



CSEG Update

CESM1 and Beyond

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Milestones

- Three releases in 6 months!
- Documentation
 - Complete Scripts User's Guide with FAQ and Code Reference
 - Complete documentation for every component (including CPL7)
 - CESM Tutorial (at workshop and on line)
- Performance/Porting
 - New Timing Table (continuously updated)
 - Machines (supported, prototype and generic machines)
- Greatly Enhanced Testing!!!
- New Features:
 - Code and input data now released through Subversion
 - New physics in all components
 - Glimmer-CISM component
 - CAM/HOMME
 - ESMF component interfaces – a new option

CPL7 Enhancements

- History/Restarts
 - PIO incorporated into history/restarts
 - Coupler history output generalized to write out only a subset of fields (used for BGC spin-up)
- New ESMF compliant component interfaces
 - Driver is still MCT based – new share code for ESMF component interfaces to translate from MCT => ESMF
- Ocean Data Assimilation
 - Uses DART and CPL7 interactive ensemble code base (not in release)
- Upcoming Goals
 - Incorporation of OpenMP in CPL7 and MCT
 - More flexible specification of fields transferred between components

Data Model Enhancements

- Data models re-written to be fully parallel
 - Re-gridding now done in parallel (can read MCT re-gridding weights or calculate MCT re-gridding weights)
 - PIO (parallel I/O) incorporated into all data models
 - Extensive share code
- Data model share code interfaces - can be used by active model components
 - Used by CICE to read in and interpolate prescribed ice coverage (“stand-alone” CAM)
 - Used by CLM and POP2 to read in and interpolate nitrogen deposition (fewer datasets to be support)



CAM Enhancements

New science

- CAM5 updates most CAM4 physics parameterizations
 - radiation (RRTMG), cloud microphysics and macrophysics, moist turbulence scheme and shallow cumulus, 3-mode modal aerosol scheme
- Chemistry options (only with CAM4 physics)
 - full tropospheric chemistry model (MOZART) and LLNL "super fast" chemistry
- WACCM4 (only with CAM4 physics)

New Functionality

- Single code base for CAM4/CAM5 (*backwards compatibility with CAM4*)
- CMIP5 boundary dataset capabilities (e.g. RCP scenarios)
- Enhanced regression testing
- Performance and memory scalability - ongoing work on communications scaling via handshaking and flow control

CAM Upcoming Goals

- Aerosols
 - Provide a prescribed version of MAM (*cut cost of running CAM5 in half*) – must first refactor MAM to use radiative constituent interfaces and
- Dynamical Cores
 - Regionally refined HOMME
 - Fully implement both the MPAS and the FV-cubed dycores
 - Enable HOMME and upcoming dycores to work with CAM5 physics package
- Radiation/Clouds
 - Update to latest RRTMG code and implement COSP simulator
- Cleanup
 - Refactor CAM's initialization sequence
 - Cleanup physics and dynamics interface code

CLM Enhancements

- New glacier multiple elevation classes for Glimmer-CISM
- New CNDV - a dynamic vegetation model coupled to the Carbon Nitrogen Biogeochemistry model (CN) (DGVM removed)
- New dry-deposition in CLM now passed to CAM
- Datasets
 - New surface datasets at all supported resolutions (including addition of glacier elevation classes)
 - Move read of aerosol datasets at model resolution to CAM and DATM (also does the spatial interpolation of data)
 - New dynamic vegetation datasets for 1850-2000 and 2000-2100 future scenarios (and nitrogen deposition)



CLM Upcoming Goals

- New crops and irrigation
- New dynamic land units (needed for Glimmer -> CLM functionality)
- Expand capabilities of single-point and regional options (bring in Ameriflux tower sites)
- New model parameterization - GPP, cold region hydrology, lakes and methane
- Parallelize surface dataset and interpolation of initial datasets generation – needed for creating very high-resolution datasets
- Utilization of PIO for all I/O
- Target a CLM4.2 model release within about a year



CICE Enhancements and Goals

Functionality

- Implemented aerosol deposition on snow and sea ice
- Implemented multiple history output capability
- PIO incorporated and used for all CICE I/O
- Implemented OpenMP capability
- More flexible computational decomposition strategies

Upcoming goals

- Performance - understand CICE performance and decomposition (especially at high resolution)
- Parameterizations – better snow treatment, prognostic salinity
- Ocean/Ice coupling – impact of multiple mixed-layer ocean and ice categories
- Grids - scientific and software support for regionally refined grids (e.g. MPAS)



POP2 Enhancements and Goals

- New Science – Ocean Ecosystem and overflow parameterization
- New Grids – gx3v7 (60 level) and tx0.1v2 (ocean only forcing)
- Model output
 - Multiple time-averaged history files, new time series files
- Performance improvements
 - OpenMP functionality now supported (and tested)
 - PIO now used for all NetCDF I/O
- Scripts - easier to now change POP2 namelists
- Improved model time flags
- Upcoming goals – continued parameterization improvements and MPAS ocean model development



New Glimmer-CISM component

- New Glimmer-CISM codebase - standalone code modified to function as a component. Required...
 - Build and namelist generation consistent with CESM, use of shr code for unit control, incorporate restart capabilities
- CPL7 – support new component and add numerous extra fields need to be communicated between CLM => Glimmer-CISM (elevation classes)
- CLM - support of new elevation classes
- New mapping tools to generate overlap files between CLM and CISM
- Now have support for the following:
 - CESM: T31_gx3v7, fv1.9_gx1v6, fv0.9_gx1v6
 - CISM: Greenland files at 5-km, 10-km, and 20-km resolution
- Upcoming goals - Glimmer-CISM parallelization



Upcoming Challenges

- CESM/DART data assimilation
 - Fully active data assimilation (all components)
 - Integration and optimization into main CPL7 code
- PIO
 - Design/implementation for asynchronous I/O
- Statically regionally refined grids (HOMME, MPAS)
 - Mapping files
- Integration of NRCM into main CPL7 code
- More high resolution simulations
- Next generation scripts – managing future complexity
- Evaluation for GPUs



CSEG Members

Dave Bailey (CICE)

Tony Craig (CLP7, Data Models, CCSM Performance/Porting)

Brian Eaton (CAM)

Diane Feddema (CMIP5 Runs/CAM)

Chris Fischer (CCSM Testing/WACCM)

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