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
CESM-CAM5 0.9x1.25_gx1v6
 CESM-WACCM4 1.9x2.5_gx1v6

ice area (aggregate) %

grid cell mean ice thickness m

grid cell mean ice thickness m

99 95 90 85 80 70 60 50 40 30 20 15 10 5

5 4.5 4 3.5 3 2.5 2 1.5 1 0.75 0.5 0.25 0.1 0.05
CESM SLP
20th century: Surface temperature (CESM-CAM5)

Observations:
HADCRU
CAM4 – 1deg
CAM5 – 2deg
CAM5.1 – 1deg
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-WACCM$_4$

Temperature Change

Global

$T_{S0} = 288.053$

Year

Northern Hemisphere

$T_{S0} = 288.529$

Year

Southern Hemisphere

$T_{S0} = 287.577$