Brazilian C cycling

Luke Smallman
David Milodowski & Mathew Williams

University of Edinburgh and NCEO, Edinburgh, UK.
Why?

• Large carbon (C) store
• Large potential as both source and sink C
• Existing models disagree on Brazilian C cycling
Model biomass diverges from EO estimates

Avitabile et al. (2016)

Exbrayat et al. 2019
Why?

• Large carbon (C) store
• Large potential as both source and sink C
• Existing models disagree on Brazilian C cycling
• Can we model the distribution and dynamics of major carbon pools across Brazil?
  – Climate sensitivity?
  – Management effects
  – Disturbance, fire
Our solution

A model-data fusion framework to estimate ensembles of location specific parameters
CARbon DAta MOdel fraMework (CARDAMOM)

Observations To calibrate out model

Drivers

DALEC C-cycle Model

MDF algorithm

Ensembles of location specific calibration

Copernicus LAI time series ($m^2/m^2$)

SoilGrids Soil C map (MgC/ha)

Avitabile Biomass estimate (MgC/ha)

CRU-JRA Vapour Pressure Deficit (kPa)

GFEDv4 Burned Fraction

GFW Forest Loss Fraction

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Comparison of CARDAMOM and assimilated observations
CARDAMOM ecosystem estimates

Net Primary Production (gC/m²/day)

Leaf Carbon Area (gC/m²)
Independent Validation

Against Net Biome Exchange of CO$_2$
estimated from atmospheric inversion
NBE Correlation

Site 1

Site 2

Site 3

Site 4

CARDAMOM
GeoChem

NBE Correlation

GEOSCHEM NBE estimates provided by Liang Feng
A data constrained future?

Simulating our constrained parameter ensembles to 2050 using CMIP6 drivers
Simulate DALEC parameter ensemble to 2050

Parameters & Initial conditions
- Parameter ensembles e.g. Woody residence time
- SoilGrids Soil C map (MgC/ha)
- Avitabile Biomass estimate (MgC/ha)

Output PDF
- DALEC Model
- Parameter Ensemble

Drivers
- UKESM forecast 2015-49
- GFEDv4 Burned Fraction - looped
- No further land use change
Median estimate of parameter ensemble At 50% CI drawn directly from the ensemble

Wood stock 2050 (MgC ha\(^{-1}\))

Wood increment 2050 (MgC ha\(^{-1}\) yr\(^{-1}\))

Wood increment significance

Climate only

Climate + CO2

Increase

NoChange

Decrease
Next steps?

• Current system only includes water stress implicitly through vapour pressure deficit

• We will run regional analyses using our new coupled C & H₂O model

• Conduct disturbance scenarios – ISIMIP / CMIP6
Thanks you & Questions?