



CLIMATE, OCEAN AND SEA ICE MODELING PROGRAM

Update on CICE Activities

Elizabeth Hunke

June 16, 2009

Outline

- 1 The Current State of the Model
- 2 The Sea Ice Age Tracer
- 3 CICE Development Activities at LANL
 - Ice – ocean dynamic coupling
 - Hydrology
 - Biogeochemistry
 - Ice berg – sea ice interactions
 - New/improved parameterizations from users

CICE 3.14

August 2006

version 3.14

- energy conserving, multi-layer thermodynamics
- ice thickness distribution with 5 categories and open water
- variables/tracers (for each thickness category):
 - ice area fraction
 - ice/snow volume in each vertical layer
 - ice/snow energy in each vertical layer
 - surface temperature
- elastic-viscous-plastic (EVP) dynamics
- incremental remapping advection
- energy-based, multi-category ridging and ice strength
- nonuniform, curvilinear, logically rectangular grids
- Fortran 90
- parallelization via the Message Passing Interface (MPI)
- netCDF or binary input/output
- users in many countries, dozens of institutions

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version 4.0

multi-layer snow
multiple-scattering radiation

ice age
melt ponds

tripole grids
regional configuration
cache-based decomposition
more coupling/forcing options
available to collaborators through
 subversion repository

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3D salinity
ice age
melt ponds
algal ecosystem
ice bergs

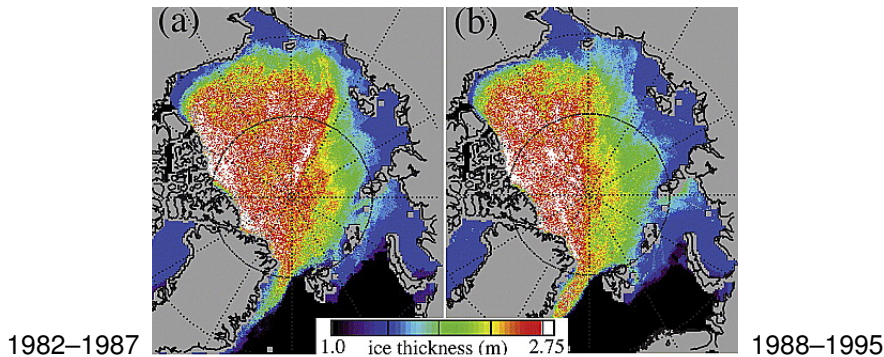
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multi-frequency history output

CICE wiki: <http://oceans11.lanl.gov/trac/CICE>

Thickness proxy from satellite-derived age estimates

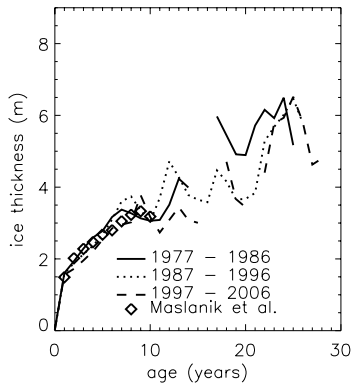
Maslanik et al., *Geophys. Res. Lett.* **34**, 2007

ice concentration + velocity \Rightarrow age
laser altimetry \Rightarrow thickness



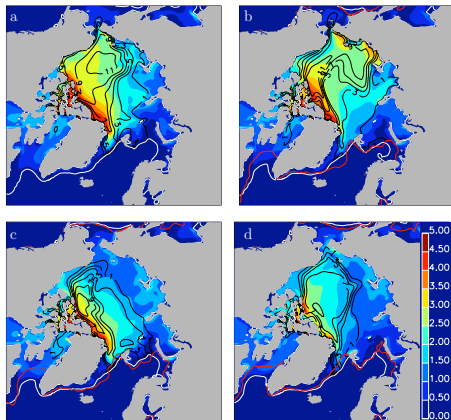
March ice thickness vs. age

Hunke, E. C. and C. M. Bitz, Age Characteristics in a Multidecadal Arctic Sea Ice Simulation, *J. Geophys. Res.*, accepted



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How much is necessary for climate modeling?

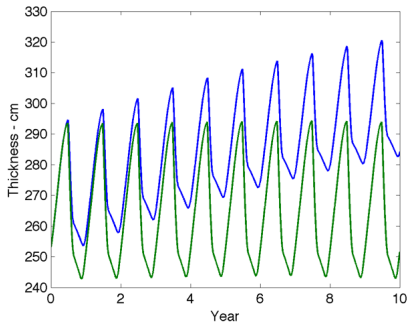
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Prognostic salinity

Green:
Well flushed
Ice bulk salinity
Currently
in CCSM

Blue:
Late spring
C-shaped
Bulk Salinity

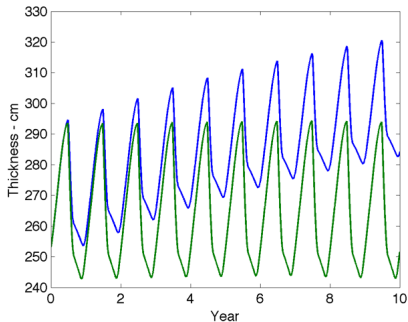


● Cecilia Bitz
University of Washington

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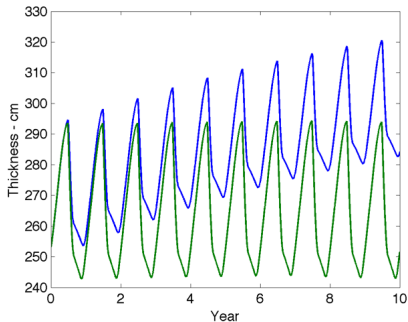
● Postdoc

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● Wang Xiucheng

Chinese Academy of Sciences

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Sea Ice Ecosystem

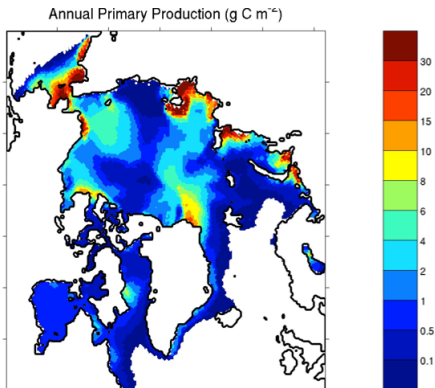
- 
- Scott Elliott
Nicole Jeffery
Mat Maltrud

Los Alamos National Laboratory

- Clara Deal
Meibing Jin

IARC, University of Alaska, Fairbanks

Sea Ice Ecosystem



- stand-alone CICE
- WOA nutrient climatology
- nitrate, silicate, ammonium, DMS(P)
- limiting by light, nutrients, melting
- coupled POP-CICE ecosystem in progress

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- Berg data: Todd Arbetter (National Ice Center)

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We rely on—and greatly appreciate—input from our community of users, especially CCSM.