Plans for the CCWG: 2007 and beyond

CCWG co-chairs Gerald A. Meehl, Warren M. Washington, and Ben Santer
CCWG activities in the past year

PCM and CCSM3 made significant contributions to the IPCC AR4 (through individual papers focusing specifically on PCM and CCSM3, and PCM and CCSM3 data in the CMIP3 multi-model dataset at PCMDI now accessed by over 1000 scientists, and over 200 papers published so far); analyses of PCM and CCSM3 climate change experiments are ongoing

CCSM3 T42 30 member ensemble (with CVWG), 2000-2061

CCSM3 5 member ensembles, 20th century experiments with natural forcings, and with anthropogenic forcings

CCSM3 carbon aerosol 6 member ensemble

Test runs of T170 version of CCSM3

Formulate mitigation scenario experiments
A strategy is being proposed by the WCRP Working Group on Coupled Models (WGCM) and Analysis Integration and Modeling of the Earth System (AIMES) for an experimental design addressing aspects of near term and longer term stabilization experiments.

Begun at an Aspen Global Change Institute session August 2006, and continued at a joint WGCM/AIMES meeting in Victoria September 2006.

EOS article summarizing process appeared several weeks ago (Hibbard, Meehl, Cox and Friedlingstein, 2007: A strategy for climate change stabilization experiments, EOS).

And a WCRP/CLIVAR/IGBP white paper (Meehl and Hibbard, 2007) contains more details.

Designed to directly coordinate climate modeling, impacts and scenario communities (IPCC WGs 1, 2, and 3).
Two classes of models for two time frames and types of scientific questions:

1. Near term (decadal prediction), out to 2030, high resolution, chemistry and aerosols, no carbon cycle feedback, single scenario (e.g. regional climate change, extremes)

2. Longer term, out to 2100 and beyond, lower resolution, carbon cycle, two benchmark stabilization concentration scenarios, low and high, (e.g. quantify carbon cycle feedbacks, relative effects of policy actions for mitigation/adaptation)
• Forward approach: start with socio-economic variables

• Reverse approach: start with stabilization scenario concentrations
**Experiment #1:**
Carbon Cycle sees increasing CO2 Concentrations and \( \Delta T \);
Land/Ocean CO2 fluxes saved to derive emissions for WG3

\[
\begin{align*}
\text{CO2 seen by carbon cycle and atmosphere} \\
\text{Land/Ocean CO2 fluxes are NOT interactive with atmosphere}
\end{align*}
\]
Experiment #2:
Carbon Cycle sees $CO_2$ Concentrations from Experiment #1; atmospheric $CO_2$ and $T$ are constant; 
Land/Ocean $CO_2$ fluxes saved to derive emissions for WG3

Difference in derived emissions between experiments 1 and 2 is magnitude of carbon cycle feedback in terms of emissions

\[ \Delta T \approx 0 \]

Land/Ocean $CO_2$ fluxes are NOT interactive with atmosphere
Experiment #3: fully coupled ESM driven by emissions
emissions from Exp. #1 are used to drive carbon cycle-climate model; difference in
climate change between experiment 1 and 3 is magnitude of carbon cycle feedback in
terms of climate change
Interpolation between benchmark scenarios done by pattern scaling and use of EMICs

Groups with either ESMs or AOGCMs can participate

Experiments are being planned to address science questions of interest to the communities involved, but could also be the basis for assessment in a possible IPCC AR5 (TBD spring, 2008)

Experiments to be done with versions of CCSM4 in about 2009-2010 time frame
Feedback solicited from modeling community leading to WGCM meeting September, 2007, Hamburg

“Scenario consortium” planning September 2007 meeting in Amsterdam to determine benchmark concentration scenarios (lead-in EMF meeting in Snowmass, CO, July, 2007)

Benchmark scenarios finalized spring 2008

Most modeling groups will finalize new model versions about 2009 and begin running experiments around 2009-2010
NCAR: Analysis of climate variability: Abrupt Climate Change, Extremes, ENSO, Southern Annular Mode

NCAR: Large ensembles and climate change signals (with CVWG)
NERSC: Ice sheet de-stabilization / sea level rise scenarios using dynamic ice sheet model
NERSC: Sulfate direct forcing
ORNL: Mitigation scenarios to precede fully coupled carbon cycle
ORNL: High-resolution future scenarios T170/FV1x1 & x1 POP
ORNL: Special DOE Scenarios for future US energy strategies

NCAR: Analysis of climate variability: Forced vs unforced decadal variability, extremes, water cycle, Arctic & North Atlantic Oscillation, Large Ensembles

NCAR: Analysis of specified hurricane simulations
NERSC: 1000 Year CCSM4 Biogeochemistry Control Run:
Carbon & nitrogen cycles + dynamic vegetation with BGCGW
NERSC: Low emissions scenarios
NERSC: Sulfate indirect forcing
ORNL: Climate Change 2100 & beyond
ORNL: Prognostic carbon aerosol forcing; coupled ice sheet runs
ORNL: Near-term High-resolution climate predictions (1980-2030)
ORNL: Special DOE US energy strategy scenarios

CCWG/CCP Research 2007-2012
June 14 2007

2007
- CSM carbon cycle
- BGC development

2008
- 1000 year CCSM4
- BGC Control Run

2009
- CCSM4 Release
- AR5 preparation

2010
- IPCC AR5 runs

2011-2012
- Very high Resolution

ALL: IPCC AR5 Simulations
NCAR: Analysis of climate variability: Monsoons & monsoon breakdown threshold: Role of aerosols
NCAR: Analysis of climate variability:
Climate change detection and attribution including regional effects of urbanization.
NCAR: IPCC AR5: Adaptation and Mitigation Scenarios
NERSC: IPCC AR5: Long-term stabilization Scenarios
NERSC: Geographic representations of probabilistic climate change
ORNL: IPCC AR5: Short-term, high-resolution
ORNL: Ultrahigh-resolution historical simulations: 0.2′Atm x 0.1′POP
ORNL: Special DOE Scenarios for future US energy strategies

NCAR: Climate change with cloud-system and cloud resolving (1-10km) models
NERSC: Very High-resolution Decadal Prediction of climate
ORNL: Very High-resolution stabilization experiments,
near-term and century time-scales
CCSM4 & IPCC AR5 Timeline

- Jun 06 CCSM Workshop
- Aug 06 Aspen Global Change Institute Workshop - design Coordinated Stabilization Experiments
- Oct 06 Working Group on Coupled Models (WGCM) - CSE proposal Approved

Jun 1 '07  Low emissions scenarios (NCAR/NREL/PNNL Collaboration)
Aug 1 '07  Prototype near term experiments (1980-2030)

Jun 1 '07  CCSM Workshop
Sep 1 '07   WGCM meeting - Formalize CSE design
Sep 19 '07  IPCC scenarios workshop (Amsterdam) - Propose benchmark stabilization scenarios
Mar 1 '08   Finalize benchmark stabilization scenarios
Jun 1 '08   CCSM Workshop

CCSM4 development

Jan 1 '09  Finalize CCSM4 Config (BGC, DynLand, AtmChem)
Jan 1 '09  CCSM4 1000yr Control
Jun 1 '09  CCSM4 Release
Jul 1 '09  CCSM4 AR5 sensitivity/test runs
Jan 1 '10  Prepare Scenario Data
Apr 1 '10  IPCC AR5 Historical runs
Jun 1 '10  IPCC AR5 Near-term Hi-Res Scenario Runs
Jun 1 '10  IPCC AR5 Long Low-Res stabilization Runs
Jan 1 '11  Runs Finish
Jun 1 '10  Process Data
Jun 1 '11  All Data Submitted

IPCC WG1 Approval