Interannual variability in Amazonian Carbon & Water Fluxes: Results from a Constrained Terrestrial Biosphere Model

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Biosphere-atmosphere feedbacks Amazonia







Amazonian deforestation predicted to change South American climate

In reality, deforestation is happening at sub-grid scales.





ED dynamics at San Carlos Tropical forest (2°N,68°W): trajectory of above-ground biomass:



Incorporating land-use change



Improved predictability at Harvard Forest: 10-yr simulations (1992-2001)

Net Carbon Fluxes (NEP)



(*Cox et al 2000*) Change in Vegetation Carbon (kg C m⁻²) (0.385)60N 30N 30S 60S 90S 🖟 180 90W 90E 0 -7 -5 -3 7 - 1 3 5 1 (Shukla et al 1990) 64 m C Santarem 200 10°N Flux tower 800 0. (3°S, -55°W) eddy sample inlet, 57.8m 600 400 10" () 20° Change in 30 Annual Forest Precipitation 40'5 60 19.75 ha for trees >35 cm, ~1000 stems 70 80"W Inventory: (mm) 3.99 ha for trees >10 cm, ~1800 stems

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ED-2 model fitting at Santarem km 67 (42°N, -72°W)

- initialize with observed stand structure



- model forced with climatology and radiation observed at tower meteorological station.

- 2 year model fit (June 2002- June 2004), in which model was constrained against:

- hourly, monthly and yearly GPP and R_{total}
- hourly ET

- above-ground growth & mortality of trees in the tower footprint.



Ecosystem models tend to have reversed seasonality in carbon Fluxes at Santarem











Mechanism is consistent with Satellite Observations of Seasonal Changes in Vegetation Greenness



(Saleska et al 2007)

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<u>References</u>: Moorcroft *et al.* 2001. *Ecological Monographs* 74:557-586. Moorcroft (2006) Trends in Ecology and Evolution 21:400-407 Medvigy *et al.* (2008) *Ecological Monographs* (in review)

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