

Update on BGC in CCSM3.5

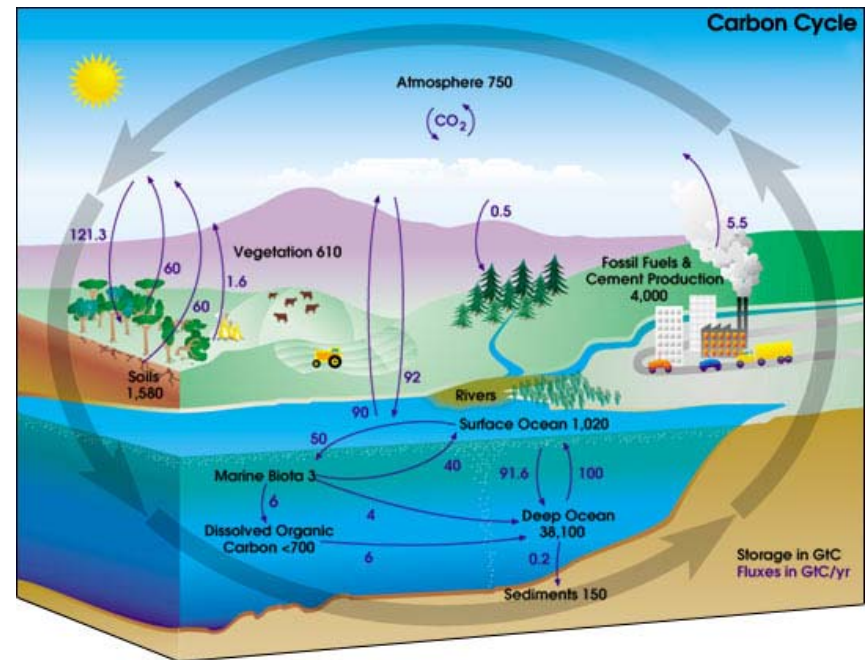
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Background

- CCSM3.5 physics was finalized mid 2007
- This is not a public release for CCSM.
- Single resolution: FV1.9x2.5-gx1v5
- Model to be used for BGC development purposes, has changed considerably from CCSM3.0
- Step 1: spinup/stabilize physics (done)
- Step 2: spinup/equilibriate BGC

Spinning Up BGC Cycles

- Objective: Generate distribution of BGC pools that is in equilibrium with CCSM model climate and has atmospheric CO_2 close to a preindustrial level.



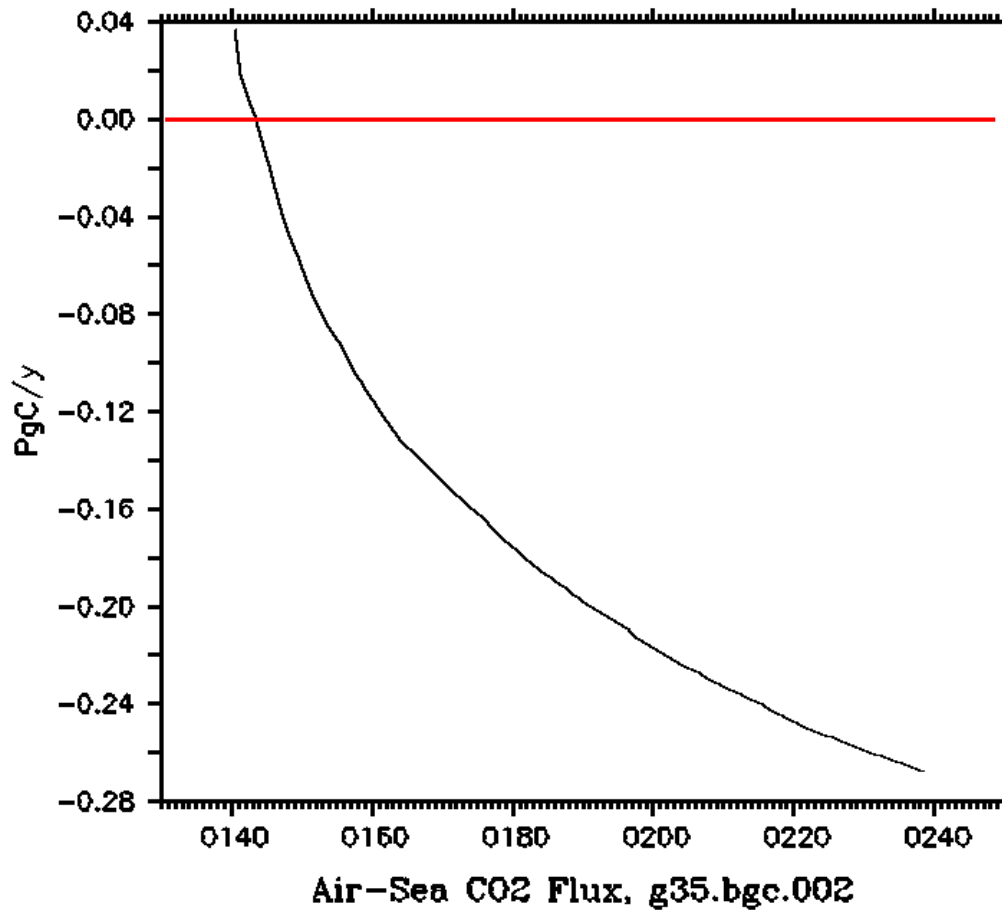
Spinning Up the Carbon Cycle

- Incrementally couple BGC, leading to fully prognostic carbon cycle, to stable 1870's configuration without BGC.
- 1) Perform short run of base coupled model to generate surface forcing for ocean BGC spinup.
- 2) Spinup ocean BGC with forcing from 1). Cycle POP physics to avoid drift away from model of Step 1). Fixed CO₂. This step is a big hurdle. How spunup do we need to be?

Spinning Up the Carbon Cycle

- 3) Spinup BEC further in fully coupled context, coupling OCN DIC to ATM CO₂. Novel idea for 4): restore LND CO₂ tracer to OCN CO₂ tracer to prevent drift.
- 4) Spinup CLM+C/N with forcing from 3), using LND CO₂ tracer.
- 5) Couple BEC from 3) and C/N from 4) in fully coupled run, keep radiation at 280ppm.
- 6) Continue 5, couple to NET CO₂ radiation.

Step 2), Initializing Ocean Tracers with Observations

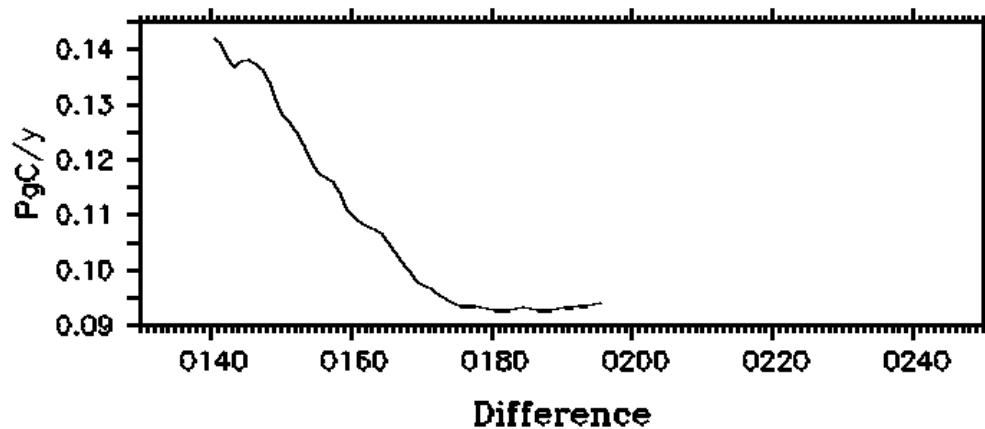
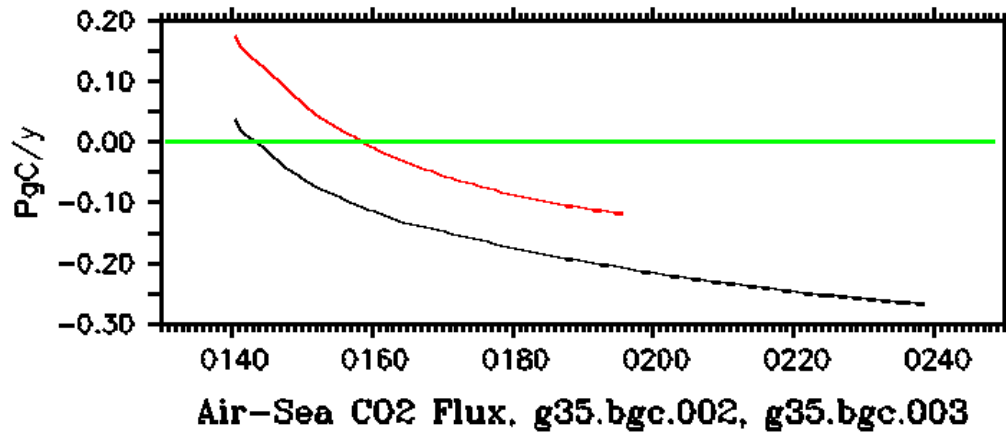


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Potential Ideas to Help 2), each with big caveats

- Devise better BGC IC from model state.
- Separate short timescale ecosystem from long timescale BGC. Spin up ecosystem and then spin up BGC using forcings from spun up ecosystem.
- Interpolate circulation to coarser resolution and spin up there.
- Green's Function/Impulse Response techniques.
- Extrapolation of trends.

Merge Spunup BGC from CCSM3.1 with Physical State of CCSM3.5



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Ocean BGC Related Changes Under Consideration for CCSM4 (and beyond)

- Ecosystem Parameter Tuning (K. Moore)
 - Si and P sources from dust
 - N cycle, diazotrophs
 - DOM cycling
- Solar Zenith Angle Aware Diurnal Cycle
- Make CaCO_3 cycle pH aware
- Dust/Fe Tracers in Sea Ice Model
- BGC Tracers in runoff
- Trace Gas Emissions

Solar Zenith Angle Aware Diurnal Cycle

