

Status of Ocean BGC and Fast Spin up for CESM3

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Background: Ocean BGC in CESM2

- Ocean BGC in CESM2 uses the MARine Biogeochemistry Library (MARBL)
 - Computational/scientific core is GCM independent
- Nutrients: PO_4 , NO_3 , NH_4 , SiO_3 , Fe
- Plankton structure is configurable
- CESM2 plankton configuration:
 - 3.5 Autotrophs: Diatoms, N-Fixers, Small Phyto, Calcifiers (implicit)
 - 1 Grazer
- Prescribed forcings: riverine inputs, atmospheric nitrogen deposition, sediment Fe fluxes
- Prognostic forcings: atmospheric dust & Fe deposition
- Support for ^{13}C and ^{14}C biotic tracers (default off)
- Abiotic ^{14}C separate from MARBL

Ocean BGC in CESM3 (MOM6)

- MARBL coupling to MOM6 nearly complete
 - some couplings between MARBL and rest of system not implemented yet
 - most substantial remaining todo is CGS (POP) -> MKS (MOM6) transition
- Several 20-year ocean-ice experiments have been performed
- Results are qualitatively similar to companion experiments with POP
- Likely CESM3 plankton configuration:
 - 4 Autotrophs: Diatoms, N-Fixers, Small Phyto, Calcifiers
 - 2 Grazers
- 8 Autotroph, 4 Grazer configuration under development too
- Abiotic ^{14}C not implemented yet
- H_2O isotopes ???
- Coupling to sea ice BGC is aspirational

Ocean BGC Fast Spin Up

- Newton-Krylov (NK) solver was used for in CESM2 to spin up ideal age, abiotic ^{14}C , DOM, DIC/ALK tracers
- NK solver works on single macronutrient in 2D model

NK Development Research Projects

- time-varying vertical coordinate of MOM6
 - making MOM6 remapping of diagnostic output more self-consistent
- Multiple macronutrients
- O_2
- Fe
- temperature & salinity