



Sea Ice Results from CESM Simulations

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CESM Atmospheric Components

Community Atmosphere Model version (CAM5):

- New RRTM radiation, MG microphysics, Aerosols, UW PBL, TMS

Whole Atmosphere Community Climate Model (WACCM₄):

- High top at approximately 150km (CAM is at 40km).
- CAM₄ physics + TMS

Turbulent Mountain Stress (TMS)

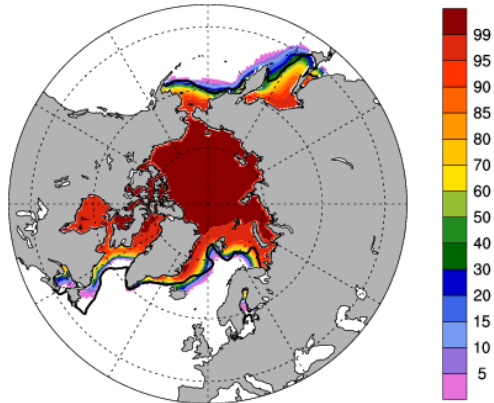
- Gravity wave drag redistributes momentum, due to unresolved gravity waves, from the mid-troposphere.
- TMS is an additional form drag that redistributes momentum from the surface.
- Both physically realistic and complementary.

Sea Ice Albedos

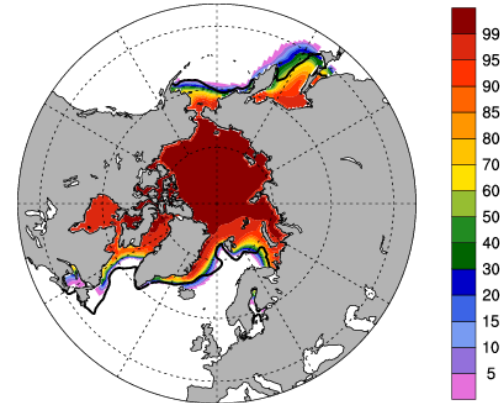
- CESM-CAM5 “albedos” are tuned higher because of additional incoming shortwave (more realistic).
- CESM-WACCM₄ albedos are the same as CESM-CAM₄.
- CAM5.1 had additional physics changes that may require lowering the albedos back to CAM₄ values.
- All more realistic than CCSM₃ values.

CESM-CAM5 0.9x1.25_gx1v6

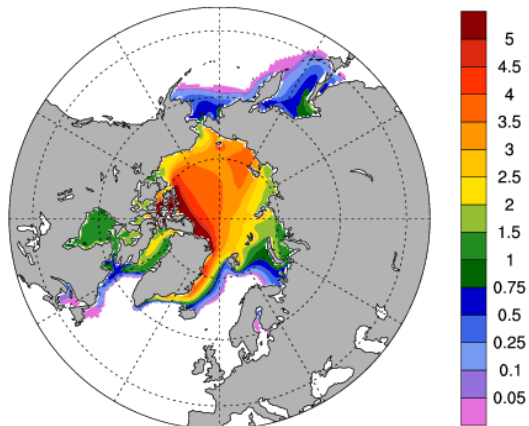
Case b40_1850_1d_b08c5cn_138j
JFM Mean Years 0230-0249
ice area (aggregate) %



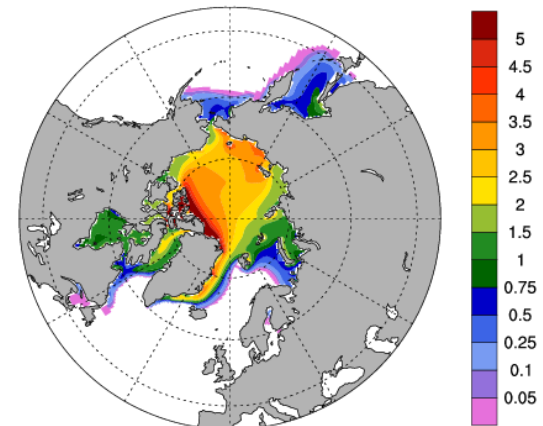
Case b40_20th_1d_b08c5cn_139jp
JFM Mean Years 1985-2004
ice area (aggregate) %



Case b40_1850_1d_b08c5cn_138j
JFM Mean Years 0230-0249
grid cell mean ice thickness m



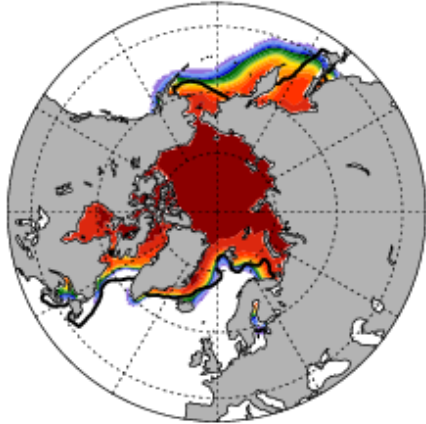
Case b40_20th_1d_b08c5cn_139jp
JFM Mean Years 1985-2004
grid cell mean ice thickness m



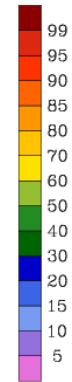
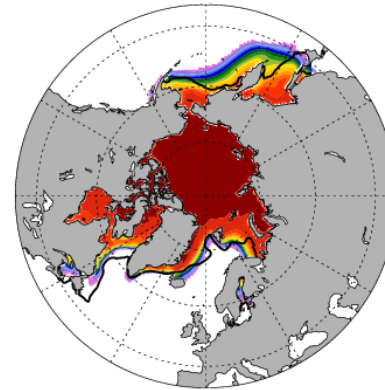
CESM-WACCM4 1.9x2.5_gx1v6

b40.1850.track1.2deg.wcm.007 Yrs 0117 - 0136

ice area (aggregate) %

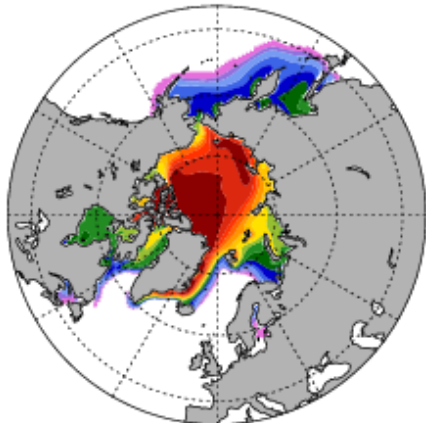


Case b40.20th.track1.2deg.wcm.007
JFM Mean Years 1986-2005
ice area (aggregate) %

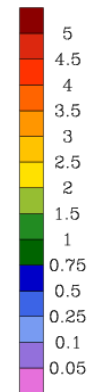
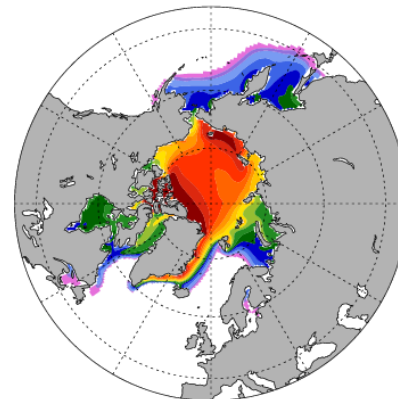


b40.1850.track1.2deg.wcm.007 Yrs 0117 - 0136

grid cell mean ice thickness m



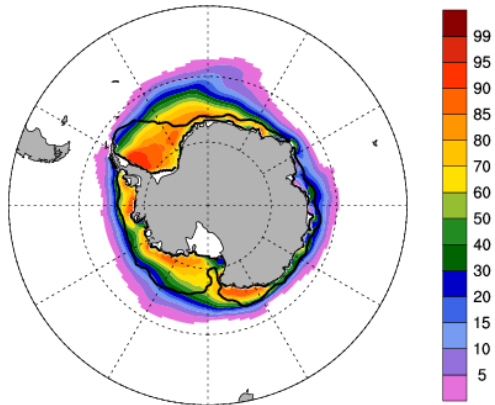
Case b40.20th.track1.2deg.wcm.007
JFM Mean Years 1986-2005
grid cell mean ice thickness m



CESM-CAM5 0.9x1.25_gx1v6

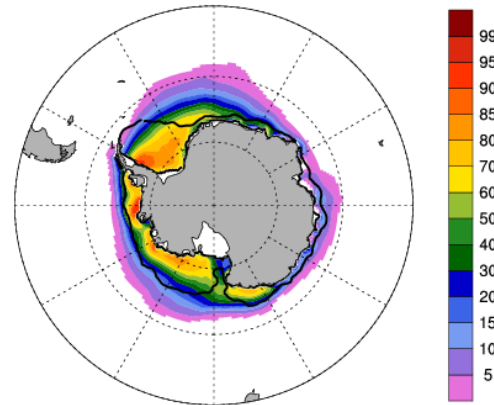
ice area (aggregate)

%



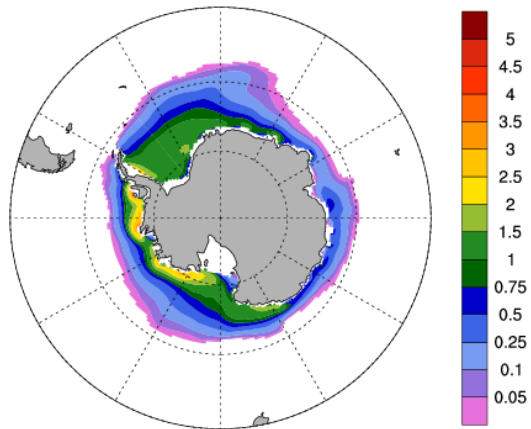
ice area (aggregate)

%



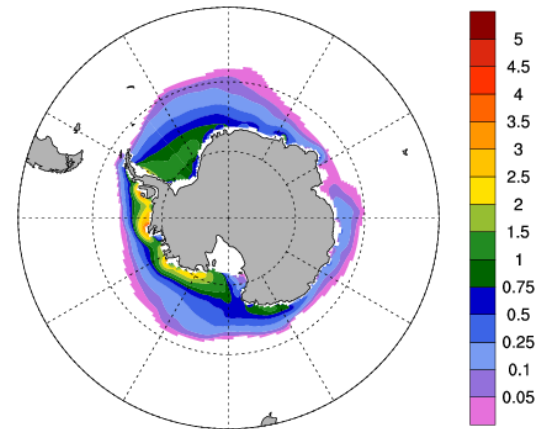
grid cell mean ice thickness

m



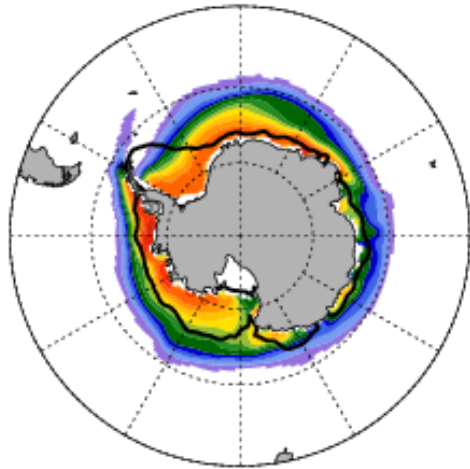
grid cell mean ice thickness

m

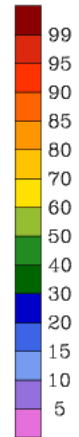
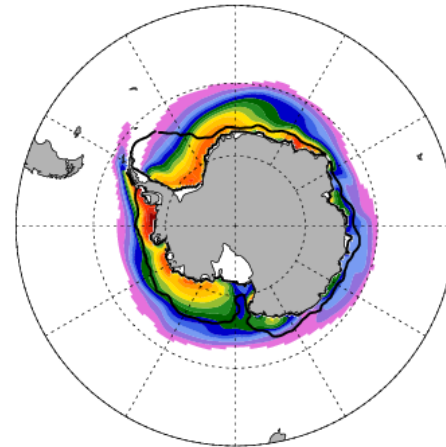


CESM-WACCM4 1.9x2.5_gx1v6

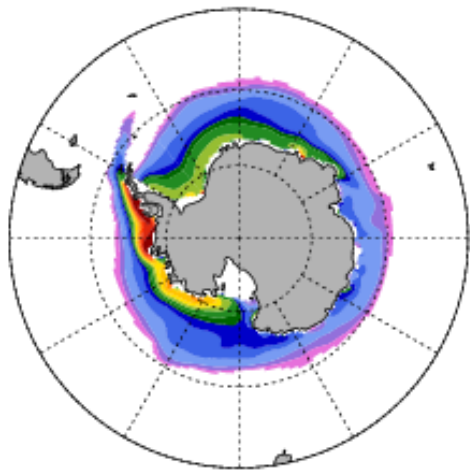
ice area (aggregate) %



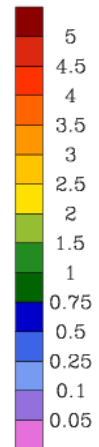
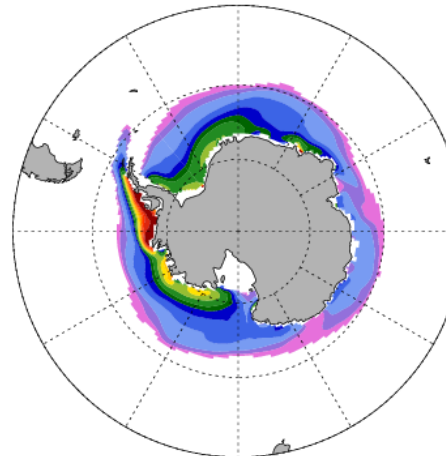
ice area (aggregate) %



grid cell mean ice thickness m



grid cell mean ice thickness m



CESM SLP

ANN

b40_20th_1d_b08c5cn_139jp (yrs 1980-1999)

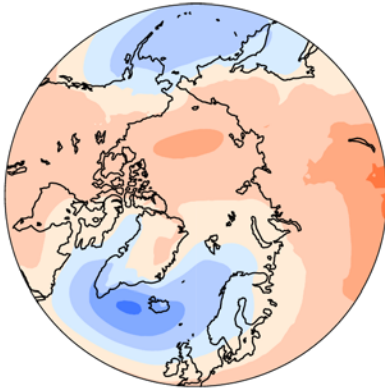
NCEP

Sea-level pressure millibars

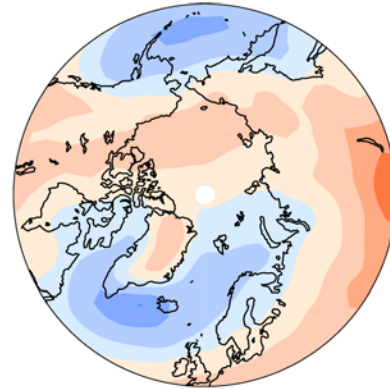
millibars

Sea-level pressure

millibars



MEAN= 1013.84 Min= 1002.65 Max= 1022.54



MEAN= 1012.58 Min= 1002.91 Max= 1023.11



ANN

b40.20th.track1.2deg.wcm.007 (yrs 1986-2005)

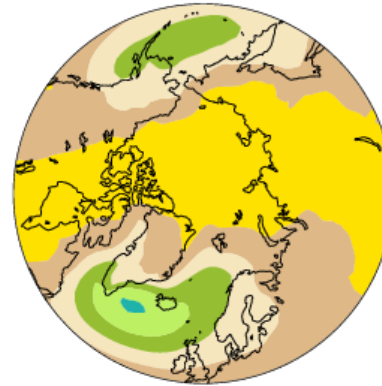
b40.20th.track1.1deg.005 (yrs 1986-2004)

Sea-level pressure

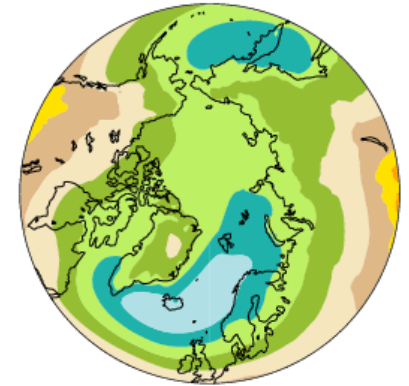
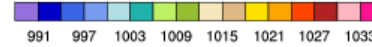
millibars

Sea-level pressure

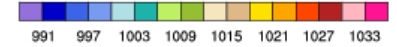
millibars



MEAN= 1016.37 Min= 1005.57 Max= 1021.18



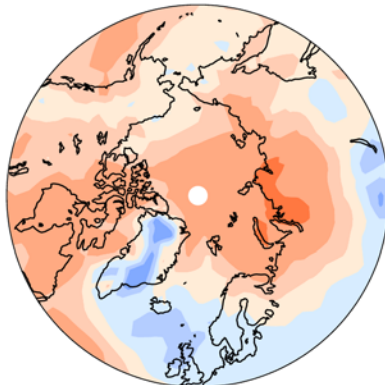
MEAN= 1009.53 Min= 1000.60 Max= 1022.12



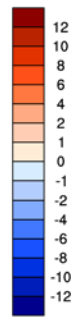
b40_20th_1d_b08c5cn_139jp - NCEP

Sea-level pressure

millibars



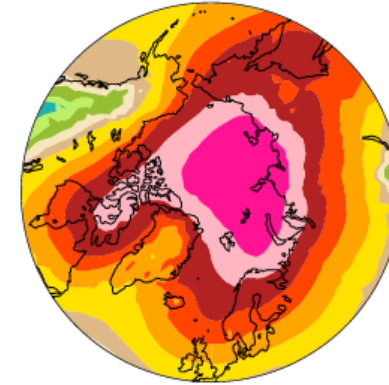
MIN = -3.43 MAX = 4.50



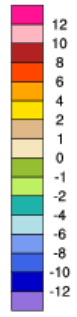
b40.20th.track1.2deg.wcm.007 - b40.20th.track1.1deg.005

Sea-level pressure

millibars



MIN = -3.01 MAX = 14.11



CESM SLP

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b40_20th_1d_b08c5cn_139jp (yrs 1980-1999)

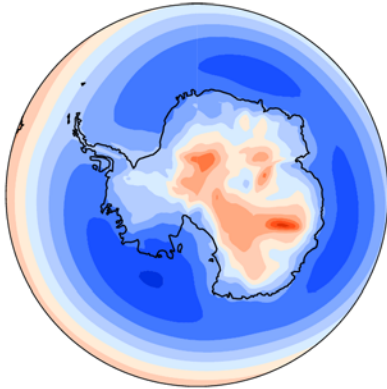
NCEP

Sea-level pressure

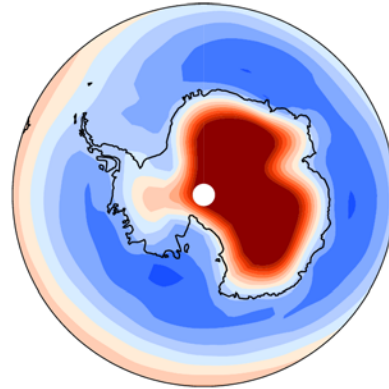
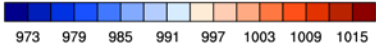
millibars

Sea-level pressure

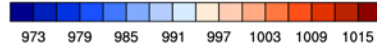
millibars



MEAN= 988.58 Min= 978.80 Max= 1010.36



MEAN= 993.54 Min= 980.97 Max= 1036.88



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b40.20th.track1.2deg.wcm.007 (yrs 1986-2005)

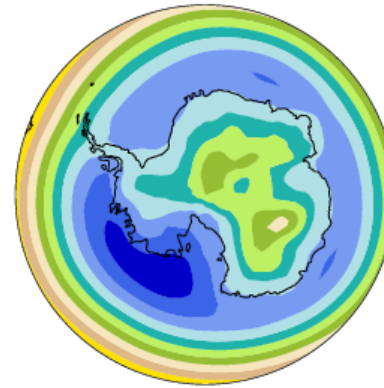
b40.20th.track1.1deg.005 (yrs 1986-2004)

Sea-level pressure

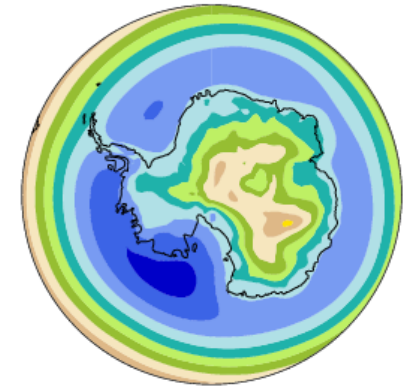
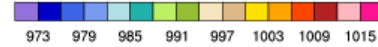
millibars

Sea-level pressure

millibars



MEAN= 985.78 Min= 974.41 Max= 1001.20



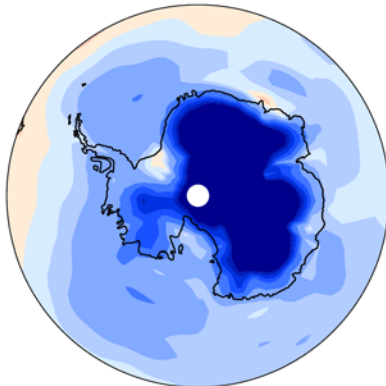
MEAN= 985.82 Min= 974.89 Max= 1000.77



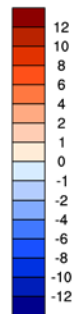
b40_20th_1d_b08c5cn_139jp - NCEP

Sea-level pressure

millibars



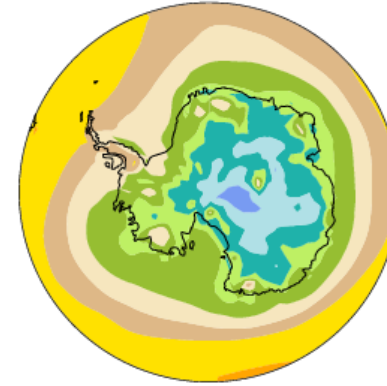
MIN = -42.13 MAX = 1.67



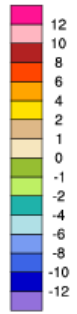
b40.20th.track1.2deg.wcm.007 - b40.20th.track1.1deg.005

Sea-level pressure

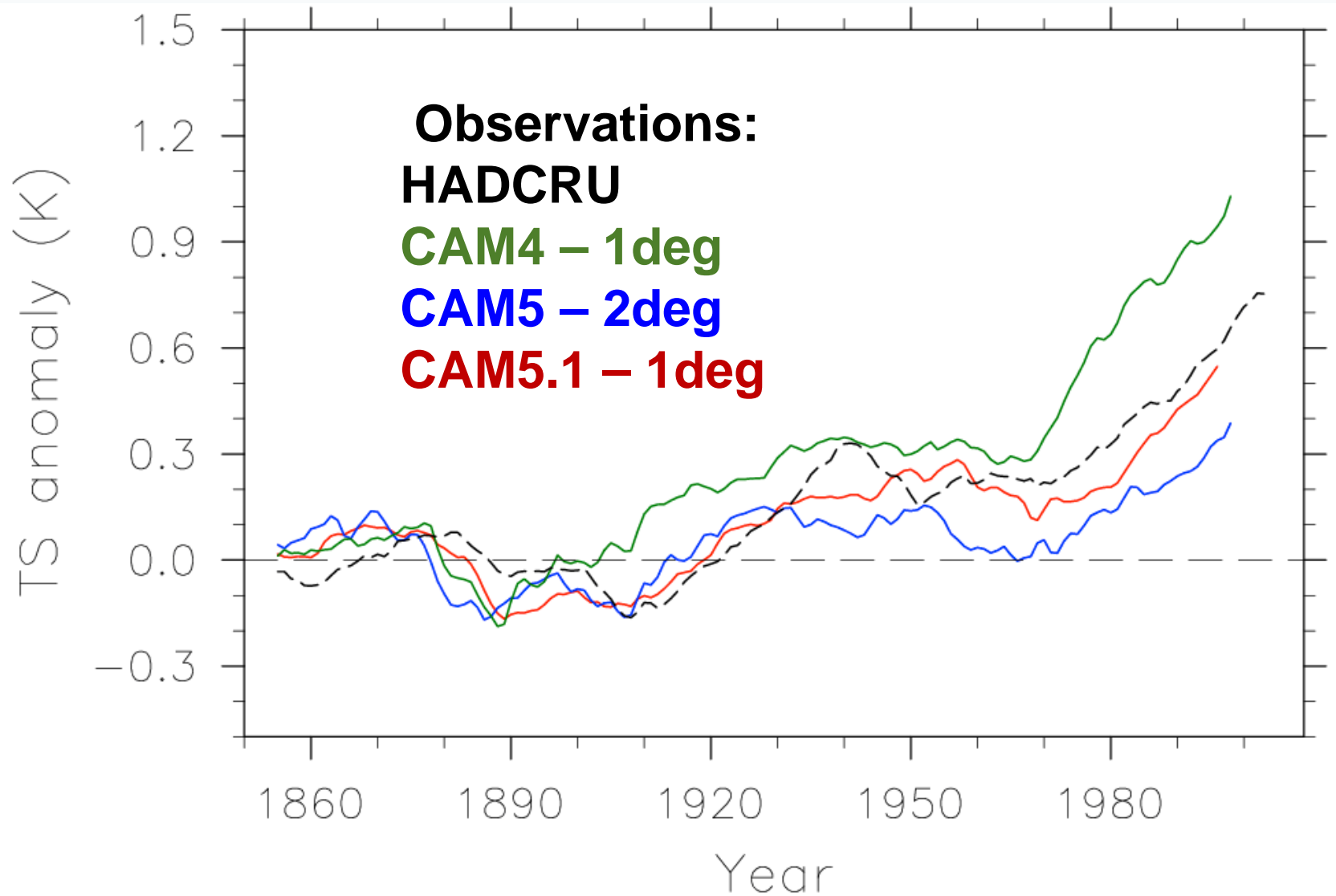
millibars



MIN = -7.59 MAX = 4.12



20th century: Surface temperature (CESM-CAM5)



Summary

- CESM-CAM5 and WACCM4 1850 controls and 20th century runs. More ensemble members? RCP?
- Better 20th century temperature change and sea ice extent.
- Ice is thicker in NH, but thinner in SH.
- Ice thickness spatial distribution is odd. TMS?

CESM-WACCM4

Temperature Change

