CLM5 Carbon Cycle

The CLM5 team
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Lots of changes!

- New C-N coupling (LUNA, FlexCN, FUN)
- Plant hydraulics
- New soil hydrology and evaporative layer
- Switch from Ball-Berry to Medlyn stomatal conductance
- Parameter changes and some ambitious attempts at calibration
- Area-based to mass-based harvest methods
- Variable soil depth
- Faster spinup
Increased GPP, but similar NPP
NPP and CUE

ANN NPP (gC/m²/d)

CLM5 (yrs 1991-2010)

CLM4.5BGC_GSWP3 (yrs 1991-2010)

ANN CUE (NPP/GPP)

CLM5 (yrs 1991-2010)

CLM4.5BGC_GSWP3 (yrs 1991-2010)

T-Test of two Case means at each grid point

Cells are significant at 0.1 level

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Historical global carbon budgets

Hoffman et al., 2014
Historical global carbon budgets

- Total ecosystem C, incl veg but excl cpool
- Total vegetation C, excluding cpool
- Coarse woody debris carbon
- Total litter carbon
- Total SOM carbon

Graphs showing the historical carbon budgets from 1830 to 2010, with trends and values depicted for different carbon pools.
Veg Carbon Stocks Increased

ANN TOTVEGC (KgC/m^2)

CLM5 (yrs 1991-2010)

CLM4.5BGC_GSWP3 (yrs 1991-2010)

CLM5 - CLM4.5BGC_GSWP3

T-Test of two Case means at each grid point

Cells are significant at 0.1 level
Are Veg C stocks reasonable?

Negron-Juarez et al., 2015

CLM5
Soil Carbon Stocks Decreased
Deep Soil Carbon Stocks Decreased
Soil carbon turnover times: comparison against observations

Observation-based estimate

Koven et al., in review

Precipitation (mm/yr)
PFT Survival probabilities:

1: Default PFT coverage maps
PFT Survival probabilities:

2: New restricted PFT coverage maps
Seasonal cycles of carbon fluxes in some important places

Polar (60-90N, -180W-180E)

Amazonia (10S-0, 70-50W)

CLM4.5BGC_GSWP3 (yrs 1991-2010)
CLM5 (yrs 1991-2010)
Interannual Variability

NBP

CLM4.5 NBP STD(IAV) [gC m\(^{-2}\) yr\(^{-1}\)]

CLM5 NBP STD(IAV) [gC m\(^{-2}\) yr\(^{-1}\)]
Interannual Variability

GPP

CLM4.5 GPP STD(IAV) [gC m$^{-2}$ yr$^{-1}$]

CLM5 GPP STD(IAV) [gC m$^{-2}$ yr$^{-1}$]
Interannual Variability

AR

CLM4.5 AR STD(IAV) [gC m⁻² yr⁻¹]

CLM5 AR STD(IAV) [gC m⁻² yr⁻¹]
Interannual Variability

HR

CLM4.5 HR STD(IAV) [gC m\(^{-2}\) yr\(^{-1}\)]

CLM5 HR STD(IAV) [gC m\(^{-2}\) yr\(^{-1}\)]
Interannual Variability
Fire

CLM4.5 COL_FIRE_CLOSS STD(IAV) [gC m⁻² yr⁻¹]
CLM5 COL_FIRE_CLOSS STD(IAV) [gC m⁻² yr⁻¹]
Spinup time reduced from ~2000 model years to ~500
GGP, LAI spinup quickly, allowing more rapid turnaround for testing
Much still to explore in this model. Thanks to everyone who pulled it together!