



BGC Practical Lab Notes

Ocean & Coupled

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What is in the CESM1 release

- POP Ecosystem model (first release)
 - Online User's Guide
 - Scientific Reference in prep
- CLM features (in CCSM4 release)
 - Carbon-Nitrogen Model
 - Land Cover & Land Use Change (LCLUC)
 - Dynamic Global Vegetation Model (DGVM)
- CAM CO₂ features (first release)
 - CO₂ constituents that use LND & OCN CO₂ fluxes as surface boundary condition
 - Pass CO₂ to driver for LND & OCN flux computations
 - Couple CO₂ constituents to radiation computations

What is in the CESM1 release

- New BGC compsets (i.e. works out of the box)
 - Spun-up Initial Conditions available
- Diagnostics from 30-year segment of 1850 controls
 - no ATM CO₂ or Ocean BGC yet
- Model Output from 30-year segment of 1850 controls
 - Available on the ESG (Earth System Grid)

New BGC Compsets

- Terminology
 - **BGC CO₂**: used by surface components
 - **RAD CO₂**: used by ATM radiative code
 - **Prognostic CO₂**: predicted ATM concentrations
 - computed from LND and OCN CO₂ fluxes
 - **Diagnostic CO₂**: prescribed ATM concentrations
- B_1850_BGC-BPRP
- B_1850-2000_BGC-BPRP
- B_1850_BGC-BDRD
- B_1850-2000_BGC-BDRD
- C_NORMAL_YEAR_ECOSYS

Spun-up Initial Conditions

- IC's are provided for coupled compsets
 - Uses physics of CAM4
- Resolution
 - ATM/LND: 0.9x1.25
 - OCN/ICE: gx1v6
 - Some other resolution IC's provided but not spun-up
- Ocean Alone IC are provided for gx1v6, gx3v7, but are not spun-up

Example Usage

- `cd $CCSMROOT/scripts`
- `create_newcase -compset B_1850_BGC-BPRP -res T31_gx3v7 -mach bluefire -case $HOME/bprp.1850.001`
- `cd $HOME/bprp.1850.001`
- `$EDITOR env_run` # to change `STOP_OPTION` to `nmonths` and
and `STOP_N` to `1`
- `configure, build, and submit`
- View output in short-term archive directory with `ncview`
- CAVEAT: IC not spun up at this resolution

POP BGC Specific Output

- ocn/hist/\$CASE.pop.h.ecosys.nday1.yyyy-mm-dd.nc
 - Selected daily ocean ecosystem variables, one file per month
 - Surface flux related, productivity & functional group vertical integrals
- ocn/hist/\$CASE.pop.h.ecosys.nyear1.yyyy.nc
 - Selected annual 3-D ocean ecosystem tracer budget terms

UNITS & SIGN CONVENTIONS

- Same quantity in different component output has
 - Different names
 - Different units
 - Different sign conventions (for fluxes)
- CAM variables CO2, CO2_LND, CO2_OCN, CO2_FFF have units kgCO₂/kg dry air
- This is **NOT** a typical unit for carbon cycle modelers
- To convert ppmv, multiply by $1e6 * 28.966 / 44$

UNITS & SIGN CONVENTIONS

Component	Variable Name	Units	Sign Convention
Atmosphere	SFCO2_LND	kgCO2/m ² /s	Positive up
Land	NEE	gC/m ² /s	Positive up
Atmosphere	SFCO2_OCN	kgCO2/m ² /s	Positive up
Ocean	FG_CO2	mmolC/m ³ ·cm/s nmolC/cm ² /s	Positive down