



10TH ICISHMO
INTERNATIONAL CONFERENCE ON SOUTHERN
HEMISPHERE METEOROLOGY AND OCEANOGRAPHY

Can Initialization Method Improve the Skill of Prediction of Southern Ocean Sea Ice at Decadal Time Scales?

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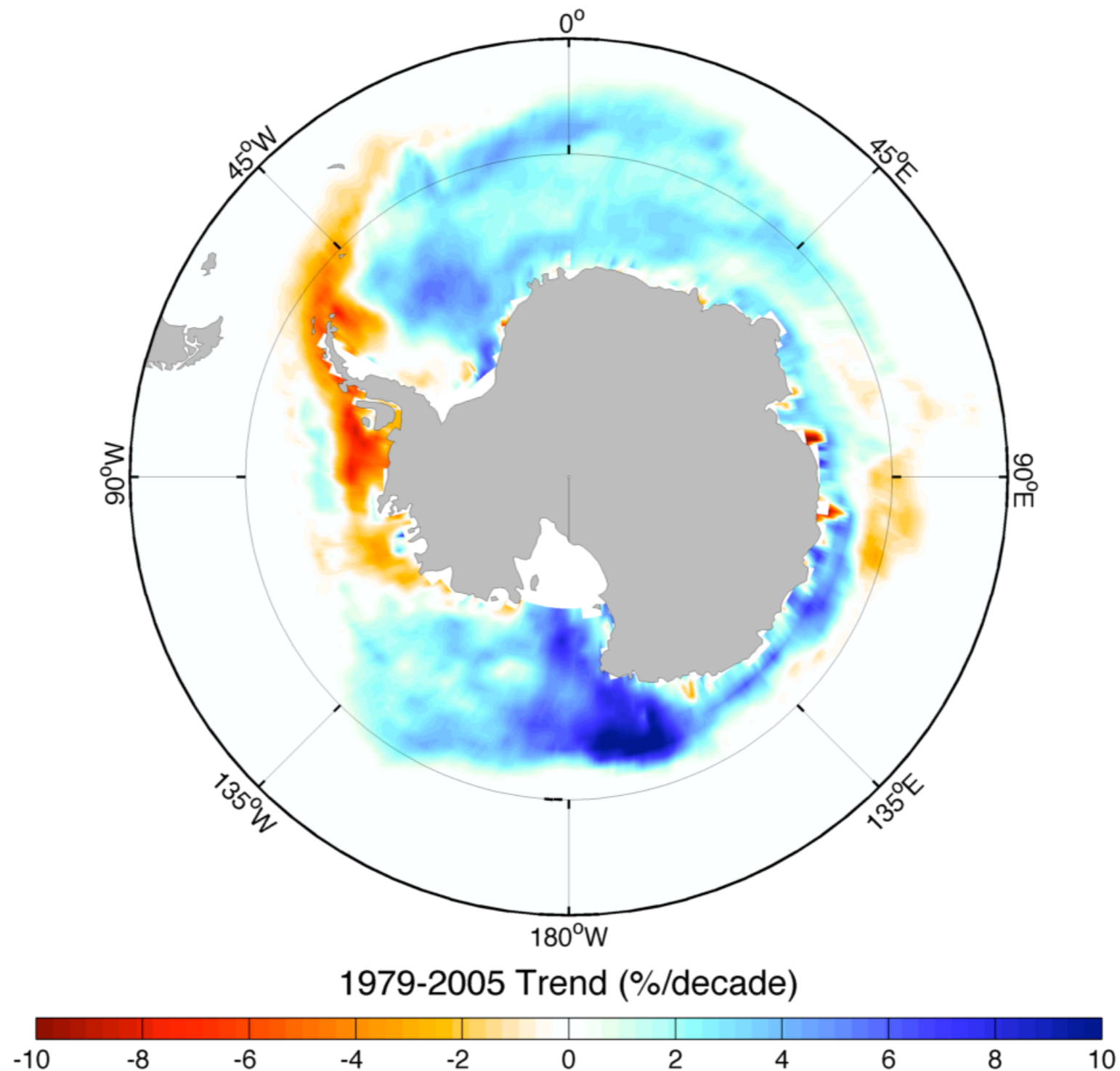
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Southern Ocean Sea Ice

Trend of observed NSIDC sea ice concentration (Comiso, 2008)



1. Objectives

- ▶ **Evaluating the skill of prediction** of Southern Ocean sea ice up to several years ahead.
 - Mean state;
 - Variability;
 - Trend.

- ▶ Assessing the **impact of the initialization** with observations on the quality of the prediction.

2. Strategy

CMIP5: Coupled Model Intercomparison Project, phase 5.
(Taylor et al., 2011)

CMIP5 Models Outputs

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graph TD; A[CMIP5 Models Outputs] --> B[Historical simulations]; A --> C[Decadal simulations (hindcasts)];
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Historical simulations

- initialized without observations;
- driven by external forcings;
- ~160 years long;
- used to study models mean state and variability.

23 Models

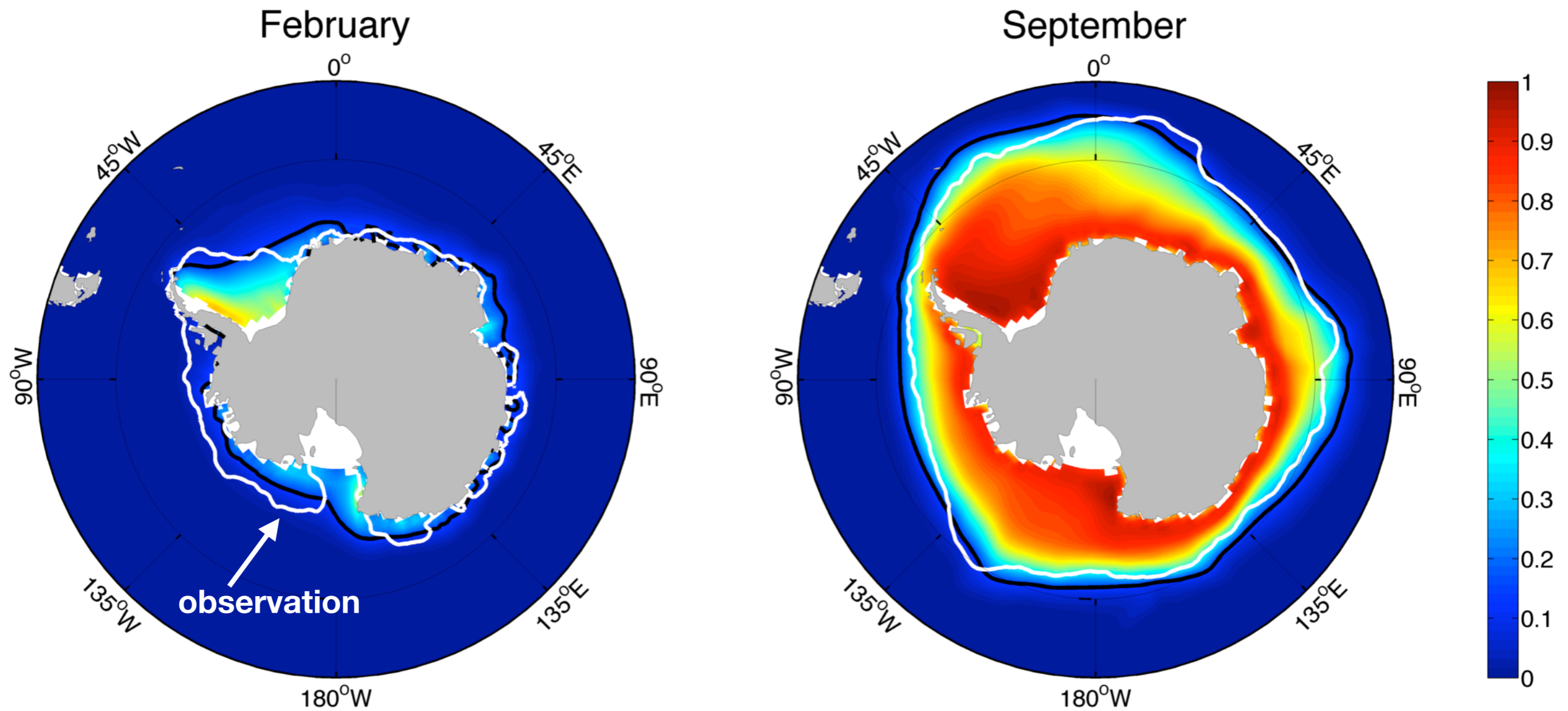
Decadal simulations (hindcasts)

- initialized with data assimilation;
- driven by external forcings;
- 5 to 30 years long;
- used to assess impacts of the initialization on the predictive skill.

8 Models

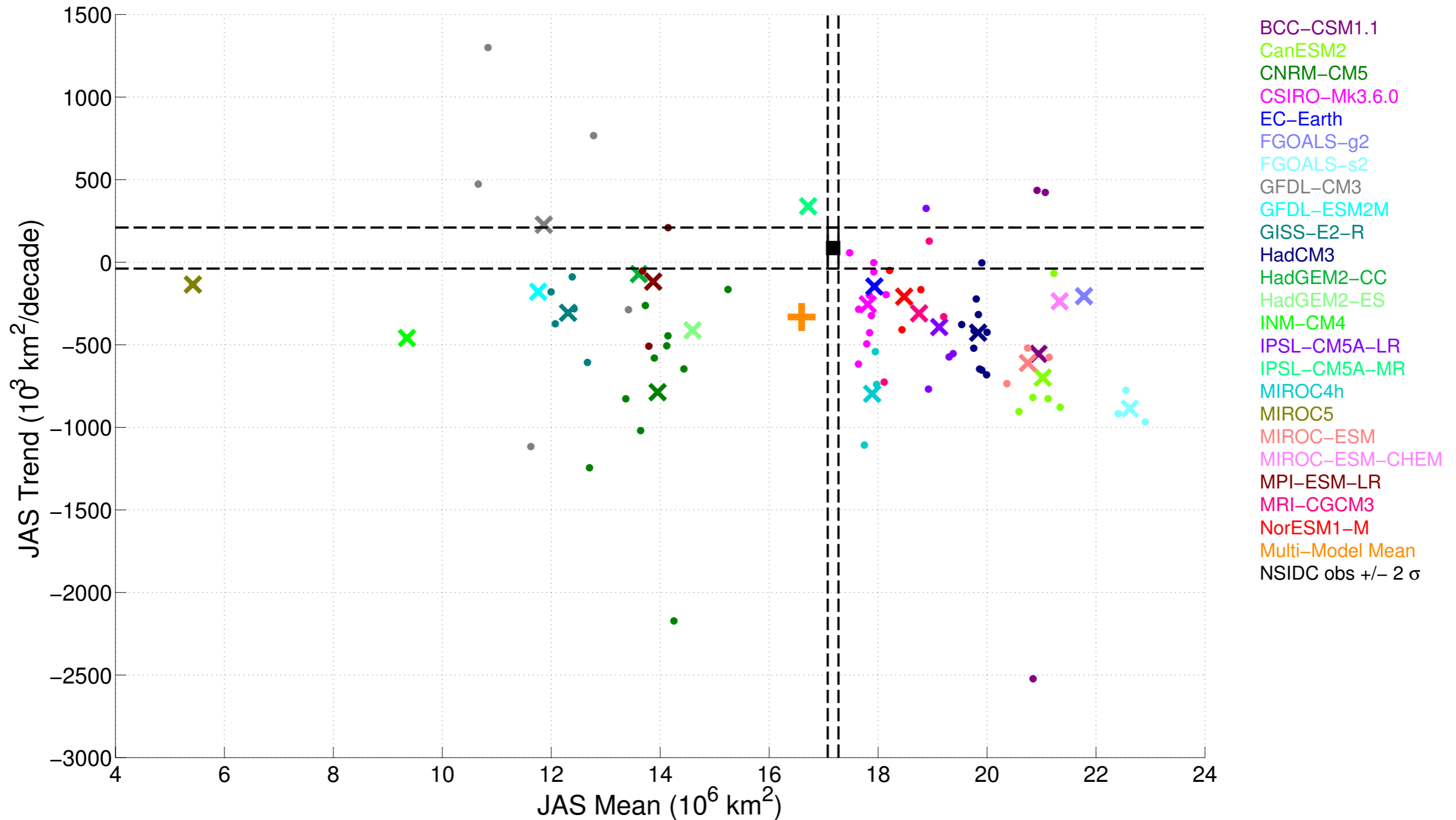
3. Historical Simulations

1979-2005 Multi-Model Mean Sea Ice Concentration



3. Historical Simulations

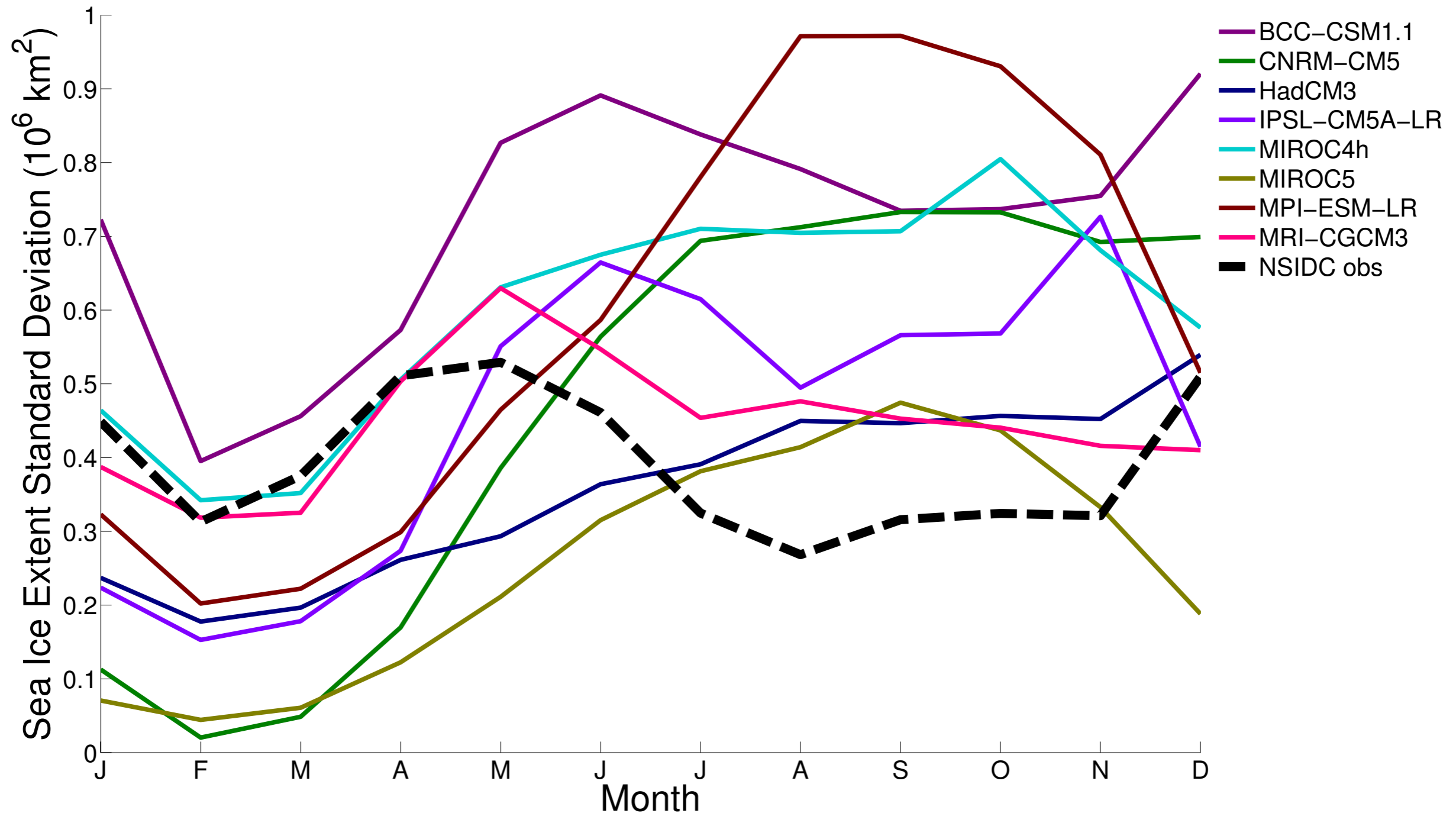
1979–2005 JAS Sea Ice Extent Trend VS. Mean – Southern Hemisphere



3. Historical Simulations

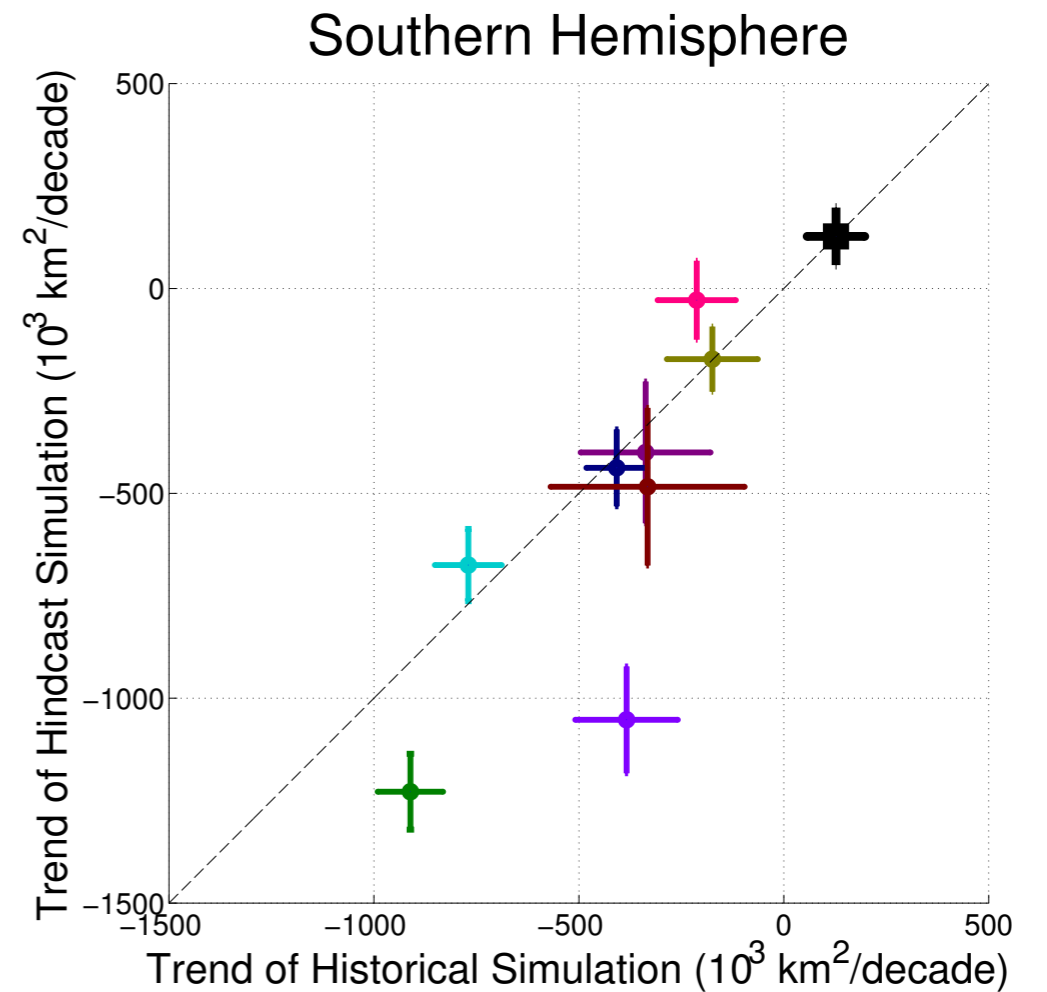
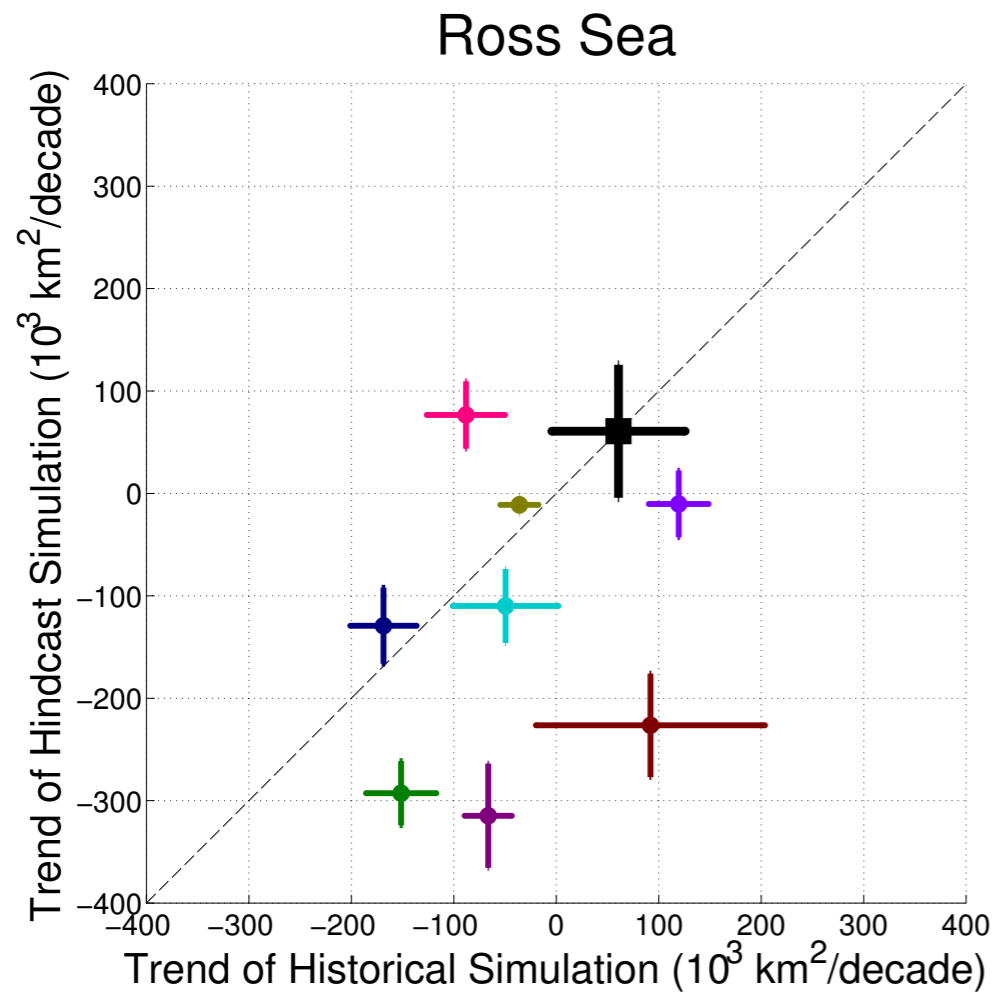
Interannual Variability

1979–2005 Sea Ice Extent Monthly Standard Deviation – Southern Hemisphere

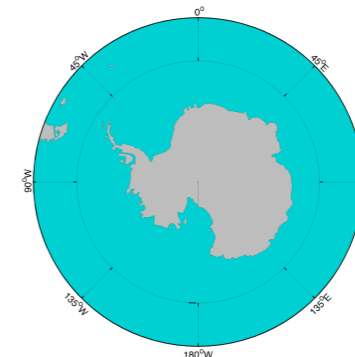
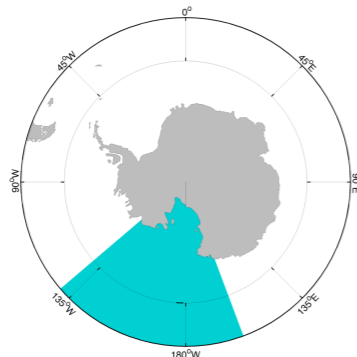


4. Hindcast Simulations

Historical VS. Hindcast 1981-2005 JAS Sea Ice Extent Trend



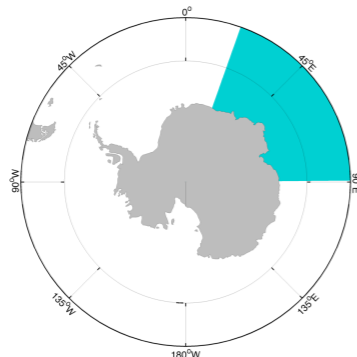
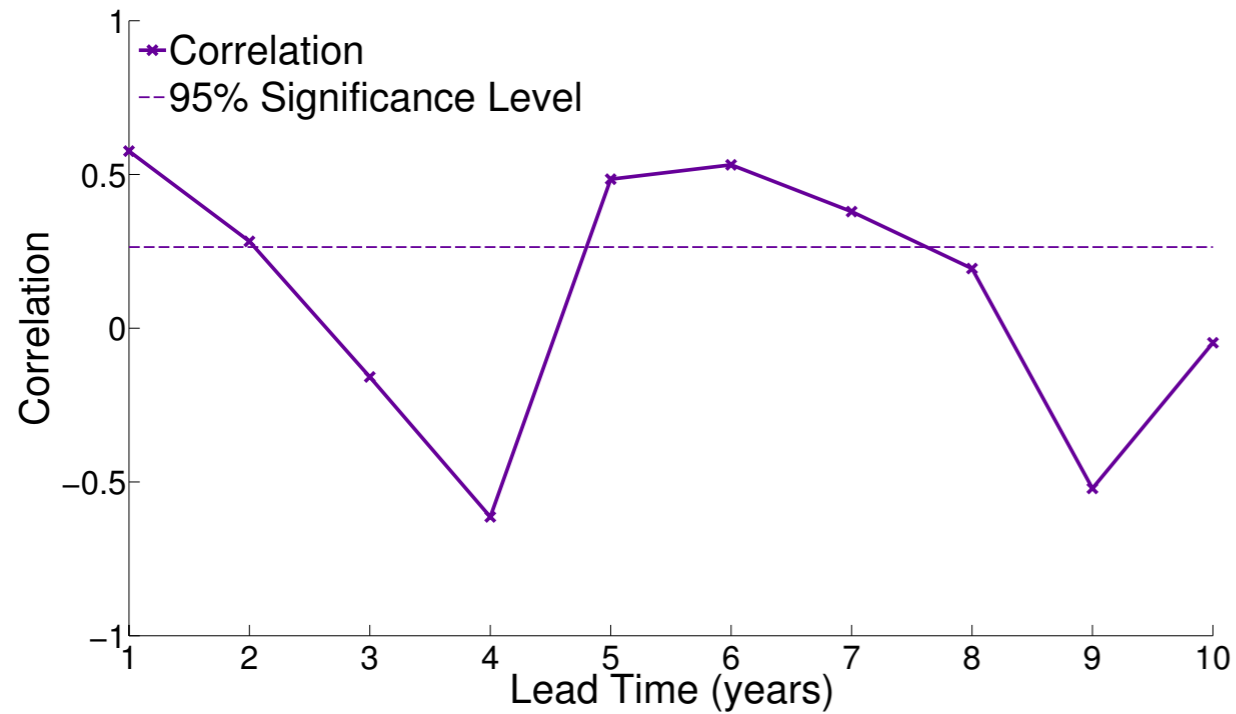
- BCC-CSM1.1
- CNRM-CM5
- HadCM3
- IPSL-CM5A-LR
- MIROC4h
- MIROC5
- MPI-ESM-LR
- MRI-CGCM3
- NSIDC obs



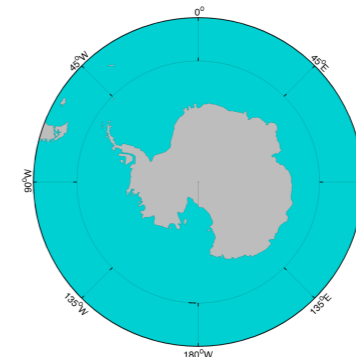
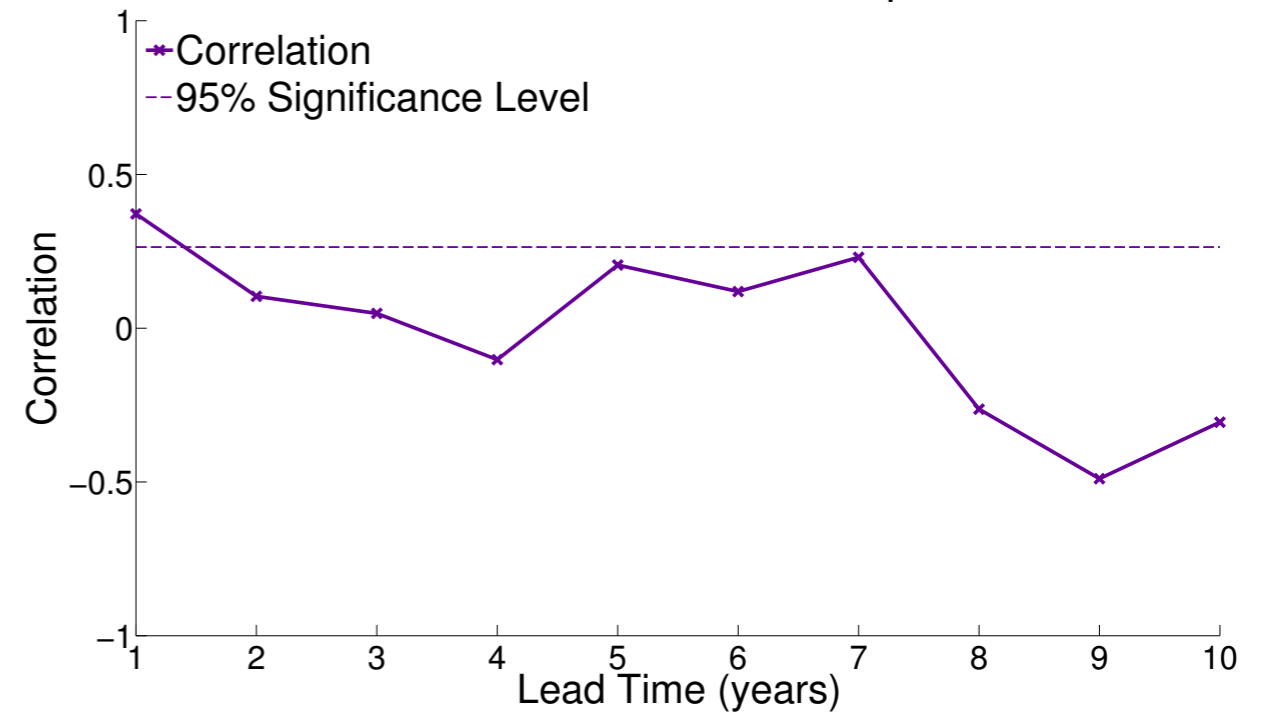
4. Hindcast Simulations

Sea Ice Extent Correlation between Hindcasts and NSIDC Observations

MPI-ESM-LR – Indian Ocean Sector – JAS



MPI-ESM-LR – Southern Hemisphere – JAS



5. Discussion

- No clear improvement of modeled sea ice extent in the Southern Ocean (mean and trend) since CMIP3.
- Large spread of models regarding their mean state and interannual variability.
- Most of the models are unable to reproduce the observed increasing trend of sea ice extent in the Southern Ocean, even if they are initialized through data assimilation of observations.
- Modeled winter sea ice extent in the Southern Ocean can be significantly correlated to observations up to 2 years ahead.

Thank you for your attention!