CSEG Update
What have we accomplished ?
What is next?

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Challenges

- Community Support
  - 3 Releases since last year - huge increase in system complexity over the releases
- Model Development Support
  - New grids and new mapping functionality
    - Required by telescoping grids and new dycores
  - New multiple component instance capability
    - Required by data assimilation, super parameterization
  - New model components
    - New global wave model, WRF as a regional atmosphere model, new external alternative land mode
  - New model science across the system
    - New build support for C++ and external libraries

Challenges (cont)

- Constant validation for new machines new compilers, and compiler upgrades
  - Overlaps both development and release needs
- New workflow challenges at high resolution
  - Post processing, data analysis, data distribution
  - Leverage ParVis and CISL efforts

CPL7 *Release Enhancements*

- New atm/ocn flux calculation
  - on either *ocean*, atm, or exchange grid*
  - validation for atm grid underway
- New vector mapping options
  - *cart3d* – map to 3d, interpolate, map back– no more npfix!
- New unified mapping module will permit
  - Runtime settings pairing individual fields with mapping files
  - Runtime settings for field by field weights normalization
  - More options for vector mapping of paired fields
- New History/Restart Functionality
  - PIO incorporated into history/restarts
  - cpl history generalized to write a subset of fields (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 (permits new CIM metatdata capability)

CPL7 *Upcoming Features*

- Support for multiple component instances
  - Upcoming in development trunk with data components (CAM, CICE and POP still need to be integrated)
  - Extension of data assimilation using DART
    - Already leveraged for POP and CLM data assimilation
  - Future Super-Parameterization in CAM/CESM
    - 2d cloud resolving model at every gridcell
    - Each SP column needs a “separate” LND/OCN/ICE gridcell
    - Leverage multiple instance capability
- Flexible field specification
  - Run time declaration of fields (as opposed to current compile time)
  - Re-factored coupler namelist generation mechanism

CPL7 *Upcoming Features (cont)*

- Mapping support for new grids
  - Regionally refined grids, MPAS icosohedral grid
- New Components on development trunk
  - Addition of new wave model component
    - Wave Watch III to provide impact of langmuir cells on ocean mix layer depth
- New Components with external developers
  - WRF as a regional component (instead of CAM)
    - Leveraging RACM work - currently validating science - many SE integration issues still to be sorted out
  - Integrated Science Assessment Model (ISAM) (instead of CLM)
    - External effort - U. Illinois, ANL, ORNL

CAM *Release Enhancements*

- CAM-5.1 physics package complete!
  - Prescribed aerosol option available using bulk aerosols.
  - Spectral element (SE) dycore is working with CAM-5.1 physics
- New COSP (cloud simulator) implementation
  - Works with both CAM4 and CAM5 physics
- New History Output Functionality:
  - Allows extra dimensions in output fields, capability for satellite track output, local time zone averaging, bundle single column output into single variables (for efficiency)
- FV dycore stability improvements (1/2 deg and higher)
  - Via vertical remapping and filter modifications
- Chemistry improvements
  - Update trop_mozart with latest MOZART4 mechanism, restore lightning NOx production in super-fast chem, include CO2 reactions and new stratospheric aerosols in WACCM, updates to wet and dry deposition

CAM *Upcoming Features*

- Prescribed version of modal aerosols - 2x speedup of CAM with CAM5 physics
- Diagnostic radiative heating rate calculations with modal aerosols
- WACCMX - new extended version of WACCM
- CARMA – new aerosol/microphysics package
- Infrastructure changes to support sub-columns (needed for SP-CAM)
- Regionally refined CAM Spectral Element capability
- Incorporation of MPAS and CAM FV into full development path

CLM *Release Enhancements*

- New Science
  - New Prognostic Crop model based on AGROIBIS
  - New Irrigation Model
- I/O Enhancements
  - PIO capability implemented and used for all I/O
  - Restart history files are now NetCDF
  - pft-physiology and RTM direction files are now both NetCDF
- Improvements to CLM build-namelist
- Code cleanup
  - Removal of numerous CPP variables and *.h files

CLM *Upcoming Features*

- Capability to run CLM on an unstructured grid (on trunk this summer)
  - Includes ability to running CLM on CAM-SE cubed sphere grid (validated)
  - Could not have been done without new ESMF offline regridding functionality
  - New surface dataset generation (hours -> minutes)
  - New initial dataset interpolation (can work at high resolution)
- Ambitious set of new science changes (CLM4.5)
  - Dynamic land units (e.g. glacier -> vegetated)
  - Connect crops and irrigation, new canopy physiology, new methane emissions model, new lake model

GLIMMER/CISM *Upcoming Features*

- Glimmer-CISM 1.6 (current)
  - 1850 control will be started for Greenland ice sheet
  - New TG compset will be created (data-land/CISM) – enable multi-thousand year spin up using 50 year output from CLM
- Glimmer-CISM 2.0 (next)
  - Current solver is serial – limits resolution of ice-sheet model and does not include higher-order dynamics needed for modeling fast-flowing ice streams and outlet glaciers
  - New parallel solver (needs Trillinos)
  - Will also have backwards compatibility with serial version
- Coupling Strategies
  - Current coupling is one way (CLM->GLIMMER)
  - Incorporate 2 way coupling of Glimmer/CISM and CLM (will require dynamic land units in CLM)

POP2/CICE

- Both models now primarily in “support mode”
- CICE
  - Re-unify the Los Alamos code base with the CESM code base
  - Continue to understand CICE performance and decomposition (especially at high resolution)
  - Add 3D and 4D history variable functionality
  - More flexibility for restarting accumulated or calendar related variables
- POP2
  - No current POP2 software liaison
  - More frequent coupling of ocn <-> coupler
  - **Ocean mixing processes associated** resolving the sub- grid scale heterogeneity in ice-ocean fluxes **- new cice fields through coupler**

Releases, Machines, Build

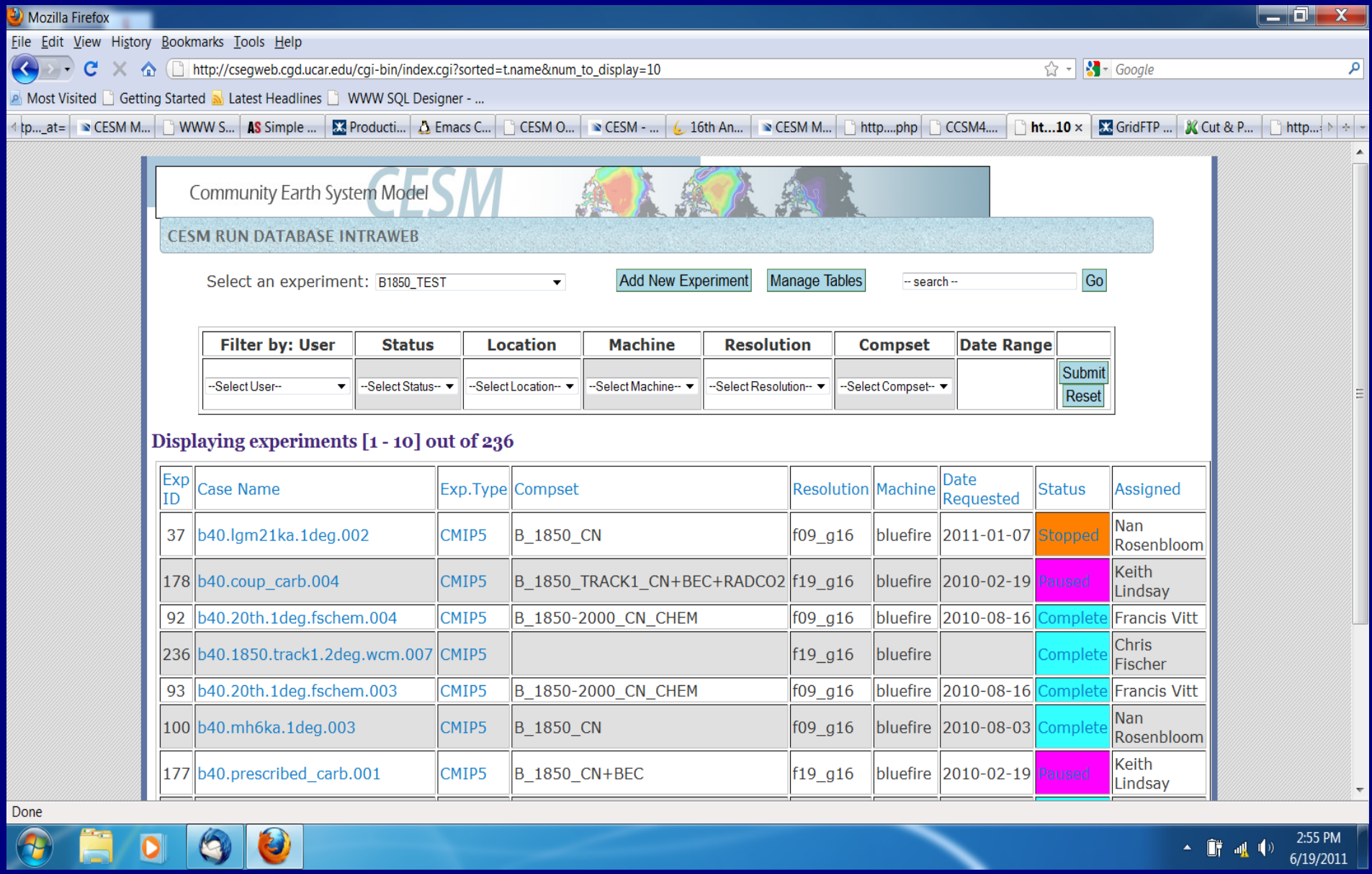
- Releases
  - Mechanism is working – three releases since last June
- NCAR/CMIP5 long term runs completed
  - Huge effort! Successful completion is result of new script features throughout CESM extensive testing process
  - Particular recognition needs to go to Andy Mai
- Machine Updates
  - New scheme being implemented to bring machines out of scripts/ directory and enable updates to machines without creating a new release
- C++ Build Support
  - Addition of Trillinos for Glimmer/CISM is requiring a more seamless incorporation of C++ libraries into CESM build

Challenges of Adding New Land Component (ISAM)
(Rahul Barman, Atul Jain)

- Scientific/Software Challenges
  - Replicating CLM <-> CPL7 functionality (fluxes, states, coupling frequency)
  - **Supporting new land resolution** (e.g., 0.5^{o}x0.5^{o})
  - Adapting ISAM to CESM configuration and build scripts
  - Meeting CESM requirements for IO, time management structure, restart variables and control flags
  - *Adapting the functionality of the River Transport Model (RTM)*
- Future Challenges
  - **Advanced load balancing algorithms using Charm++/Adaptive-MPI (AMPI) systems - employs migratable objects, enabling dynamic load balancing and enhanced scalability**
  - **evaluate this on Blue Waters**

New Internal Run Database (Alice Bertini, CCR)

- Provides *start to end* documentation of an experiment
  - Run request – define all requirements for new experiment
  - Run views - examine all details of (and update) status of an existing experiment
    - Examine svn run repository
    - Go directly to run diagnostics
    - Capability to duplicate run in the future


Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://csegweb.cgd.ucar.edu/cgi-bin/index.cgi?sorted=t.name&num_to_display=10
Most Visited Getting Started Latest Headlines WWW SQL Designer - ...
Community Earth System Model
CESM
CESM RUN DATABASE INTRAWEB
Select an experiment: B1850_TEST
Add New Experiment
Manage Tables
-- search --
Go
Filter by: User
Status
Location
Machine
Resolution
Compset
Date Range
--Select User--
--Select Status--
--Select Location--
--Select Machine--
--Select Resolution--
--Select Compset--
Submit
Reset
Displaying experiments [1 - 10] out of 236
Exp ID
Case Name
Exp.Type
Compset
Resolution
Machine
Date Requested
Status
Assigned
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178 b40.coup_carb.004 CMIP5 B_1850_TRACK1_CN+BEC+RADCO2 f19_g16 bluefire 2010-02-19 Paused Keith Lindsay
92 b40.20th.1deg.fschem.004 CMIP5 B_1850-2000_CN_CHEM f09_g16 bluefire 2010-08-16 Complete Francis Vitt
236 b40.1850.track1.2deg.wcm.007 CMIP5 f19_g16 bluefire Complete Chris Fischer
93 b40.20th.1deg.fschem.003 CMIP5 B_1850-2000_CN_CHEM f09_g16 bluefire 2010-08-16 Complete Francis Vitt
100 b40.mh6ka.1deg.003 CMIP5 B_1850_CN f09_g16 bluefire 2010-08-03 Complete Nan Rosenbloom
177 b40.prescribed_carb.001 CMIP5 B_1850_CN+BEC f19_g16 bluefire 2010-02-19 Paused Keith Lindsay
Done
2:55 PM
6/19/2011

CSEG Members
Resources are a growing Challenge

Dave Bailey (CICE)

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

Brian Eaton (CAM, EaSM – get title)

Jim Edwards (CAM, CESM Build/Scripts)

Diane Feddema (CESM Testing)

Chris Fischer (CAM)

Brian Kauffman (POP/ROMS NRCM)

Erik Kluzek (CLM)

Andrew Mai (Production Runs)

Nancy Norton (MOBY EaSM)

Bill Sacks (Glimmer-CISM, Coastal EaSM)