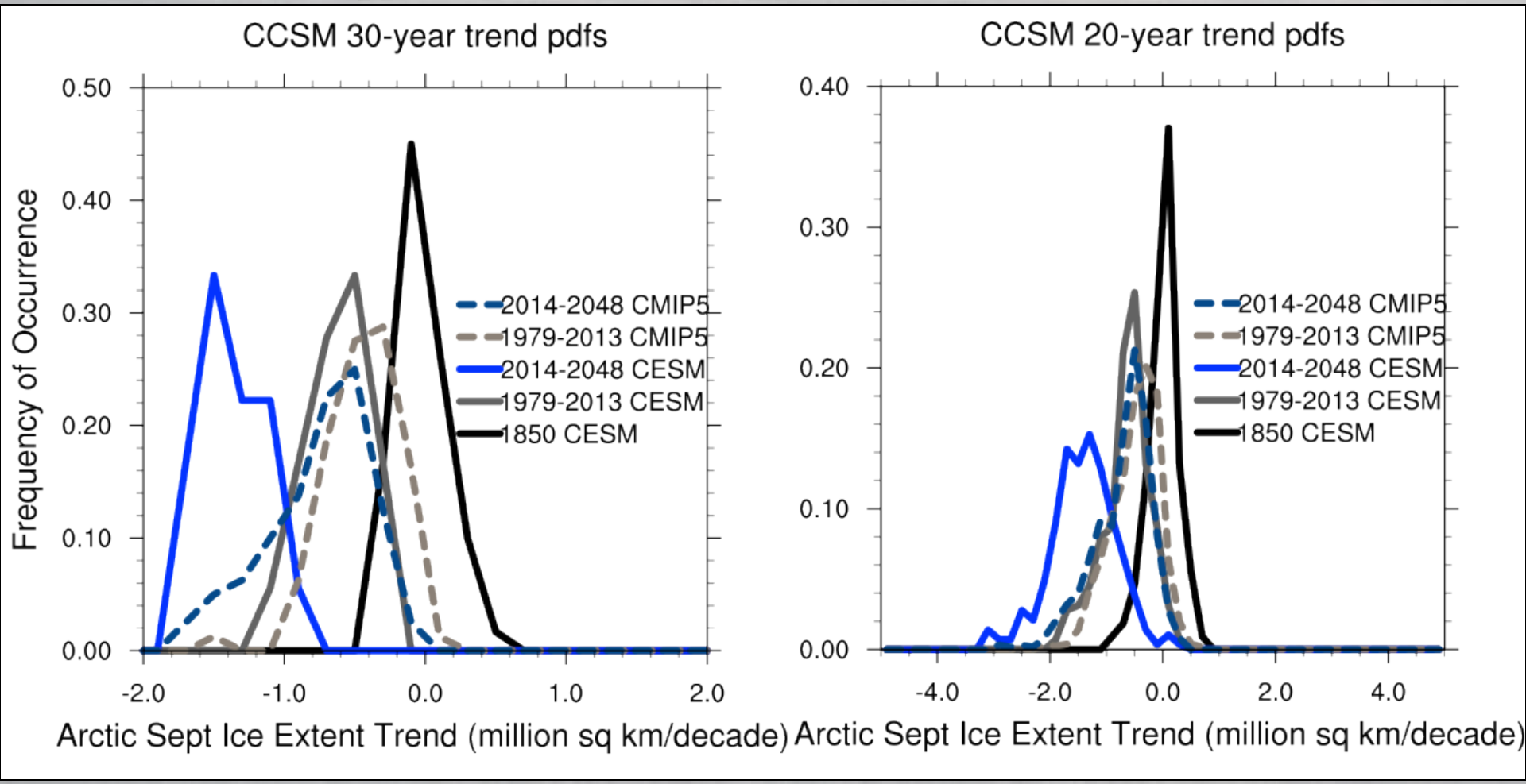
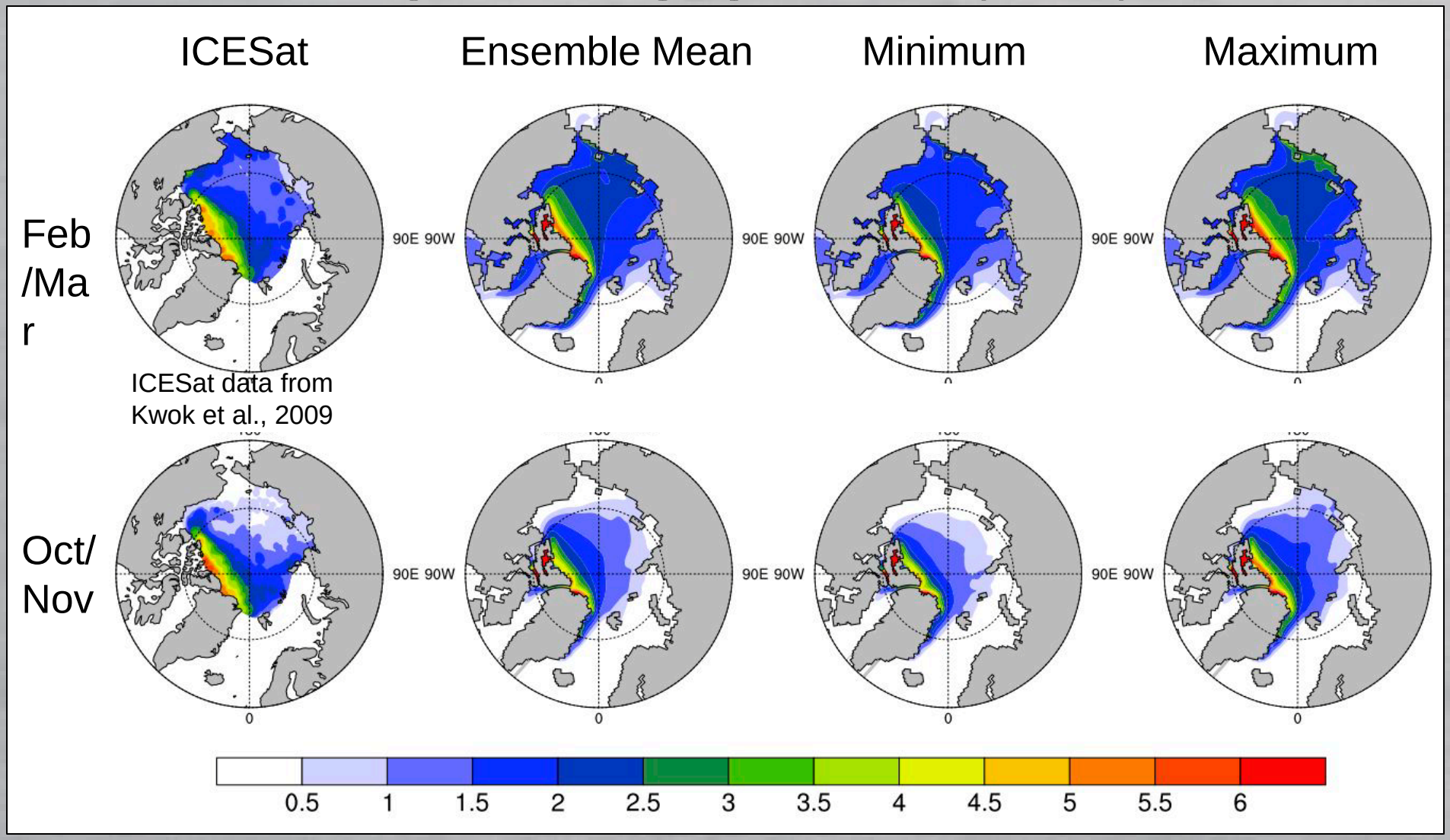


CMIP5 data courtesy of Andy Barrett and Julienne Stroeve (NSIDC)

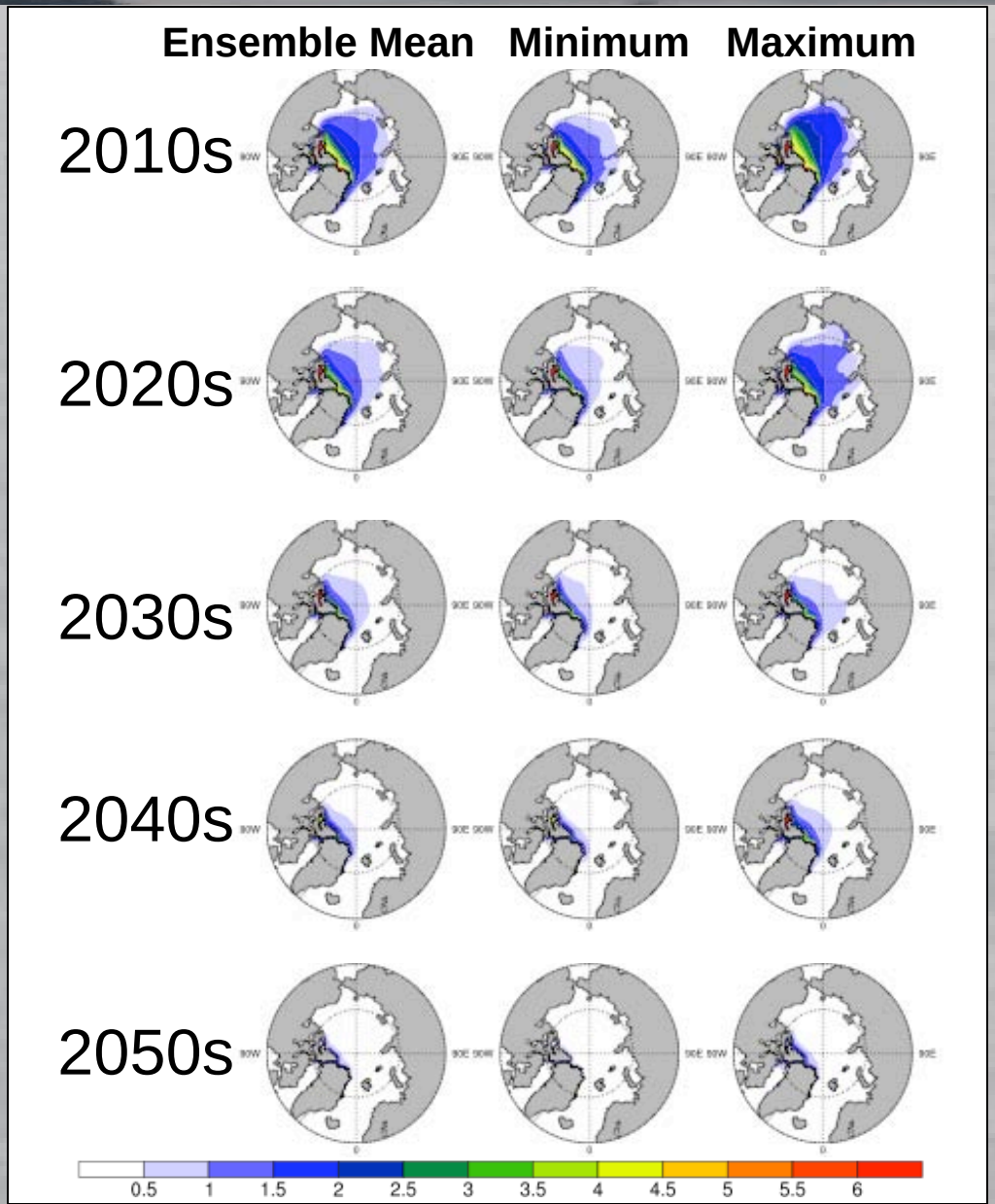
Ice thickness in the CESM LE

Sea ice thickness

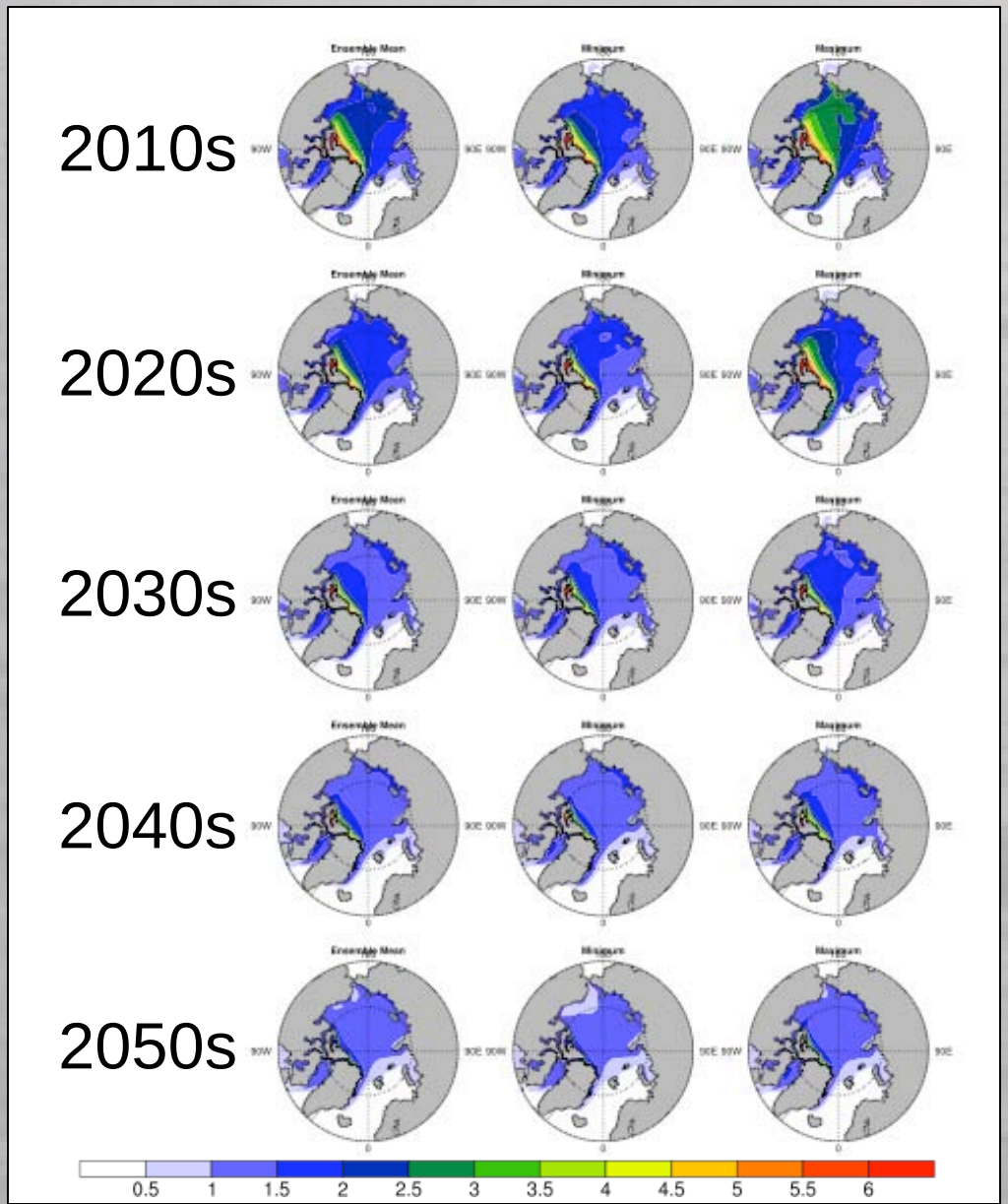
15-year average (2003/04-2007/08)



Sea ice thickness projections (Oct/Nov)



Sea ice thickness projections (Feb/Mar)



Summary

- Internal variability plays a big role for Arctic sea ice evolution
- Internal variability as shown by 18-member CESM1.1 ensemble only explains a small part of CMIP5 model spread
- Its important to remember the role of internal variability for model validation and for projections of ice free conditions
- **Lots of future work to do:**
  - What can we learn form the LE for smaller ensembles for Arctic sea ice?
  - What can we learn about the timescale of predictability?
  - What can we learn about causes of variability in sea ice evolution?
  - And more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Thanks!
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CliC Sea ice and Climate Modelling Forum

Goals:

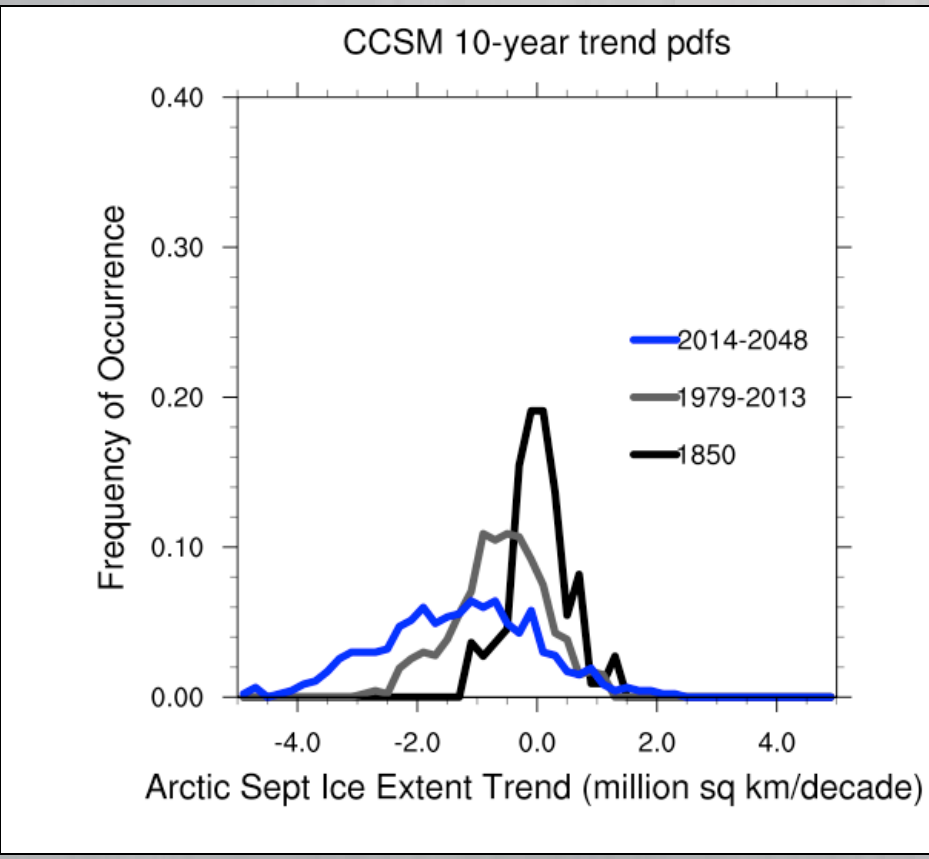
- complement the goals of the CliC Sea ice working group and ASPeCT
- focus specifically on the modeling of sea ice and the role of sea ice in climate
- bring together the different sea ice modeling communities (coupled ice-ocean modeling, global and regional climate modeling) to advance the science of sea ice modeling on topics related to sea-ice physics, model development, model evaluation, and the role of sea ice in climate
- Organize 1-2 international workshops, sponsored by CLiC

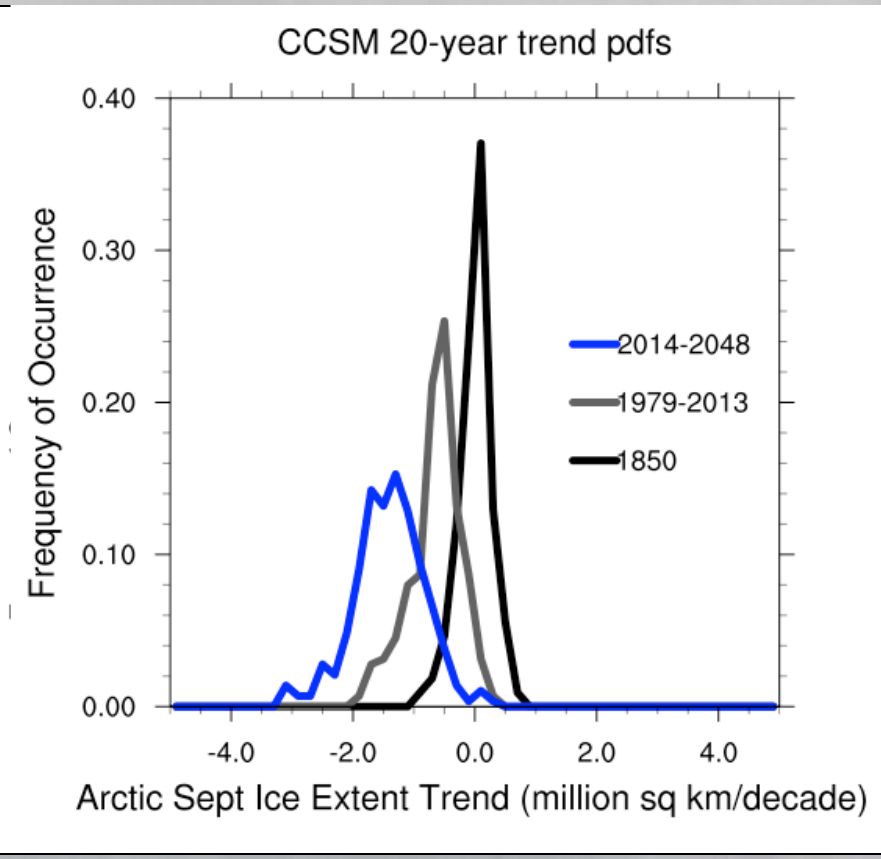
CliC Sea ice and Climate Modelling Forum

Possible Discussion Topics for a workshop:

- Observational needs for sea ice models – what do we have, what do we use, what do we need, what should be standard variables for model evaluations (beyond the sea ice extent)?
- Sea ice model intercomparisons (forced and coupled). What do we know about biases in the sea ice models versus biases due to coupling? Ways forward?
- How can we make the best use of the experience from different sea-ice research communities (forced models, coupled models, one-column models, theory, observations)?
- Which variables are needed for model evaluations against observations, how should/can they be defined consistently across models, what kind of studies have been done and what kind of studies are lacking?
- What are the strengths and weaknesses of the current sea ice projections from CMIP5? How can we work to improve them for CMIP6?
- Why is it that models tend to underestimate the recent decline in Arctic sea-ice extent, and simulate a decline in Antarctic extent over a period of observed modest increase?
- Can bias correction, calibration, weighting or other 'post-processing' approaches be used to reduce uncertainty in future sea-ice projections?

September sea ice extent trends





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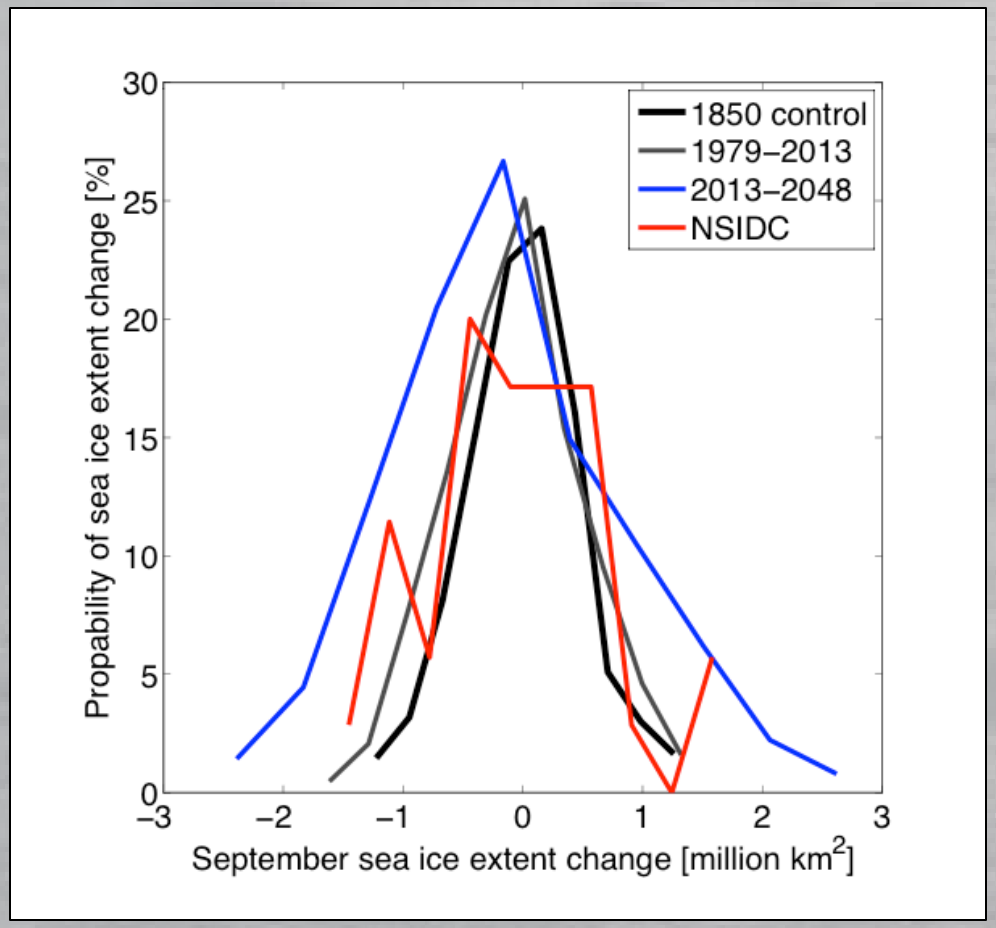
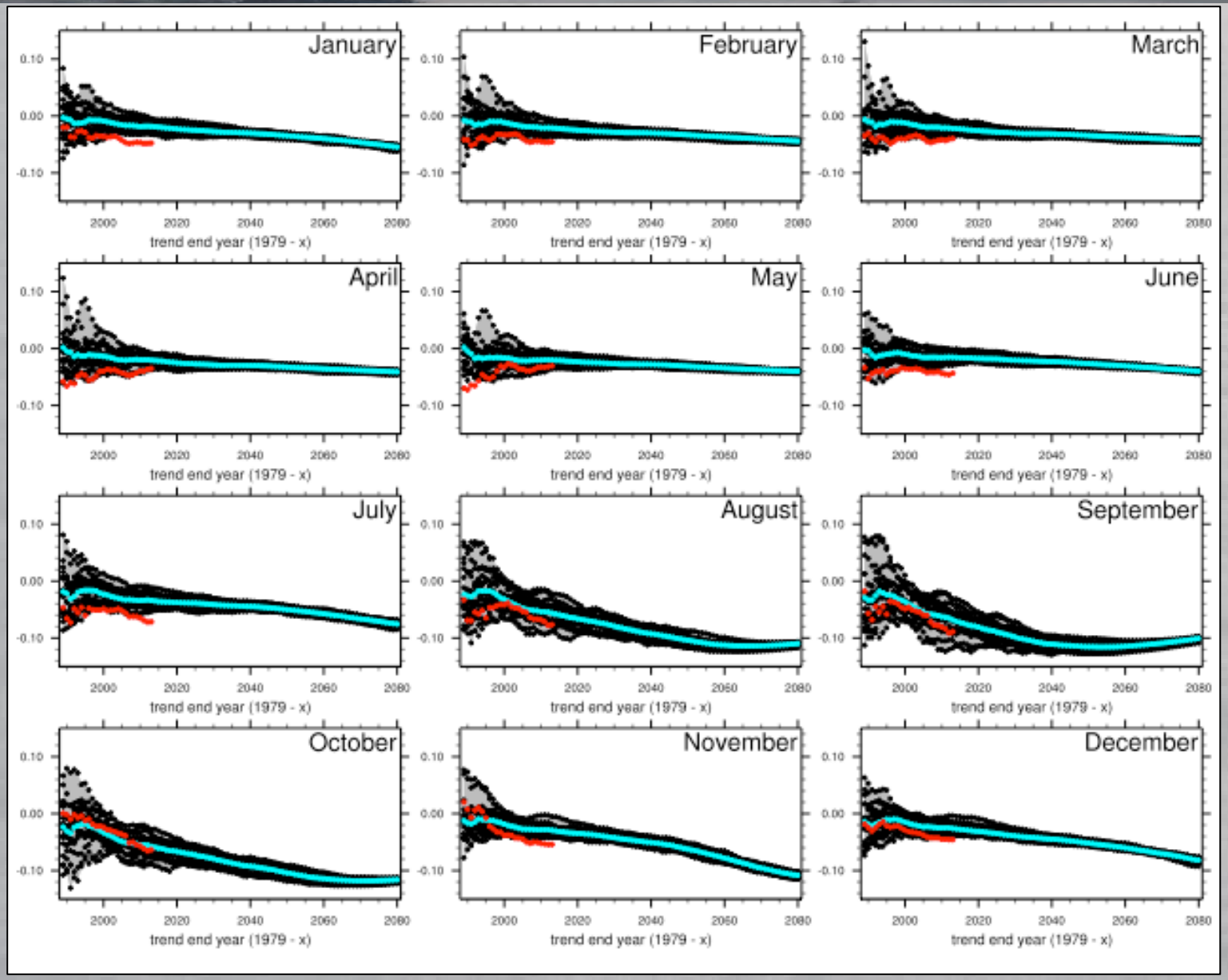
Interannual variability of the September sea ice extent



Natural internal variability is enhanced in a warming Arctic

Sea ice extent trends 1979-X



CESM members
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