

Report of the CCSM Software Engineering Working Group Meeting
23 June 2005
The Village at Breckenridge

Mariana Vertenstein presented a brief update on CSEG projects. There was significant progress in the new data model rewrite effort, and in particular, as it applies to the new data atmosphere model, datm7. New general data model "framework" (dx7) code has been generated to permit reuse of data model "building block" code. All input datasets are assumed to be CF-1.0 compliant. The "framework" code was then utilized to create datm7, which now permits use of combinations of CCSM history output or observational data as forcing data (latm6 and datm6 are now merged in datm7). The "framework" code was also utilized to implement prescribed ice functionality in CSIM5. An update of ocean modeling development efforts was also provided. Progress was made in making POP2 a CCSM component. The planned physics upgrades were completed and most other upgrades (e.g., history file changes) are almost completed. In addition, other ocean models, in particular, MICOM and HYCOM, have also been made CCSM components. This work is complete, but not publicly available. Finally, a summary of the Pre-ESMF Stage 1 Development was provided. The pre-ESMF part of the Stage 1 Evaluation Plan has taken longer than expected. The projected completion date is now December 2005. Both design and requirement documents have been implemented as part of this process. Other projects are also occurring in conjunction with this effort that is going to test ESMF infrastructure utilities (e.g., regridding and concurrency). It was stressed that the use of ESMF infrastructure for pre-ESMF Stage 1 (e.g., time manager) is independent of success of the Stage 1 Evaluation Project.

Cecelia DeLuca presented an update on the ESMF project. The next phase of ESMF development is being defined by a set of new, major initiatives that build on and extend the ESMF software to create interoperable modeling environments within particular domains. These ESMF-based initiatives include the Battlespace Environments Institute (BEI), a DoD-wide effort to develop integrated forecasts; the NASA Modeling, Analysis and Prediction (MAP) Program, which focuses on climate and chemistry; the NOAA/NASA Integrated Dynamics through Earth's Atmosphere initiative (IDEA), which extends the NOAA GFS to include upper atmospheric processes; and a pilot project to integrate ESMF with the Space Weather Modeling Framework (SWMF). Another initiative funded in FY05 based on ESMF is the Curator database, which combines ESMF components with data services from the Earth System Grid (ESG). The Curator will serve as a foundation for tools that possess semantic information and can archive and manipulate both models and data.

Rob Jacob gave an overview of modifications made to cpl6 for supporting biogeochemistry. The hard coding of the number of fields and their indices has been removed. Two new functions were added that allow component models to determine at runtime how many and which fields are exchanged with the coupler. The fields module in cpl6 is now much easier to read and modify. All component coupling interfaces were

rewritten in order to support runtime determination of coupling fields. This is now being used as the default mode of communication in CCSM.

George Carr made a short presentation covering three topics. (1) CSEG is looking at the use of a portable timer library (PAPI) by all components of CCSM. This would be a single method that would improve timer accuracy and reduce performance overhead while remaining portable. (2) CSEG is looking at the use of a portable application performance characterization utility (Tau). Tau supports both auto and manual program instrumentation of code that generates trace information. Tau supports a graphical interface for the viewing and analysis of the trace information. (3) Porting/Performance status was presented regarding the Cray X1/X1E, the SGI Altix, Xeon and Opteron Linux clusters, IBM, and NEC platforms.

As an addendum to the Software Engineering Working Group Meeting, George Carr also presented "An Introduction to Load Balancing CCSM3 Components." This was a two-hour workshop where examples were examined to show how to adjust and measure runtime performance aspects of the CCSM model. Roughly 25 non-NCAR and 10 NCAR participants attended. A copy of the presentation slides can be downloaded from the CCSM website at <http://www.cesm.ucar.edu/models/ccsm3.0/CCSMLoadBalanceWorkshop.pdf>.

Pat Worley presented an overview and recent progress report of the SciDAC CCSM Consortium. Worley gave a short update to the project report given at the March 16, 2005 SEWG meeting. Until recently the project's software engineering efforts were focused on three tasks: (1) helping with release of CCSM for use in the IPCC Fourth Assessment Report; (2) porting and validating CCSM to the Cray X1; and (3) writing papers for the special issue of *IJHPCA* on software engineering in climate and weather models. With the completion of these tasks, the highest priority has been software engineering support for the FY2005 deliverables: (1) high resolution climate change simulations using CCSM3 on vector systems; (2) carbon cycle simulations using CCSM3 for Coupled Climate Carbon Cycle Model Intercomparison Project (C4MIP); and (3) coupled climate-carbon cycle model simulations with interactive land and chemistry. Other ongoing software engineering tasks include continued optimization on the Cray X1 and further POP and CICE model development. Expected new activities include expanded efforts on porting CCSM or CCSM components to other high performance computing architectures such as the Cray XT3 and the SGI Altix, support for additional atmospheric chemistry, including efficient transport and load balancing, and helping improve CCSM interfaces and testing methodology, in preparation for the integration of new dynamical cores and new grid systems.

An attendee list is unavailable.