Update on BGCWG Activities, Jun 2013

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• Community & BGCWG Experiments with CESM1
• BGC Developments in CESM1.2
• Near-term Activities & Developments

NCAR is sponsored by the National Science Foundation
Community Experiments with BGC

- Large Ensemble CESM1.1(CAM5,BGC)
  - BGC essentially unchanged from CESM1
  - Diagnostic PI DIC tracer
- 1850 Control
  - Ocean BGC included @ 0285-01-01
  - Experiment currently past 0735
- 20C Transient
  - Branched off 1850 Control @ 0402-01-01
  - Additional O(30) ensemble members will branch at 1920
Additional Coupled Experiments with CESM1(BGC)

• CESM1(BGC) Ensemble Members
  – 2\textsuperscript{nd} Ensemble of 20C done
  – Use spread to put sensitivity experiments in context

• Extensions of RCPs to 2300
  – How does BGC responds to extreme climate change?
20C CO$_2$ Flux to Atmosphere
CESM1.1(CAM5,BGC)
Land BGC in CESM1.2 Release
CLM4.5

• Non-default, CLM4 supported in CESM1.2
• Addresses biases & adds/enhances functionality
• Revised photosynthesis model, multilayer canopy, temperature acclimation
• Vertically resolved soil biogeochemistry
• Methane
• Revised fire model
• etc.

• Evaluated in CLM-only experiments
Ocean BGC in CESM1.2 release

- Default, not backwards compatible
- Addresses biases & adds/enhances functionality
- Generalization of functional group implementation
- Diagnostic PI DIC tracer
- PAR Absorption
- Phytoplankton Iron/Carbon Ratios (Fe quotas)
- Remineralization Curves (for un-ballasted POM)
- Optimized grazing and aggregation
- Updated initial conditions (O2) and forcing (iron)

- Evaluated in Ocean-Ice hindcast experiments
Ocean BGC Specific Activities

• Enhanced interaction with OMWG
  – Address biases in physical model directly impacting BGC
• Comprehensive Ocean BGC Diagnostics Package
  – Currently available upon request
  – Commit to CESM repo soon
• Newton-Krylov based fast spinup
• Offline tracer tools
• Ecosystem dynamics with resolved eddies
Ocean BGC Developments beyond CESM1.2

- Explicit calcifier functional group
- Ocean Acidification feedbacks
- PAR under sea-ice
- Optional Phaeocystis functional group
- Fe in Sea-Ice
- Carbon Isotopes
- NH$_4$ emissions, N$_2$O tracer
- Spatially varying iron ligand
- Methane module
- Couple to Sea-Ice Algae
Working Group Wide Activities

• Additional Science with CESM1(BGC)
• Move towards coupled integrations with new BGC parameterizations in CESM1.2
• Respond to SSC requests (to all Working Groups)
  – Information on priorities for short-term (~ next year) component model developments, including the scientific motivations for these.
  – Documentation on the component model development process / protocols.
  – Information on what metrics, diagnostics, and expert judgements are used for component model assessments.
  – Science topics/questions for CESM2