

# Update on BGCWG Activities, Jun 2013

Co-Chairs: Keith Lindsay (NCAR),

Gordon Bonan (NCAR), Jim Randerson (UC-Irvine)

Community Liaison: Keith Lindsay (klindsay@ucar.edu)

- 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

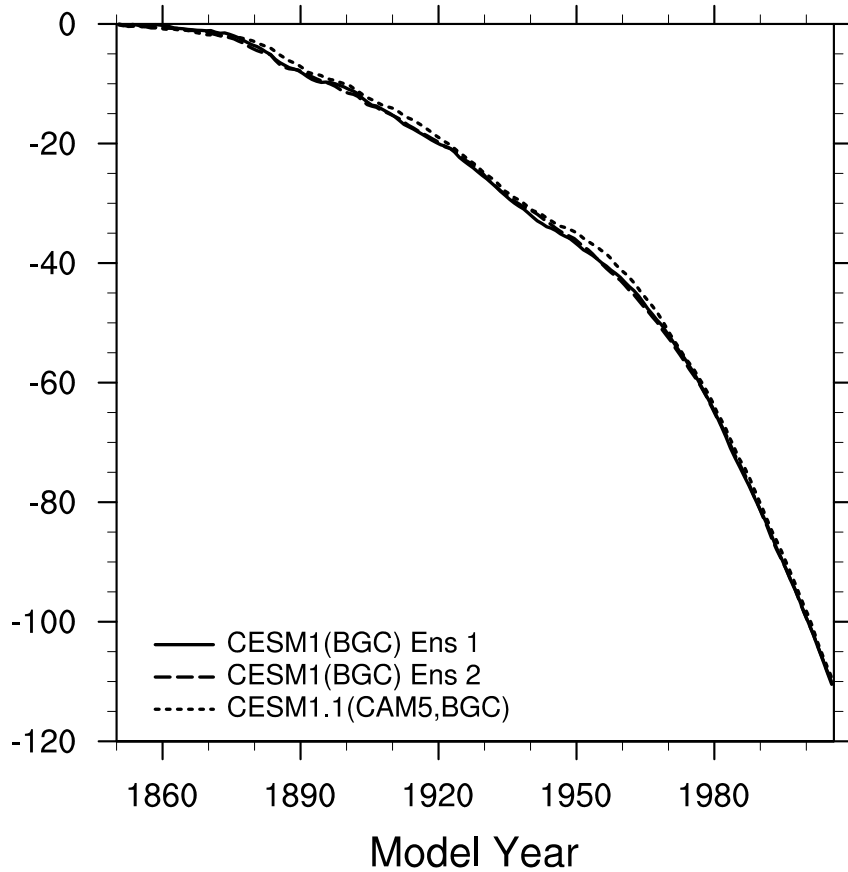
- Large Ensemble CESM1.1(CAM5,BGC)
  - BGC essentially unchanged from CESM1
  - Diagnostic PI DIC tracer
- 1850 Control
  - Ocean BGC included @ 0285-01-01
  - Experiment currently past 0735
- 20C Transient
  - Branched off 1850 Control @ 0402-01-01
  - Additional O(30) ensemble members will branch at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

# Additional Coupled Experiments with CESM1(BGC)

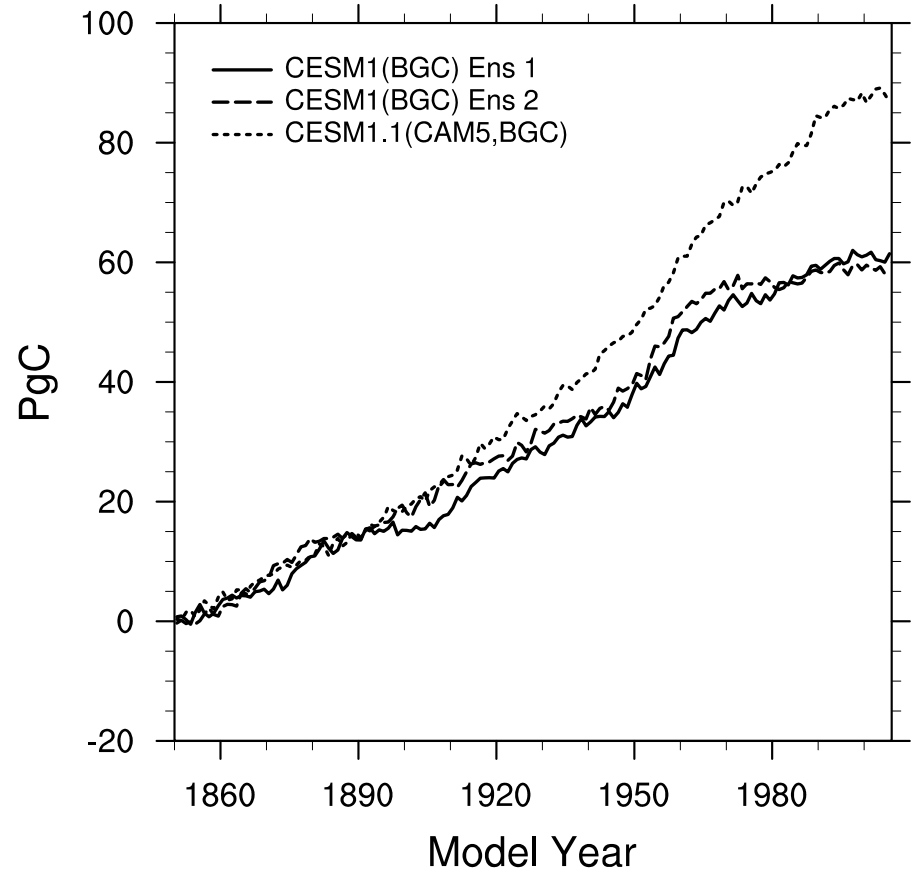
- CESM1(BGC) Ensemble Members
  - 2<sup>nd</sup> Ensemble of 20C done
  - Use spread to put sensitivity experiments in context
- Extensions of RCPs to 2300
  - How does BGC responds to extreme climate change?

# 20C CO<sub>2</sub> Flux to Atmosphere CESM1.1(CAM5,BGC)

Cumulative Sea to Air CO<sub>2</sub> Flux



Cumulative Land to Air CO<sub>2</sub> Flux



# 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 (O<sub>2</sub>) 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
- $\text{NH}_4$  emissions,  $\text{N}_2\text{O}$  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