

CCSM Scientific Steering Committee Minutes
Thursday, 10 November 2005
Vislab, Webcast, and Conference Call

Attendees: Peter Gent (Chair), Jim Hurrell, Gordon Bonan, Jim Carton, Jim Hack, Danny McKenna, Chris Bretherton, Cecilia Bitz, Scott Doney, Bill Large, Mariana Vertenstein, Jay Fein, Anjuli Bamzai, Dave Bader, Bill Collins, Peter Hess, and Jerry Meehl.

1. **Discussion of Scientific Plan on Development for CCSM4.** Gent outlined scientific topics for development for CCSM4 as improving physics in the tropics, ENSO, and the carbon cycle; making progress on an interactive carbon/nitrogen cycle; and adding indirect effects of aerosols and atmospheric chemistry. Each one would add to the cost of computing time. Also, the finite volume (FV) dynamical core has been identified as the next generation atmosphere model, but no coupled runs have been successful yet. There is a problem getting the FV runs through SCD's computers, and a suggestion was to develop a lower-resolution FV model.

Large reported on the COLA workshop. Several modeling group members attended and agreed to a commitment to coupled experiments; to a proposal of seven communal experiments and designation of a lead investigator for each; to develop a detailed design; to demonstrate features by January 2006; to duplicate experiments by June 2006; and to reconvene at the CCSM annual workshop. There is no up to date information about the progress of this work, and a way needs to be found to know the progress.

Large also reported on the Tropical Variability Task Team (TVTT). Several meetings have been held at NCAR with participation from non-NCAR scientists from the Boulder area. The group is trying to maintain the interest of these NOAA and CU Boulder scientists. The group has decided that they need to get away from exclusive use of the low-resolution model and use the T42 and T85 atmospheric models, and computing resources/access will become more of an issue.

The interaction with WRF is progressing. CCSM has provided WRF with the radiation code, and CCSM scientists will analyze the climate and contribute to decisions on the project's future. The SSC will decide how much CCSM involvement will continue and how to use the WRF model with CCSM. Some suggestions of use were as infrastructure and as a nested regional climate model.

Boville continues to work on the FV dynamical core with others. An update on the progress needs to be given. The addition of chemistry to CCSM hinges on the FV dynamical core, but FV has only been run at 2 x 2.5 degrees and 1 by 1.25 degrees, and it has not been tuned at lower resolutions. The Land and BGC Working Groups need the FV atmosphere model at lower resolutions, so they can analyze their new component with the FV. It was reported that to produce an acceptable fully coupled simulation with FV, all model component scientists will need to work together to fix problems. The SSC

will strongly encourage all the working groups to work together to produce this simulation by the June 2006 workshop.

Bonan reported that the original work using CSM1 has been published, the carbon cycle has been documented, and it has been ported to CCSM3 using T31 resolution. Future plans for land and biogeochemistry are a comparison of three models (CASA', Thornton's CN model, and IBIS) to become the next biogeochemistry component. BGC working group members are developing the protocol and metrics by which to compare the models and are discussing how to achieve consensus about which model or particular parameterizations will be chosen. Inez Fung and Jim Randerson are leading this process. Currently the working group members are using CLM with the CASA' model because they have experience with the model's long-term behavior, and they are also pushing forward using Thornton's CN model fully coupled to gain experience with it. The Land and BGC Working Groups are discussing and working on the necessity of adding the nitrogen cycle and dynamic vegetation, how much nitrogen is needed, and when the new component will be ready. It is hoped that the model comparison can be completed before the June 2006 workshop.

Bretherton reported on the plans for including the indirect effect of aerosols in CCSM4. A CAM Microphysics workshop is being held, and further meetings of this group will be held at the AMWG meeting and the June 2006 workshop. Future plans are a new microphysics scheme, consistent microphysics within cumulus parameters and stratiform clouds where appropriate, droplet activation based on aerosol information and diagnosed updraft velocity, and use of multiple independent columns for consistent treatment of subgrid variability. Bretherton stated that microphysics is an excellent catalyst for WRF/CAM cross fertilization and it needs NCAR management encouragement.

Collins reported that after consultation with several colleagues (Hess, McKenna, Doney, Mahowald, Prather, Thornton, Moore, and Lindsay) that CCSM will not need full atmospheric chemistry, specifically for the purpose of implementing a terrestrial and oceanic carbon cycle. There are other reasons for implementing reactive chemistry, in particular, for simulating climate interactions with ozone and aerosols, however. This group suggests that CH₄, VOC, and CO are important for chemistry, and the BGC Working Group should continue work on their component and work with the Chemistry-Climate Working Group offline. Open issues are the number of forcings to be included that require reactive chemistry, what is the upper lid on WACCM, and how low can WACCM go and how many points are needed. The highest priorities between now and the June 2006 workshop for the ChemWG are to include the Ghan scheme and investigate more involved aerosol schemes.

2. **Define IPCC AR5 Needs and Experiment Design.** Collins and Meehl presented the goals of the design exercise as a) identifying major scientific objectives of IPCC runs, b) identifying subsidiary scientific objectives, c) mapping/integrating these objectives into the CCSM Science Plan, d) designing the simulations, and e) creating an implementation plan. Collins stated that starting with an experimental design plan is

crucial and should include a) contents and goals of the experiments, b) description of all forcing agents vs. time, c) description of pre-industrial spin up, d) experimental basis for pre-industrial spin up, e) description and plan for CCSM resource requirements, and f) plan and timeline for dissemination of experiments. Other needs highlighted were to develop forcings early in the process, to design the model spin up, to start early so that milestones are sequential and not concurrent, to ensure throughput of data processing and transfer goes smoothly, and to plan early for model resolution, ensemble size, and model capabilities. Collins and Meehl also suggested a draft outline of the IPCC plan based on the goals of the design above. Collins, Meehl, Bonan, Doney, etc., will write a White Paper to be presented to the CAB at their February 2006 meeting on this topic.

Other comments and questions were that we should understand the version of the CCSM model that will be released before the model is frozen and released; at least a 200-300 year simulation needs to be completed before the model is released; can modeling groups request a longer time between IPCC reports; can CCSM do less scenarios; will CCSM have two models, one with carbon cycle and one without; and will the different models be tuned differently. It also was suggested that CCSM should frame IPCC as useful rather than a drag on the program; that reducing biases does not run on a timeline, and the SSC should know what CCSM will do for IPCC by the workshop and communicate the plans to help the working groups set priorities.

3. **Status of the CCSM/ESMF Project.** Vertenstein gave a status report on the CCSM/ESMF Project, stating that the overall goal of the Stage 1 ESMF evaluation is not just to evaluate ESMF, but to also implement design improvements that can lead to a single-executable sequential CCSM that can easily use more than one coupling scheme. A single executable sequential CCSM will be much easier to port, debug, and support than a concurrent system; in certain scenarios it will give better performance; it should give the same climate as the current CCSM; it will be much easier to perform performance analysis and tuning; it will enable code re-usage among different configurations; stand-alone CAM custom surface models will no longer be needed; and rewrite of data models will prove extremely useful since they will be utilized in both sequential and concurrent systems. The goals are to produce a single executable sequential CCSM that permits plug and play functionality, permits all current stand-alone CAM functionality, and keeps backwards compatibility with current multiple executable/concurrent CCSM; to design the system so that alternative coupling mechanisms can be examined and used; and to have more than one coupling system incorporated to benefit testing and system validation. The CAM re-engineering has been completed, and we still must implement a top level application driver, implement ESMF superstructure and infrastructure constructs, and carry out tests to demonstrate that ESMF coupling has satisfied the Stage 1 Evaluation metrics. The current design will have the capability of using MCT as a very quick way to examine the incorporation of new science in the current system (such as using the LANL CICE model as a replacement for the current CAM sea ice surface component) and will also ensure that ESMF can be easily “swapped” for MCT as a coupling scheme. ESMF Stage 2 evaluation plans are to use ESMF to create a single executable sequential CCSM that supports all active components and where the ice and ocean components are on different grids and couple at

different frequencies; determine validation criteria for such a system; and prototype the use of ESMF concurrency with a simple CCSM application (e.g., all data components). Stage 3 plans would involve creating a single executable fully concurrent CCSM using ESMF.

Another software engineering project that has been suggested to CCSM is Earth System Curator, which is a pilot project to build uniform access to both model output data sets and to the models themselves. A positive for doing this would be that we could reproduce runs and have archival, which we do not have now, of interpolation from one grid to another. If CCSM is interested in doing this, resources to write software code to obtain the metadata will be needed.

4. **Status of FY06 CCSM Budget.** At this time we are looking at level funding from FY 2005, with no new staff hires planned, and the CSEG group continuing understaffed. FY 2006 is the last year for funding of some CCSM staff, such as the polar liaison, and several software engineering positions, and new proposals for funding are in progress. Bamzai suggested that some software engineering support could come from the next SciDAC announcement of opportunity. She reported that the AO will be out the end of December 2005, that it will be on a fast track, and that it will be one large solicitation. The proposals are due in March 2006, with decisions by June 2006. The NSF Cyberinfrastructure project is another opportunity for software engineering support, and Steve Meacham is the NSF contract. Fein will let CCSM know when the AO will be announced.

5. **Status of CSL Proposal.** Gent reported that allocation targets were sent to the CCSM Working Group co-chairs, along with a request to begin writing justifications. The new allocation will start February 1, 2006 and be in effect for 18 months. Gent also reported that CSL Accomplishments Reports are due, and input has been requested from the WG co-chairs.

6. **2006 CCSM Workshop Plans.** The SSC decided that the 2006 workshop would be held at The Village at Breckenridge again. The theme will be "Modeling Across Scales" with speakers presenting on global superparameters and cloud resolving and IPCC bake offs/model intercomparisons, such as regional changes over land. Gent stated that the workshop will probably be organized across working groups, with themes of abrupt climate change, tropical variability, and carbon cycle.

7. **CAB Annual Letter.** The SSC decided that Gent would draft a formal response to the CAB Annual Letter, responding to their recommendations. The CAB recommended that the SSC develop an updated Science and Implementation Plan, and the SSC will provide a one-year budget plan and will update the Science Plan after the 2006 workshop. The CAB recommended that treatment of aerosol-cloud interactions become a development priority, and the SSC has encouraged this by recommending a Microphysics Task Team be formed and a workshop for planning be held. The CAB recommended cross working group meetings at the next workshop, and the SSC agrees and will plan the workshop accordingly. The CAB recommends hiring software

engineers to ensure implementation of an ESMF capability, and the SSC regards a tester and land software engineer as higher priorities. The CAB recommends a dedicated CCSM postdoc program at NCAR, and the SSC would like to have a postdoc program but there is no funding available. The CAB recommended the SSC take the initiative to develop an agenda for IPCC AR5, and the plans discussed in 2. above responds to this.

8. **Update on SSC Members.** Gent showed a chart of the current SSC members, and suggestions for new members were discussed. Gent stated that he would invite some current members to continue for one year and add some new members for two-year terms to stagger the terms of the members more.

9. **CAB and CAB Meeting Details.** Gent reported that Zwiers, Pacala, and Hollingsworth would rotate off the CAB, and that David Rind, NASA/GISS, Scott Denning, CSU, and Paola Malanotte-Rizzoli, MIT, would be invited to become CAB members. The CAB meeting has been scheduled for February 27 and 28, 2006, at NSF, and Gent invited the SSC members to attend.