CMMAP Land Activities

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CMMAP Team Meeting, Boulder CO, 22-24 Jan 2013

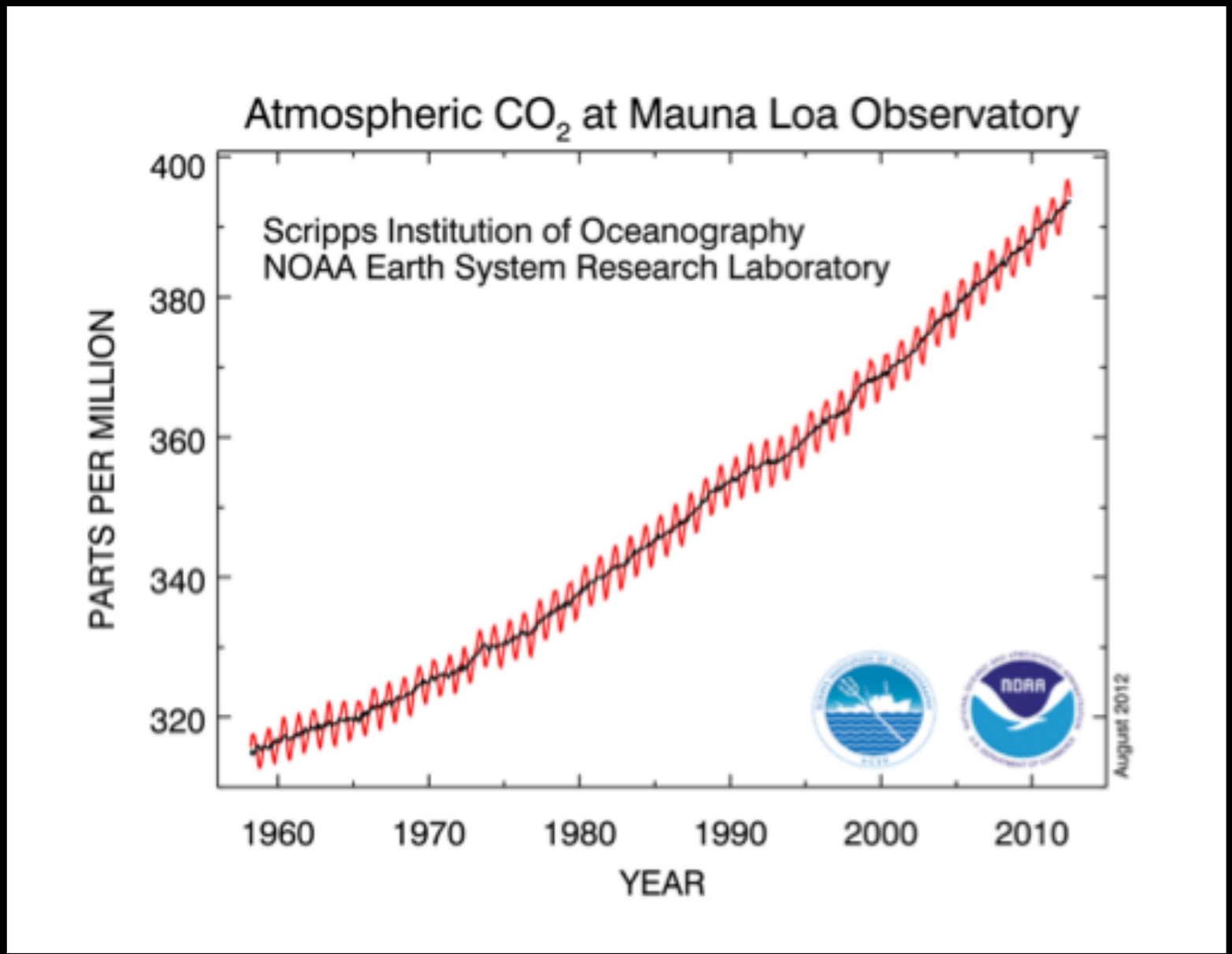
Overview: Land Hour

1. Land Flux
2. Programming Issues
3. Mesoscale Behavior
4. Wetlands (Parker)

Overview: Land Breakout

- Scott Denning: Multiscale Modeling of Modeling and Measurement of Metabolism and Mixing
- Marat Khairoutdinov: Validation of a simplified land surface model and its application to the case of shallow cumulus convection development
- Don Dazlich: Homogeneous versus heterogenous SiB3 in a Cloud-Ensemble model
- Nick Geyer: SiB component flux (GPP, Rtotal) evaluation at eddy covariance flux towers
- Gordon Bonan: Latest CLM developments

Missing Sink



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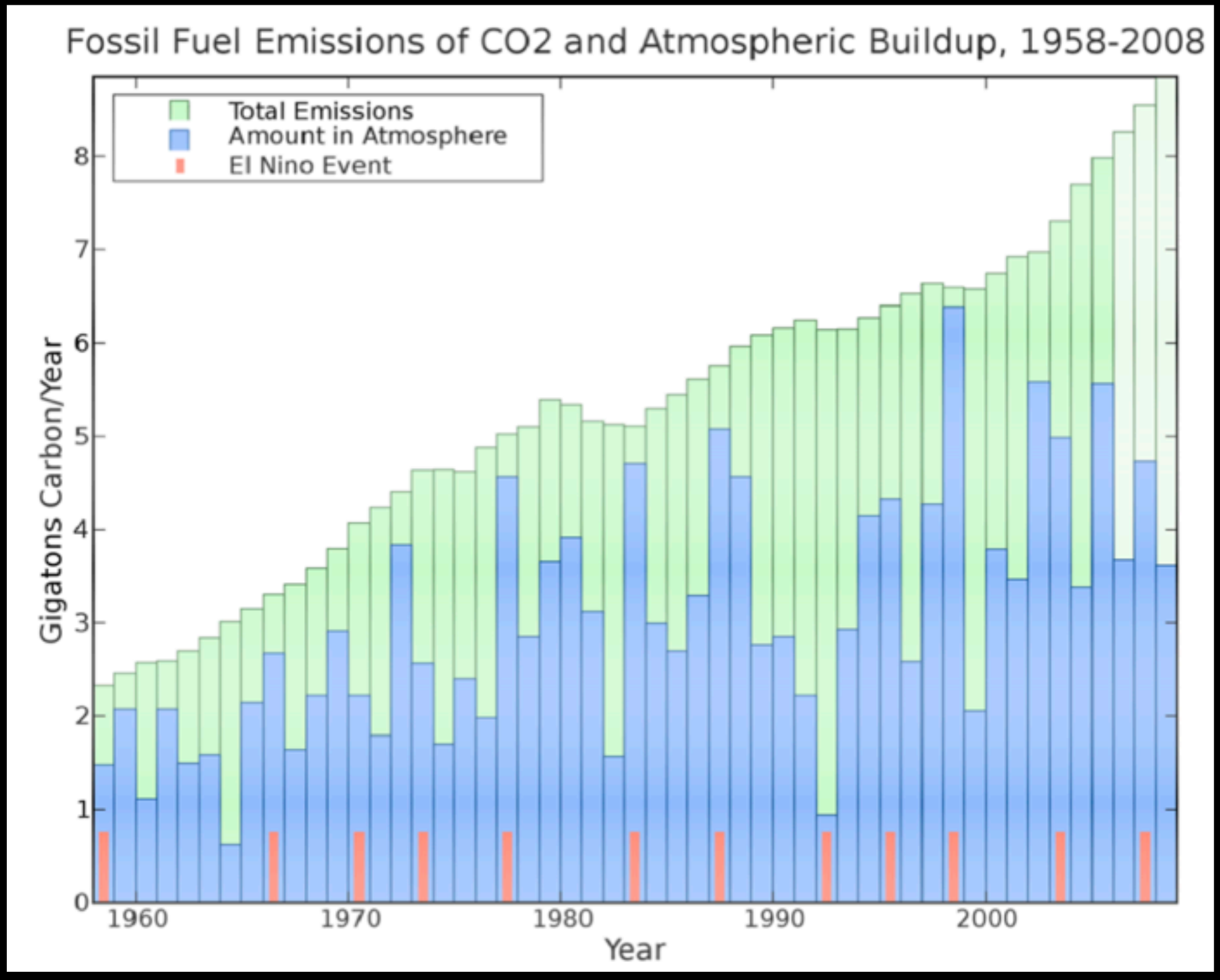
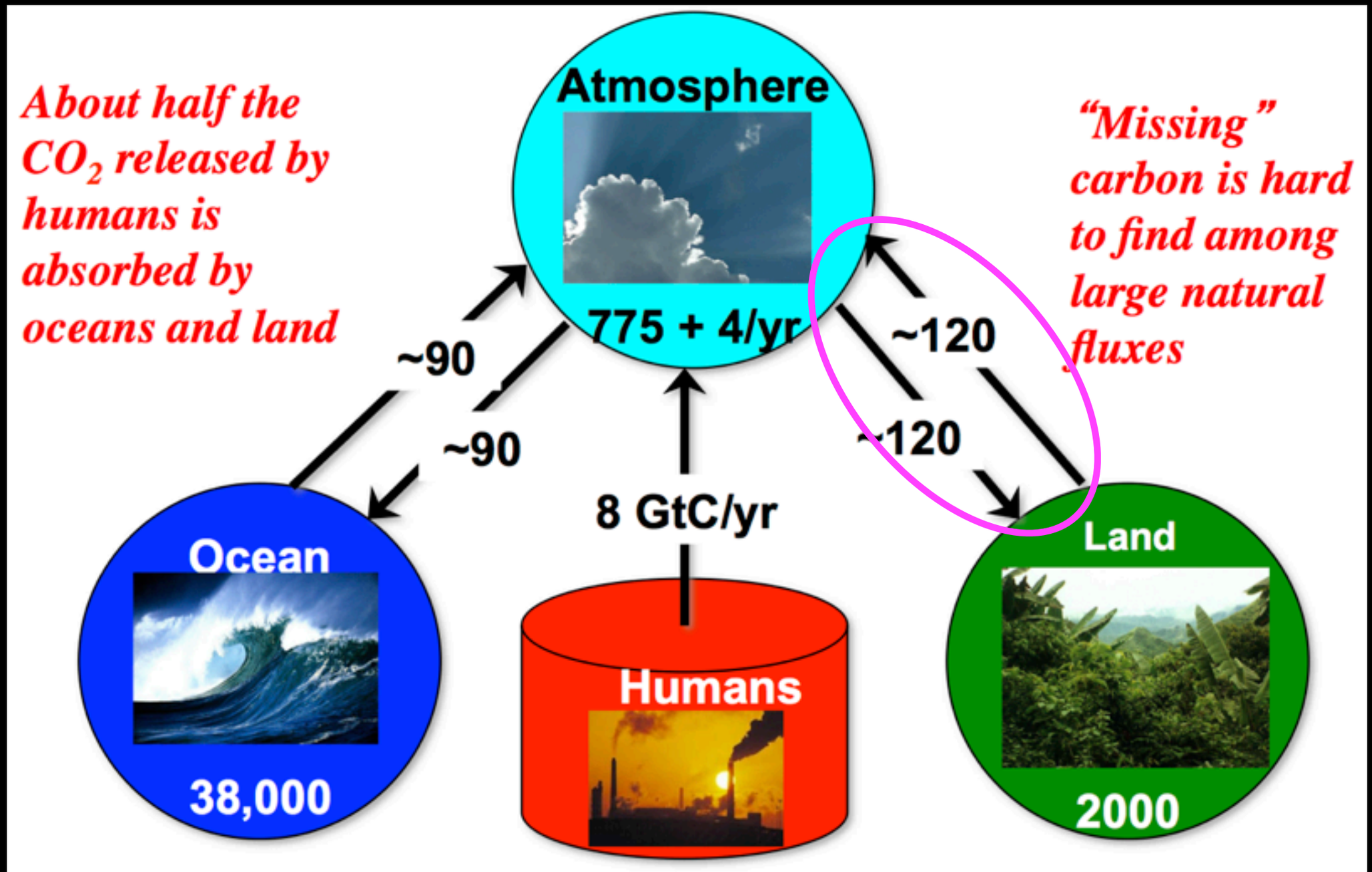
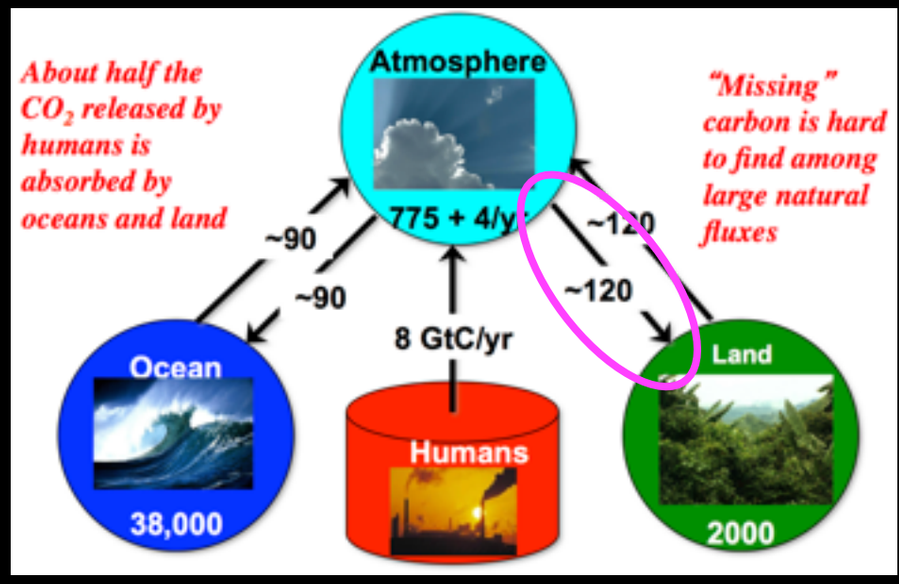


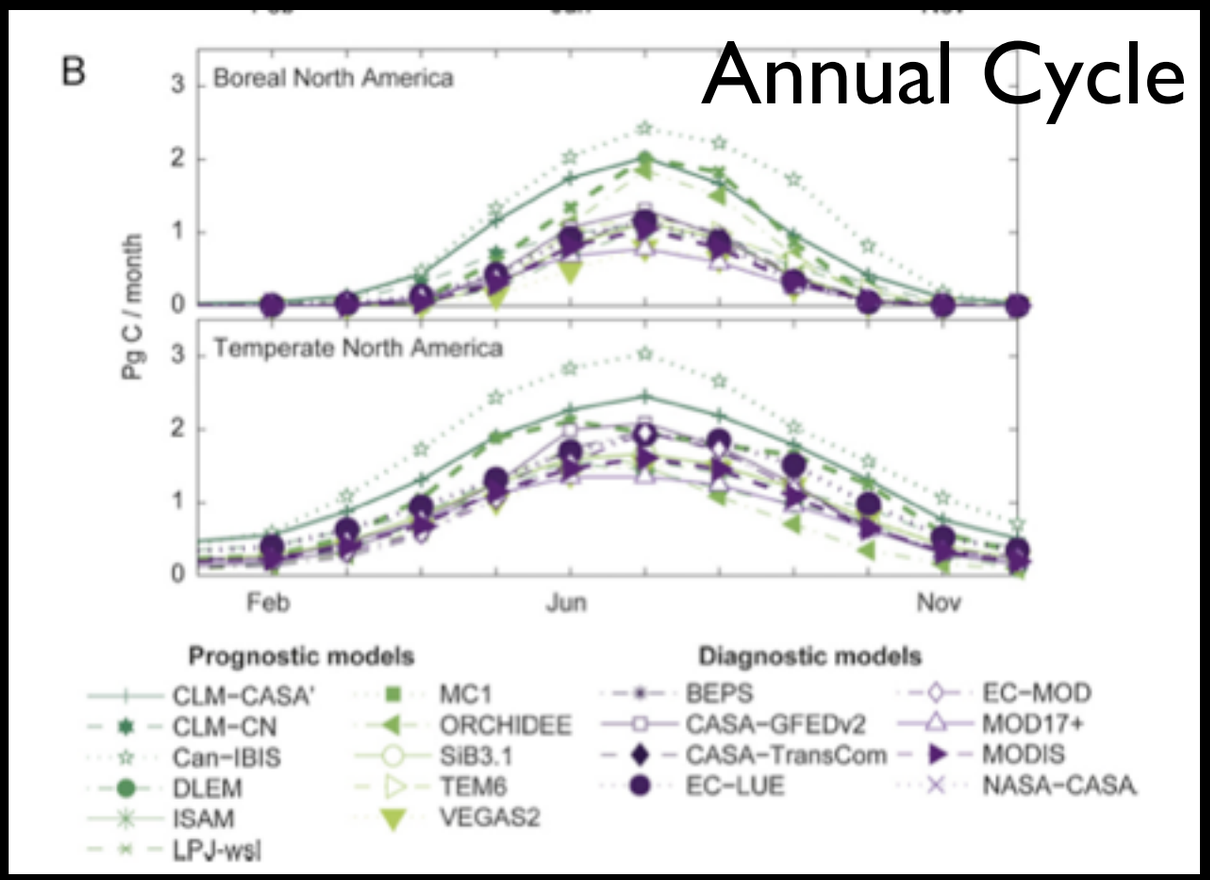
Carbon Cycle



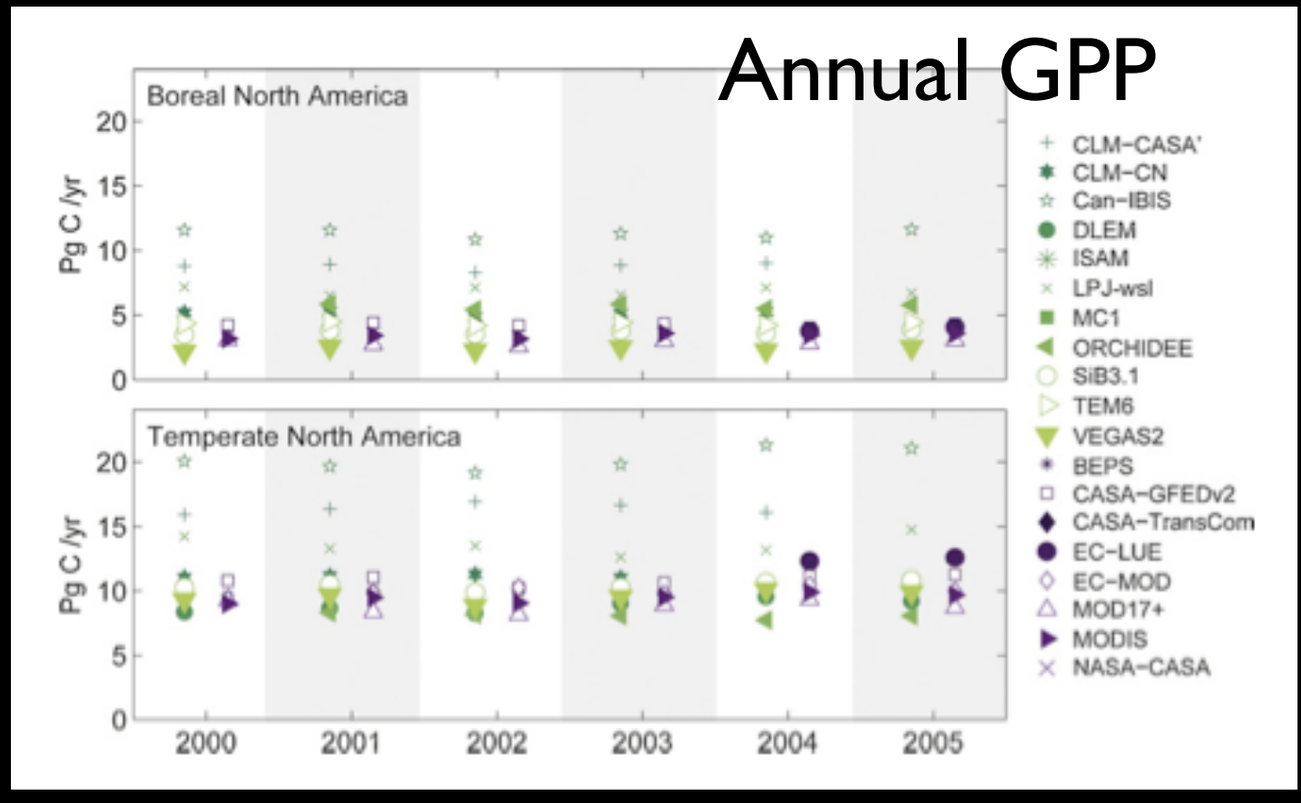
Gross Primary Productivity (GPP)



Annual Cycle

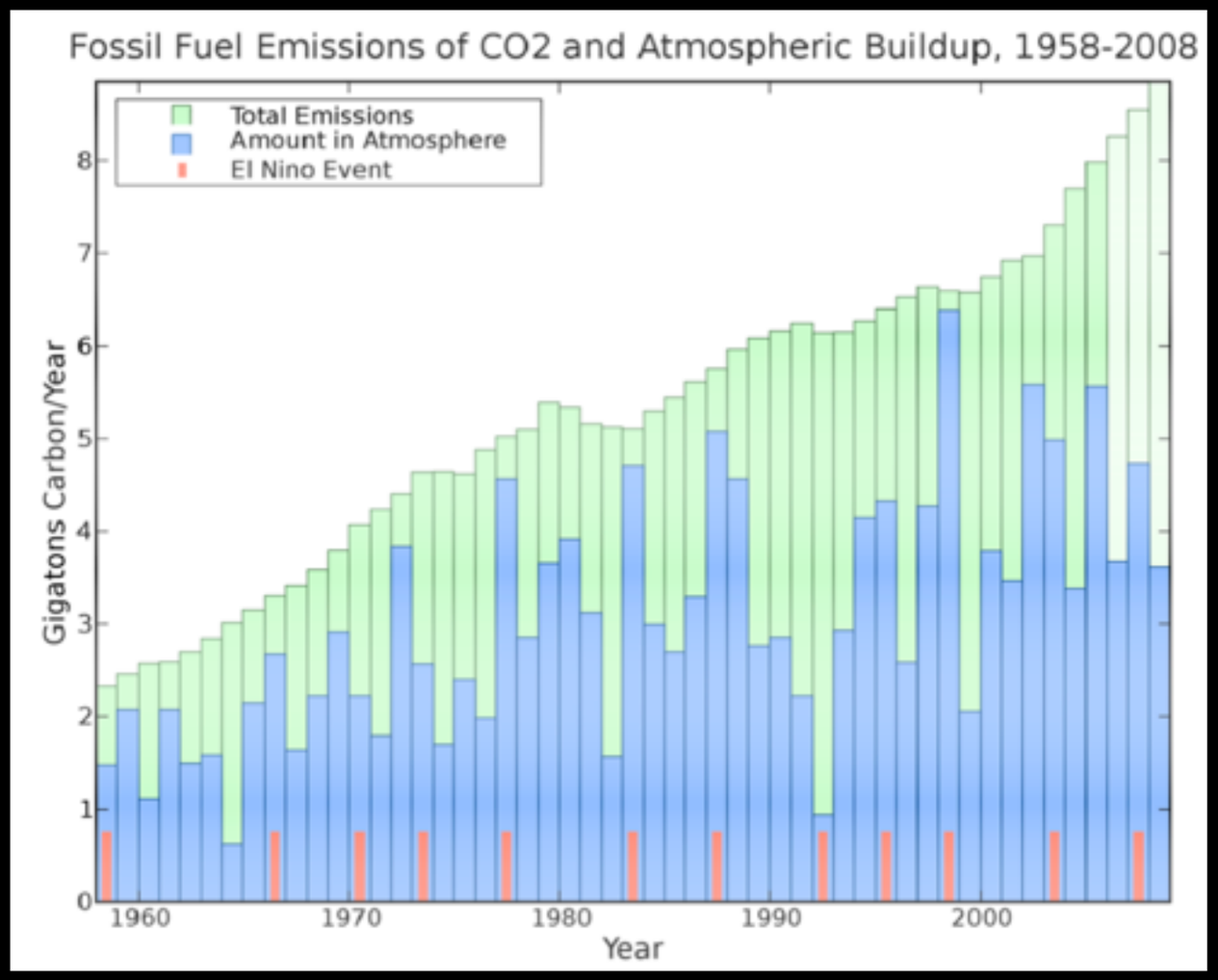


Annual GPP



Both plots from Huntzinger et al., 2011

Missing Sink



- Do we understand the processes that control the amount of anthropogenic CO_2 that remains in the atmosphere each year?

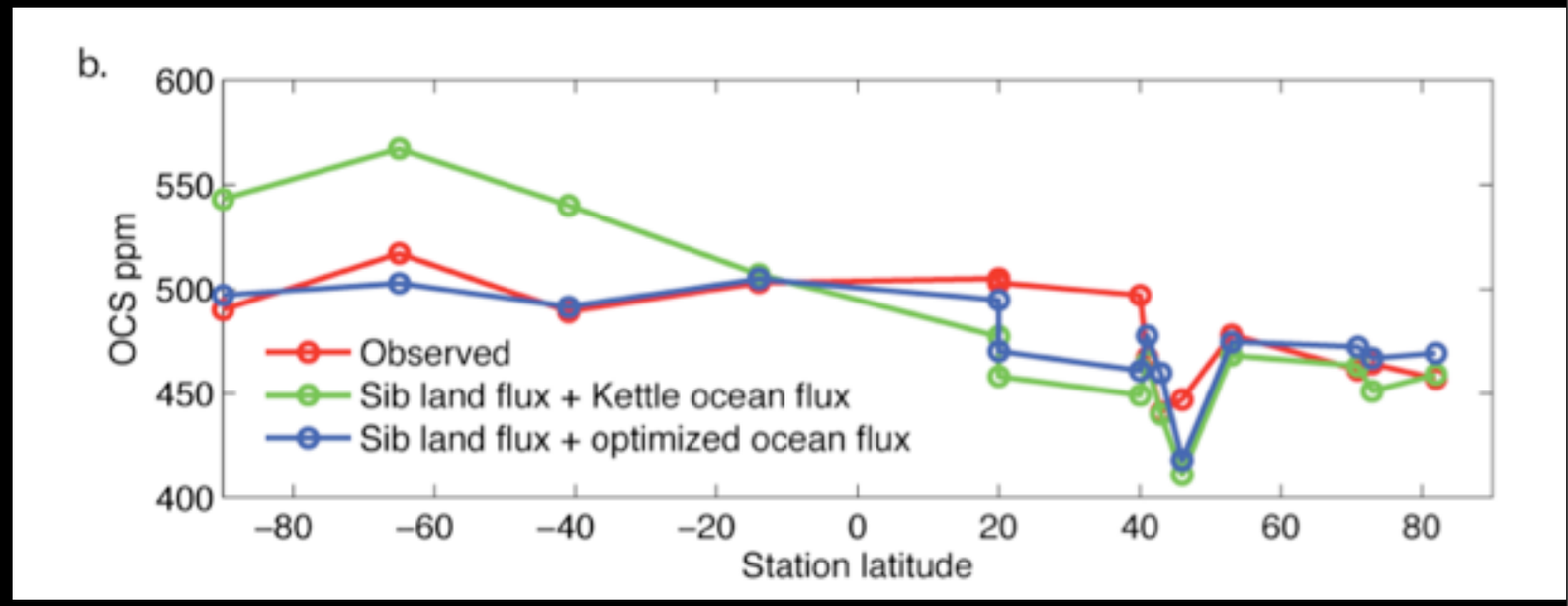
- Can we explain their behavior in the future?

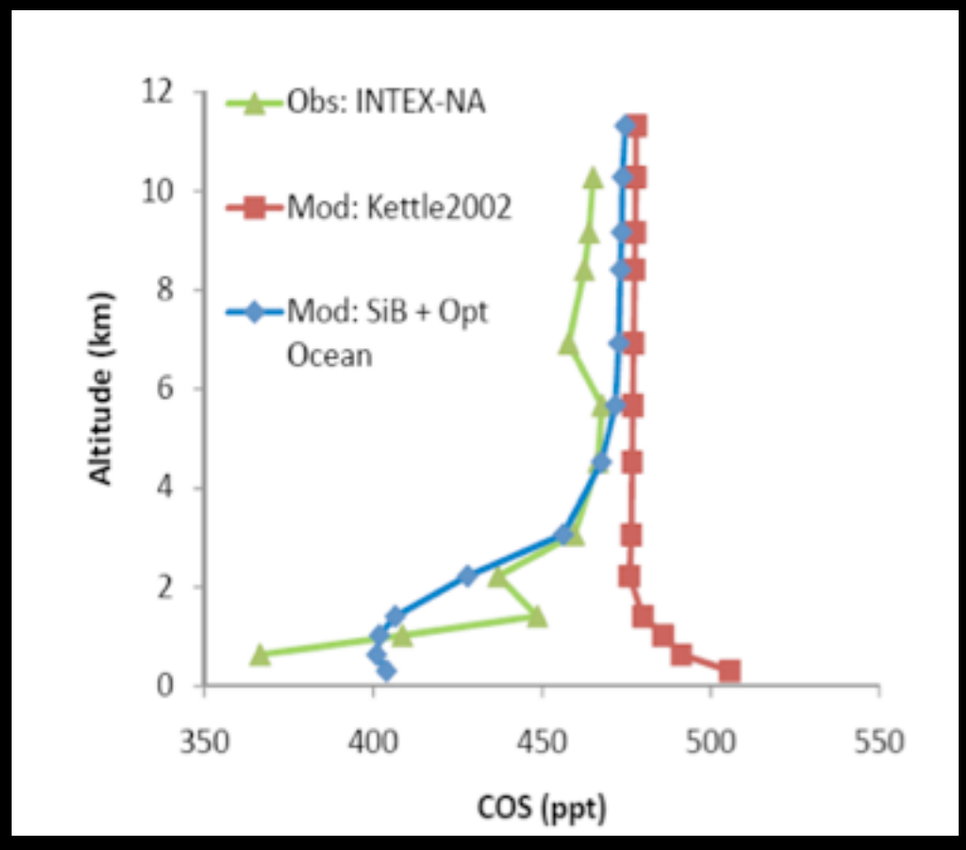
Land: New Methods

- GPP
  - Carbonyl Sulfide (OCS)
  - Chlorophyll Fluorescence
- Respiration
  - Explicit pools (SiB4)
  - Inversions

Land: Carbonyl Sulfide (OCS)

- Analog to CO2; taken up during photosynthesis
- Does not have the same large terrestrial source (oceanic)
- Use to evaluate simulated GPP



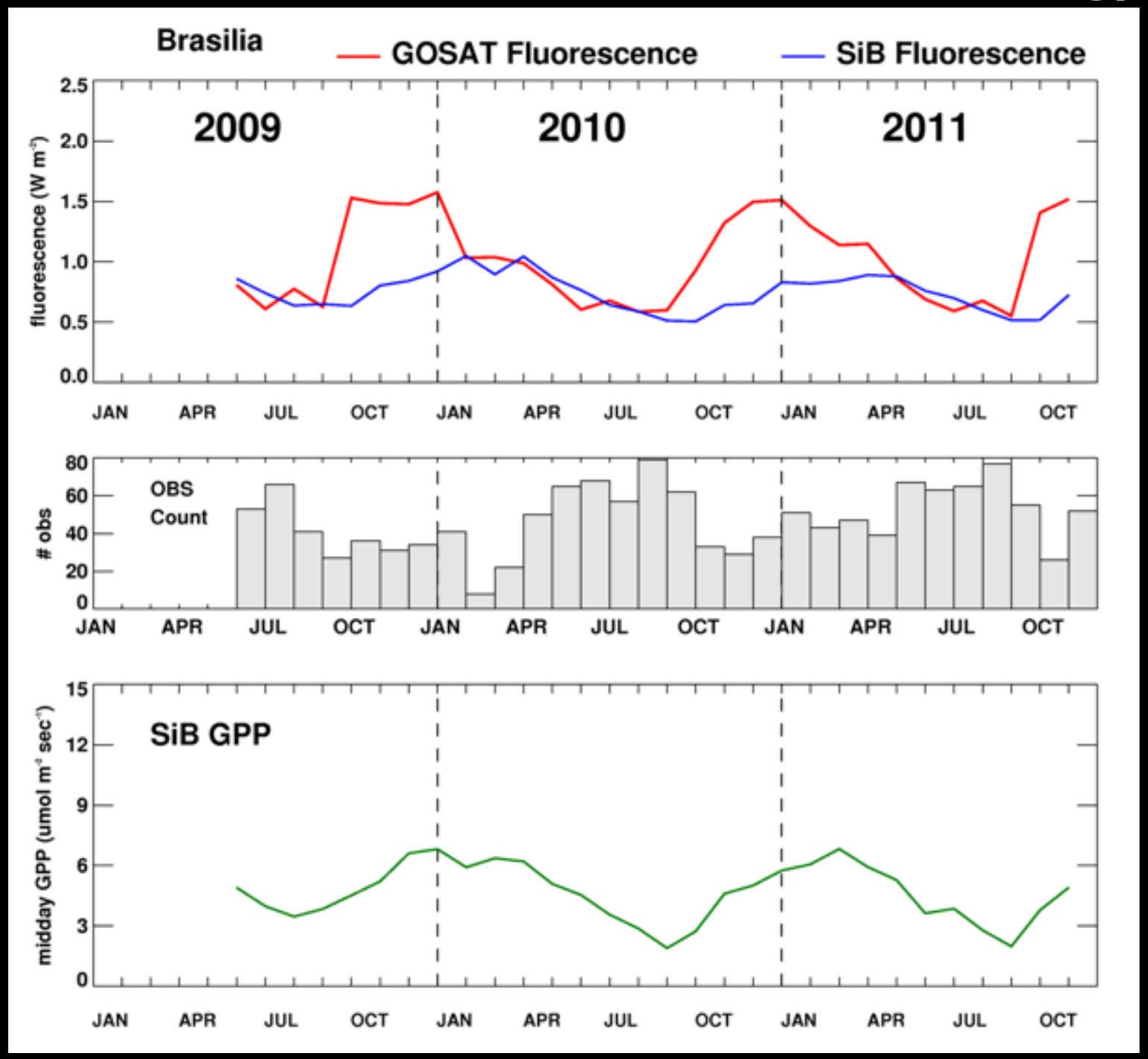


Both figures: Berry et al., (in review)

Land: Chlorophyll Fluorescence

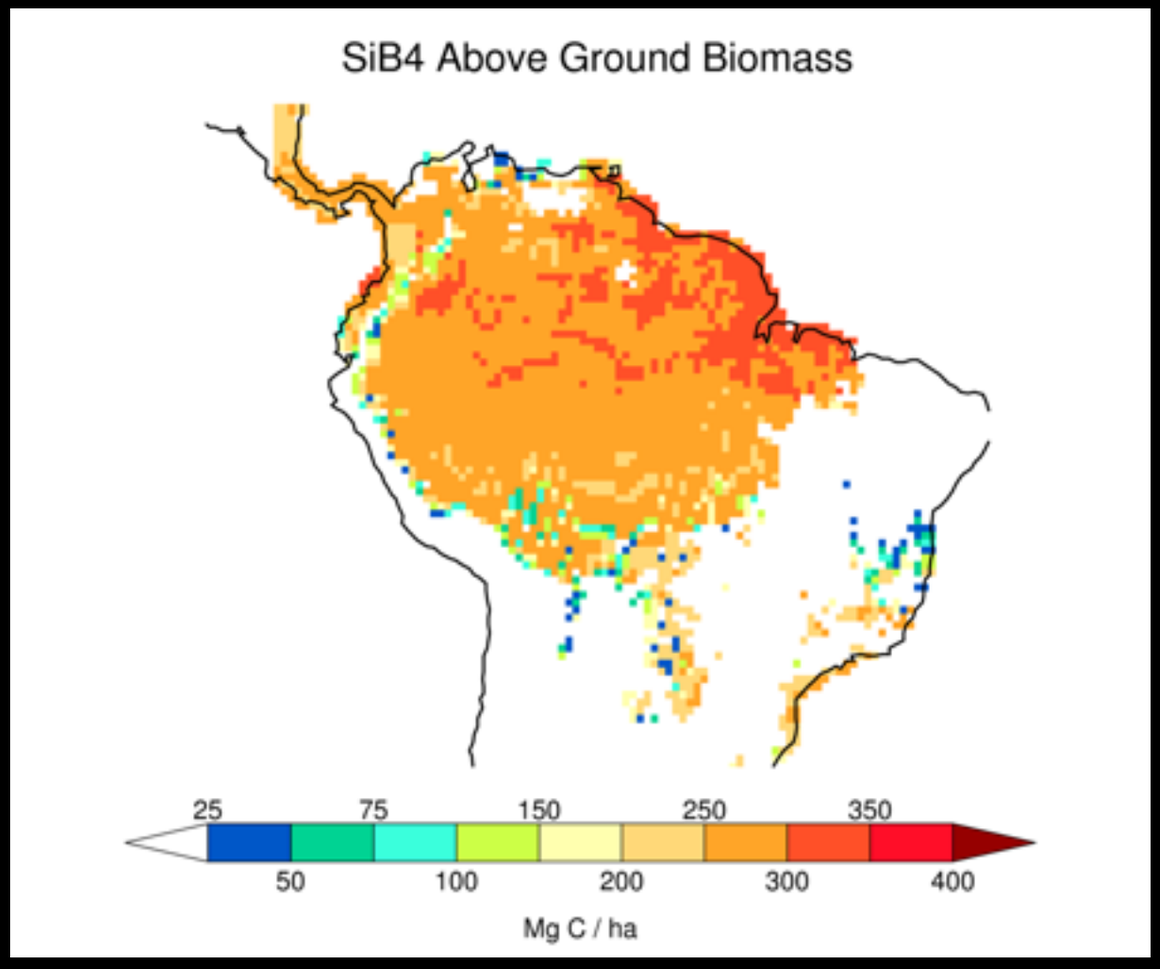
Light Energy

- Photosynthesis
- Heat (NPQ)
- Fluorescence

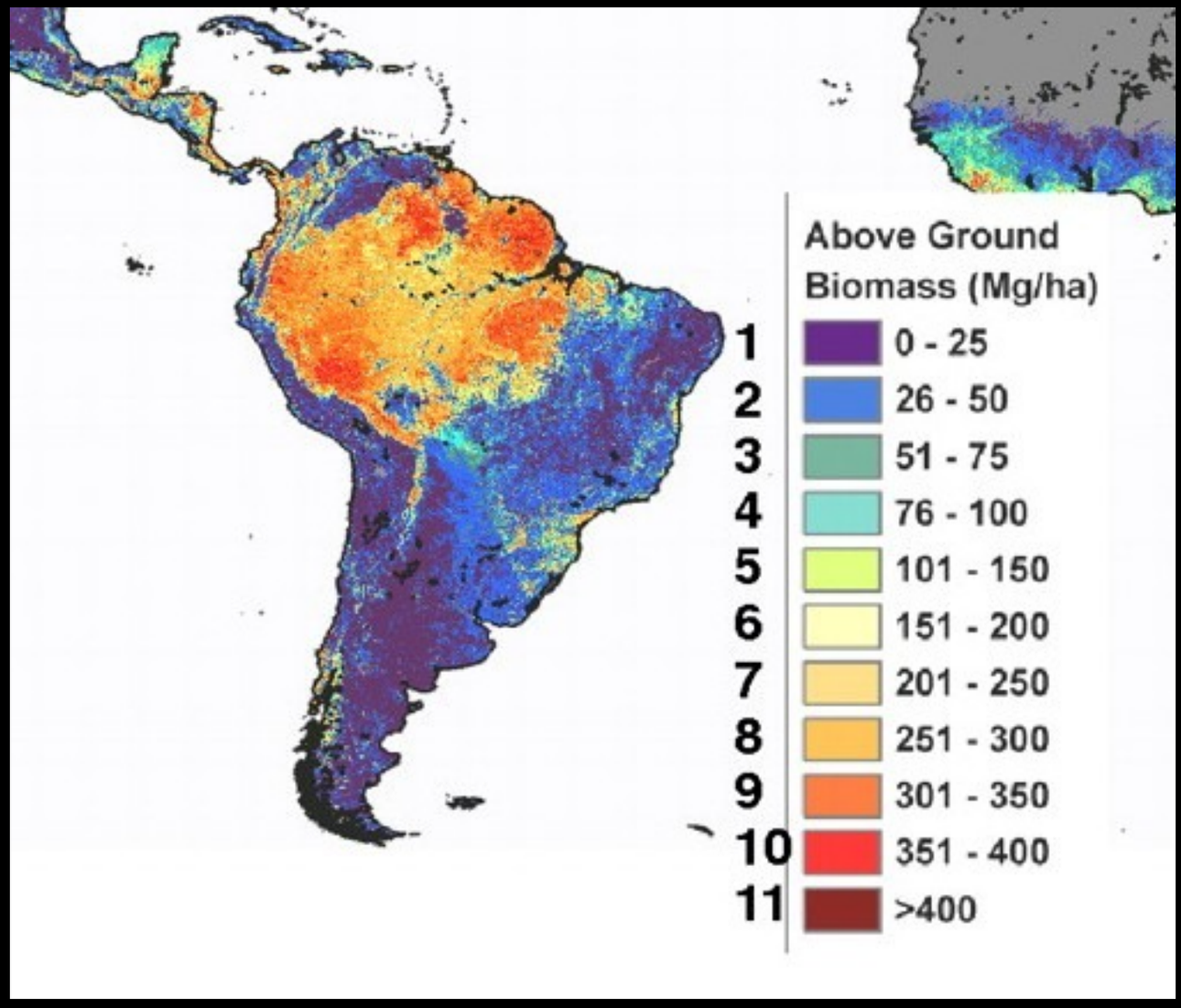


- Simulated Fs
- Compare w/ Satellite
- Global coverage!

Land: Respiration



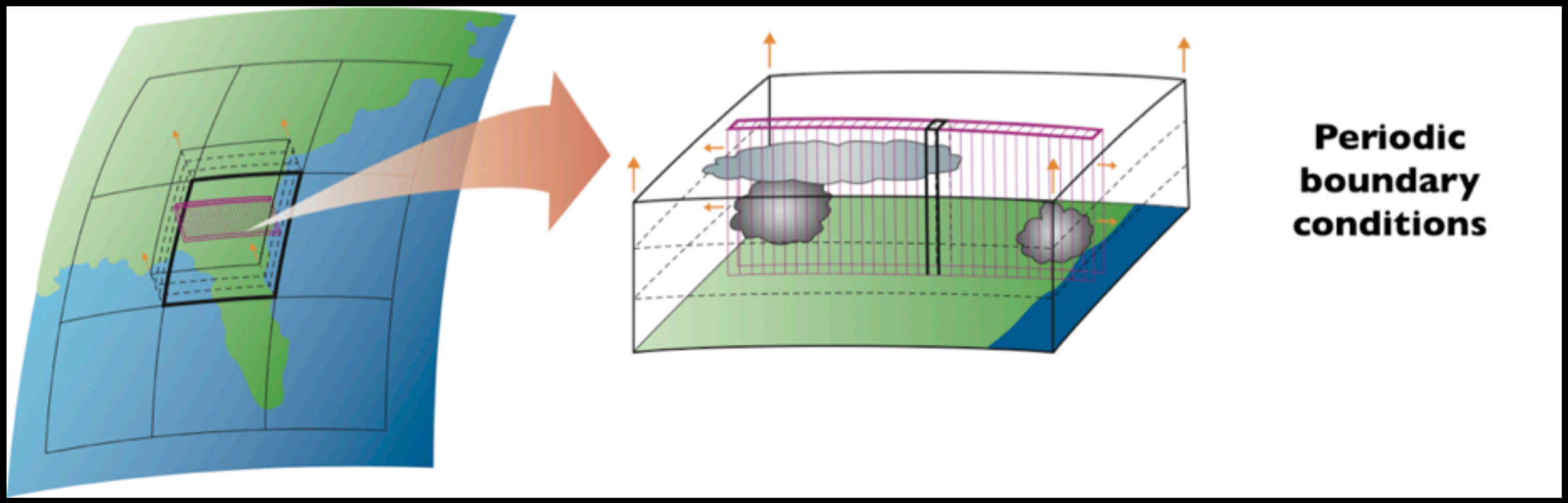
Simulated Biomass (SiB4)



Observed Biomass (Saatchi)

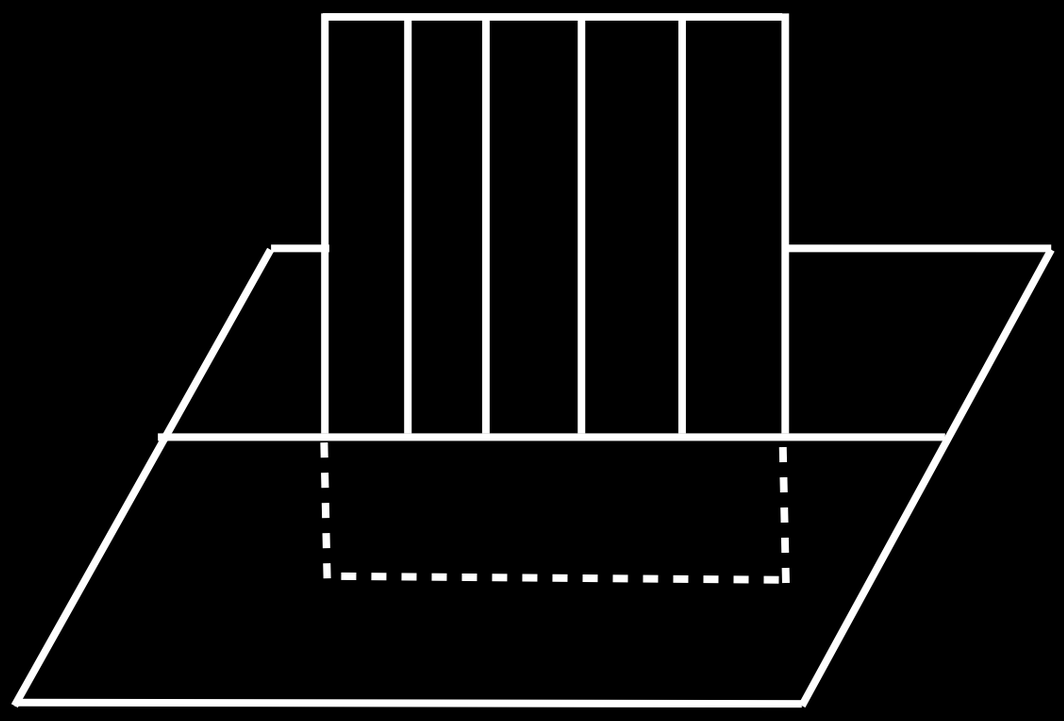
2. Programming

- How do we represent the land surface in MMF?



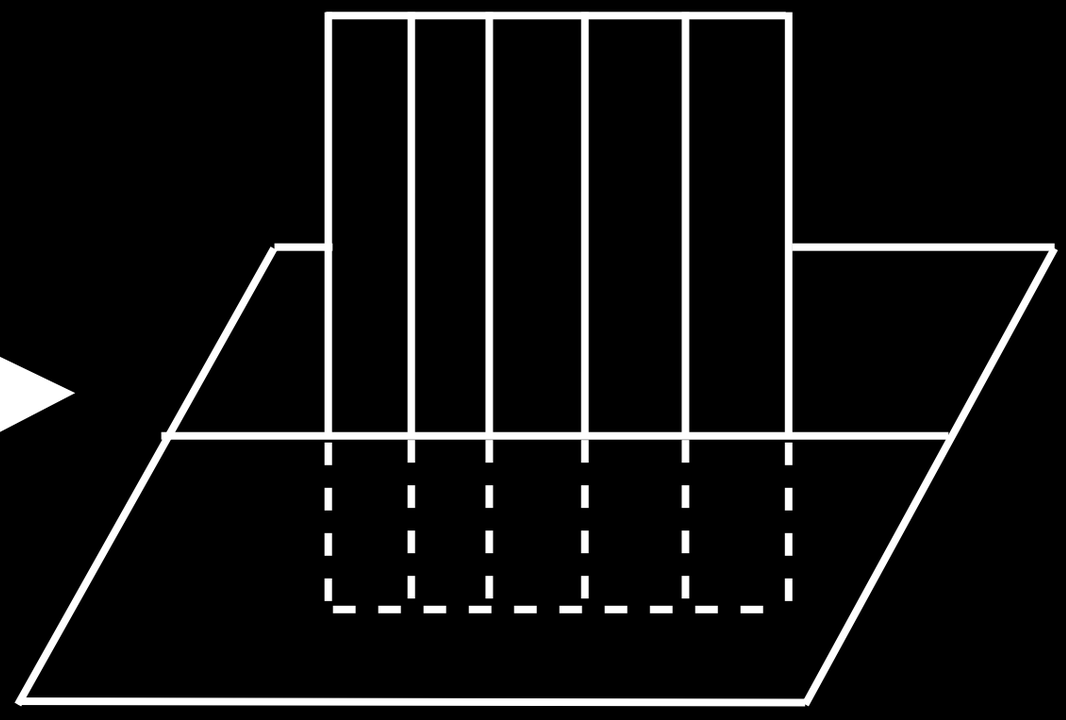
Superparameterized CESM (SP-CESM)

From this



Multiple atmospheres, single land

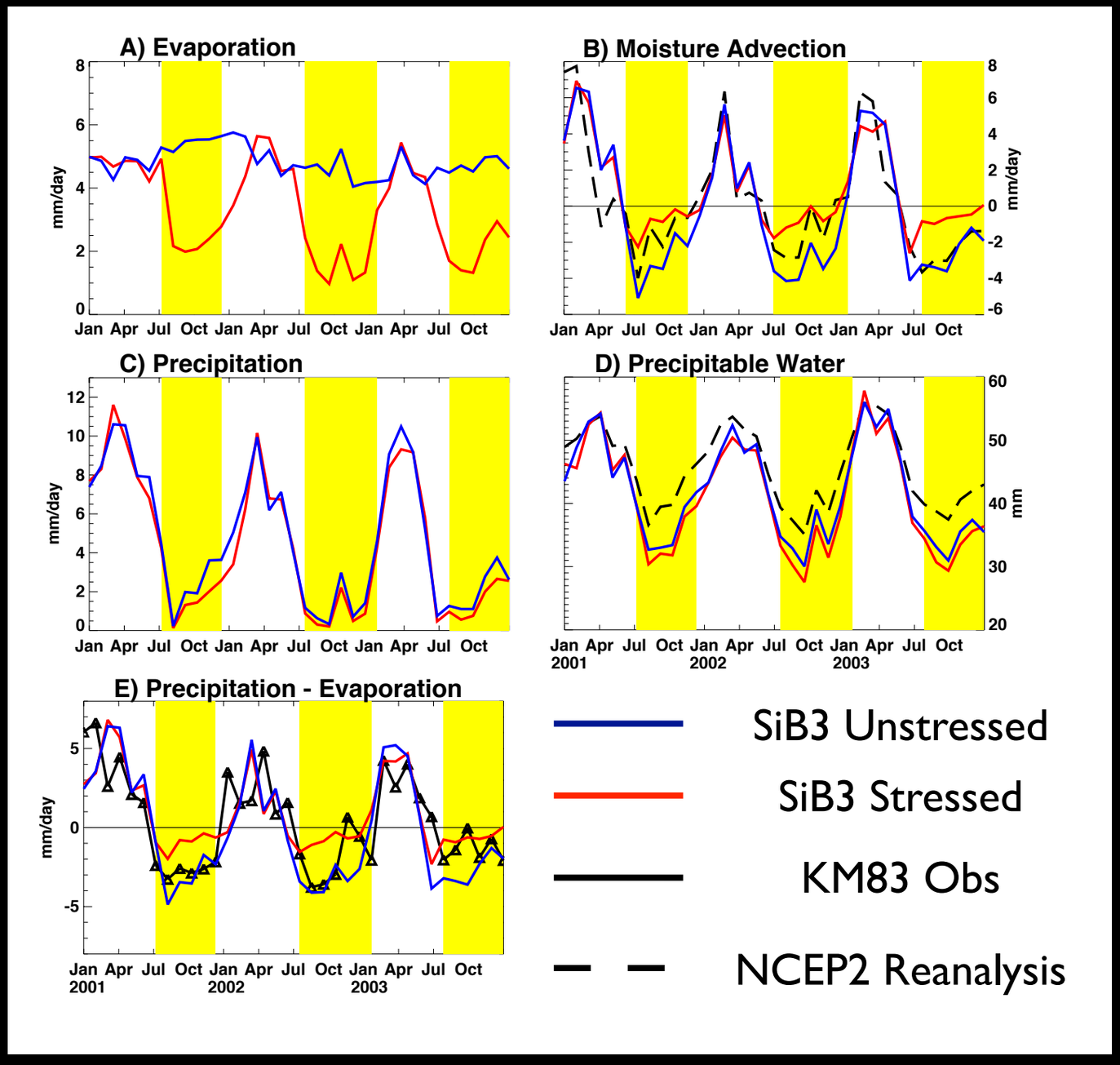
To this



Multiple atmospheres, multiple land

Superparameterized SCM

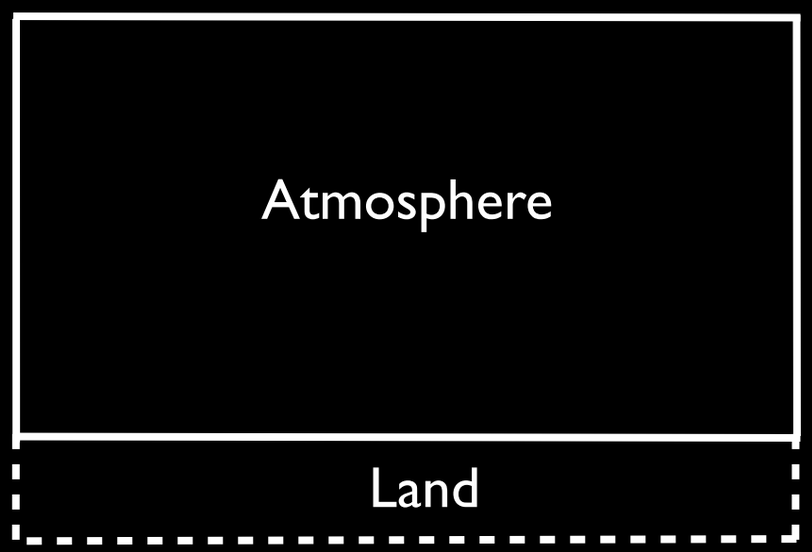
From Harper et al., 2010



- Previous work has shown how surface influences atmosphere
- Now we can look into superparameterization

Superparameterized Single Column Model (Super-SCM)

From this



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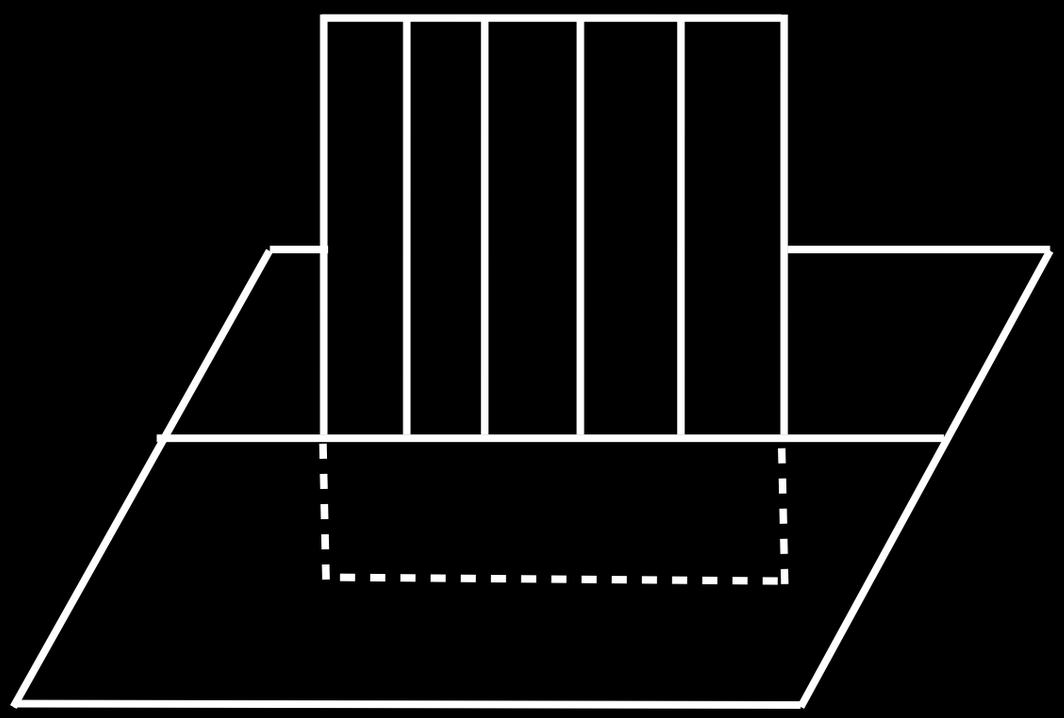

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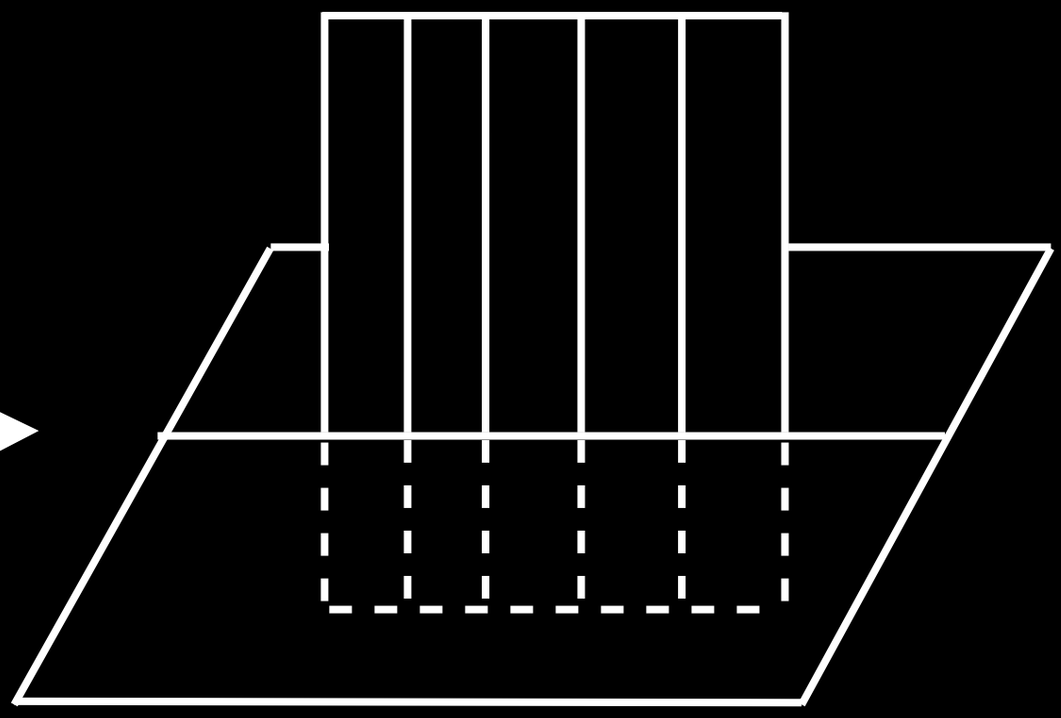

MOVIE!

- January (rainy season) , Tapajos River site (Brazil)
- Atmospheric forcing: ‘relaxed’, meaning large-scale behavior is tied to observations
- CO_2: initialized at 385 ppm, allowed to evolve
- 64 land columns