# Chemistry-Climate Working Group Meeting Feb. 2013

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# Recent/on-going news & activities

- Aerosol liaison: Po-Lun Ma (PNNL)
- ACCMIP papers (9; see http://www.atmos-chem-phys-discuss.net/special_issue176.html)
- PORT paper
- Preparation for CCMI (combined with WACCM)
  - 1960-2010: free running and specified dynamics
  - 1960-2100: free running (RCP6.0)
- Large ensemble CESM1: 1950-2050 (40 members, no chemistry) details are still be discussed
- Sub-column representation in CAM

# Aerosols

- Special collection of talks on marine aerosols (later today)
- Joint session Tu Morning
- 4 aerosol packages
  - BAM: long history but no coupling with clouds
  - MAM3: preferred for climate studies with CAM5
  - CARMA: emphasis on short simulations
  - LLNL sectional scheme: exploratory

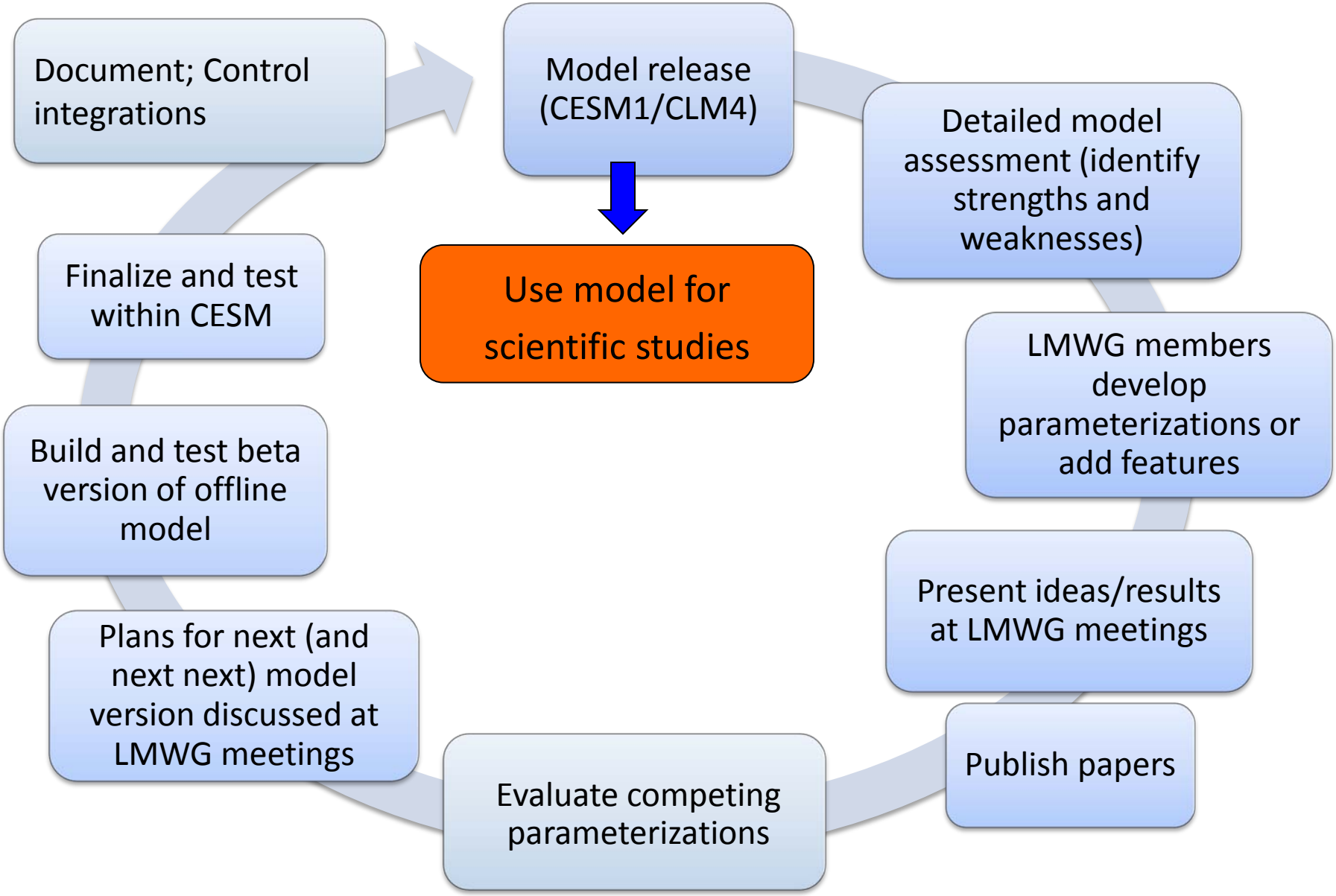
# CSL proposal & Yellowstone

- Allocated amount reduced to 80% of request
- Significant effort requested to reduce size & amount of output files (use HPSS only for what is really needed to be stored for a long time)
- Development: 2.8 M CPU-hours
- Production: 6.1 M CPU-hours
- CESM1_1_1 ported to Yellowstone

# Input to SSC

- What is the process for model evaluation? Do we have metrics? How is that used to decide what goes on the trunk?
- New procedure for testing port (to new computers/compilers/…) validations
- CESM2 planning
- Short-term development plans

# Model Development Process: CLM



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# General Setup

From M. Levy and D. Nychka (NCAR)

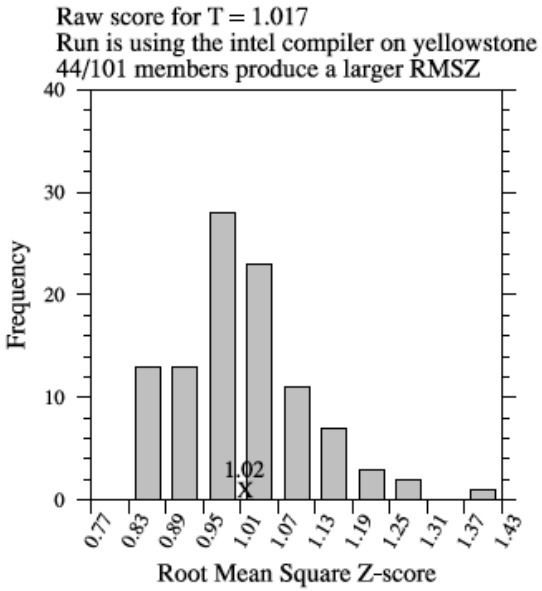
## Generate an ensemble on a trusted machine

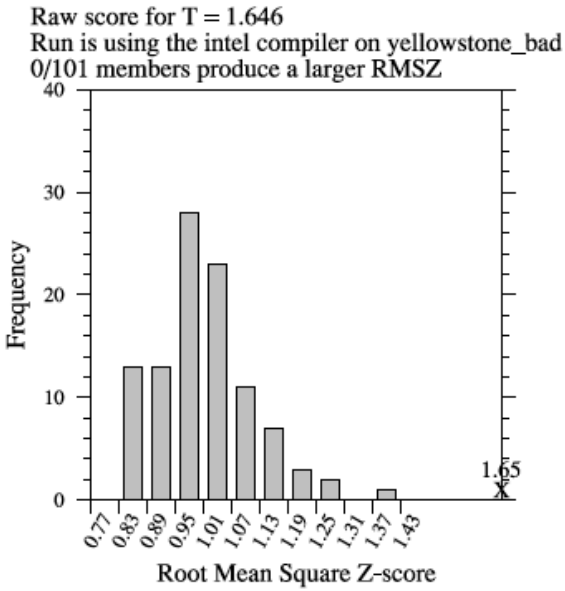
We [CSEG] run 101 B1850C5CN ensemble members that differ only in the CAM pertlim parameter (101 values used are $\{-5.9, -5.8, \ldots, -1.1, -1, 0, 1, 1.1, \ldots, 5.8, 5.9\} \cdot 10^{-14}$). These are one-year runs and we look only at annual averages of the output.

## Run on the machine you wish to validate

You [the user] run three B1850C5CN runs with that differ only in the CAM pertlim parameter (the three values should be chosen randomly from the 101 used above). These are also one-year runs with annually averaged output.

# Comparing a Run to the Ensemble




## Two-Step Process

1. Compute the RMSZ score for each variable using the 101-member ensemble mean and standard deviation
2. See how the run compares to the 101 RMSZ computed based on the other 100 members
   - Good: RMSZ for all variables falls within the ensemble RMSZ values

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# CESM2 Planning: Draft!

- Development targets?
  - High resolution capabilities
  - Improved/Enhanced Biogeochemical cycles
  - Improved capability for Sea level prediction
  - Human system interactions
  - Decadal prediction capability
  - Others?

# Timeline for CESM2 Development?

- Release target of May, 2016
- Component model targets for CESM2:
  - CAM6; POP-updated? Or MPAS-O; CLM5?; CICE5 (or MPAS-I?); Chemistry?; BGC?; WACCM?
- Timings for development
  - May, 2013 – CAM-SE; CLM4.5; Ocn BGC mods
  - May, 2014 – CAM-SE; CLM4.5; BGC mods; CISM2; POP-updated?; CICE5? WACCM-SE?
  - May 2015 -
  - May 2016 – CESM2 Release

# Biases targeted for improvement in CESM2?

- Southern Ocean ventilation
- OMZs
- Double ITCZ
- Asian Monsoon
- Indirect effect
- Factors that require further assessment?
  - Modes of variability
  - Ocean ventilation
  - ?

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# ChemClimWG Development Plan (from June meeting 2012)

- Top Priority
  - Update to MEGAN/include maps when possible (in the release version)
  - Improvements to the dry deposition (Thanks to Maria Val Martin!)
  - Coupling chemistry with MAM and CAM5 physics (in the release version)
  - SE/FV dynamical core comparison: on-going tracer tests based on SD configuration
  - kPP mechanism
  - Box Model or SCAM w/ chemistry
- Medium Priority
  - Update SOA mechanism: Colette Heald's SOA in the release version (additional work by K. Barsanti)
  - Implementation of FAST-J photolysis rate computation (DOE funding: M. Prather/P. Cameron-Smith)
  - Conversion of preprocessor to KPP?
  - Vertical resolution and model top?
  - WACCM lite?
- Low Priority
  - "Coarse resolution" FV
- Diagnostics:
  - Tools for model result differencing
  - Benchmark numbers: methyl chloroform lifetime ozone budget terms, methane lifetime, mass-weighted tropospheric OH, lightning NOx, sf(co/nox/isoprene)

# ChemClimWG Development Plan (from June meeting 2012 + updates)

- Top Priority
  - Update to MEGAN/include maps when possible (in the release version)
  - Improvements to the dry deposition (Thanks to Maria Val Martin!)
  - Coupling chemistry with MAM and CAM5 physics (in the release version): more than mass-weighting ?
  - Superfast in CAM5 (LLNL)
  - SE/FV dynamical core comparison: on-going tracer tests based on SD configuration
  - kPP mechanism + master list of reactions (version control)
  - Box Model or SCAM w/ photochemistry
  - Implementation of FAST-J/CLOUD-J photolysis rate
  - Fire emissions of what? Number?
  - Specified dynamics in FV and SE (pressure fixer): trop main issue?
- Medium Priority
  - Update SOA mechanism: Colette Heald's SOA in the release version (additional work by K. Barsanti); link with MAM
  - VBS modeling of SOA (separate from MOZART at this point)
  - Conversion of preprocessor to KPP?
  - Vertical resolution
  - WACCM lite (try to get this going before Breck)?
- Low Priority
  - "Coarse resolution" FV
- Diagnostics:
  - Tools for model result differencing
  - Benchmark numbers: methyl chloroform lifetime ozone budget terms, methane lifetime, mass-weighted tropospheric OH, lightning NOx, sf(co/nox/isoprene)

# CSL Allocation

| | Experiment | Configuration | #runs | #years per run | hour/yr | total core-hr | Requested |
|---|---|---|---|---|---|---|---|
| D.1 | Chemistry in CAM-SE | F_1degree_CAM5_STRATTROP | 40 | 2 | 1600 | 128000 | 50 |
| | | F_0.5degree_CAM5_STRATTROP | 20 | 2 | 6400 | 256000 | 25 |
| | | F_0.25degree_CAM5_STRATTROP | 10 | 2 | 20000 | 400000 | 10 |
| | | F_1degree_CAM5_STRATTROP_SE | 40 | 2 | 1800 | 144000 | 50 |
| | | F_0.5degree_CAM5_STRATTROP_SE | 20 | 2 | 7200 | 288000 | 25 |
| | | F_0.25degree_CAM5_STRATTROP_SE | 10 | 2 | 28800 | 576000 | 10 |
| D.2 | Chemistry schemes | F_2degree_CAM5_TROP | 40 | 10 | 415 | 166000 | 50 |
| D.3 | Vertical resolution(100 levels) | F_1degree_CAM5_STRATTROP | 10 | 5 | 6500 | 325000 | |
| D.4 | Land use/SOA | B_2degree_CAM5_TROP | 10 | 4 | 500 | 20000 | |
| | | B_1degree_CAM5_TROP | 10 | 1 | 1660 | 16600 | |
| D.5 | MAM aerosols | multiple resolutions | | | | 433000 | |
| D.6 | Aviation impact | multiple resolutions | | | | 80000 | |
| D.7 | Kinetic energy backscatter | F_1degree_CAM5_STRATTROP | 1 | 50 | 1660 | 249000 | |
| Total | | | | | | 2832600 | 3058100 |
| P.1 | 1850 Control | B_1degree_CAM5_STRATTROP | 1 | 250 | 2000 | 500000 | 300 |
| | 4xco2 ctrl | B_1degree_CAM5_STRATTROP | 1 | 250 | 2000 | 500000 | 300 |
| | 4xco2 ctrl w/ 2100 emissions | B_1degree_CAM5_STRATTROP | 1 | 250 | 2000 | 500000 | 300 |
| | 2000 climate/2000 emissions | B_1degree_CAM5_STRATTROP | 1 | 200 | 2000 | 400000 | 300 |
| | 2000 climate/2100 emissions | B_1degree_CAM5_STRATTROP | 1 | 100 | 2000 | 200000 | |
| | 1850-1950 | B_1degree_CAM5_STRATTROP | 1 | 100 | 2000 | 200000 | |
| P.2 | Response to regional forcing | B_2degree_CAM5_TROP | 15 | 100 | 500 | 750000 | 20 |
| P.3 | LGM-CH4 | F_1degree_CAM5_STRATTROP | 8 | 30 | 1660 | 398400 | 10 |
| P.4 | Hindcast | F_0.5degree_CAM5_STRATTROP | 3 | 5 | 20000 | 300000 | |
| | | F_1degree_CAM5_STRATTROP | 10 | 20 | 1660 | 332000 | |
| | | F_1degree_CAM5_STRATTROP_SD | 5 | 30 | 3320 | 498000 | |
| P.6 | GeoMIP | B_1degree_CAM4_STRATTROP | 1 | 320 | 1400 | 448000 | |
| | | B_1degree_CAM4_BGC | 1 | 500 | 480 | 240000 | |
| P.7 | Land use/SOA | B_2degree_CAM5_TROP | 28 | 10 | 500 | 140000 | |
| | | B_1degree_CAM5_TROP | 6 | 10 | 1660 | 99600 | |
| P.8 | MAM aerosols | multiple resolutions | | | | 289000 | |
| P.9 | Data assimilation | F_2degree_CAM5_TROP | 160 | 1 | 400 | 64000 | |
| P.10 | Aviation impact | multiple resolutions | | | | 250000 | |
| Total | | | | | | 6109000 | 6958600 |