



CESM Update

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CESM Chief Scientist

CESM

Management Working Group Changes

Merger of Climate Variability
and Climate Change Working
Groups

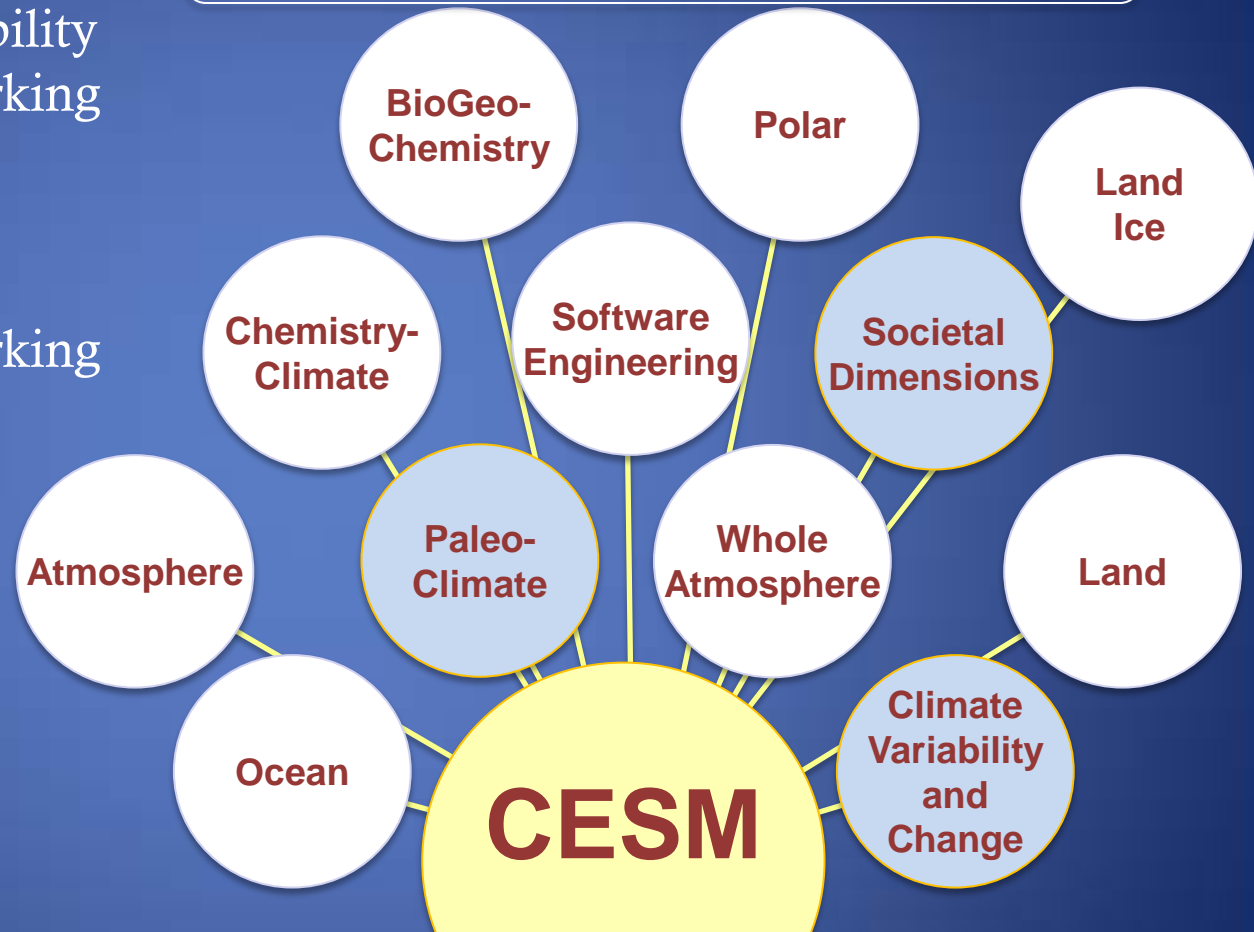
Formation of
Societal Dimensions Working
Group



CESM is primarily sponsored by
the National Science Foundation
and the Department of Energy

CESM Advisory Board

CESM Scientific Steering Committee



<http://www.cesm.ucar.edu/management>



CESM Tutorial

- Third Annual CESM Tutorial planned for 30 July – 3 August, 2012
- Announcement is out and applications are being accepted
- We are again targeting about 80 participants
- Thanks to Dave Bailey for chairing the organizing committee

<http://www.cesm.ucar.edu/events/tutorials/073012/announcement.html>



CESM Project Updates/Announcements

Experiments

Information from <http://www.cesm.ucar.edu/experiments/cesm1.0/index.html>

Community Earth System Model

CESM 1.0 EXPERIMENTS, DATA AND DIAGNOSTICS

Stand-Alone Diagnostics

- CAM4.0
- CAM5.0
- CLM4.0
- CICE4.0
- POP2

J. Climate Special Issue Collection

- CCSM4
- CESM1 (restricted)

Note that although CESM1.0 supersedes CCSM4.0, users can run equivalent CCSM4.0 experiments from the CESM1.0 code base. Also note that the CCSM4.0 experiments below are equivalent to running CESM1.0 (CAM4). All current CESM release codebases (e.g. cesm1_0, cesm1_0_1, etc.) can also reproduce the climates shown below.

If you still have questions after reviewing the details of the model runs below, it is recommended that you contact the relevant CESM Working Group Liaison.

Note about CCR diagnostics: Sudden large spikes in CCR diagnostic fields most likely indicate a CCR software diagnostics failure, and have absolutely nothing to do with the fidelity of the simulation. Use CCR diagnostics with caution.

Jump To: Control Simulations, 20th Century Single-Forcings Simulations, 20th Century All-Forcings Simulations, RCP Simulations, AMIP Simulations, CO₂ Simulations, Paleoclimate Simulations

CONTROL SIMULATIONS

Brief Description	Case Details	Diagnostics				Length of Run Diagnostics		
		Atm	Ice	Land	Ocean			
CCSM4 1* Pre-Industrial Control Case Name: b40.1850.track1.1deg.006 Data Location: ESG	Details	863-892 w/observations	Atm	Ice	Land	Ocean	CCR	Ocean Timeseries
		863-882 - CCSM3 T85 Pre-Industrial Control	Atm	Ice	Land	Ocean		
CCSM4 1* Pre-Industrial Control (MOAR) Case Name: b40.1850.track1.1deg.006a Data Location: ESG	Details	1050-1079 w/observations	Atm	Ice	Land	Ocean	---	Ocean Timeseries
CCSM4 2* Pre-Industrial Control Case Name: b40.1850.track1.2deg.003 Data Location: ESG	Details	501-530 w/observations	Atm	Ice	Land	Ocean	CCR	Ocean Timeseries
		501-520 - CCSM3 T42 Pre-Industrial Control	Atm	Ice	Land	Ocean		

PI Controls

- CCSM4: 1°, 2°, T31,
- CESM1: BGC, FASTCHEM, WACCM

20C runs

- All forcings-6 members
- single forcings

RCPs 2.6, 4.5, 6.0, 8.5

- 6 ensemble members

Paleoclimate Runs:

- Last Millenium, LGM, Mid-Holocene

Additional CESM1.0(CAM5) runs including 1° and 2° 1850, 20C and RCPs



CESM Project Updates/Announcements

Experiment Data Release

Information from <http://www.cesm.ucar.edu/experiments/cesm1.0/index.html>

CESM Earth System Grid Collection

CCSM4 and CESM1 long-term runs and post-processed single-field output, includes;

- CESM1 PI controls with BGC, FASTCHEM, WACCM
- Paleoclimate simulations
- CCSM4 20C and RCPs
- CCSM4 20C Single Forcing Simulations



CESM Project Updates/Announcements

Experiment Data Release CMIP5 Archive

- CCSM4 simulation output for atmosphere, ocean, land, sea ice available for many fields for:
 - Preindustrial control, historical (20C) runs, RCP simulations
- Atmospheric output from CCSM4 paleoclimate runs available for:
 - Mid-Holocene
 - Last Glacial Maximum
 - Last Millennium (some land data also)
 - Ocean, Sea Ice, Land output from these runs arriving soon
- Atmospheric output from 1%CO2 run available
- Atmospheric output from historical single forcing runs
- CESM1(BGC) and Decadal prediction runs coming soon
- Other runs (CESM-CAM5, etc) to follow



CCSM4/CESM J. Climate Special Collections

- 24 Papers available via AMS early-online release
- Numerous other papers in various stages of review
- Many CESM papers still in preparation
- Document major model components and numerous aspects of simulated variability and change



The screenshot shows the AMS Journals Online website. At the top, there are logos for the American Meteorological Society and AMS Journals Online. Below the logos, there are navigation links: Journals, Subscribe, For Authors, Information, and Online Help. A search bar is visible on the right side. The main content area is titled "CCSM4 Special Collection" and "CESM1 Special Collection". Under "CCSM4 Special Collection", there is a "Theme Description" section that states: "This collection consists of papers analyzing results from the recently completed and released Community Climate System Model, version 4; see <http://www.cesm.ucar.edu/models/cesm4/>. The coupled simulations range from runs of past paleoclimates, a long preindustrial control, forced by 1850 conditions, an ensemble of 20th century runs, and four ensembles of the future climate using different Representative Concentration Pathways." Below this, there is a "CESM1 Special Collection" section with a "Theme Description" that states: "The second part of this collection has papers analyzing results from the recently completed and released Community Earth System Model, version 1; see <http://www.cesm.ucar.edu/models/cesm1.0/>. The new components that are available which turn it into an Earth System Model are: carbon cycle modules in the land, ocean, and atmosphere components; an interactive chemistry component in the atmosphere; a version of the atmosphere that reaches into the upper stratosphere, called WACCM; and a completely new land ice component. In addition, an updated version of the atmosphere component, CAM5, is available, which uses several new parameterizations, and can simulate the indirect effects of aerosols." Below the descriptions, there is a section titled "The CCSM4/CESM1 Special Collection organizers are:" followed by the names and affiliations of Peter Gutz and Jim Harrell. At the bottom of the screenshot, there is a list of abstracts for AMS articles, including titles like "Tropical Atlantic Biases in CCSM4", "Climate system response to external forcings and climate change projections in CCSM4", "Climate Sensitivity of the Community Climate System Model Version 4", "Contrasts between urban and rural climate in CCSM4 CMIP5 climate change scenarios", and "Late 20th century simulation of Arctic sea ice and ocean properties in the CCSM4".

<http://journals.ametsoc.org/page/CCSM4/CESM1>

CESM Project Updates/Announcements

Model releases:

Near Future Releases

Mid-Late February – CESM 1.0.4

- Capability for Interannual Forcing for data atmosphere model
- WACCMX capability (vertical extension of WACCM through thermosphere/ionosphere ~500km)
- Pre-tag testing complete



CESM Project Updates/Announcements

Model releases:

Near Future Releases –

Spring (early June) Release CESM1.1.0

- Spectral Element (SE) Dynamical Core (HOMME) in CAM
- Control Runs (~1-degree) to include:
 - Short (~200 yr) control,
 - 1XCO₂ run, 2XCO₂ SOM runs
- Possible functionality additions: high resolution land datasets, chemistry in CAM5, orography generating tools, others



Proposal for Climate Simulation Laboratory Computational Resources

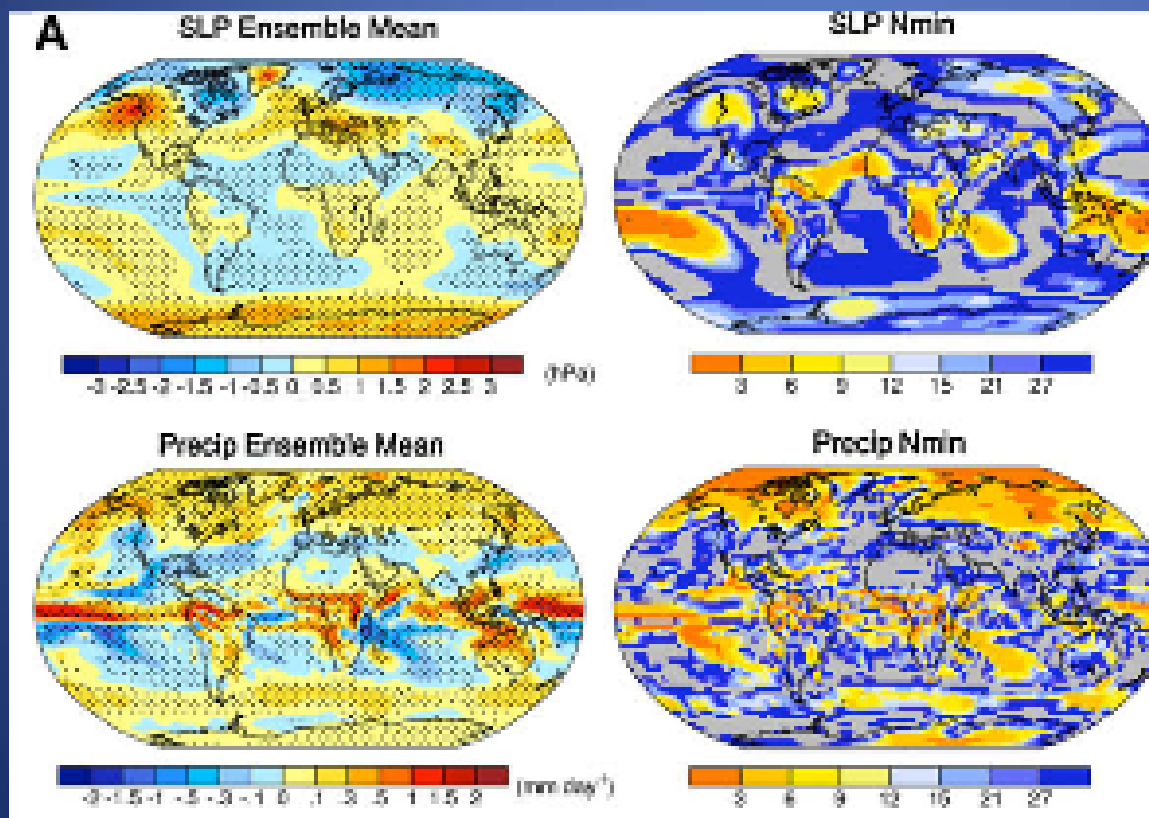
- Dedicated climate model computing facility
- Supported by the multiagency USGCRP
- Yellowstone resources available at the NWSC Center CSL Resources August, 2012-January, 2014
- Working Groups requesting resources for Development and Production simulations
- Additional “Community Projects” are proposed
 - Broad cross-working group simulations with numerous scientific applications



Proposed Community Projects

Large Ensemble Project. 1950-2099 (RCP 8.5):

- 40 members, CESM-CAM5 with BGC
- 10 members, CESM-CAM5 with atmospheric chemistry
- 10 members, CESM-WACCM (2°)
- 10 members, CESM1.5



CCSM3 40-member ensemble mean epoch Differences for DJF (2051–2060 minus 2005–2014)

(Right) minimum number of members needed to detect a significant epoch difference response

From Deser et al., 2010

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Last Millennium Ensemble Project. 850-2005

- 10 members, CESM-CAM5, 2°
- 4 members, single forcings (GHG, Volcanic, Solar Variability)
- 1 member, land-use, orbital changes
- 2 members with WACCM5



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High Resolution Control Integration

- Spectral Element Dynamical Core,
- 0.25° Atm, 1° Ocean/Ice
- 300-year integration



Where we are heading

- Capability for Higher Spatial Resolutions
- New Earth System Component Capabilities
- Improved Model Processes



Increasing Model Capabilities

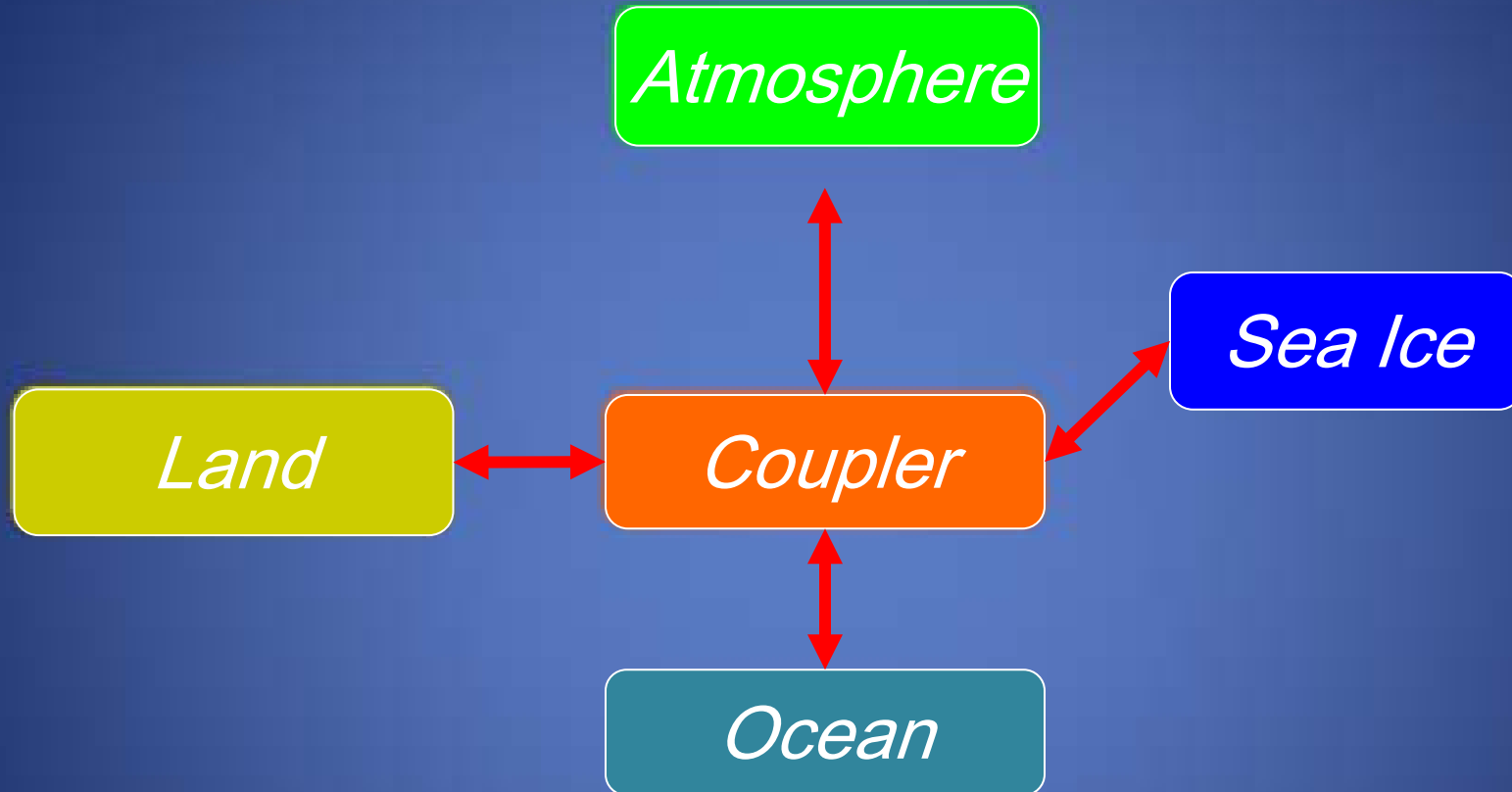
A subset of developments underway/being considered:

- Coupling to (Data Assimilation Research Testbed) DART, multi-instance capability
- Super-parameterization
- Ocean wave model (WaveWatch)
- Ionosphere Model
- Refined and regional grids
- Water and Carbon Isotopes
- New atmosphere dynamical cores
- New Land Ice dynamical cores
- And More...



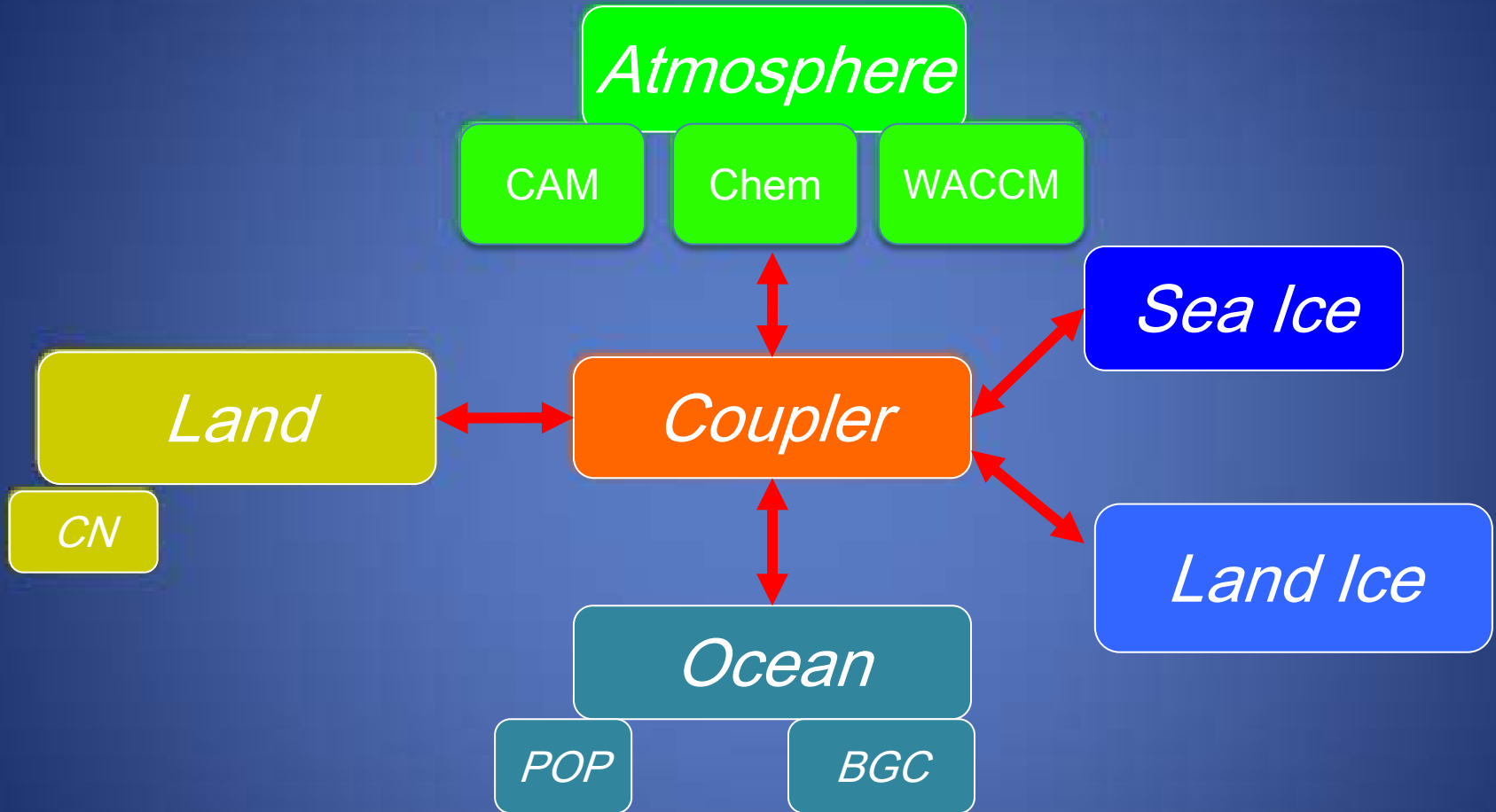
Increasing Components/Capabilities

Community Climate System Model

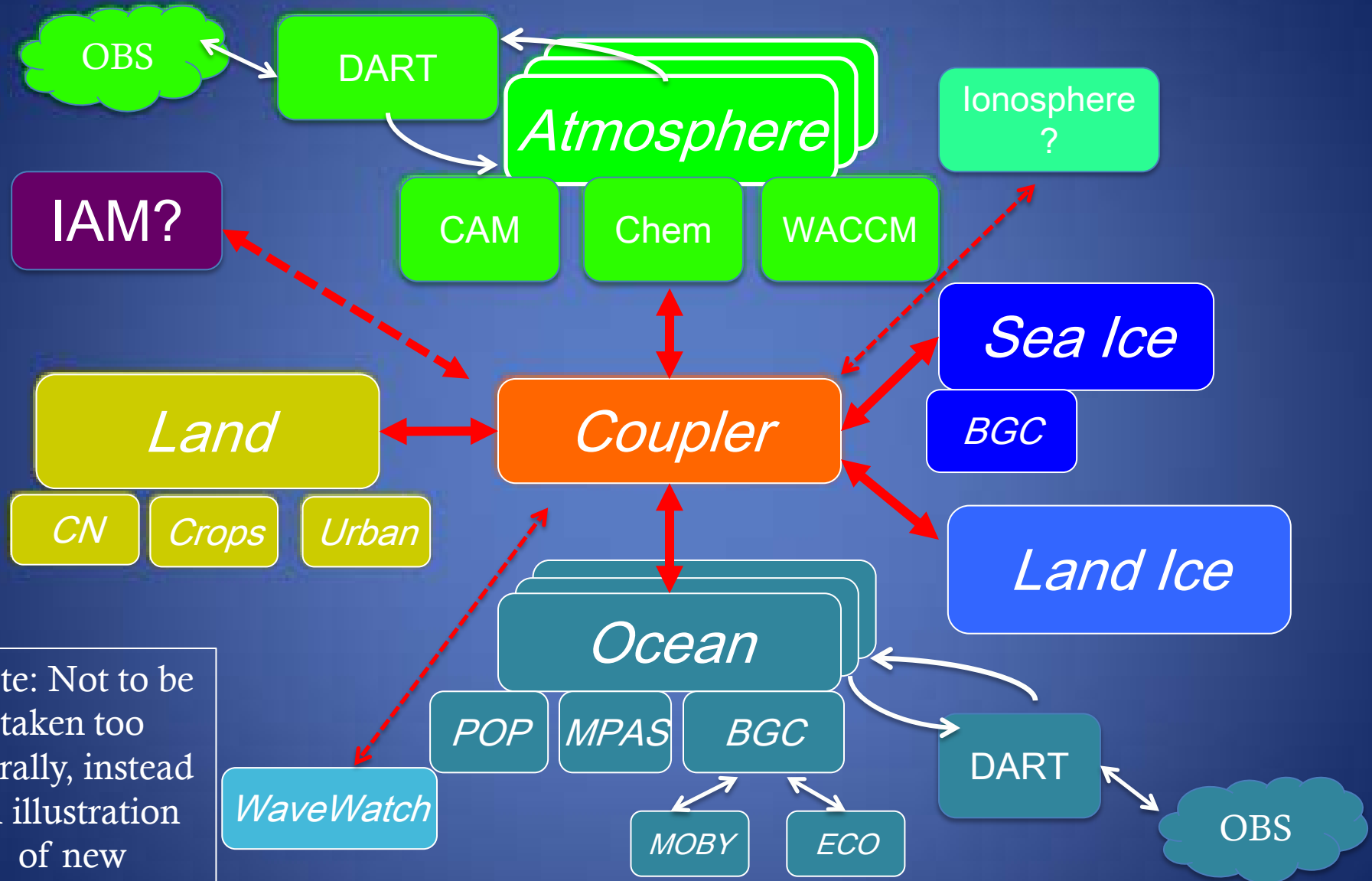


Increasing Components/Capabilities

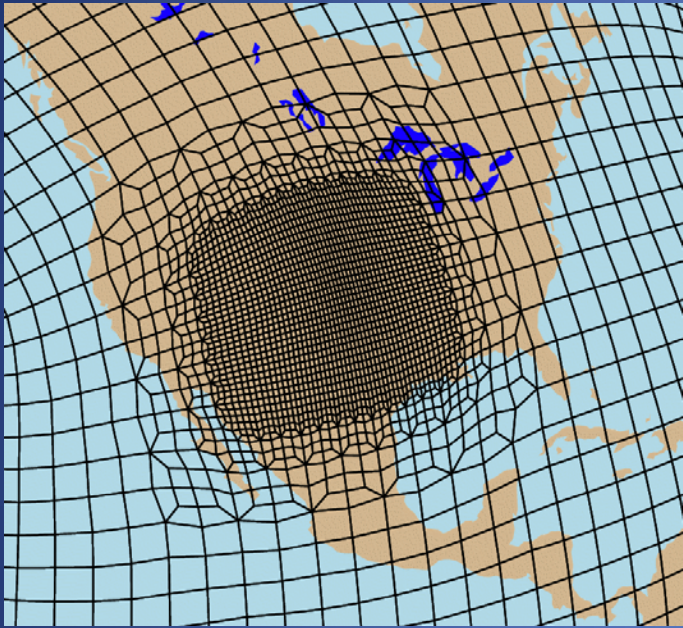
Community Earth System Model



Increasing Components/Capabilities



Capability for Higher Resolution/Refined Grids



Regional refinement
(1° to $1/8^\circ$ over USA)

Progress on unstructured grids

Land can run on same grid – user sets up customized Input files as pre-build step (new tool chain capability)

Also introducing regional modeling capabilities (WRF)

New Developments Enable New Science

For Example:

- Assess the importance of new feedbacks and interactions
- Examine regional variability/change
- Apply new tools (isotopes, etc.) to studies of climate variability and change



Questions?



Some Polar Science

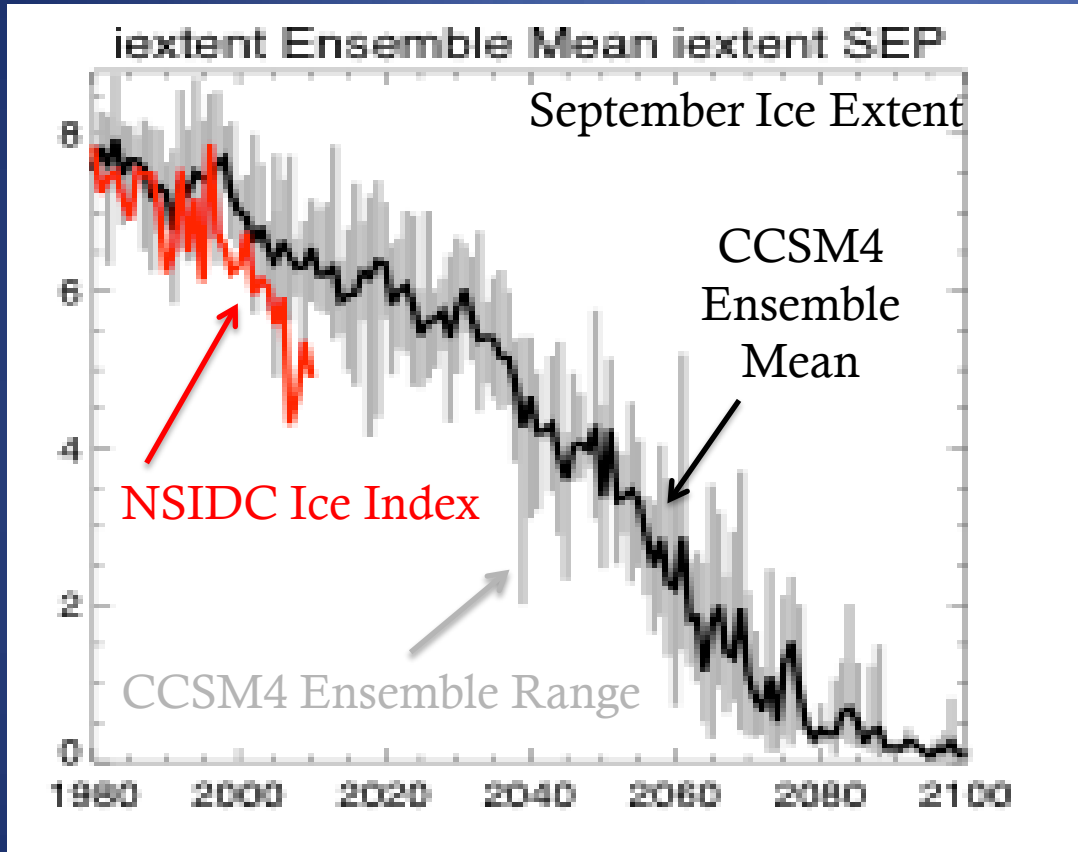


Land Ice, Polar Climate, Paleoclimate Working Group Meeting
February, 2012

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Simulated Future Arctic Change



- September Extent with RCP8.5 Scenario
- Reaches near ice-free conditions by ~2070
- Significant polar amplification

Vavrus, S. J., M. M. Holland, A. Jahn, D. A. Bailey, and B. A. Blazey, 21st-Century Arctic Climate Change in CCSM4. *J. Climate*, 2011, accepted

Simulated Sea Ice Seasonal "Triggers" Timing of Melt Season Onset, Freeze-Up

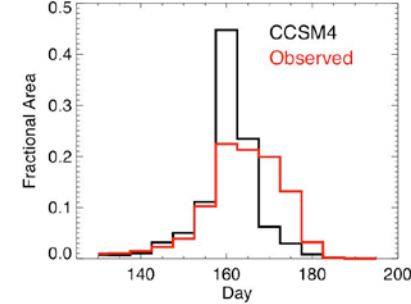
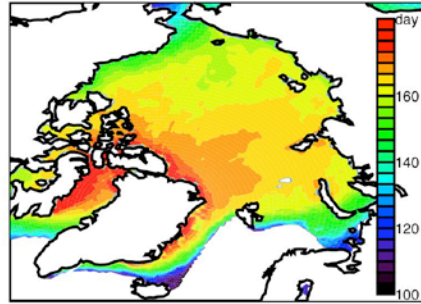
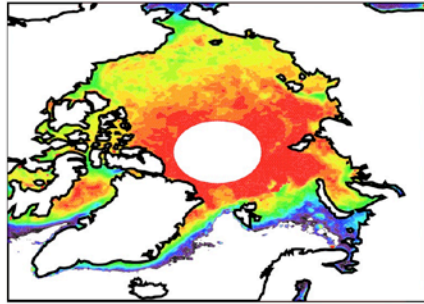
Satellite-derived
Markus et al., 2009

CCSM4

Melt Onset Model

Melt Onset

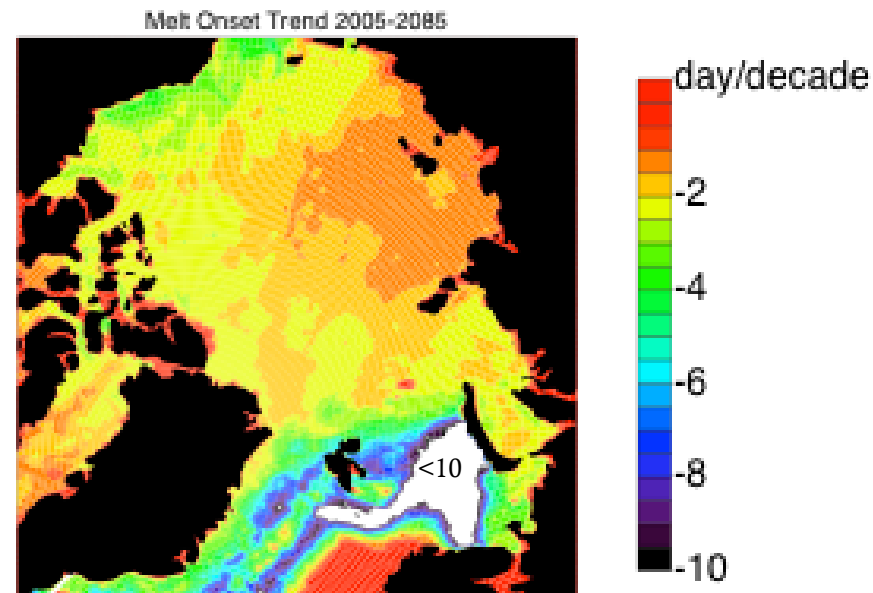
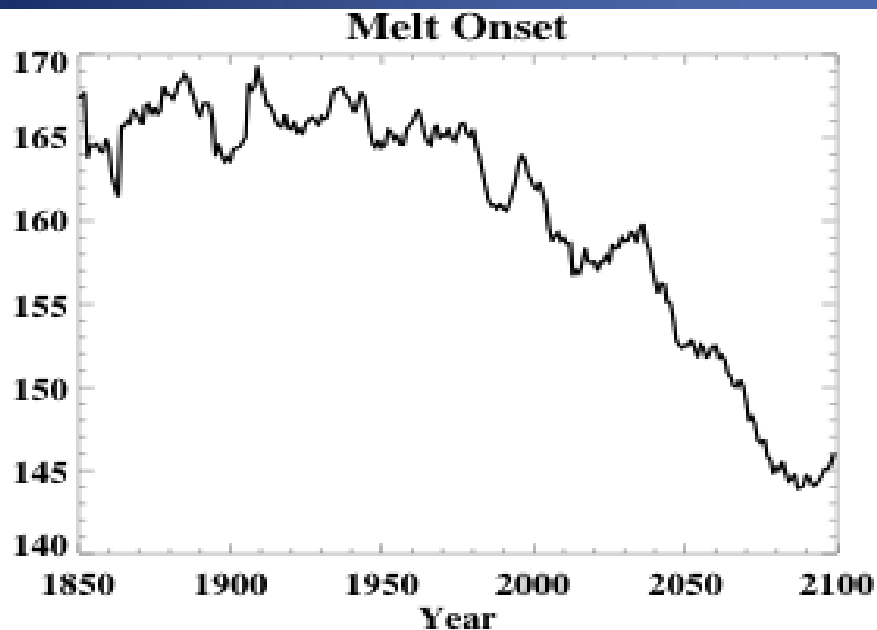
Melt Onset



(From Jahn et al., 2011)

Arctic Change - Melt Onset

Melt Onset Trend 2005-2080

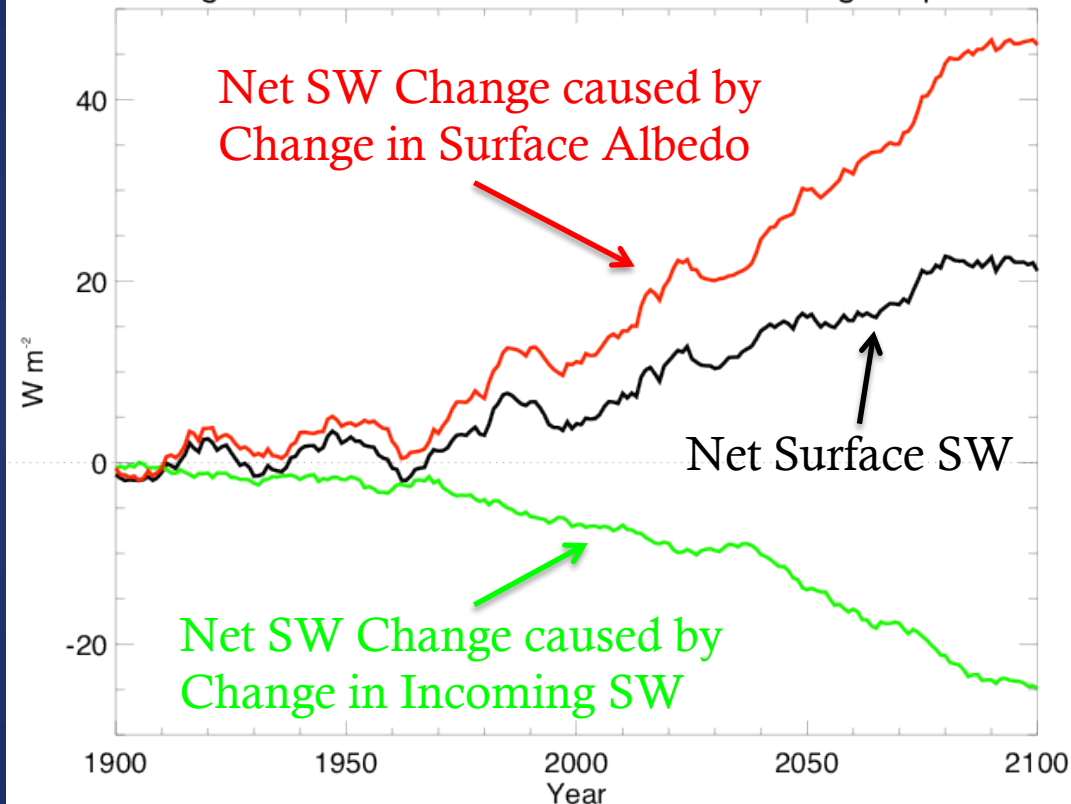


Earlier surface Melt Onset

- From ~2 - 10 days earlier per decade depending on location
- For Arctic average, trend is ~2 days/decade over 21C

Changing Net Shortwave Budgets

Change in Arctic Surface Net Shortwave Budget April-Oct



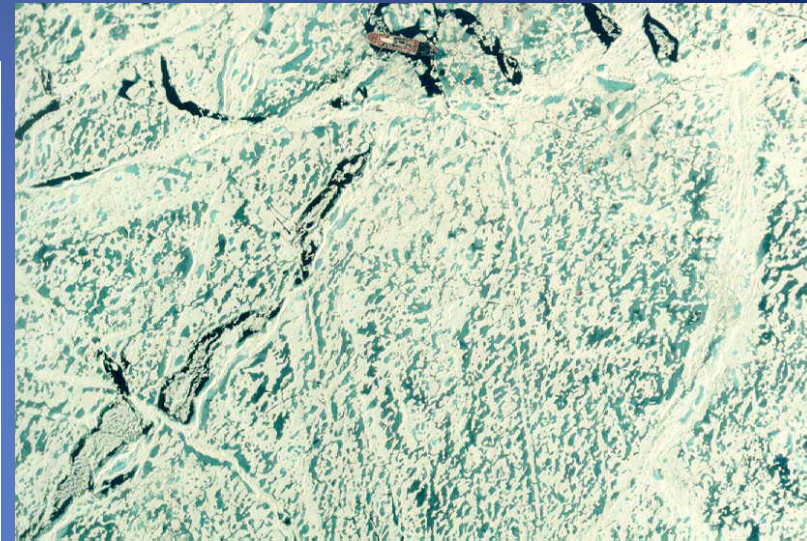
Net April-Oct SW increases $\sim 20 \text{ W/m}^2$

Less **Incoming SW** due to increased clouds and reduced multiple-reflections

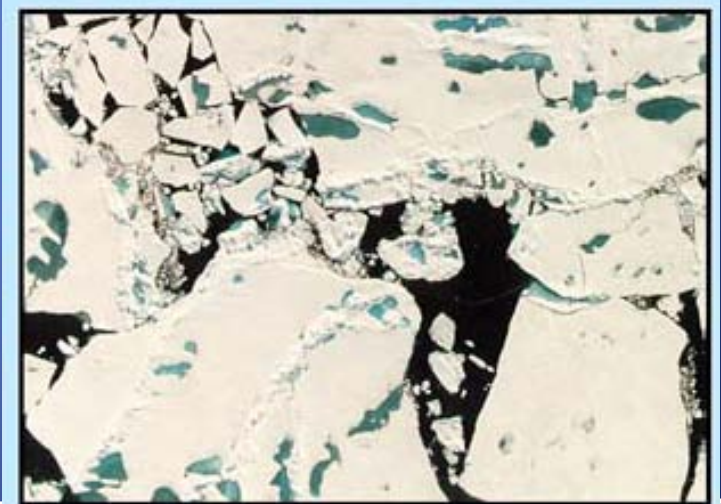
Less reflection due to a decreasing surface albedo

Changing Net Shortwave Budgets

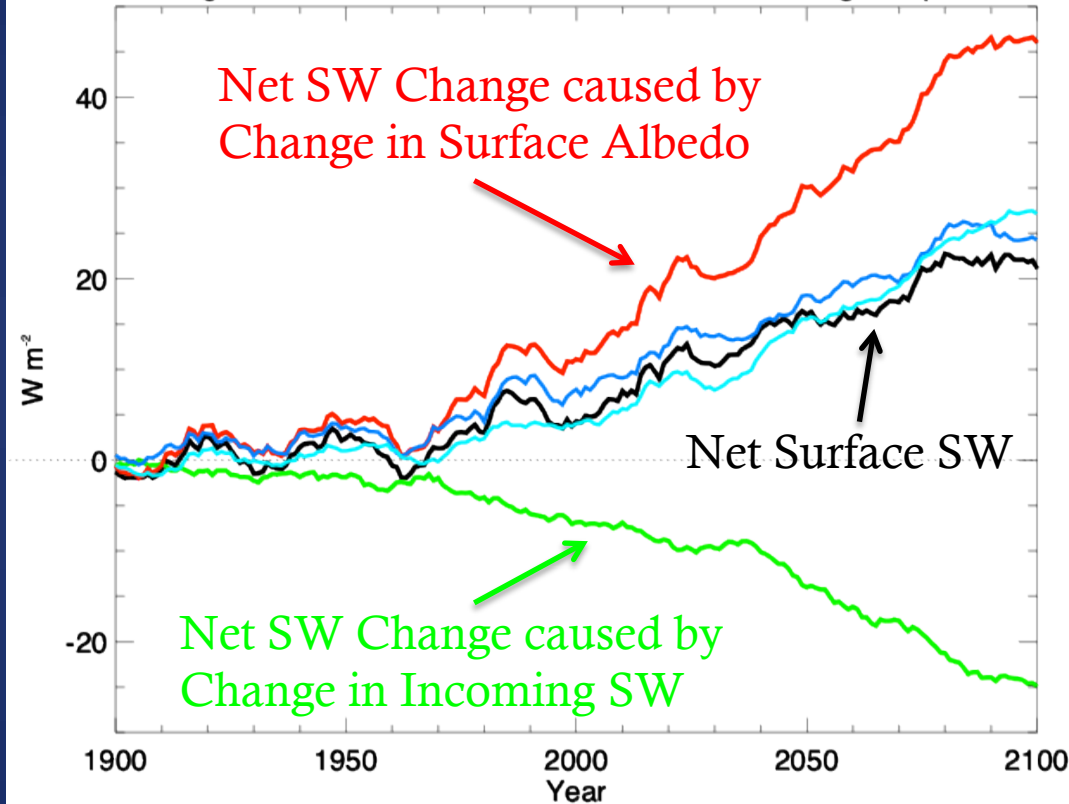
Albedo - Sea Ice Component



Albedo - Ice Area Component



Change in Arctic Surface Net Shortwave Budget April-Oct



Extra Slides

