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Sea-ice initialization for decadal predictions with EC-EARTH

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Decadal predictions for CMIP5

- EC-EARTH model (IFS-OASIS-NEMO)
- EC-EARTH consortium tests full-field and anomaly initialization for decadal predictions
- Ocean initialization from NEMOVAR re-analysis, but NEMOVAR doesn't include sea-ice
- How to initialize sea-ice?
  In particular sea-ice thickness?

Sea-ice initialization

- Test 4 different methods for sea-ice initialization:
  - Full field from a forced NEMO run
  - Climatology from a forced NEMO run
  - Model climatology
  - Anomaly from a forced NEMO run added to the model climatology

Experimental setup

- Start decadal simulations in 1970, 1980, 1990 and 2000
- Initial conditions for atmosphere from ECMWF re-analysis
- Initial conditions for ocean from NEMOVAR, use anomaly initialization
- 4 different methods for sea-ice initialization

Experimental setup 2

- Initial conditions for sea-ice
  - Full field from NEMO run forced by NCEP/NCAR re-analysis
  - Climatology from forced NEMO run
  - Climatology from a long EC-EARTH run
  - Anomaly from forced NEMO run added to EC-EARTH model climatology

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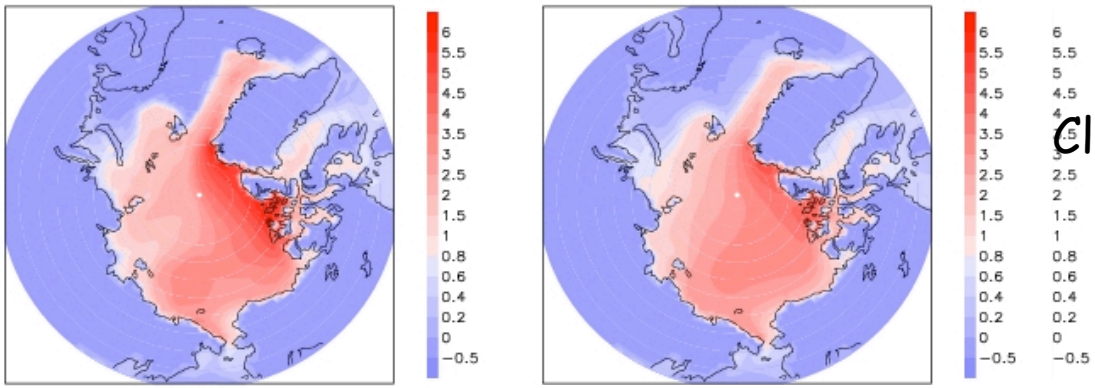
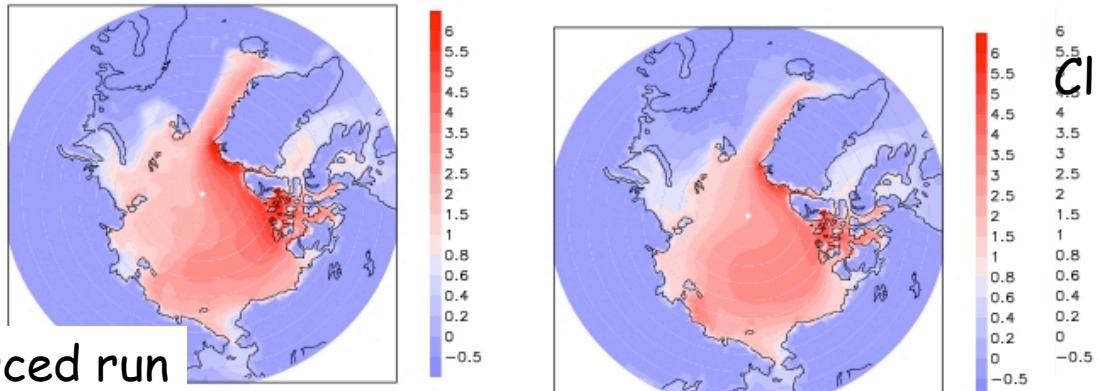
Sea-ice initial conditions NH

Full field



Climatology forced run

Anomaly forced run
+ model climatology



Climatology EC-EARTH

Initialization date 1-Jan-1990

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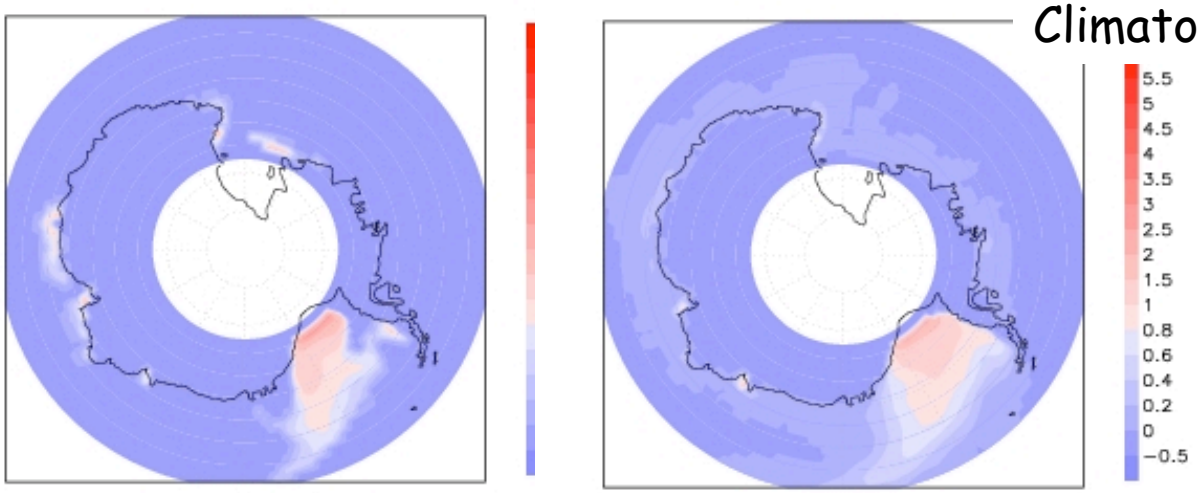
Sea-ice initial conditions SH

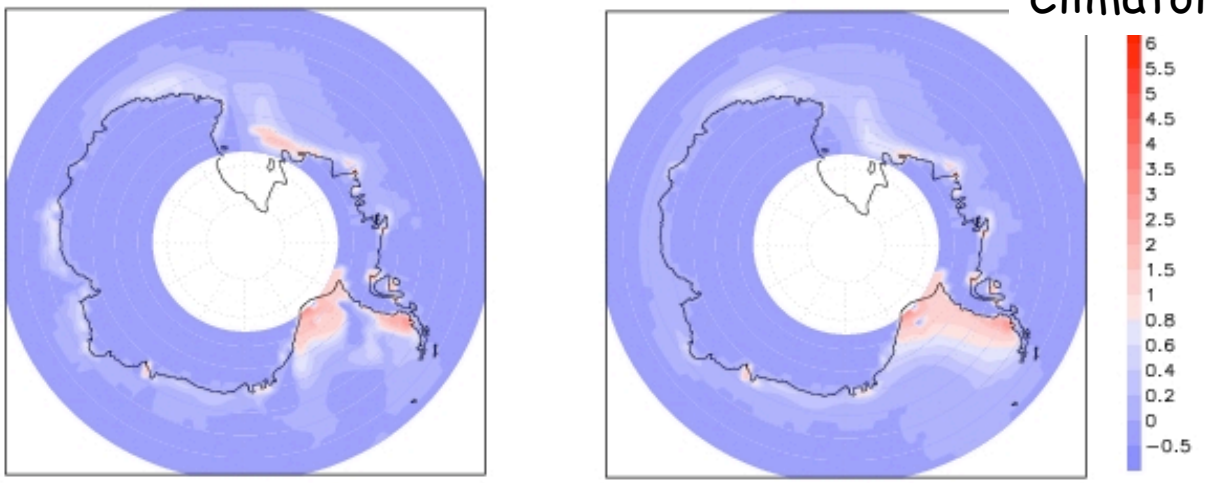
Climatology forced run

Full field



Climatology EC-EARTH

Anomaly



Initialization date 1-Jan-1990

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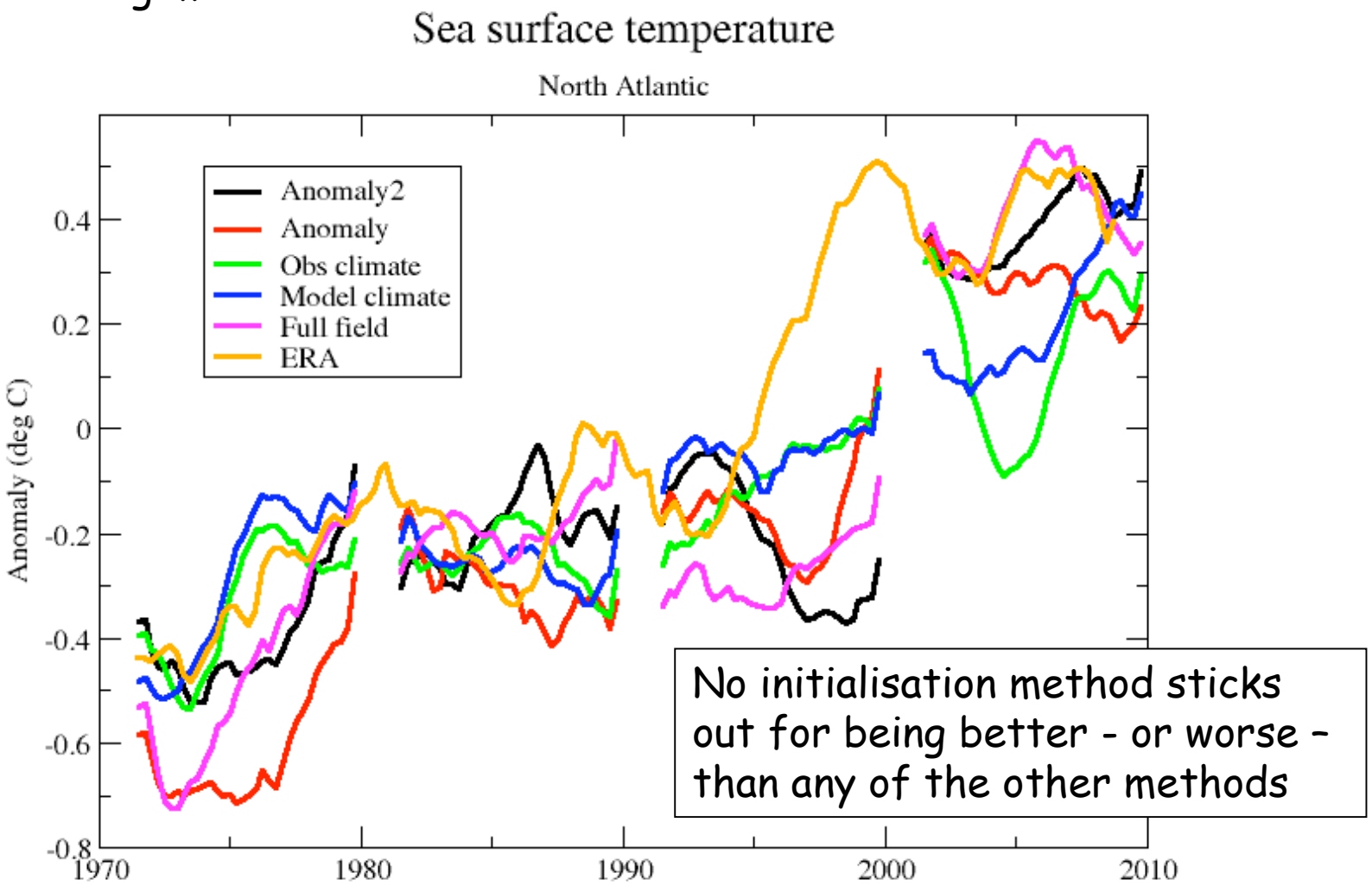
Results

Seasonal anomalies
3-yr running mean



No initialisation method sticks out for being better - or worse – than any of the other methods

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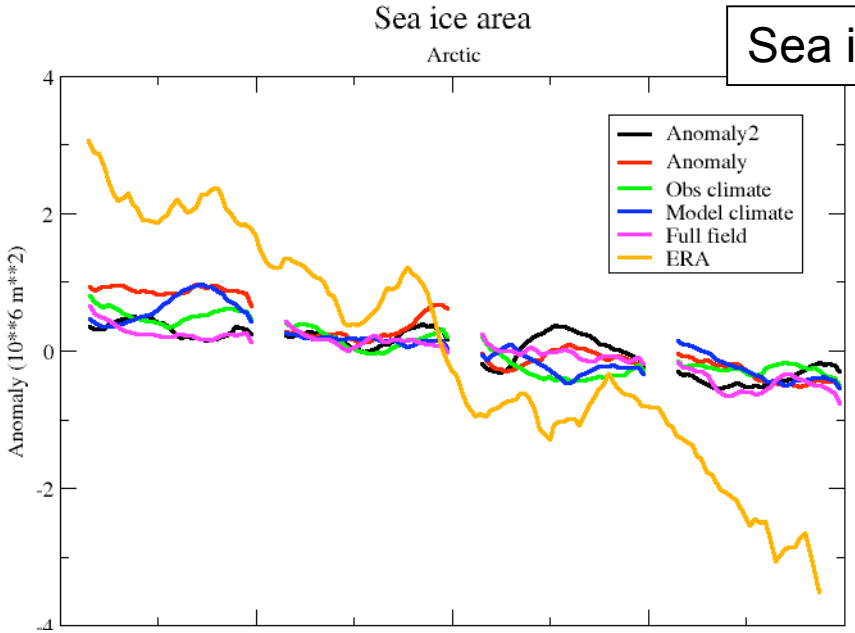
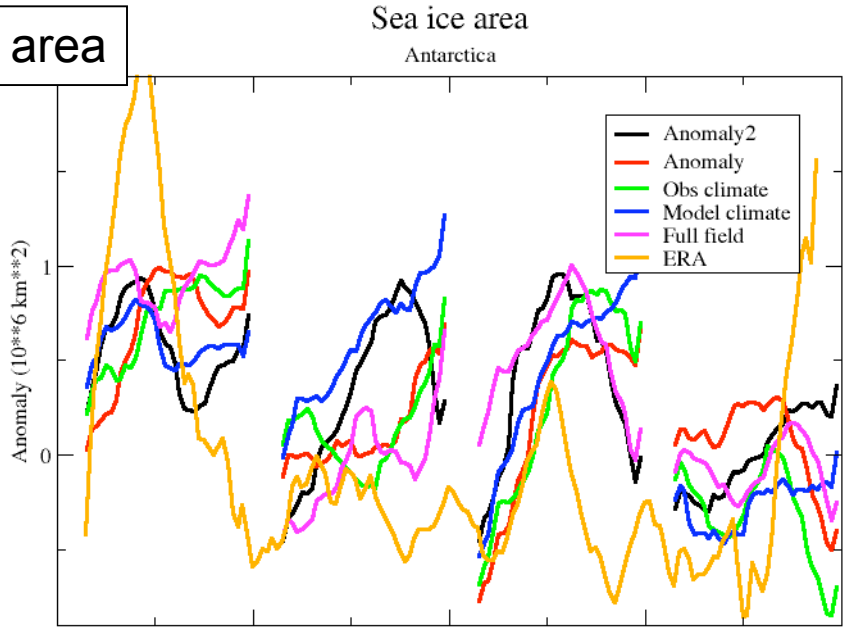
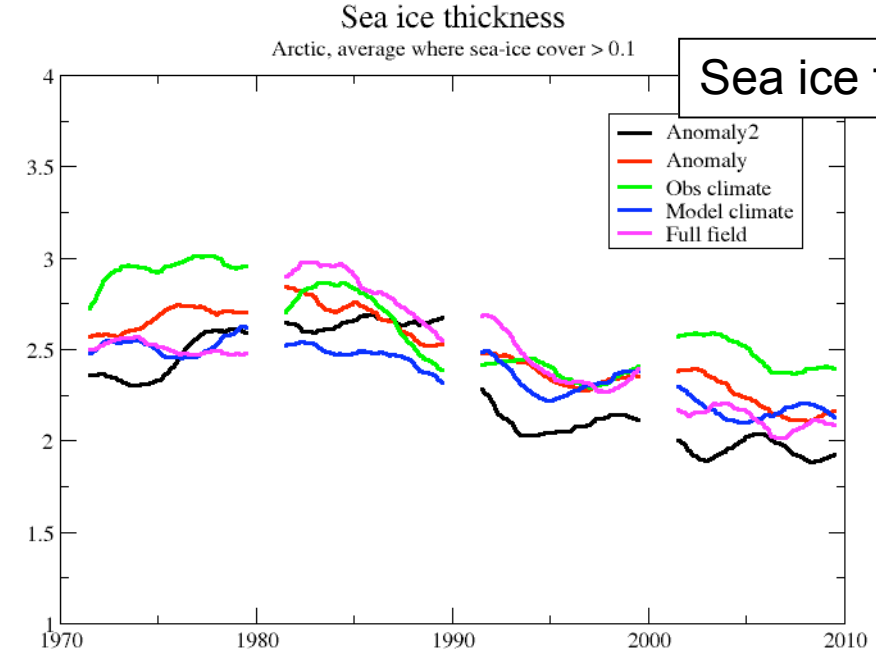
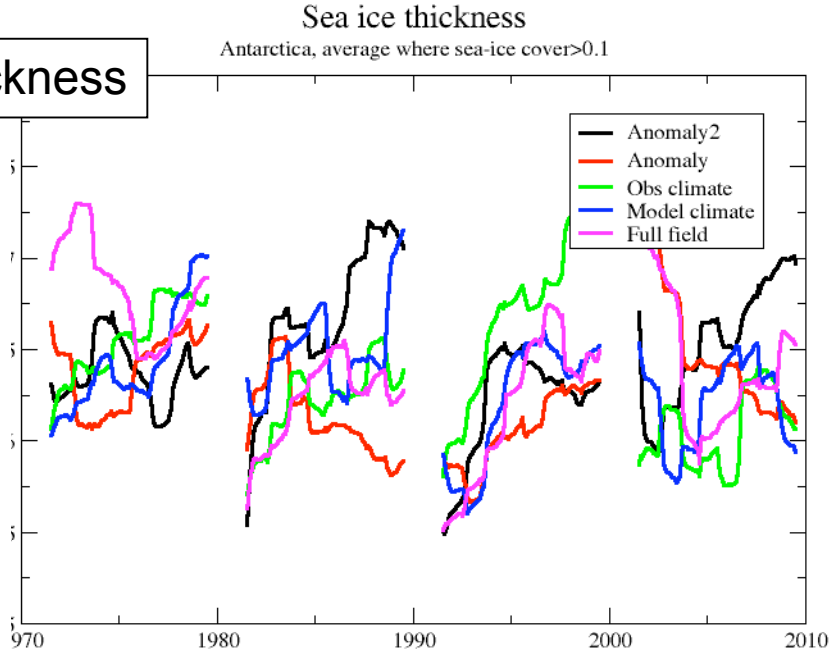
Sea ice area

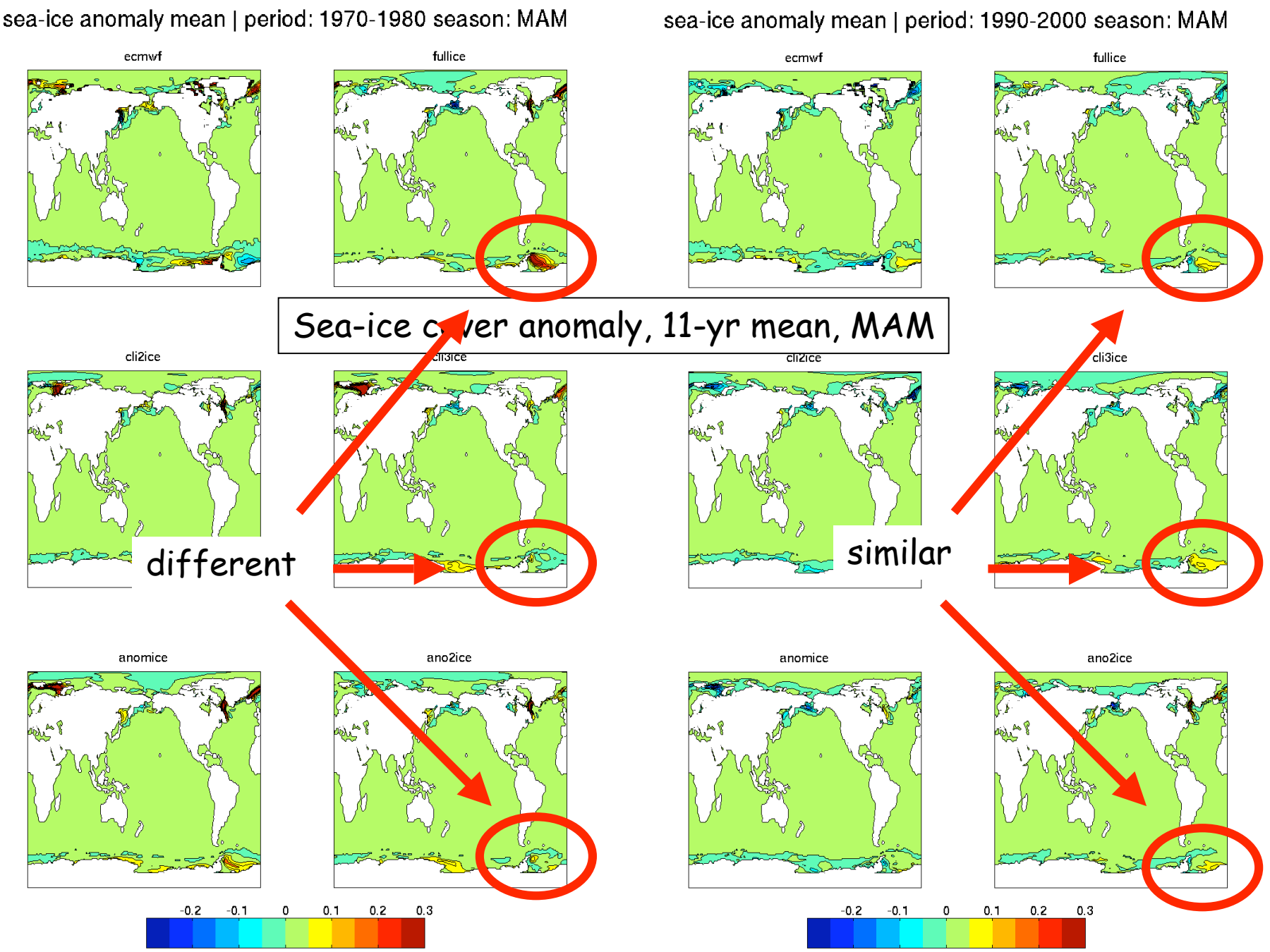




Sea ice thickness






sea-ice anomaly mean | period: 1970-1980 season: MAM
sea-ice anomaly mean | period: 1990-2000 season: MAM
ecmwf
fullice
ecmwf
fullice
Sea-ice cover anomaly, 11-yr mean, MAM
cli2ice
cli3ice
cli2ice
cli3ice
different
similar
anomice
ano2ice
anomice
ano2ice
-0.2
-0.1
0
0.1
0.2
0.3
-0.2
-0.1
0
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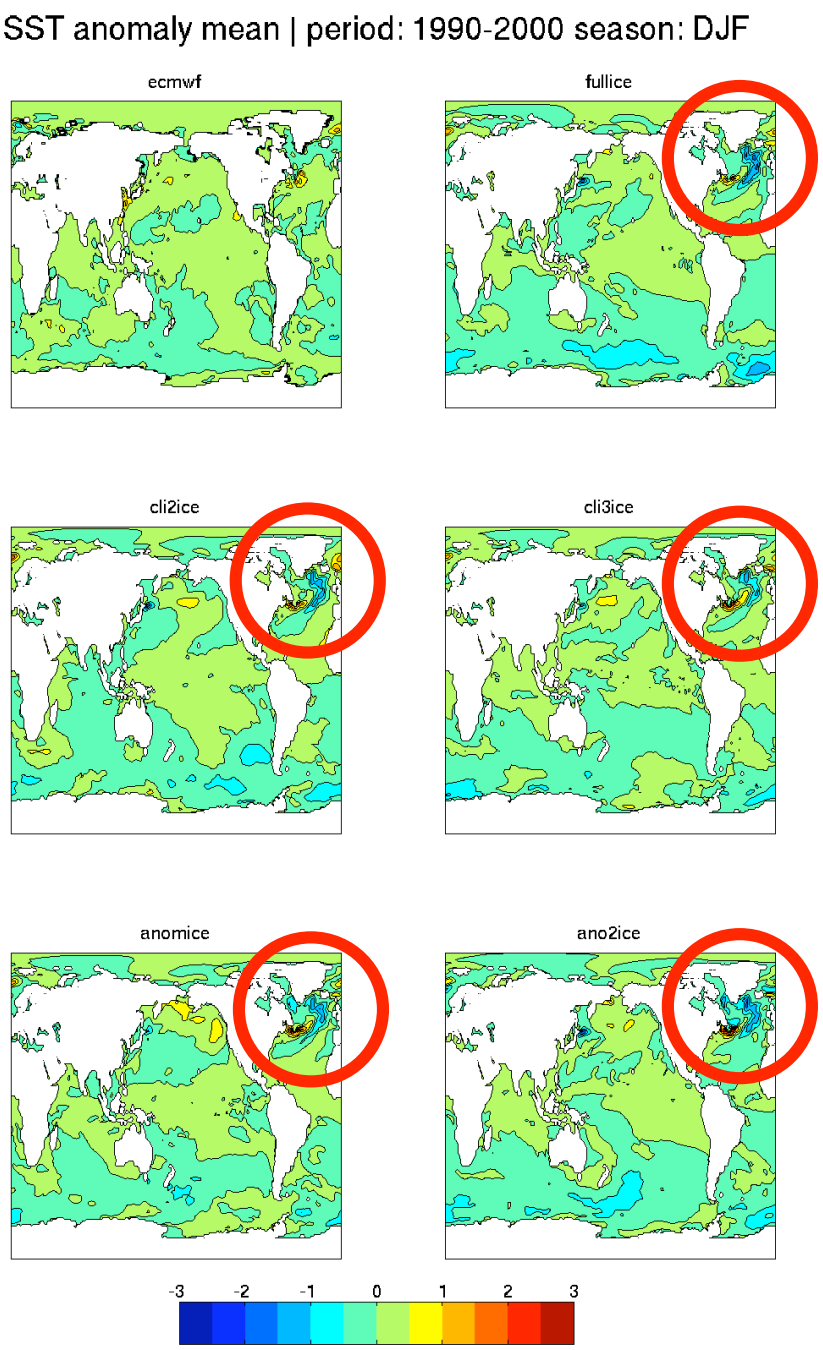
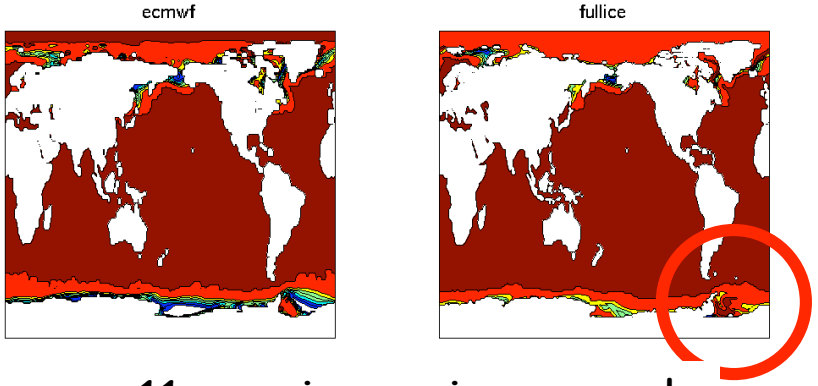
0.2
0.3



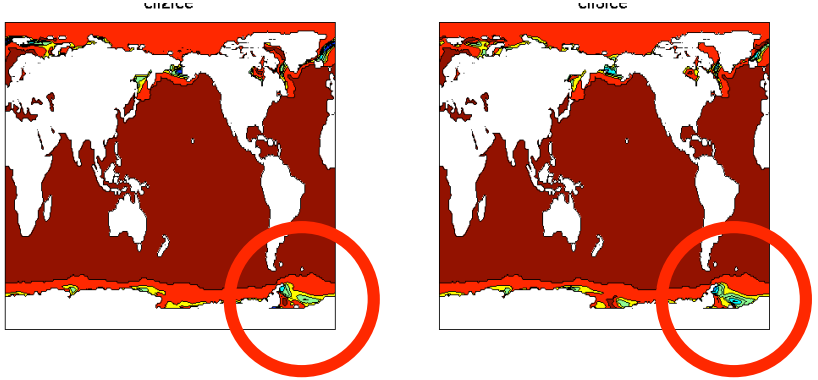
SST anomaly, 11-yr mean, DJF

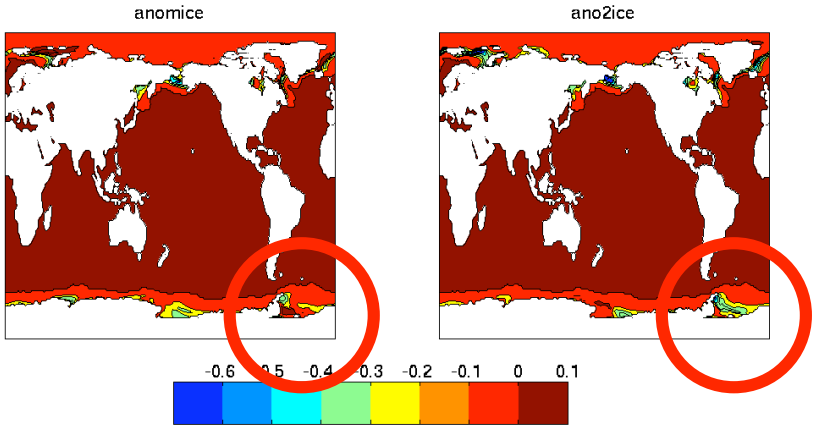
Similar structure and magnitude independent of sea-ice initialization

sea-ice anomaly min | period: 1970-1980 season: MAM

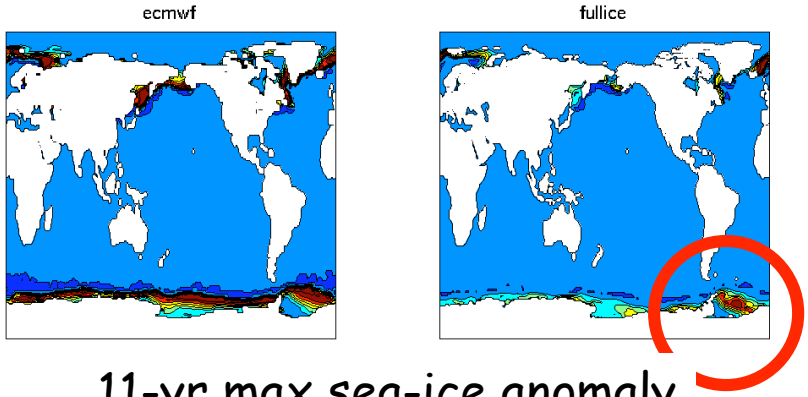


11-yr min sea-ice anomaly

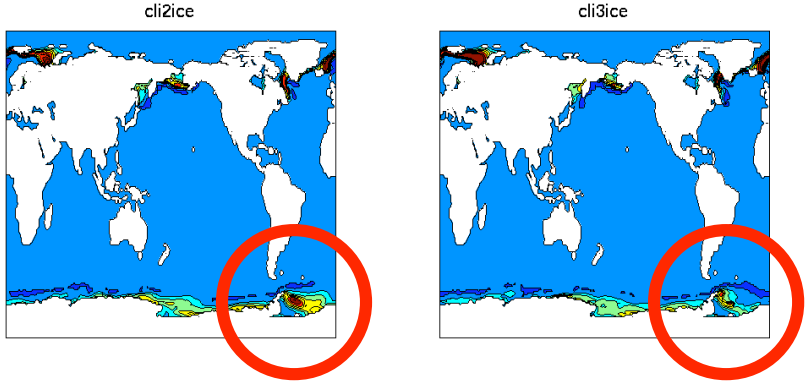


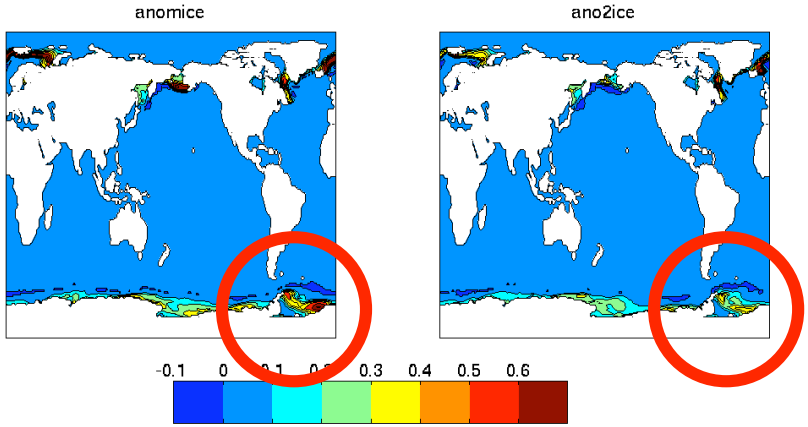


sea-ice anomaly max | period: 1970-1980 season: MAM



11-yr max sea-ice anomaly





Conclusions

- 4 different intialization methods for sea-ice have been tested
- Differenct initialization methods yield different SST and sea-ice in the decadal simulations
- Annual means and decadal means are different, but there is no systematic behaviour
- None of the tested sea-ice initialization methods is superior or inferior