

Minutes of the CCSM Scientific Steering Committee Meeting
Friday, 12 November 2004
via Vislab, Webcast, and Conference Call

Attendees: Bill Collins (Chair), Jim Hurrell, Gordon Bonan, Mariana Vertenstein, Phil Merilees, Danny McKenna, Jim Hack, Bill Large, Scott Doney, Jim Carton, Anjali Bamzai, Chris Bretherton, Jay Fein, Dave Bader, Ben Santer, Cecilia Bitz, and Lydia Shiver

1. **Welcome (Collins).** Collins welcomed Mariana Vertenstein, new CCSM Software Engineering Manager, and Lydia Gates and Kiran Alapaty from NSF.

2. **Status of CCSM IPCC Simulations (Collins).** Collins reported that there are seven CCSM IPCC runs that are finishing on U.S. machines now, and the Earth Simulator (ES) runs are finished. CCSM is requesting additional run time from DOE's Oak Ridge National Laboratory on the Cray X1. The NCAR and ES CCSM IPCC data are being archived on the Mass Storage System at NCAR, and we are also transferring data to PCMDI (<http://www-pcmdi.llnl.gov>), the official IPCC archive. The sequence of data that will be transferred is the atmosphere and land data for the 20th century runs, followed by the control runs, scenario runs, and then POP and CSIM. The estimated schedule is at <http://swiki.ucar.edu/cgd-ccr/48>. There are several peer-reviewed papers in progress on these IPCC runs (e.g., Meehl et al.'s sea level rise paper and Bryan's and CRIEPI's high-resolution run analyses), and the CCSM special issue of the *Journal of Climate* is in progress.

CCSM is the highest volume contributor of data and has submitted the largest number of ensemble runs. Some high-resolution CCSM data also will be available at PCMDI. Hurrell reported that only four modeling groups have contributed IPCC data so far, and CCSM is one of those groups.

Fein said that the wonderful description of the tremendous work that has been done by CCSM staff for the IPCC report was appreciated by all the agencies that have provided support to CCSM in this effort.

3. **CCSM Program Plan (Merilees).** Merilees reported that this plan is an update to the CCSM Science and Business Plans, that it is based on CCSM's proposal put forward for the CSL allocation, and that it is a possible framework to allocate CCSM software engineering resources. Due to budget constraints and the future budget outlook, this plan discusses what CCSM can do now realistically. There are 10 major experiments listed in the CCSM's CSL allocation proposal, including abrupt climate change, changing land cover, eddy-resolving ocean, transients in paleoclimate, carbon plus nitrogen cycle, arctic climate sensitivity, etc. These major experiments are of interest to several CCSM working groups, and these topical issues, such as abrupt climate change, could be a template for how the working groups collaborate in the future.

The three major thrusts of the development aspects of this plan are to make CCSM:

- a. a more complete model (more physics capabilities, e.g., chemistry, high-resolution runoff land, and ice)

- b. a more useful model (e.g., software engineering component for ease of use, more efficient, more portable, more compatible with regional scale models), and
- c. a more accurate model (e.g., improvements in parameterizations of physical processes).

Community support is defined as:

- a. support for the “released” code and “public” data
- b. support by liaison scientists
- c. support for the CCSM annual workshop
- d. support for committees and working groups.

Currently, Merilees reported that 60% of CCSM’s human resources are in community support and 40% are in model development and scientific experiments. A table of which working groups are involved in which parts of the program plan was shown, along with the names of CCSM staff support. Then a matrix was shown that illustrates the distribution of the CCSM Software Engineering Group’s (CSEG) efforts by working group to support a more useful model, a more complete model, and community support. This matrix revealed that to provide all the CSEG support deemed important, we are short 57 man-months of staff resources (approximately 5 people), and that does not include any support for a more accurate model. Fein stated that SGERs could be used to help provide for this shortfall.

Large stated that the CCSM Business and Science Plans were very ambitious, and that there is a need to prioritize and shift some resources. Bonan stated that the working groups need more distributed resources also. McKenna stated that the chemistry component needs to be more visible and that a chemistry working group needs to be formed in order to hopefully alleviate the lack of CSL resources for chemistry climate modeling in CCSM.

Collins stated that we would add the coupled chemistry component efforts and the SciDAC efforts to the Program Plan. Bonan stated that we also should add the implications of the work of the various working groups that is not described in the CSL proposal, and Collins agreed to attempt to add all of these things. The Program Plan may need to be renamed to make it crystal clear that it is a plan for what will be done with the CCSM human and computer resources that we are likely to have. Bonan also stated that the SSC must find an adaptive management approach to deal with the science needs as the model is further developed and ideas brought forward from the community. The science community is looking at CCSM for opportunities to get their ideas included into the development of CCSM. This requires software engineering support for the development of component models.

Collins thanked ACD, CGD, DOE, and NASA for their contributions to the CCSM project.

Collins then reported on the state of human resources within CSEG and the loss of many key people from this group. He stated that the CSEG group is currently down one FTE right now, and all the staff turnover directly impacts the project. Collins also discussed how

the Climate Modeling Section has lost several long-term support staff recently, and right now that shows a two-person reduction to CCSM. Collins did report that he had approval from CGD and NCAR management to hire a new AMWG liaison, which is very important to the project. The Paleoclimate Working Group and the Climate Variability Working Group now have a one-half (1/2) time liaison to help them, but that person is a net loss to oceanography and sea ice efforts. SciDAC funds will support an additional software engineer in the CSEG group to support the Biogeochemistry Working Group.

Details of CSEG's projects can be seen at <http://www.cgd.ucar.edu/cseg/Projects/projects.shtml>. Overall, the group is working 50% of its time on a more useful model, 40% on community support, 10% on a more complete model, and 0% on a more accurate model. Vertenstein stated that CSEG has some interesting software engineering tasks to do, but the biggest drain on the group's time is porting to any and all platforms and testing on all of these platforms. The rapidly evolving computing systems are also a huge drain on resources. Hack stated that testing is essential, and he suggested cutting back on the external porting to many platforms. Large suggested the CSEG group support only the released version of the model on a specific number of platforms. Collins introduced the CCSM Model Support Policy, and he said that it addresses these issues for the coupled CCSM, but the working groups must adopt a model support policy for each component model. He has requested each component model working group develop a model support policy. Bonan stated that having policies help, but it also creates expectations from the community. Doney suggested publicizing the CSEG Bulletin Board more, and Collins and Vertenstein stated that this would be done but they wanted the SSC's feedback on the policy first. Bader suggested that CCSM define one standard configuration that it supports on Linux machines and have very specific instructions on running CCSM on Linux machines posted on the Web. Bader and Carton also stated that it would be very important to have complete technical specifications on the web for the user community to use, and Vertenstein reported that George Carr is working on this now and hopes to provide and maintain technical specifications and instructions more quickly in the future.

Collins stated that CCSM will not be remembered for how clean the code is, but it will be remembered for the science that is done with the CCSM.

4. **CCSM Model Support Policy (Vertenstein).** Vertenstein summarized this draft policy and asked for feedback from the SSC. She stated that the policy applies to CSEG:
 - a. support is machine dependent (categories 1-4)
 - b. support for compiling and running given for Category 1 machines only, where CSEG has logon and run privileges
 - c. support is given for three years after the date of a major release or for six months after the next major release, whichever is longer
 - d. future Category 1 machines will be determined by the amount of potential production time for CCSM, and
 - e. the Earth Simulator is not Category 1 because the release code was not validated.

She suggested that the division of community support efforts between CSEG and working group liaisons would be that CSEG would support only “vanilla” versions of CCSM (defined as the fully coupled model only), and the liaisons would support all non-standard (changes introduced) versions. Also, CSEG staff would be available to help the liaisons on a case-by-case basis. CSEG would support the community by moderating daily a CCSM Bulletin Board as “first responders” and notifying appropriate CSEG members of issues that need a response, CSEG would notify liaisons that a response is needed by them, CSEG would post non-supported periodic updates on the Web as CCSM is ported to new machines, and CSEG would keep CCSM User’s Guide, CCSM Bulletin Board, and FAQ Web pages up to date.

Large and Bonan stated that the working groups need different types of support from their liaisons, and they suggested further time be spent discussing and revising the draft policy. Hurrell suggested that support by the working group liaisons should be discussed with the working group co-chairs and priority levels be set by the co-chairs. Vertenstein will clarify parts of the policy and resend a draft to the SSC and working group co-chairs. She also stated that keeping the user’s guide and FAQ pages and moderating the bulletin board would be a high priority within the CSEG.

Vertenstein suggested that distributing the CCSM on the Earth System Grid would help to give accurate statistics on users, what platforms are being used by the community, and what using CCSM for. The Earth System Grid has a built in database to do the tracking.

5. **ESMF Plan (Vertenstein).** Vertenstein stated that the goal of CCSM’s involvement in ESMF is to construct a single executable for CCSM and remove the need for stand-alone component models. She suggested coding CAM first into the ESMF framework, so that CSEG could test the time manager utility, merge functionality, and M->N communication across components that includes redistribution. The regridding capabilities and access at the interface level to regridding weights and flexibility for concurrent vs. sequential runs would be tested in Stage 2. CAM and CLM must be subroutinized with current data models anyway, and if ESMF does not improve CCSM, it can easily be stripped out.

Vertenstein stated that she thinks Stage 1 will be successful, and that Stage 2 is more risky. She stated that the ESMF has a good staff team and good testing tools. She also is concerned about vectorization platforms in ESMF, but she thinks that ESMF will be able to address any problems.

Other issues of concern were raised, including that there is no software engineering support for the sea ice model to be put into ESMF and avoiding having stand-alone component models that diverge from the fully coupled system. Collins stated that he would communicate again with the working group co-chairs that voiced concerns and ask them if there are any further issues with ESMF plans and if their concerns have been addressed. Collins will update the SSC on this issue.

6. **Draft Response to CAB Annual Letter (Collins).** Collins summarized Fein’s six main points that need to be addressed from the CAB Letter.

- a. Growth has been accomplished with essentially the same NCAR core people for at least the last six years and the toll it is taking is clearly evident.
- b. NSF and DOE should take very seriously the problem of training the next generation of coupled system model scientists and developers and develop a plan to recruit and train young scientists in this area.
- c. All versions of CCSM have had similar systematic biases, and these biases must be reduced as soon as possible.
- d. To assess realistic future possibilities for CCSM, a report on how the program and resources have actually grown and how whether or not the future projections still seem possible must be articulated.
- e. An aggressive national policy that recognizes the critical need for and resolution of the need for more computational resources must be written and lobbied for, especially due to the plans to add chemistry, biology, middle atmosphere, and higher resolution.
- f. A national strategy for producing IPCC models and simulations should be written.

After much discussion, Collins agreed to revise the draft letter response to the CAB, stressing future scientific leadership as a priority, to send it to NCAR and CAB management, and then to finalize the letter from the SSC in response to the CAB letter. Some suggestions for revisions needed are:

- a. mention the CCSM Program Plan for development that is being written
- b. change the wording regarding continuing to devote a significant fraction of our computational resources to experiments on systematic errors to state that these experiments are not included in the CSL allocation that CCSM has at this time and that there is a need for more computational resources. The CAB should be credited with emphasizing the priority to reduce biases.
- c. change the information on the need to augment scientific and support staff to include that the scope of CCSM is much larger than in the past, and there is much more stress on the manpower and computer resources
- d. stress that the critical mass of atmospheric model development is done at NCAR, and it is critical that young scientists be hired right away and trained and mentored so that the atmospheric model development will continue in the future. State the importance of replenishing the young scientists at NCAR for all core model development, and propose that incubator programs, such as highly targeted graduate student programs, be funded and implemented right away,
- e. stress that future IPCC activities that are important are that forcing uncertainties are a key point in future IPCC activities and that a national strategy should be developed for IPCC regarding the high degree of difficulty of evaluating global scale differences vs. different forcings, and
- f. adding that NCAR and CGD management are moving to replace the AMWG scientific liaison.

7. **10th Annual CCSM Workshop (Collins).** The SSC members agreed that the CCSM workshop would be held at The Village at Breckenridge in Breckenridge, Colorado, from

21 to 23 June 2005. The theme for the 10th annual workshop is Crosscutting Science Using CCSM. The plenary sessions will have two speakers each who are familiar with CCSM and will present on CCSM results regarding IPCC, Paleoclimate and Abrupt Climate Change, and Challenges of Building an Earth System Model (biases discussion).

Collins thanked Fein for the additional funding for the workshop. It also was agreed that some plenary speakers from NCAR who are most familiar with the model would be good speaker choices.

The workshop will be revamped to allow more discussion time in plenary sessions, short working group business meetings, a formal poster session, and the return of the wrap-up session. We will also celebrate the 10th anniversary of the CCSM project during the workshop.

The SSC members recommended looking at local Boulder/Denver venues for the 11th annual workshop (2006). The theme Collins suggested for the 11th annual workshop is the coupled chemistry-climate system, and the theme for the 12th annual workshop (2007) is IPCC results.

The SSC recommended that the working groups discuss Earth System Modeling in regards to simple and complex models at their spring meetings, and not to have a special session on this topic at the workshop.

8. **Second Tropical Biases Workshop (Collins).** Collins will draft a letter to Shukla, COLA, and send it to the SSC for comments, encouraging them to hold this workshop and suggesting some successful ways to make the workshop beneficial:

- a. a summary of the 1st tropical biases workshop should be written and analyzed as to next steps
- b. a steering committee formed including a CCSM representative
- c. have hypotheses and agree on numerical experiments to test
- d. run experiments and analyze
- e. have workshop
- d. issue formal report of the workshop.

Bretherton stated that we might want to revisit the issue of formation of a coupled model working group to help across all working groups with biases. Merilees stated that we should encourage COLA to have this workshop and to build upon what was learned from the first tropical biases workshop. Fein suggested that a delay of this workshop would be positive in order to see IPCC results and what scrutiny is put to simulations, results, and improvements.

9. **Data Management (Merilees).** Merilees stated that the current CCSM Data Policy is about five years old and that it needs to be updated due to questions that are being asked by the community. He then defined the elements of the draft CCSM Data Policy as:

- a. definition of the different categories of CCSM data sets

- b. definition of ownership rights and responsibilities of the different categories of CCSM data sets
- c. coordination of the distributed CCSM data archives across NSF, DOE, and NASA data centers
- d. requirements for archiving and accessing the CCSM data
- e. provision for fast and easy Web access to CCSM data
- f. provision for registering and auditing the characteristics of CCSM data users
- g. definition of a life cycle for CCSM data and provision for the long-term stewardship and stability of CCSM data
- h. metadata requirements and standards for CCSM model data sets.

He also defined “public” data as owned by the CCSM SSC, managed by the CCSM Project Office, and freely available to all. Private data sets are owned by principal investigators or the CCSM working groups that created them, and they are managed by the working groups. He requested feedback on the new policy and stated that more discussions will be held with CCSM scientists on these issues. When the new policy is complete, it will be integrated with the current CCSM Data Policy.

10. **Distribution of Working Groups Analysis Packages (Collins).** The SSC recommended that each working group discuss having their diagnostics packages available to the community on the Web by next summer. CSEG could possibly help with this. Collins will discuss the diagnostics packages that the Climate Change Working Group has already provided and request they be on the Web for community use.