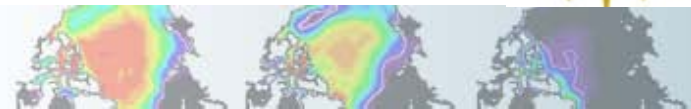


Future Development Plans

Short and Long Term

Atmospheric Model Working Group

NCAR is sponsored by the National Science Foundation



CAM Strategic Planning Process

- ✓ Draft document from core AMWG developers (led by Andrew Gettelman)
- ✓ Discussed and amended at the AMWG winter meeting in January 2010

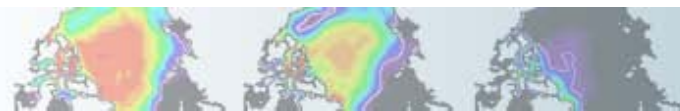
Available on AMWG website:

http://www.cesm.ucar.edu//working_groups/Atmosphere/

CAM Evolution



Model	CCSM3 (2004)	CCSM3.5 (2007)	CCSM4 (Apr 2010)	CESM1 (Jun 2010)
Atmosphere	CAM3 (L26)	CAM3.5 (L26)	CAM4 (L26)	CAM5 (L30)
Boundary Layer	Holtslag and Boville (93)	Holtslag and Boville	Holtslag and Boville	UW <i>Diagnostic TKE</i> Park et al. (09)
Shallow Convection	Hack (94)	Hack	Hack	UW <i>TKE/CIN</i> Park et al. (09)
Deep Convection	Zhang and McFarlane (95)	Zhang and McFarlane Neale et al.(08), Richter and Rasch (08) mods.	Zhang and McFarlane Neale et al., Richter and Rasch mods.	Zhang and McFarlane Neale et al., Richter and Rasch mods.
Stratiform Cloud	Rasch and Kristjansson (98) <i>Single Moment</i> Zhang et al. Macrophysics (03)	Rasch and K. <i>Single Moment</i> Zhang et al. Macrophysics	Rasch and K. <i>Single Moment</i> Zhang et al. Macrophysics	Morrison and Gettelman (08) <i>Double Moment</i> Park Macrophysics Park et al. (10)
Radiation	CAMRT (01)	CAMRT	CAMRT	RRTMG Iacono et al. (2008)
Aerosols	Bulk Aerosol Model (BAM)	BAM	BAM	Modal Aerosol Model (MAM) Ghan et al. (2010)
Dynamics	Spectral	Finite Volume (96,04)	Finite Volume HOMME	Finite Volume HOMME
Ocean	POP2 (L40)	POP2.1 (L60)	POP2.2	POP2.2 – BGC
Land	CLM3	CLM3.5	CLM4 – CN	CLM4
Sea Ice	CSIM4	CSIM4	CICE	CICE



CAM Strategic Plan

Science Goals:

- Enable credible climate simulation and prediction across scales
- Build functionality to meet different user needs.
- Provide a robust tool for conducting application or curiosity driven science

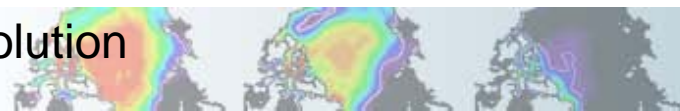
Short term plan (two years)

1. Understanding and Reducing existing model biases

- Clear-sky long-wave radiation biased low at TOA
- Strong anthropogenic indirect cloud effect (shortwave)
- Deficient amount of middle and low clouds
- Low in-cloud water content
- Biases in MJO, diurnal cycle of precipitation
- Excessive amplitude in El Nino SST anomalies (nino3)
- Double ITCZ
- Large seasonal amplitude of mid-latitude land surface temperature
- Biases in precipitation and weather statistics

2. High resolution

- Develop, integrate and test dynamical cores to support high resolution simulations (HOMME, MPAS etc.)
- Conduct and analyze high-resolution simulations (0.5 degree and 0.25 degree)



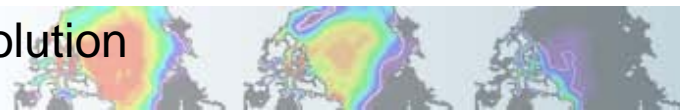
Short term plan (two year)

3. Improved parameterizations

- Specific components are outlined in http://www.cesm.ucar.edu//working_groups/Atmosphere/ for convection, cloud microphysics and macrophysics, boundary layer turbulence, gravity waves, chemistry, aerosol, and radiation
- MMF

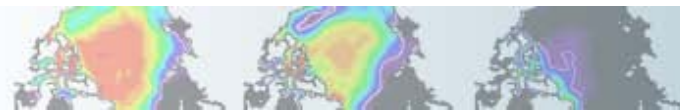
4. Evaluation and Validation

- Develop, use and distribute improved evaluation tools and metrics (observations, simulators, testbeds)
- Conduct and analyze IPCC AR5 simulations
- Improve community collaborations



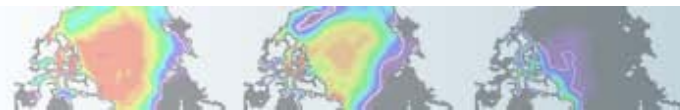
Long term plans

1. Enable high resolution simulations of regional climate change by pursuing multiple paths (Nested model, HOMME, MPAS etc.)
2. Develop physical parameterizations that work across scales: cloud permitting -> mesoscale -> global (see science plan for details)
3. Build functionality for user specific applications

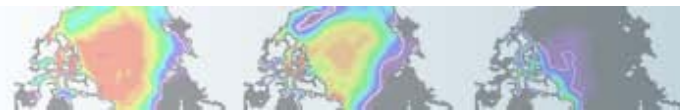


Climate Science for a Sustainable Energy Future (CSSEF)

- ✓ DOE cross-lab effort to reduce uncertainty in climate science
- ✓ CESM will be the major research tool
- ✓ Deliver science improvements to CAM6/7
- ✓ Atmosphere component
 - ✓ Science goal: Improved hydrologic cycle
 - ✓ Develop a high resolution global model using HOMME (≤ 12 km)
 - ✓ Use regional refinement to calibrate model (ARM sites)
 - ✓ Utilize test-bed framework (e.g., CAPT, FASTER)
 - ✓ Perform uncertainty quantification (UQ) methods to inform calibration
 - ✓ Validate in global high-resolution climate simulations
- ✓ High resolution goals dovetail well with CAM strategic plan



Comments and Discussions



1. CAM4 and CAM5
2. Resolutions
3. How to participate and contribute
4. AMWG meeting

