Soil organic carbon response to harvested crops: a comparison between biogeochemistry model versions
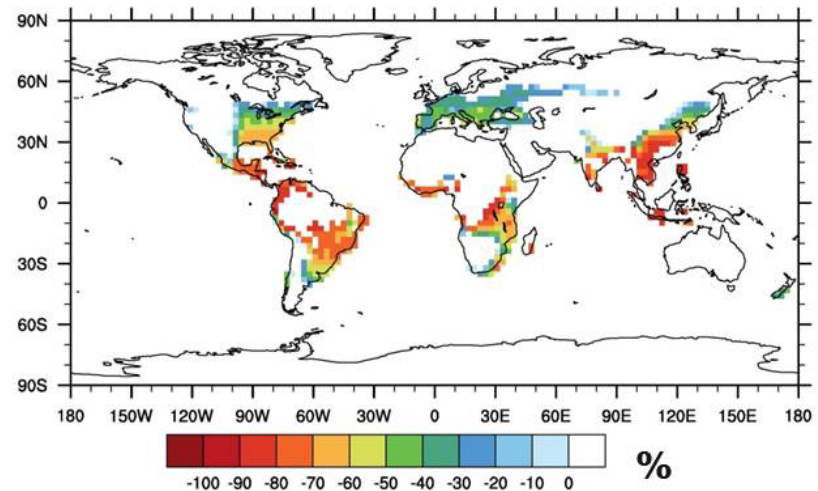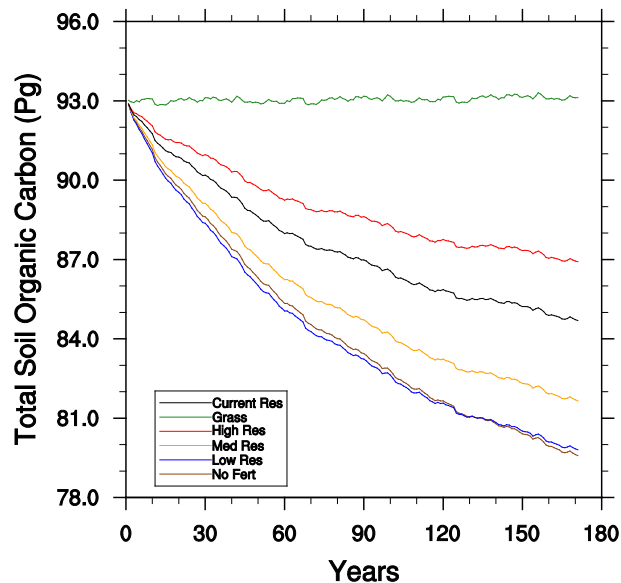
Beth Drewniak

Background/Motivation

- CLM4.5 – harvest puts grain into litter pools

- Microbes = Happy

- Farmers = Sad

- But, removing grain has a big impact on the carbon cycle

http://www.sipcamadvanblog.com/wp-content/uploads/2013/03/corn_harvest.jpg
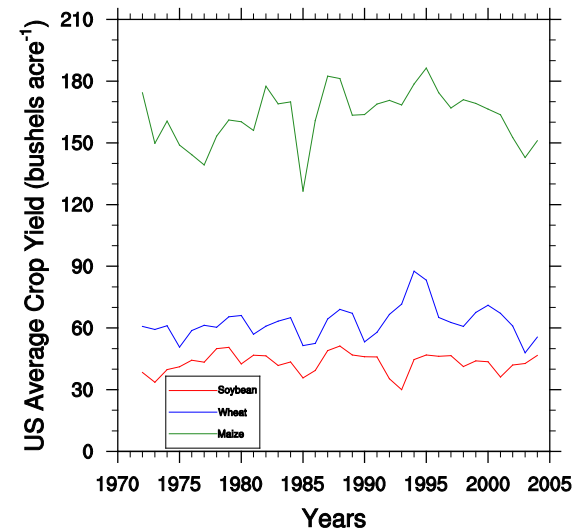
First: Calculate Yields

- Calculate grain yield (adapted from Agro-IBIS):

$$Yield = grainc * fyield * convfact / cgrain$$

- grainc = grain carbon (g/m^2)
- fyield = adjustment factor for portion of grain that is actually harvested
- convfact = conversion to get from g/m^2 to bu/acre
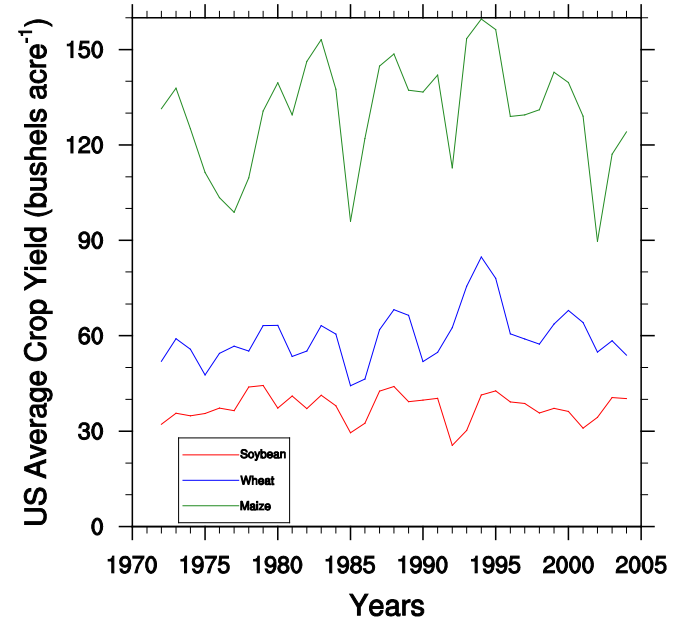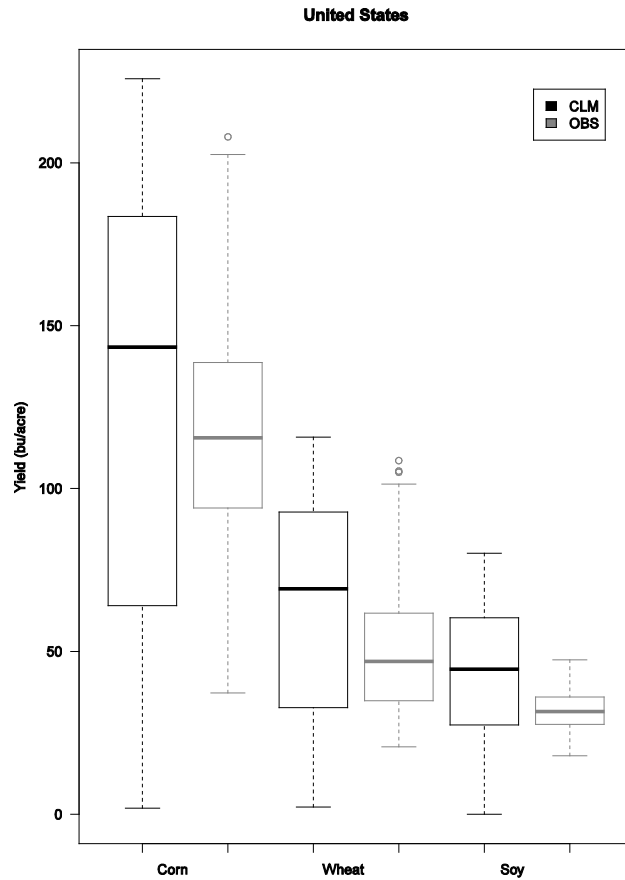- cgrain = amount of carbon in grain (0.45)

Harvesting Grain

- Grain carbon and nitrogen pushed into product pool

- Decays over 1-yr

- Can be coupled to atmosphere as respiration

- Option to put leaves and stems into product pool, currently not used
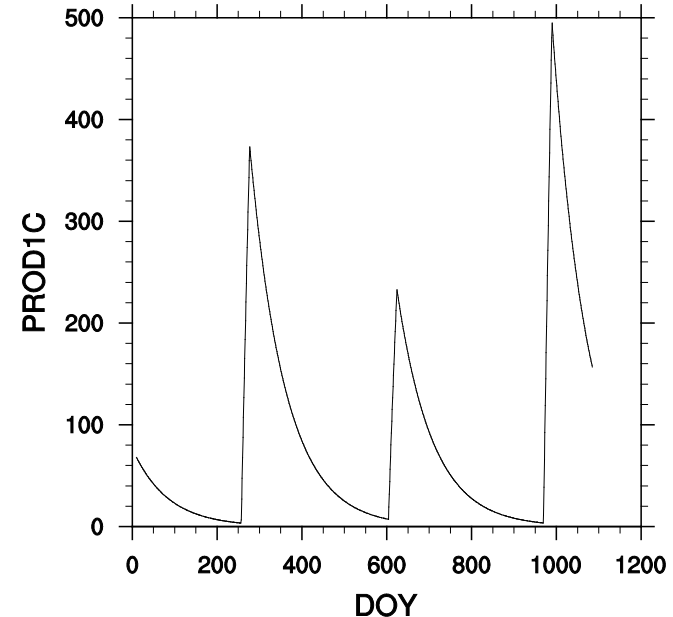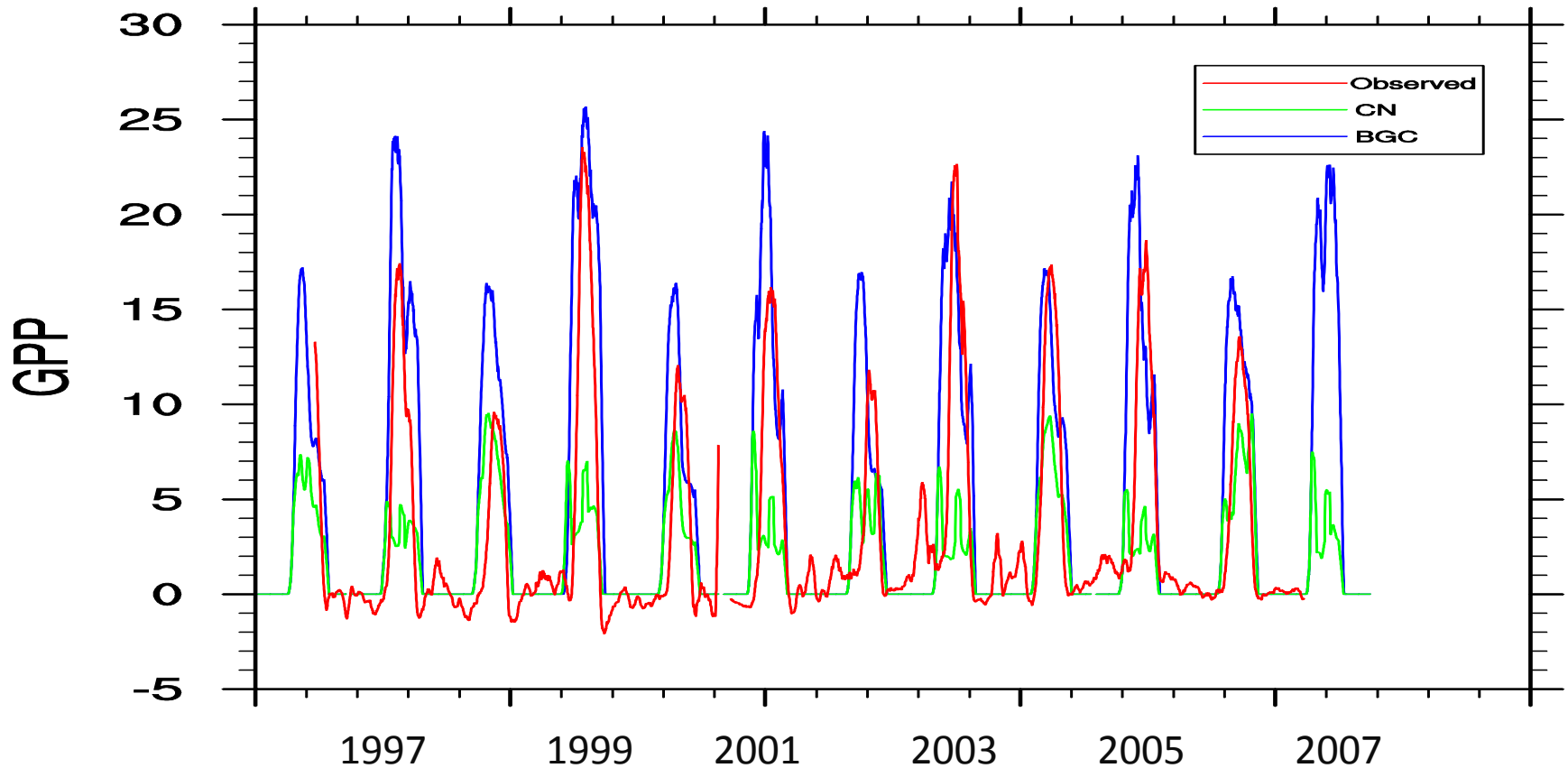
Yields when crops are harvested

PTCLM: Bondville, IL
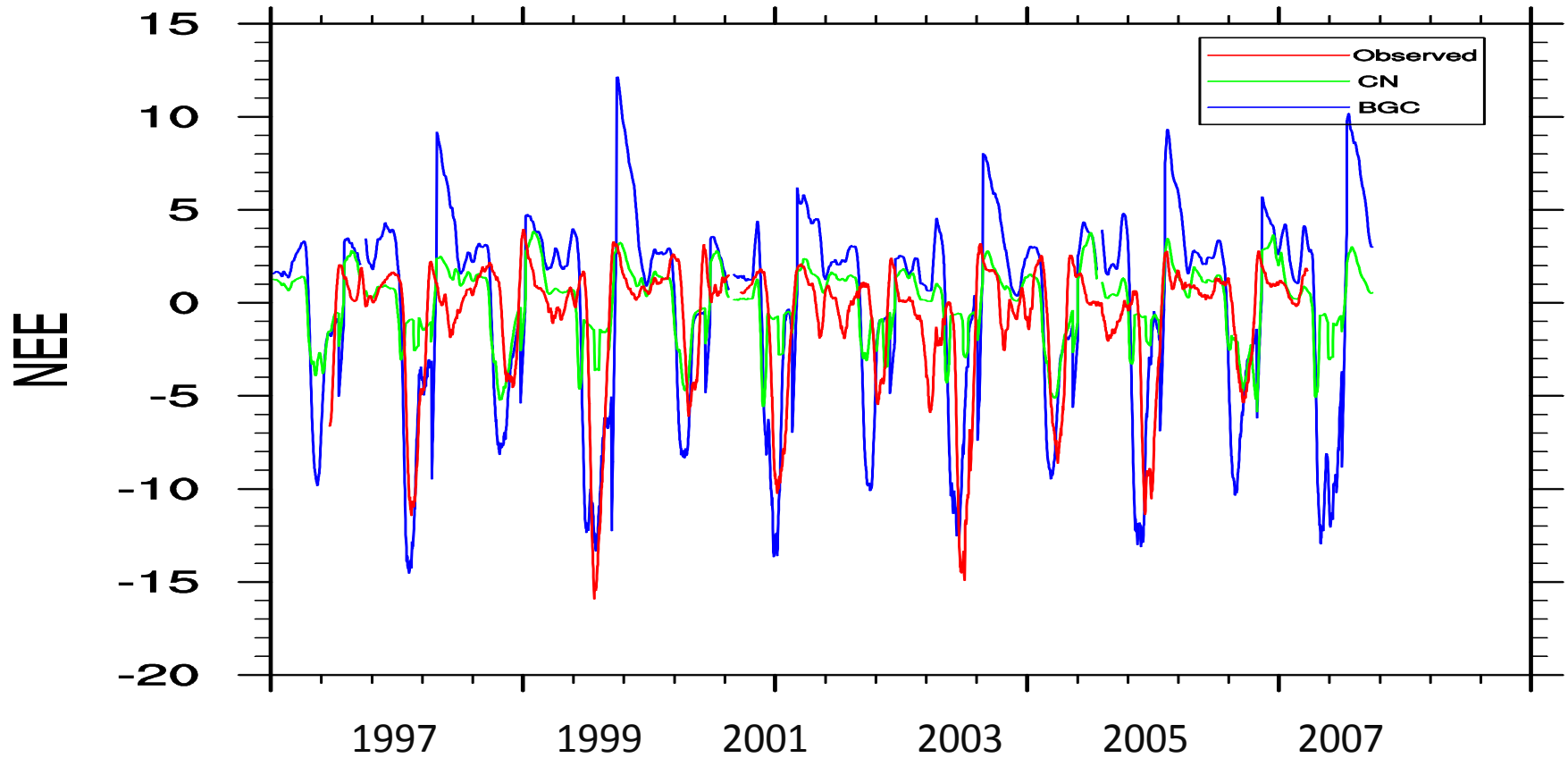## Ameriflux site
BGC vs. CN
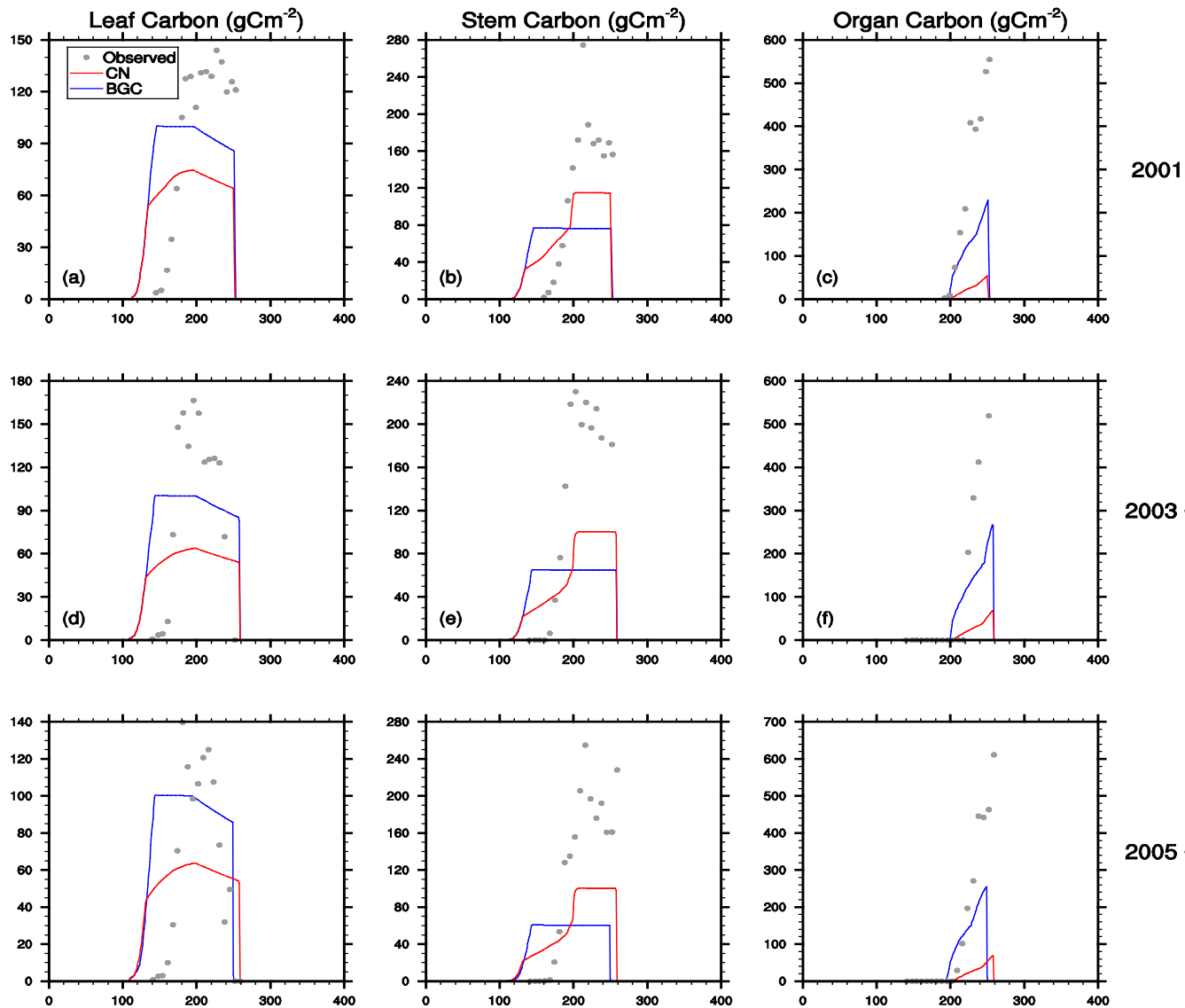

Photo Courtesy of David Cook

Gross Primary Productivity at Bondville, IL under a corn-soybean rotation
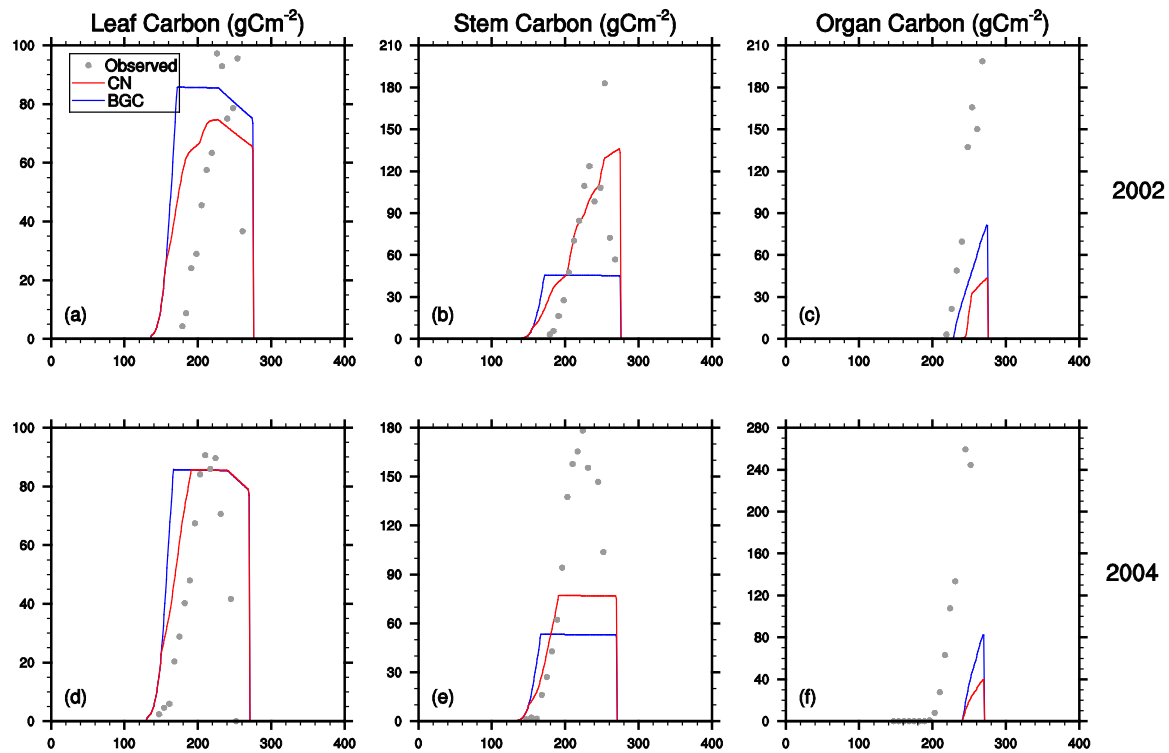
Net Ecosystem Exchange at Bondville, IL
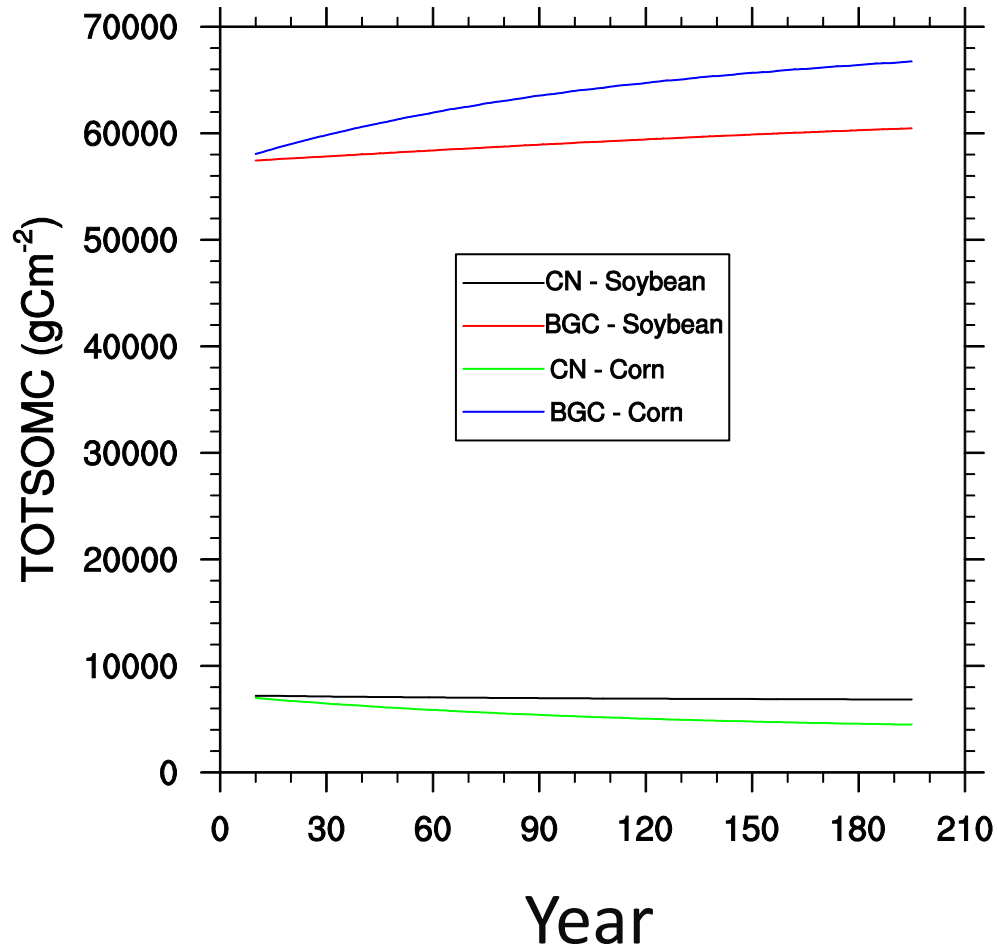
Corn at Bondville, IL

Soybean at
Bondville, IL

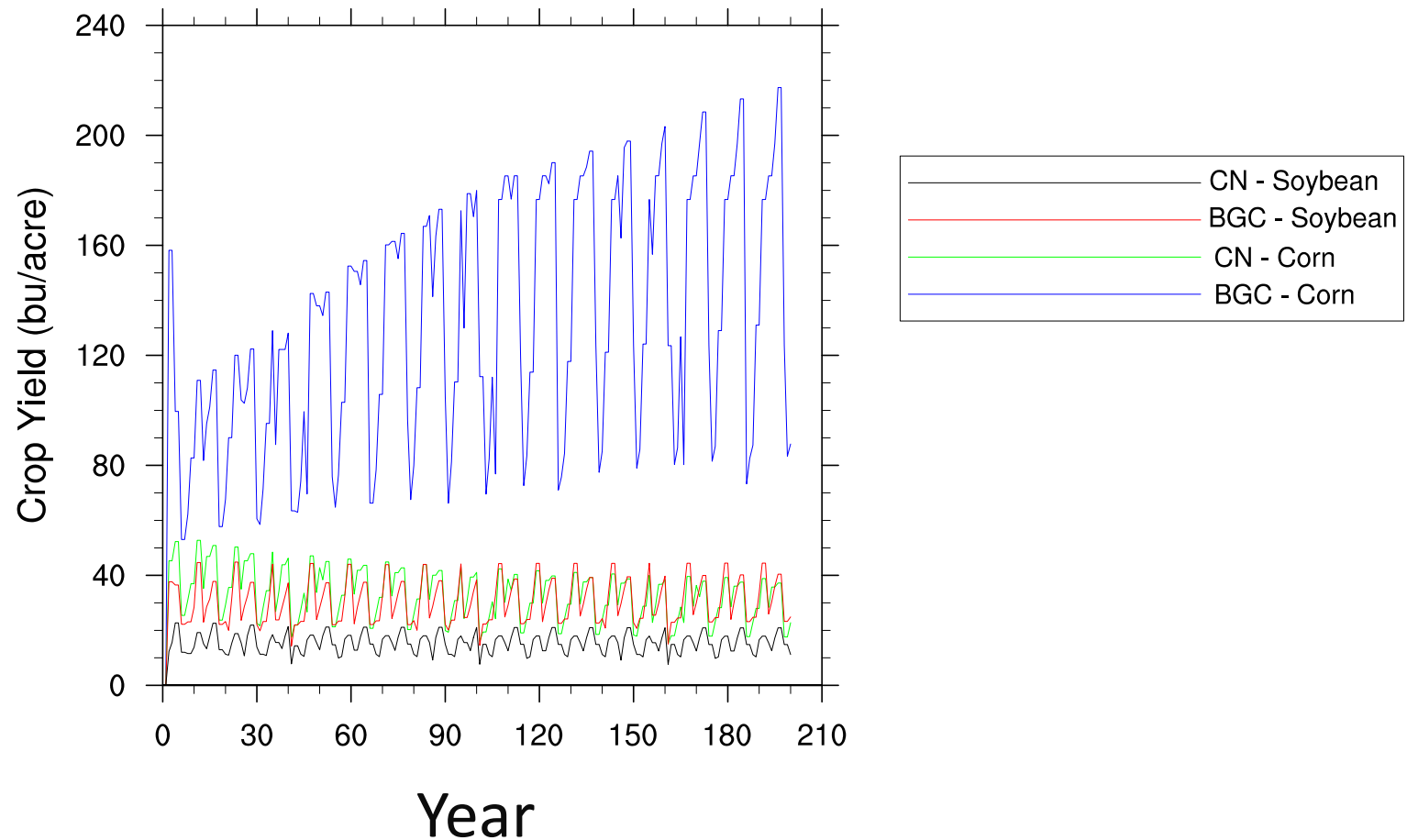# What about Soil Carbon?
...and other crazy plots
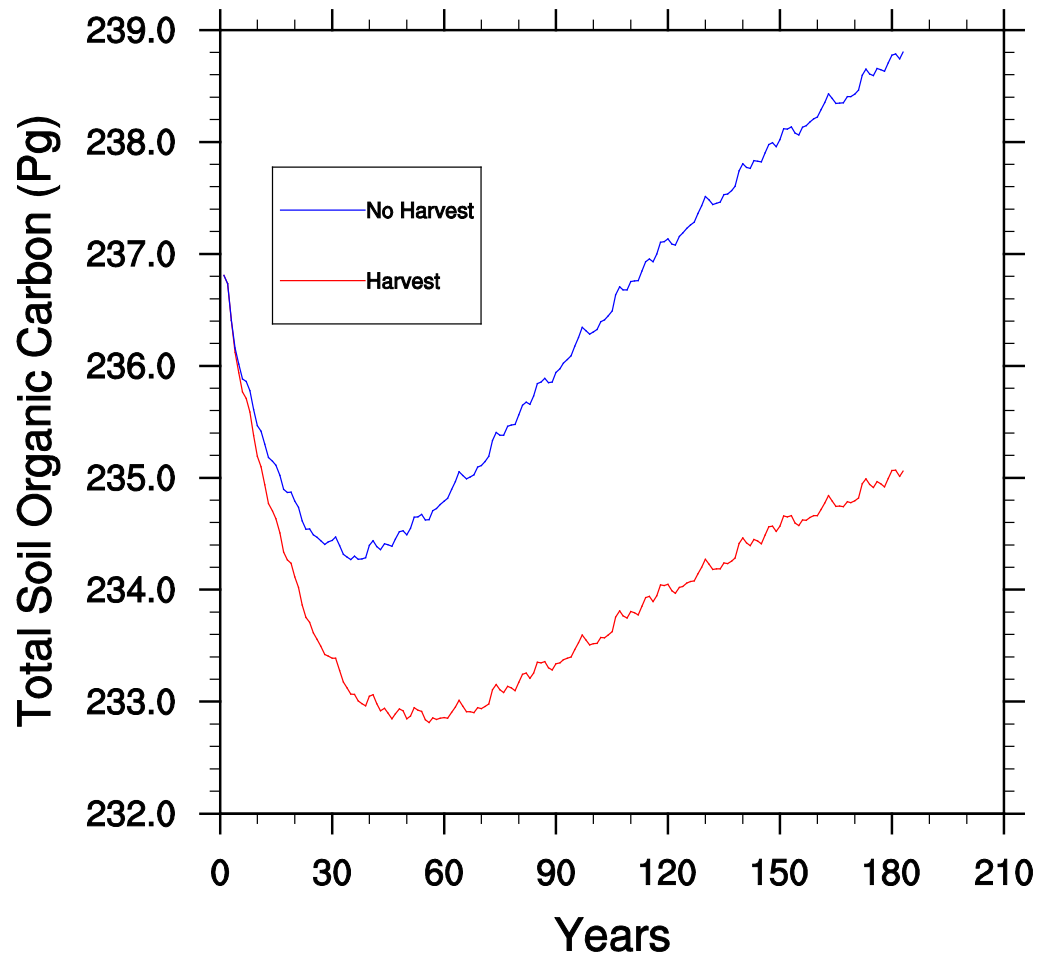
At Bondville, IL

Crazy corn yields – increasing, and huge variability
Other crops are OK

A global perspective

Conclusions

- Harvest does have an effect on plant productivity

- BGC works great for corn, CN works better for soybean

- Harvest results in a decrease in SOC for CN, but not for BGC
  - Increases in SOC result in increasing yield

- Model needs to be properly spun up with crops

Future Directions

- CSI (Corn Scenario Investigation) to resolve the corn yield
  - Run with other atmospheric forcing data?
- Calibrate parameters – in progress for soybean
- Start testing residue harvest
- Incorporate other management practices

Thanks

Acknowledgements