CCSM2.2 sensitivity to 2% increase in snow-covered ice albedo

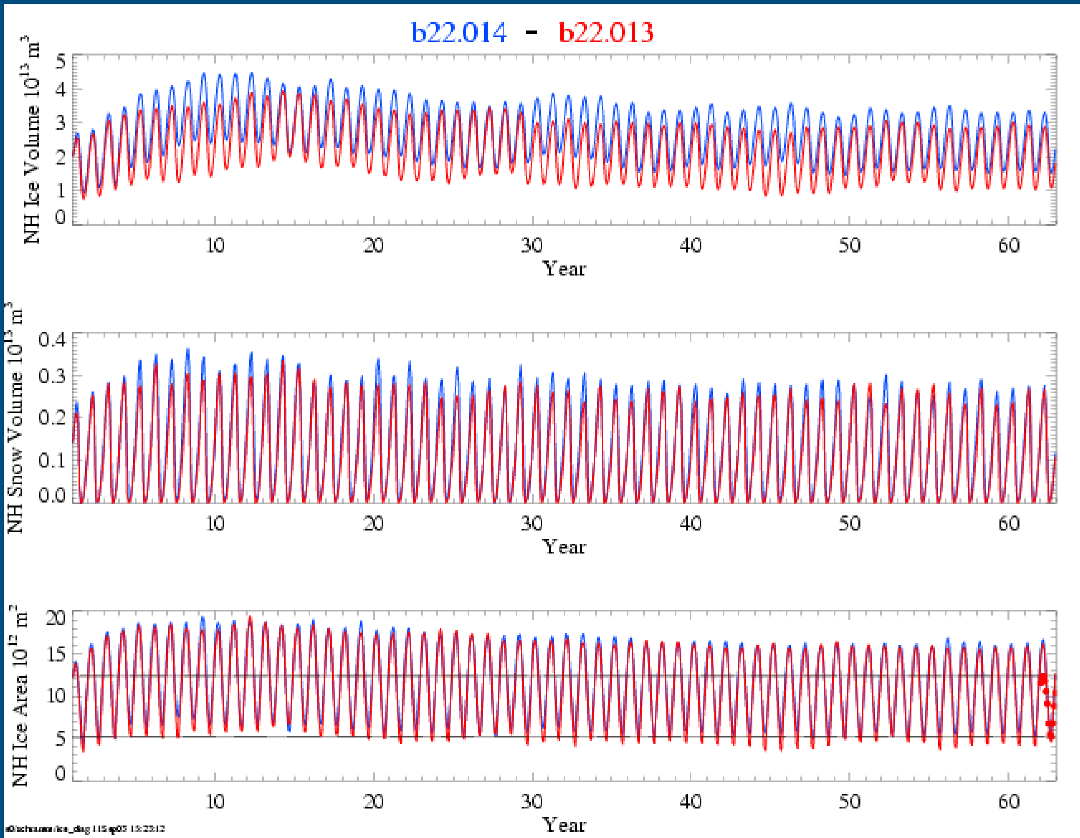


Figure by Julie Schramm

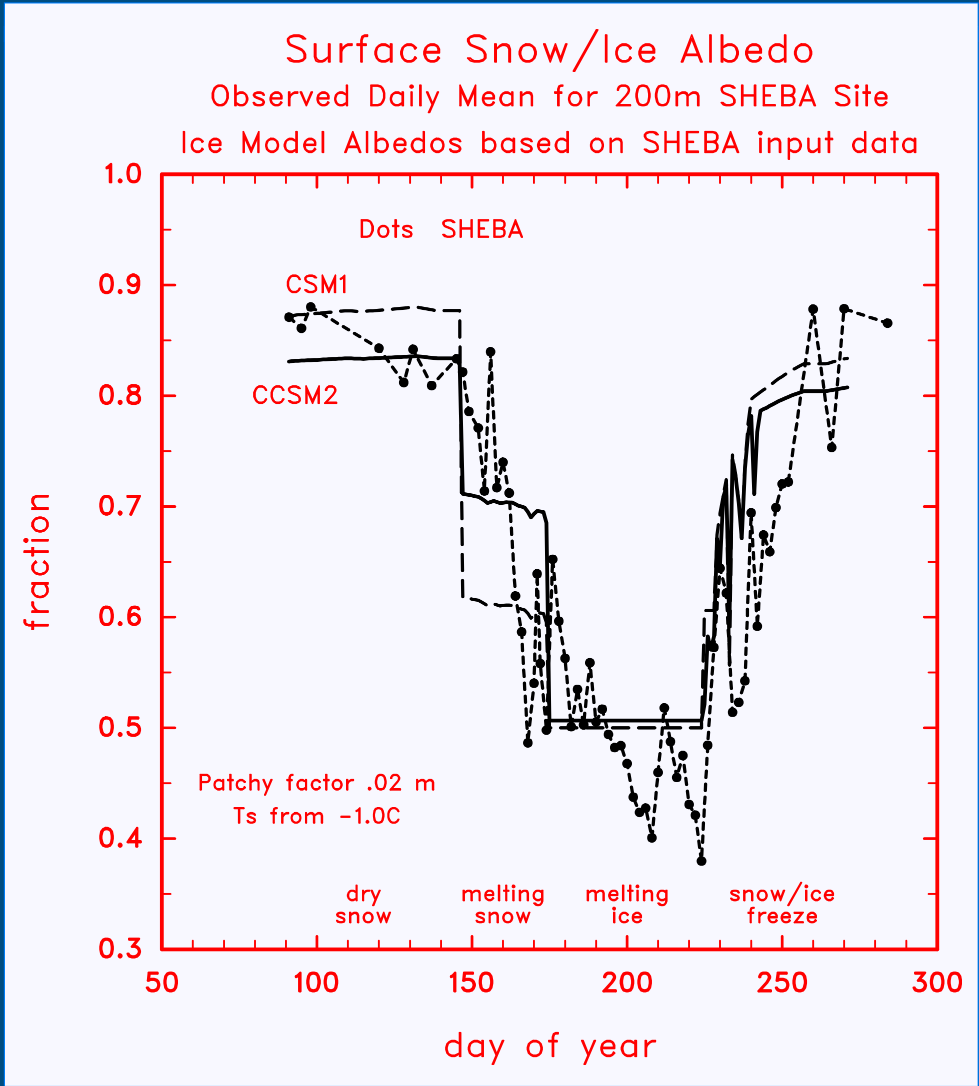


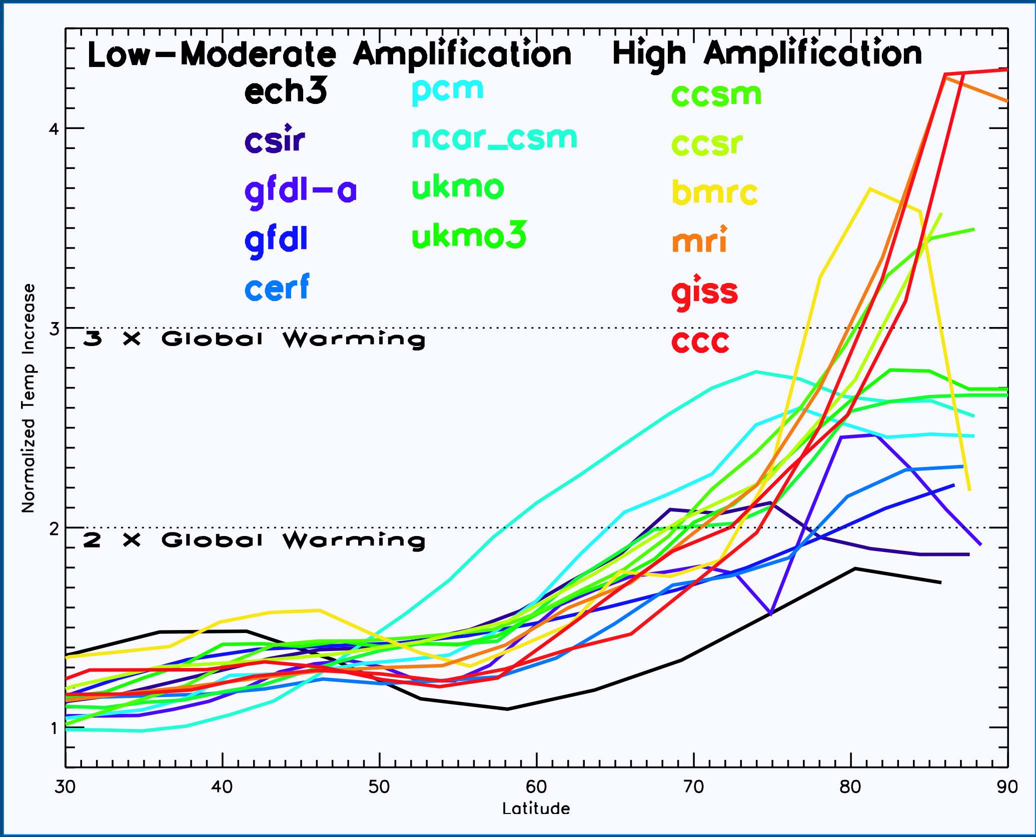
Figure by Bruce Briegleb

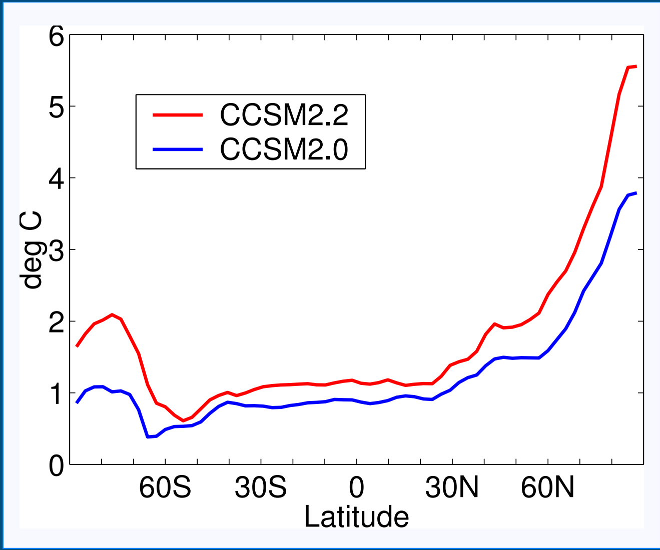
Outline:

I Polar Climate Science Issues - working towards understanding the model we have created.

II Plan for Science Plan

CMIP zonal mean temperature, normalized by global mean
Holland and Bitz (2003)

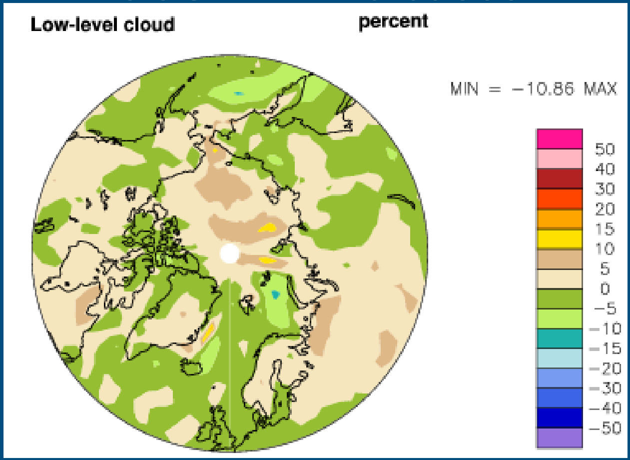




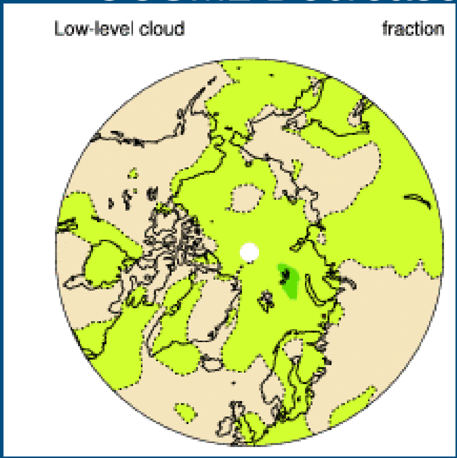
Zonal Mean Surface Warming at $2XCO_2$

DJF Low-Level Cloud

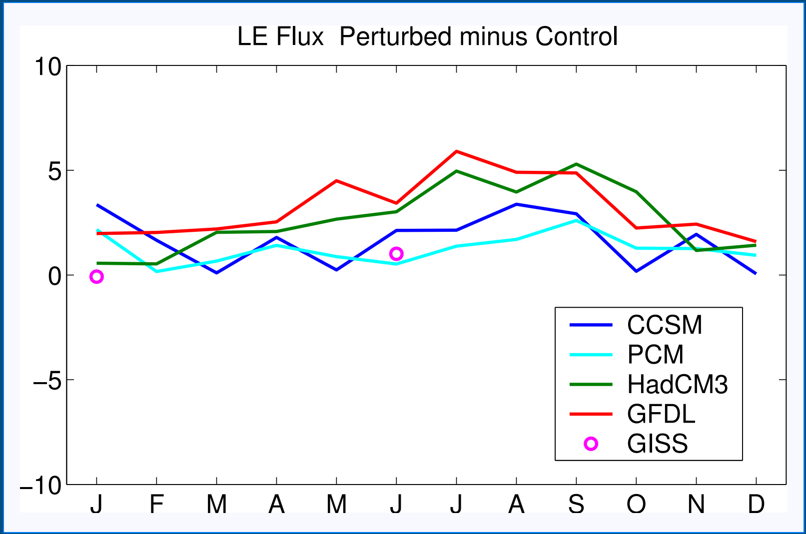
CCSM2.2 Increases



CCSM2 Decreases

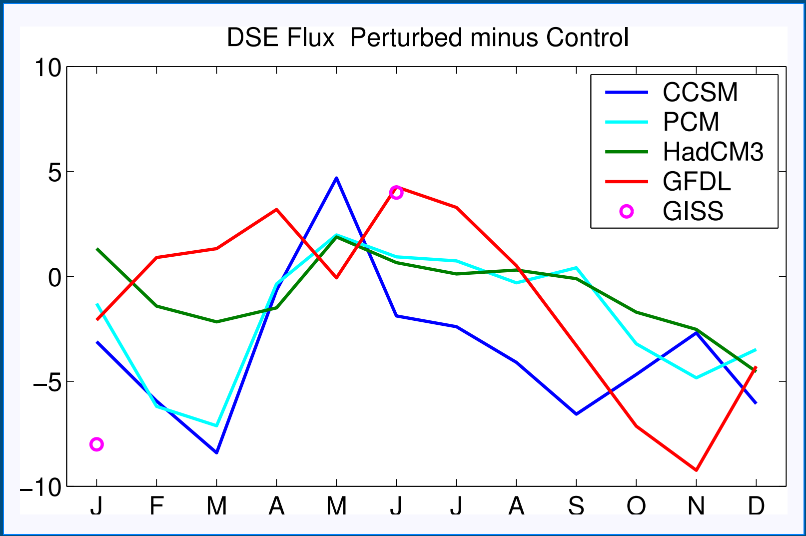


Atmospheric Heat Transport ($W\ m^{-2}$) at 70° N
Bitz/Hall/Winton

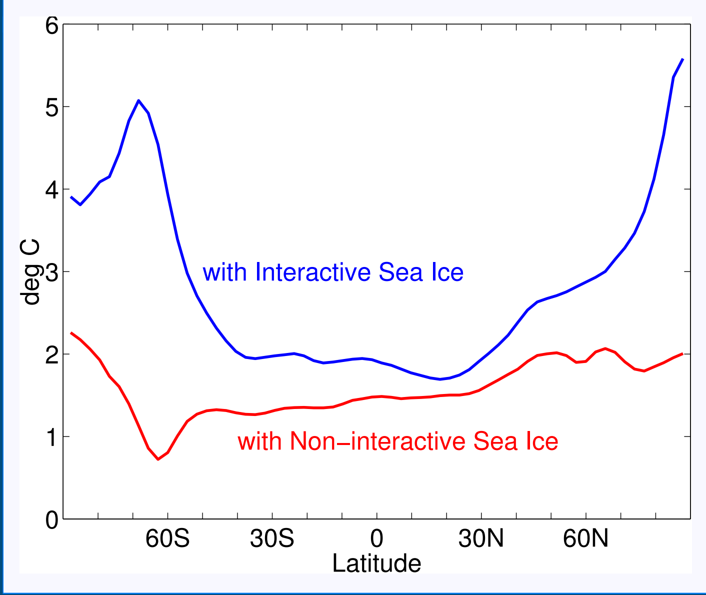


LE=Latent Energy
Lqv term

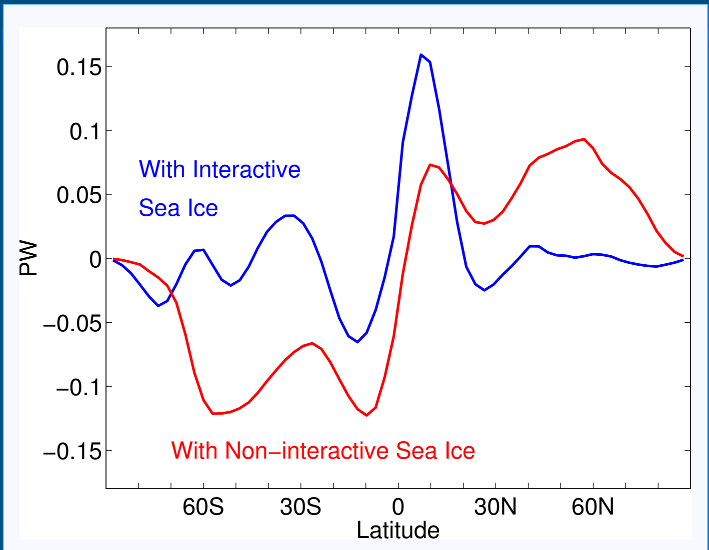
DSE=Dry Static Energy
$c_pTv + gZv$ term



	70-90°/ Change
CCSM2	2.8
PCM	2.3
GISS	2.2
GFDL-R30	2.0
HADCM3	2.4

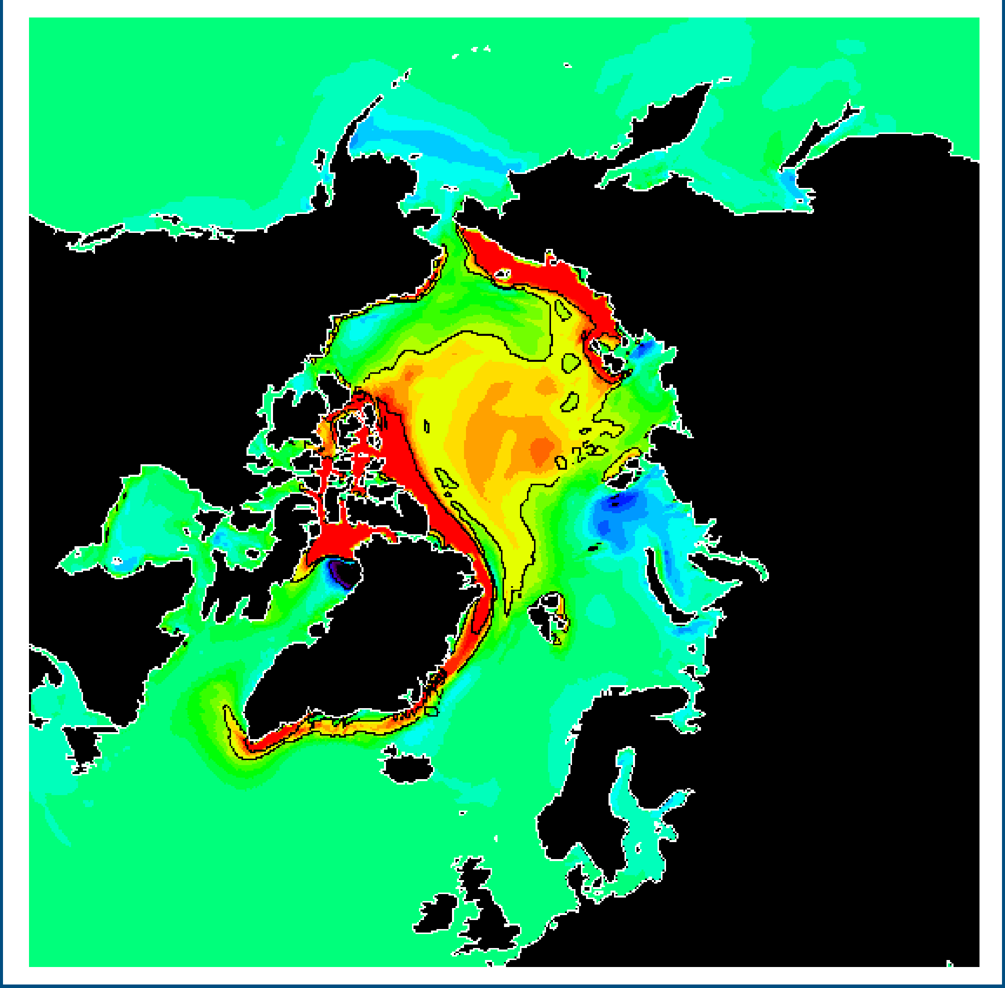


Equilibrium Warming at $2XCO_2$ in CAM2 SOM



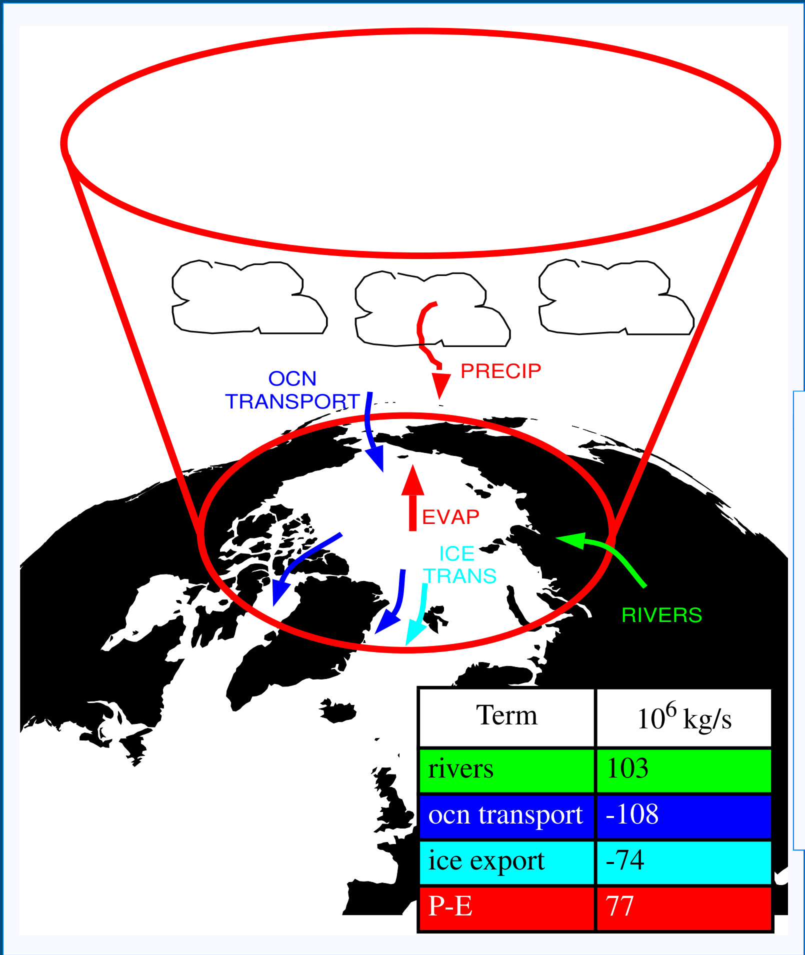
Atmospheric Heat Transport in Petawatts

Ice Thickness Sensitivity to Resolving Thickness Distribution



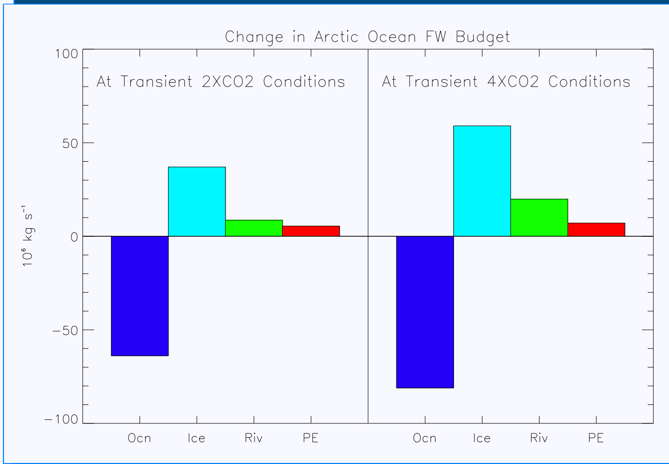
Work and figure by Marika Holland

Freshwater Budget Study
Holland/Wu/Lynch/Serreze



Term	10^6 kg/s
rivers	103
ocn transport	-108
ice export	-74
P-E	77

Change Due to Increased CO_2



Figures by Marika Holland

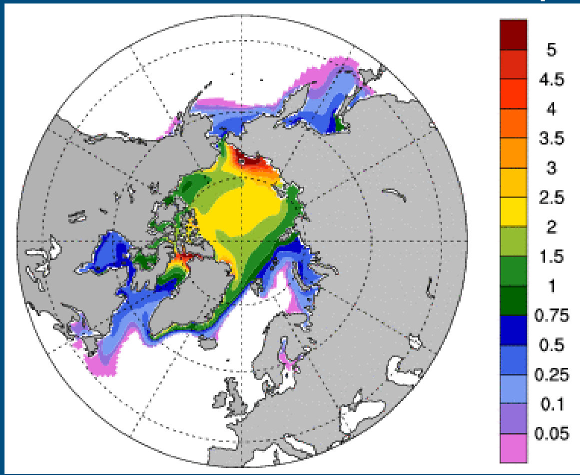
Arctic Model Intercomparison Project
Hunke/Maltrud/Holland

Ice/ocn coupled at global 0.4° resolution CICE/POP

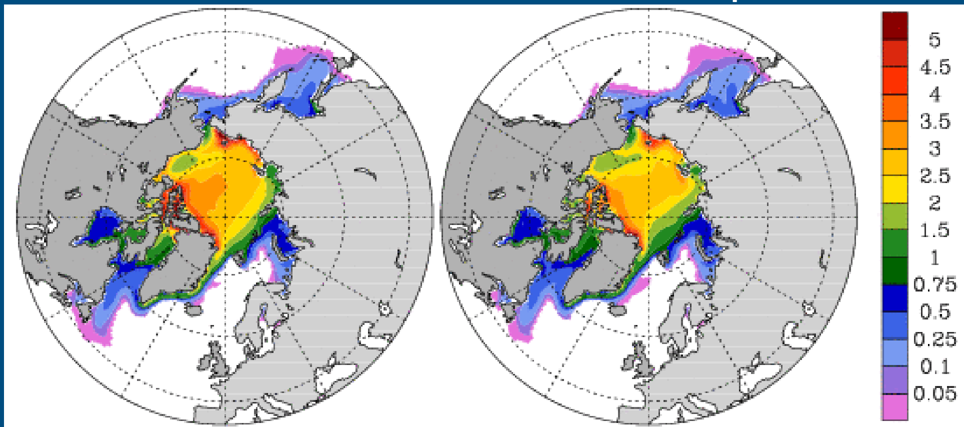
CCSM has good surface salinity and halocline

Arctic surface circulation improvements at T85

Ice Thickness with T42 Atmosphere

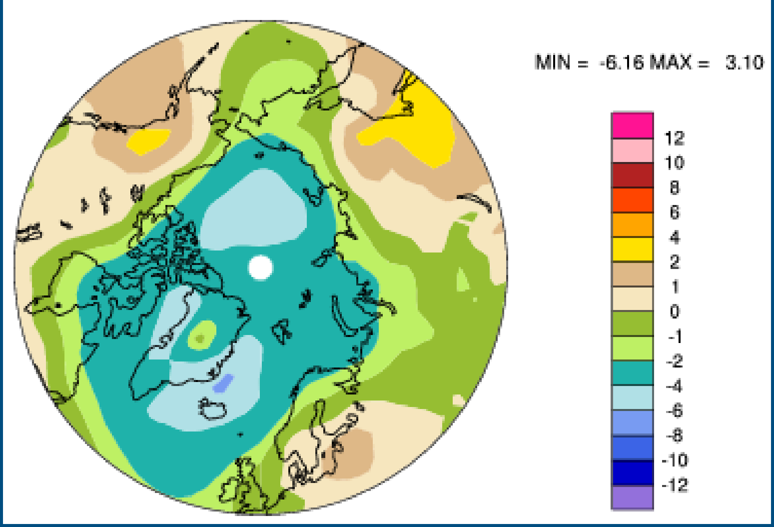


Ice Thickness with T85 Atmosphere

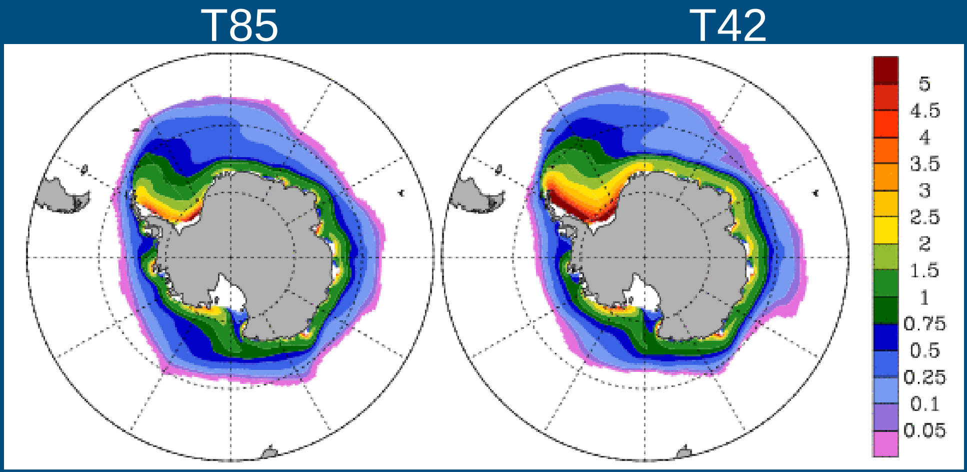


T85 circulation is much better in summer
Moritz/Bitz

JJA Sea Level Pressure - T85 minus T42



Southern Hemisphere sea ice is too thick and extensive in CCSM



Bias is possibly due to weak winds off the continent, weak cyclogenesis in the Antarctic peninsula region, and poor resolution of the Antarctic coastal current.

II Plan for Science Plan

Successfully accomplished already:

1. Remapping horizontal advection and ice brine rejection
2. Arctic temperature and ice thickness bias - thanks to atmosphere and land model WGs

Work in progress:

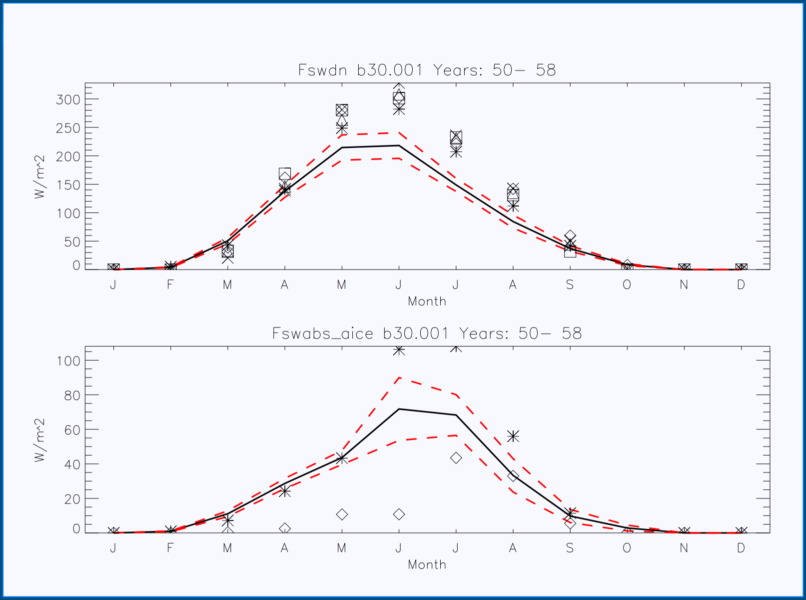
1. Already talked about climate sensitivity study plans
2. Snow model improvements - Bill Lipscomb

   Treat rain and melt water flow, multilayer thermal structure, blowing snow, and snow to ice transformation.
3. Spectral radiative transfer through ice - Bitz/Light/Perovich

   Model's radiative transfer in thin ice absorbs too much and transmits too little. Transmitted radiation is distributed among all ice types while absorbed flux heats just the thin ice. Could exagerate ice-albedo feedback.

Problems that require solutions in other component models

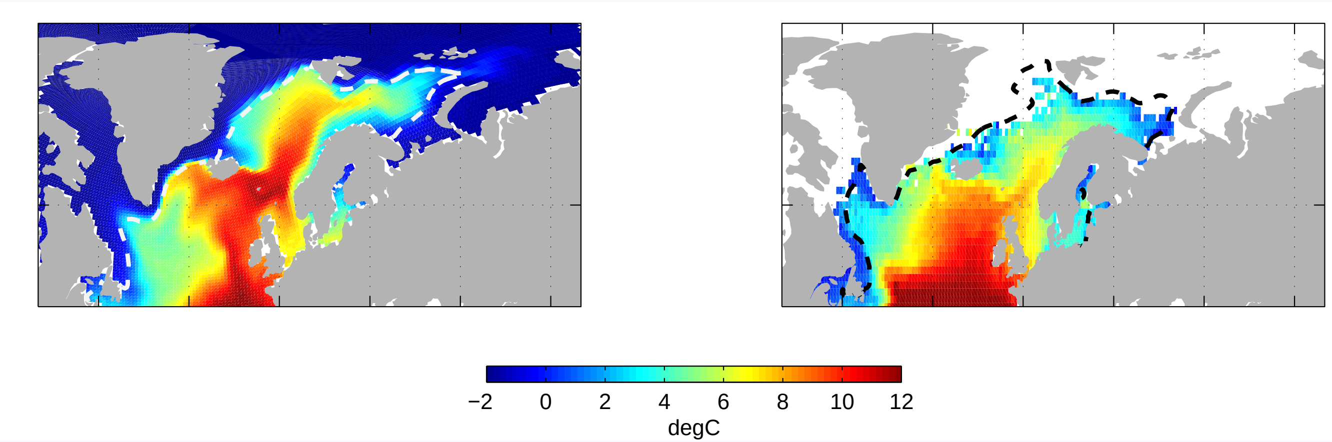
1) downward shortwave deficit over sea ice



Observations from Persson et al. "Measurements near the Atmospheric Surface Flux group tower at SHEBA: Near-surface conditions and surface energy budget", JGR, 2002.

2) too strong heat transport into Norwegian and Barents Seas

DJF CCSM2.0 COADS and microwave sea ice edge



Additional CSIM progress and plans not mentioned in Science Plan

1) CSIM Vectorization - Julie Schramm
2) CSIM Core Requirements List - Elizabeth Hunke/Julie Schramm

Future work - not planned yet

1) characterization of ice types and their influence on physics: enhanced melt and mechanical disintegration of ridges/keels, pancake ice growth, melt ponds, and lateral melt of floes.

2) ice dynamics: ice rafting, anisotropy of ice mechanics near coasts, and ice-ocean drag formula, new rheology