

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

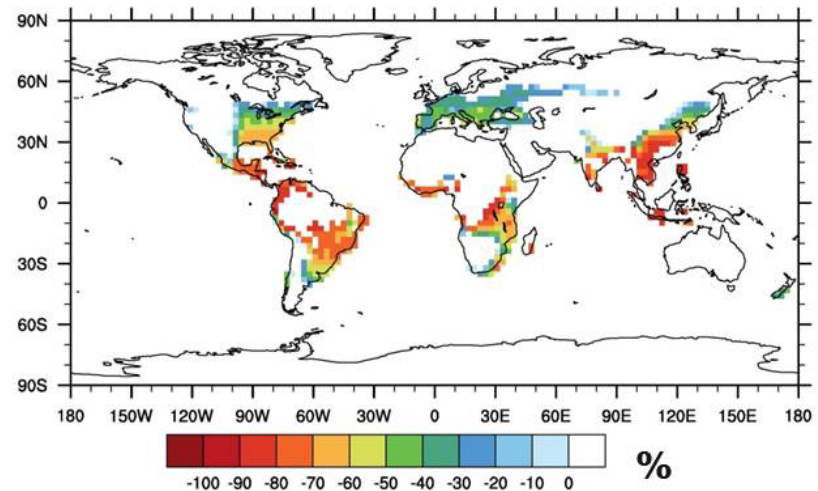
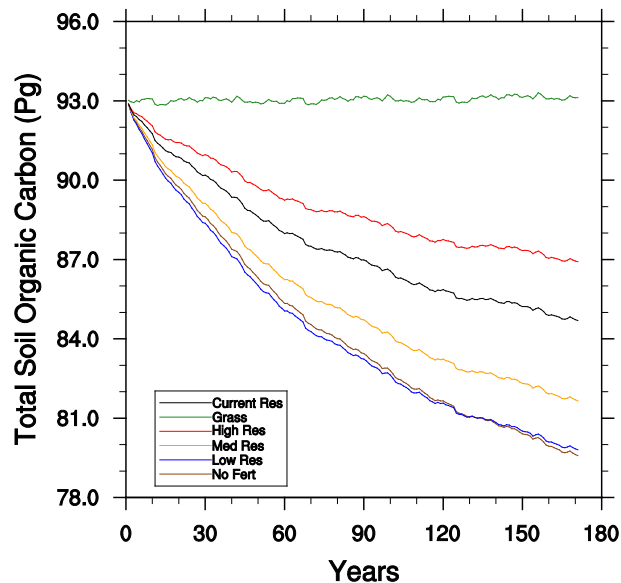
Beth Drewniak

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

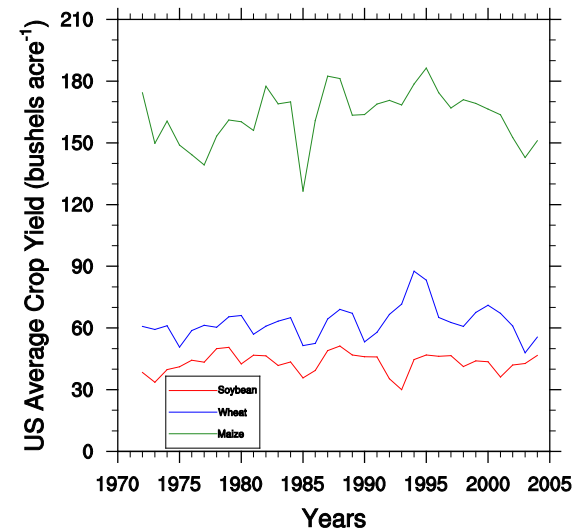


First: Calculate Yields

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

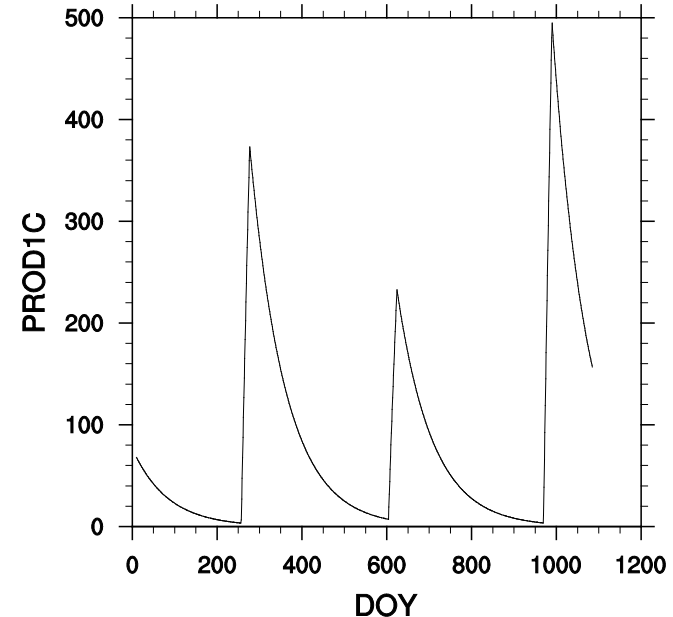
$$\text{Yield} = \text{grainc} * \text{fyield} * \text{convfact} / \text{cgrain}$$

- 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)

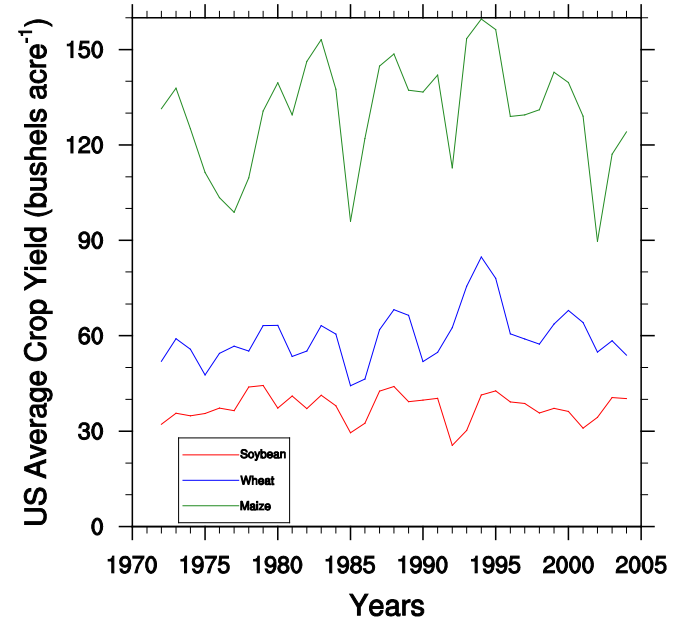
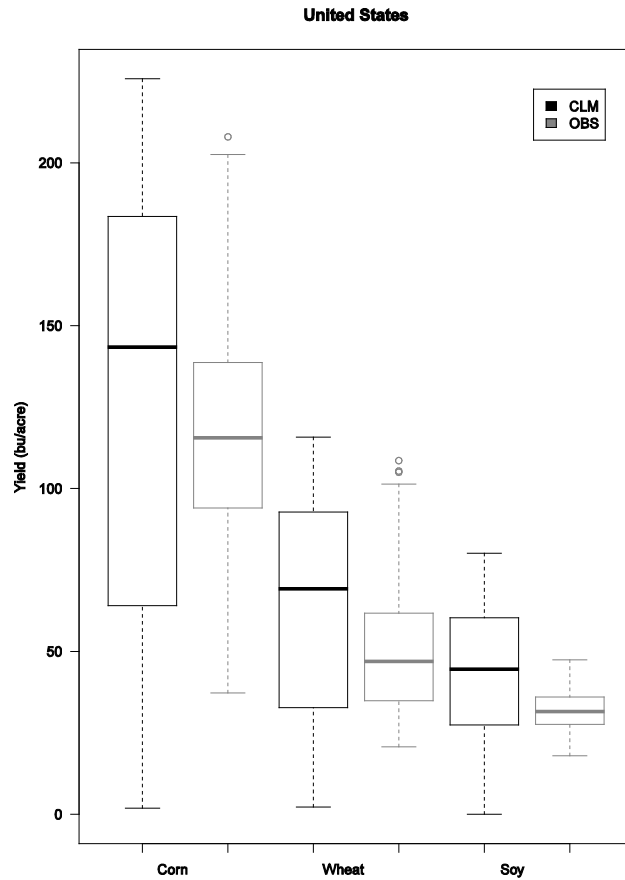


Harvesting Grain

- 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

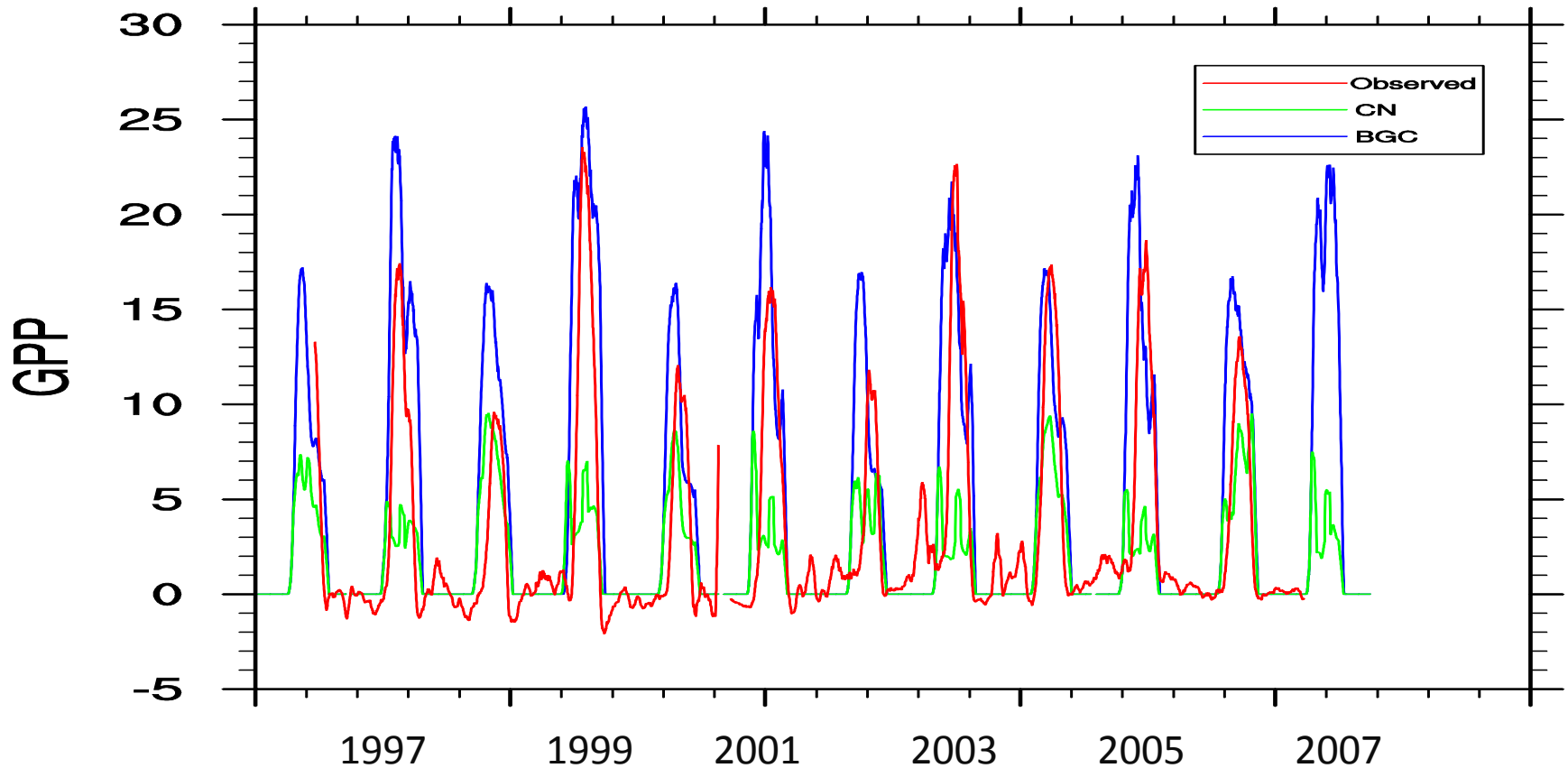


PTCLM: Bondville, IL Ameriflux site BGC vs. CN

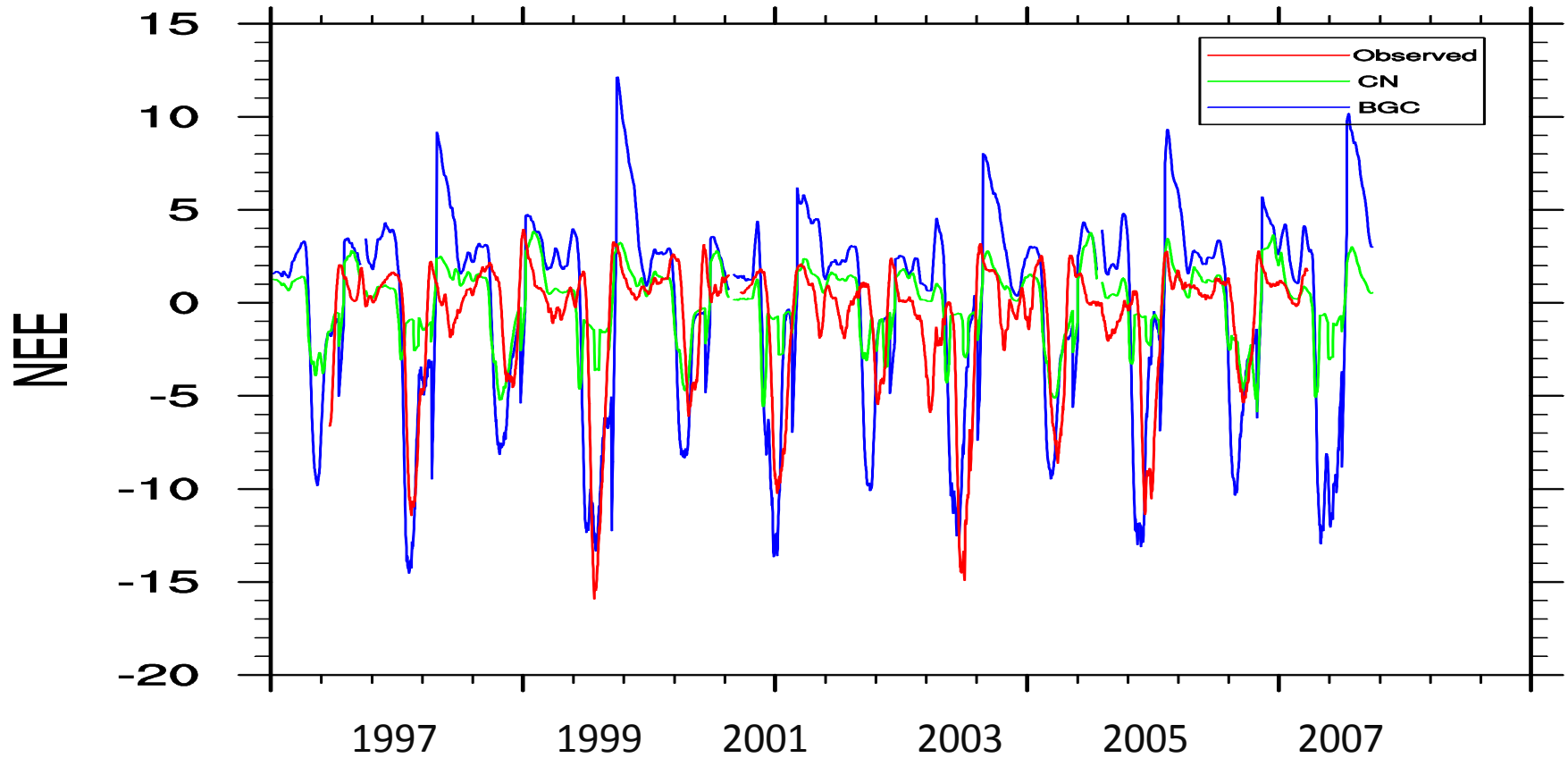


Photo Courtesy of David Cook

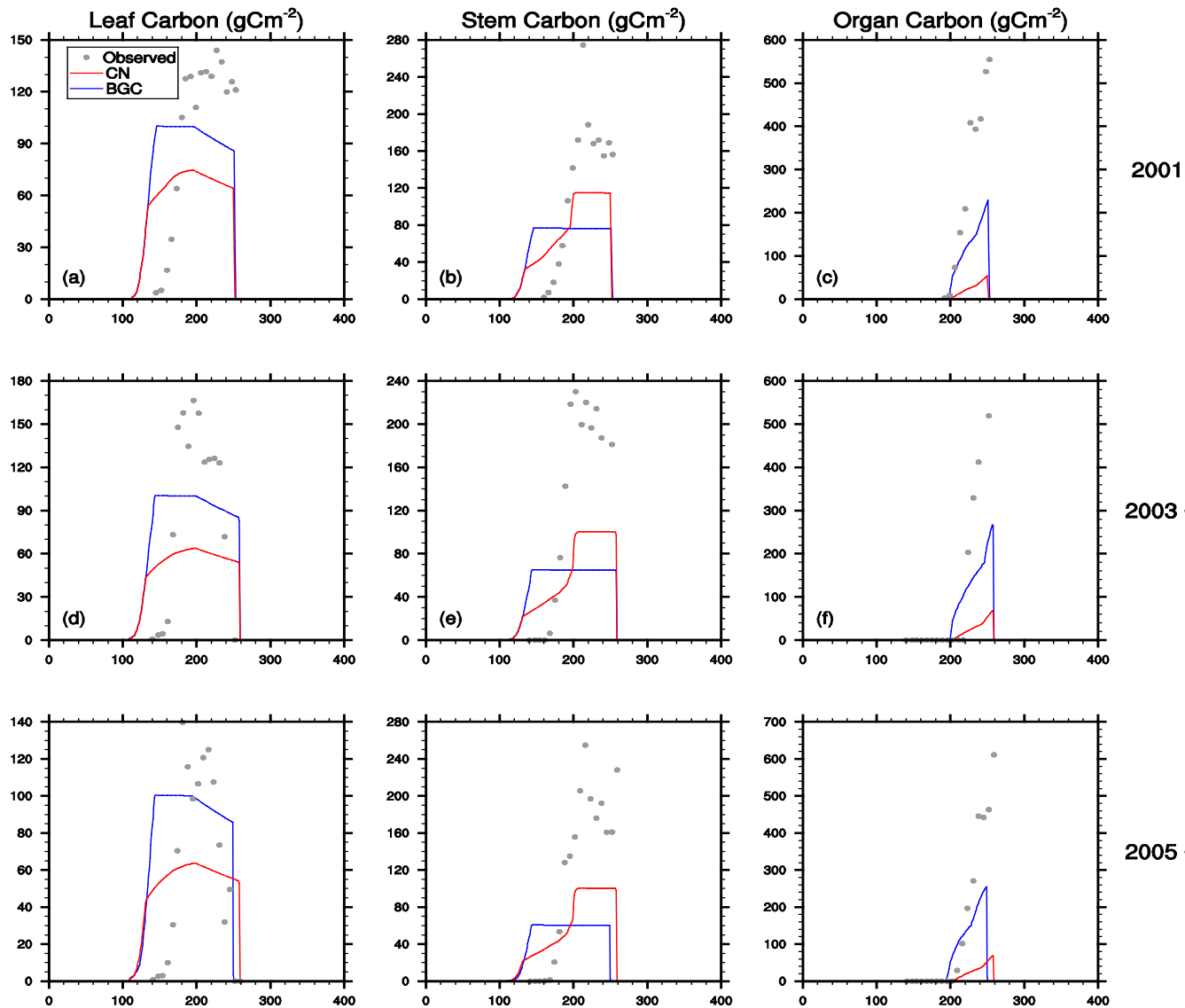
Gross Primary Productivity at Bondville, IL under a corn-soybean rotation



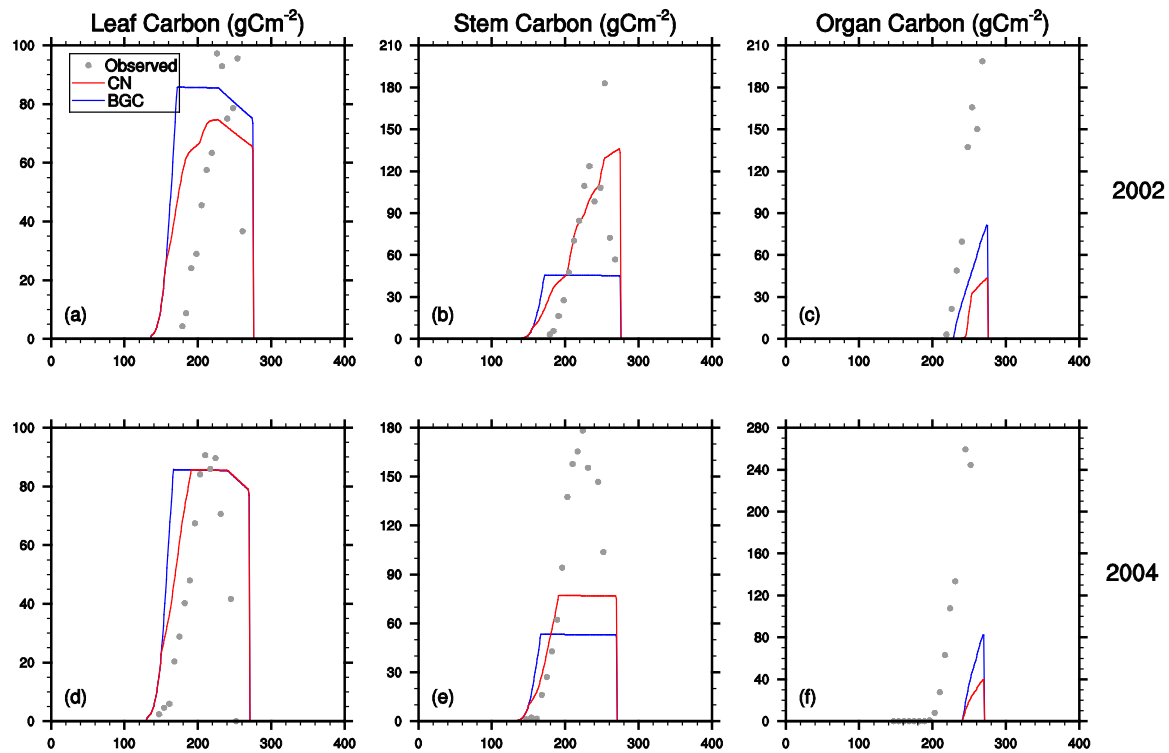
Net Ecosystem Exchange at Bondville, IL



Corn at
Bondville, IL



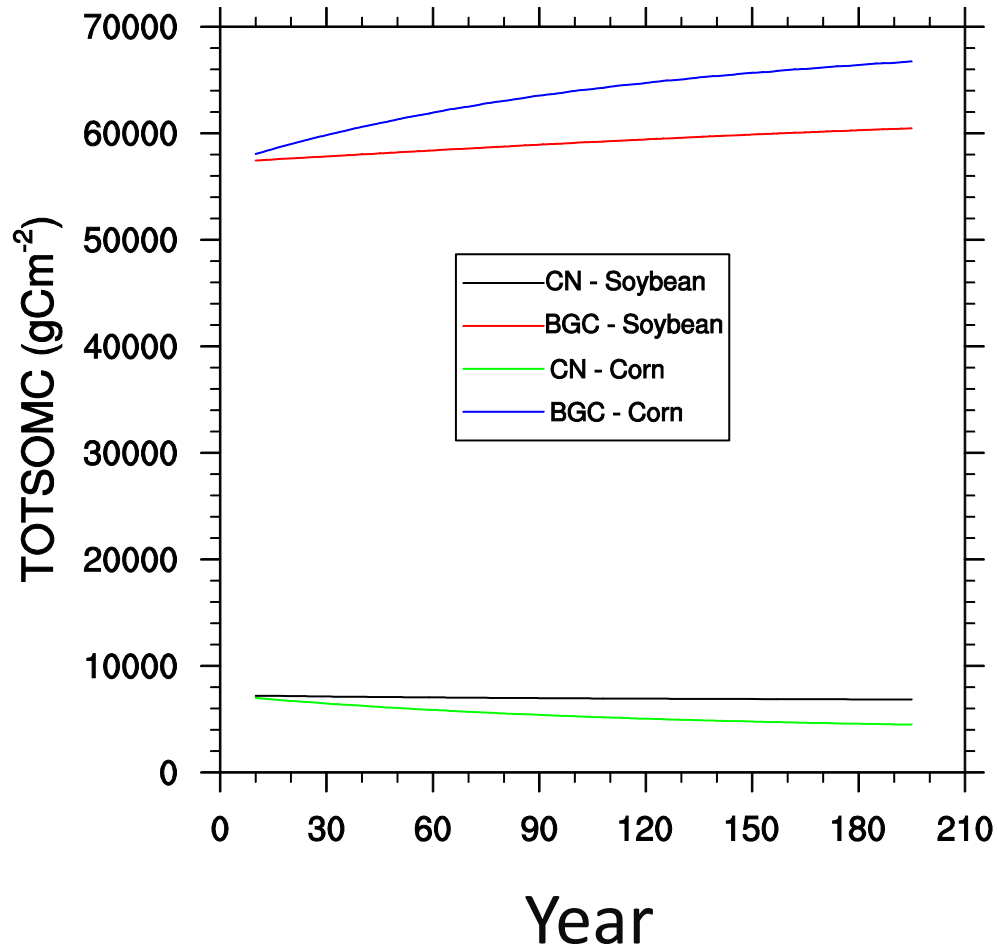
Soybean at Bondville, IL



What about Soil Carbon? ...and other crazy plots

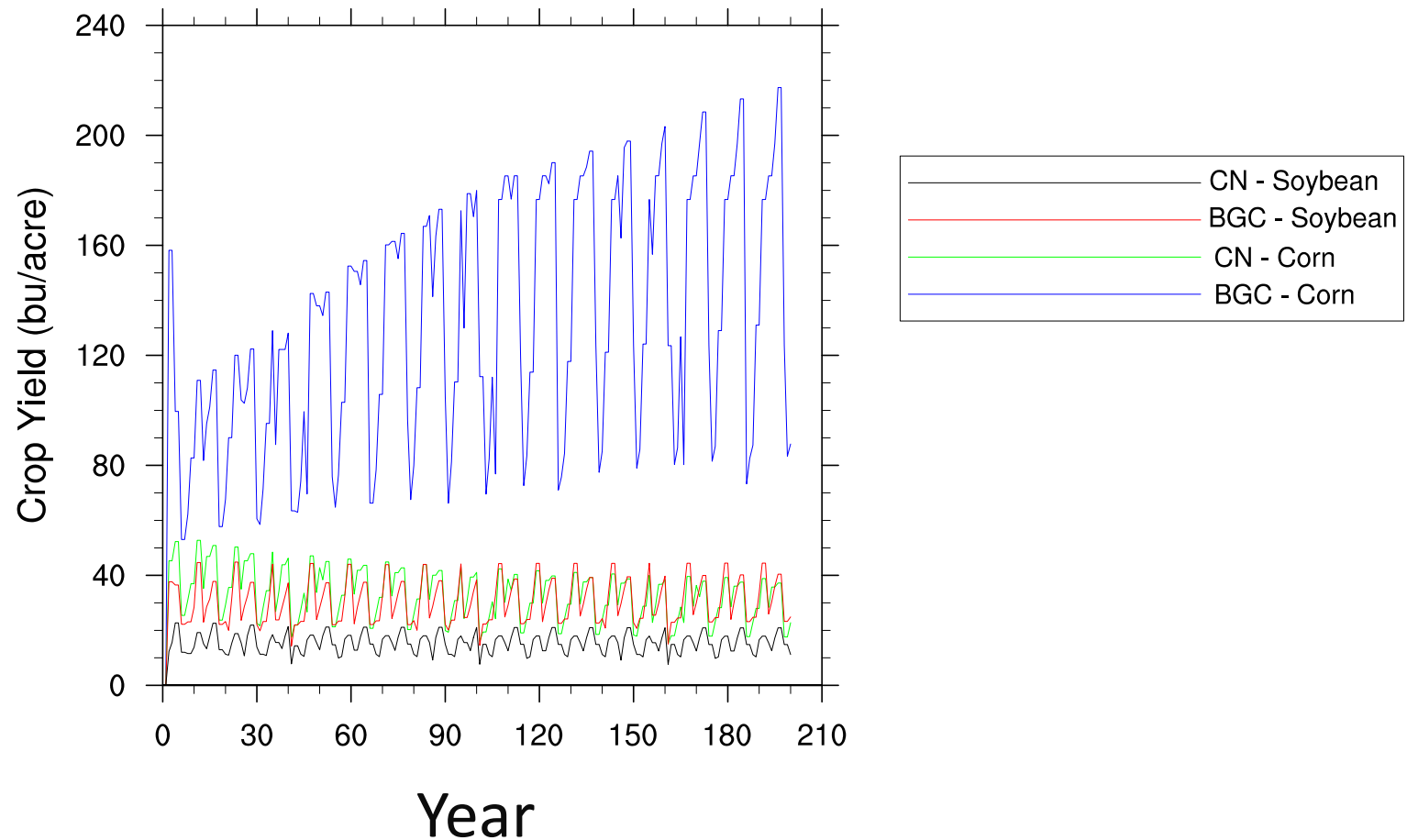


At Bondville, IL

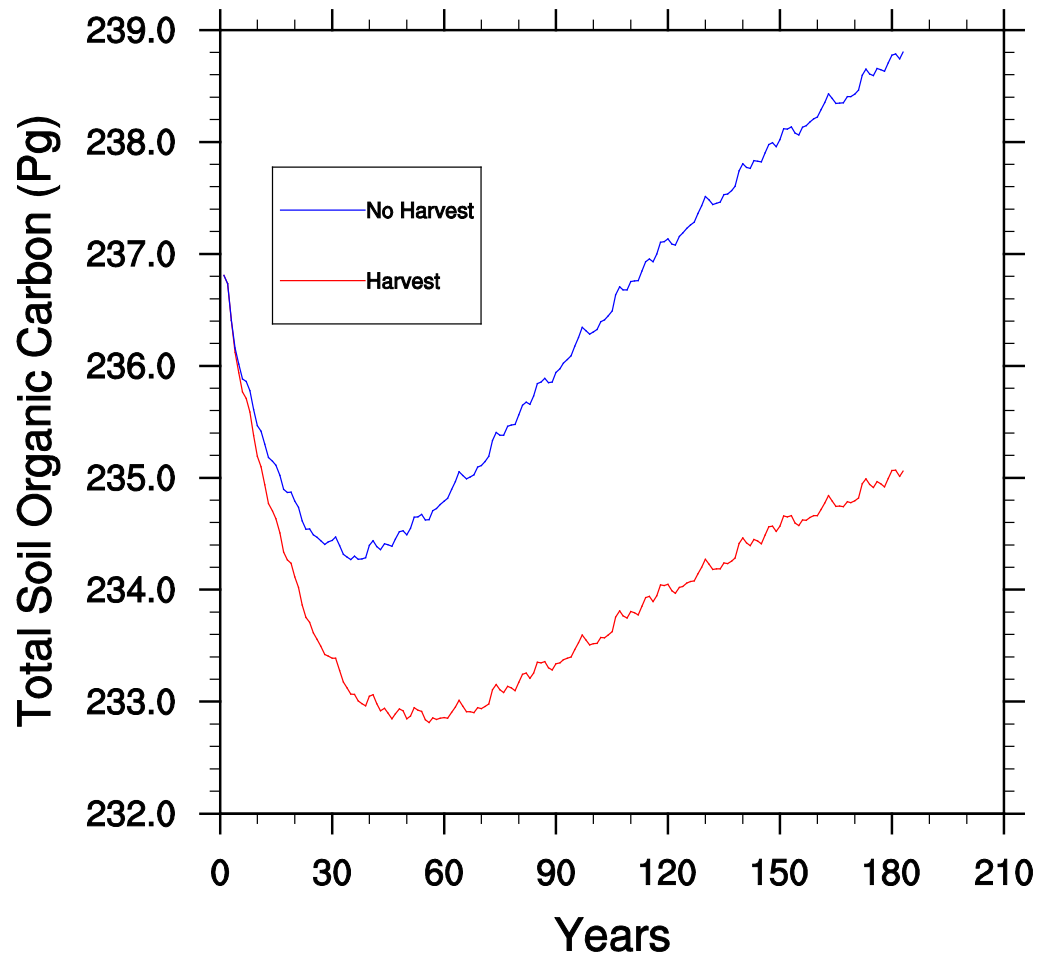


Crazy corn yields - increasing, and huge variability

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

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