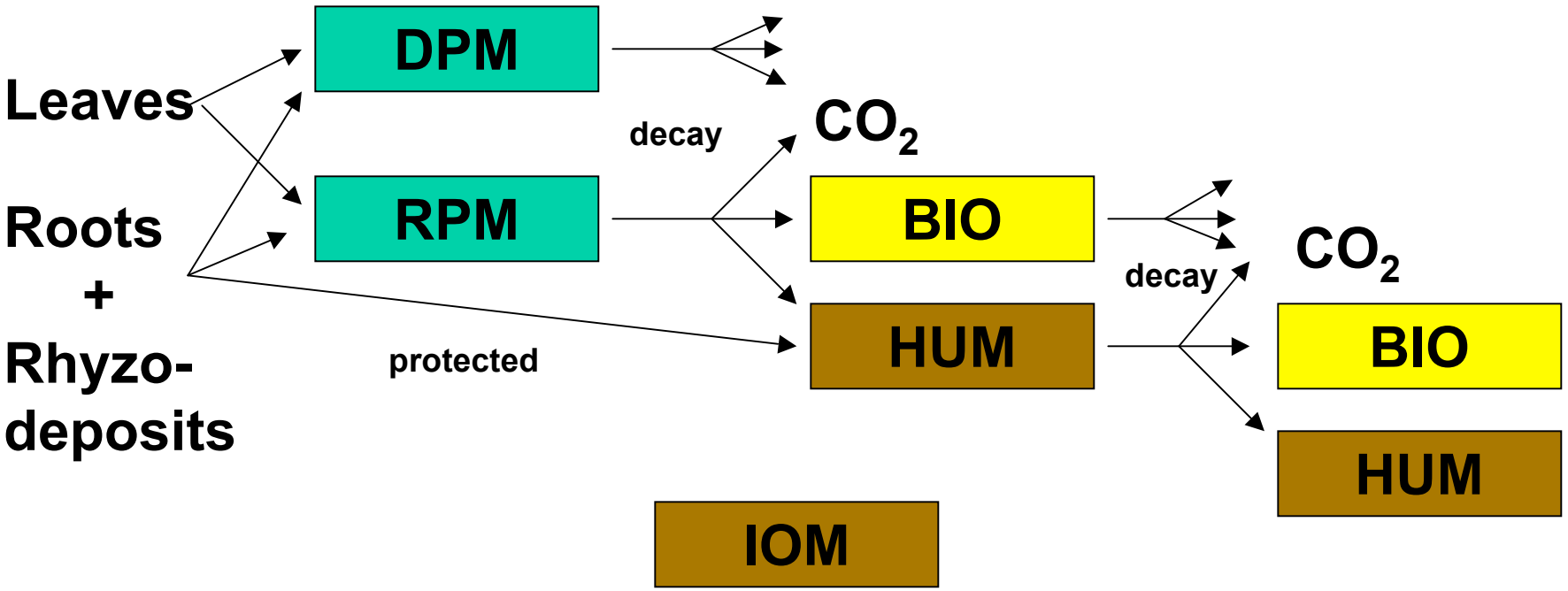
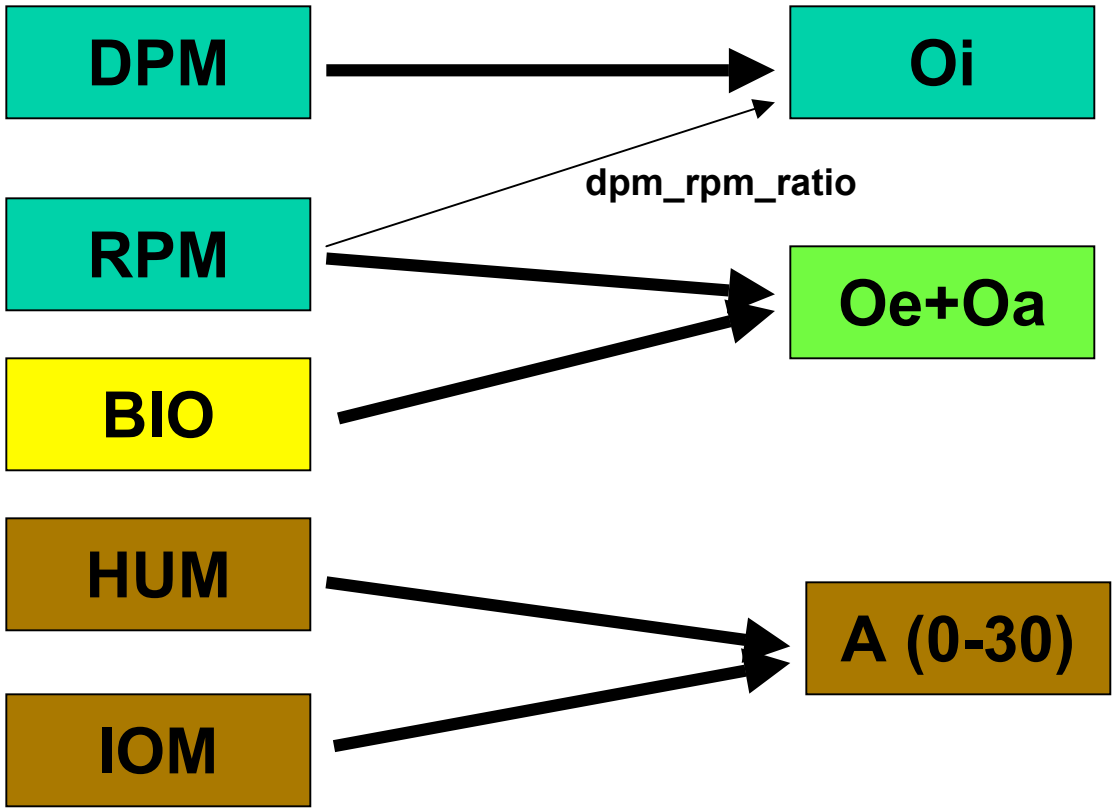
Structure of the Rothamsted Carbon Model



RPM : Resistant Plant Material
DPM : Decomposable Plant Material
BIO : Microbial Biomass
HUM : Humified OM
IOM : Inert OM

Recategorization of Rothamsted Compartments



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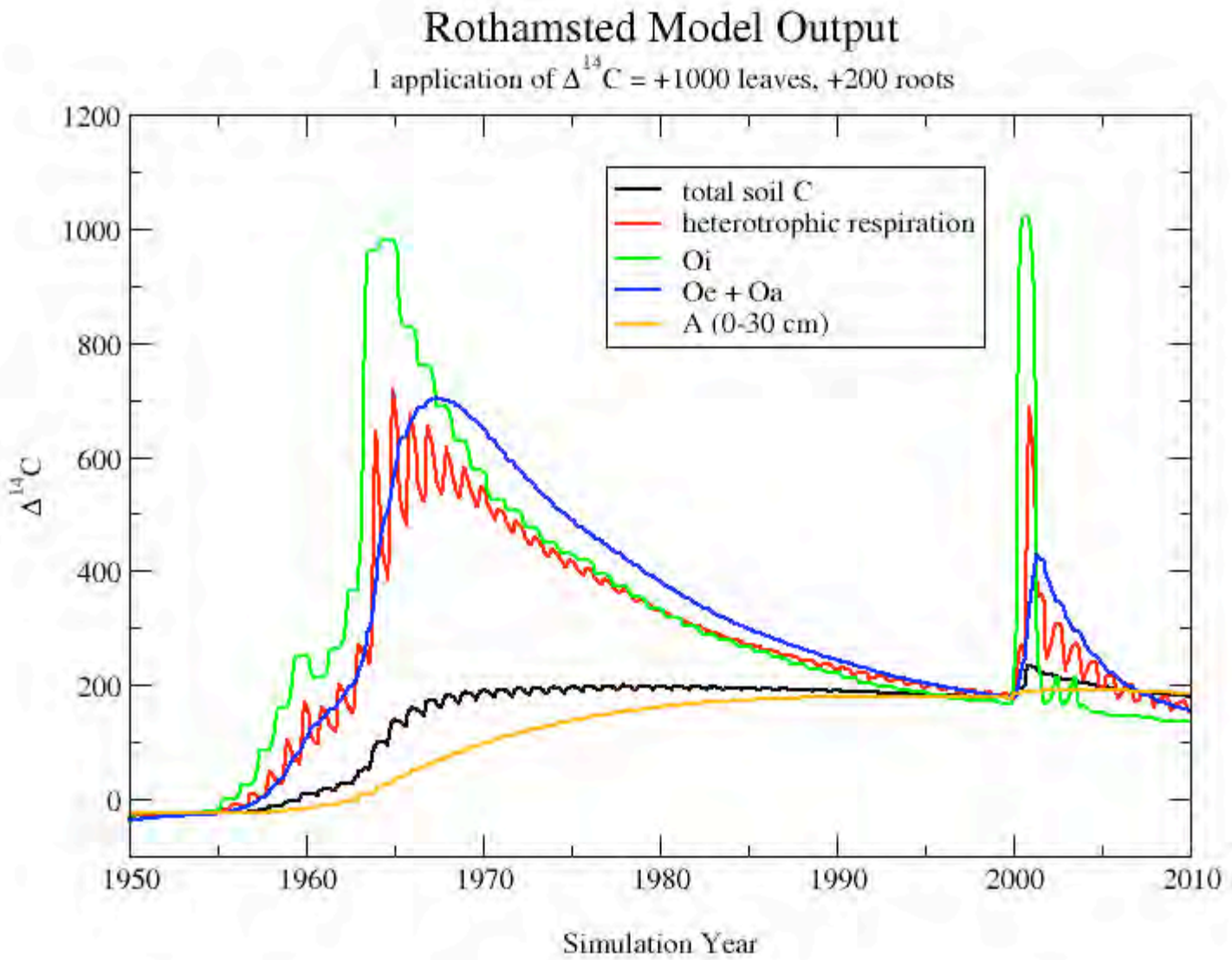
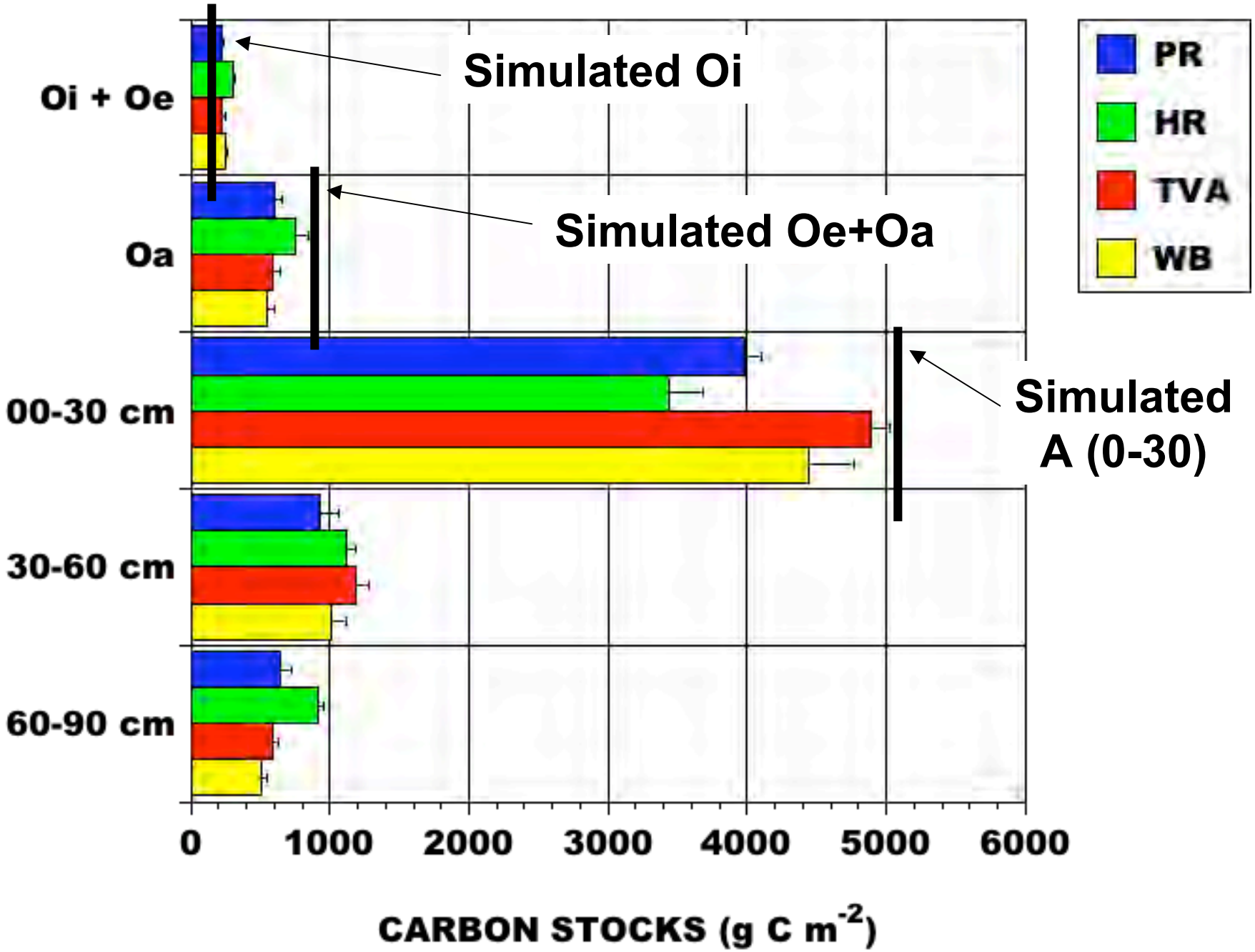

Rothamsted Model Output
1 application of Δ14C = +1000 leaves, +200 roots
total soil C
heterotrophic respiration
Oi
Oe + Oa
A (0-30 cm)
Δ14C
Simulation Year
0
200
400
600
800
1000
1200
1950
1960
1970
1980
1990
2000
2010

Assumptions

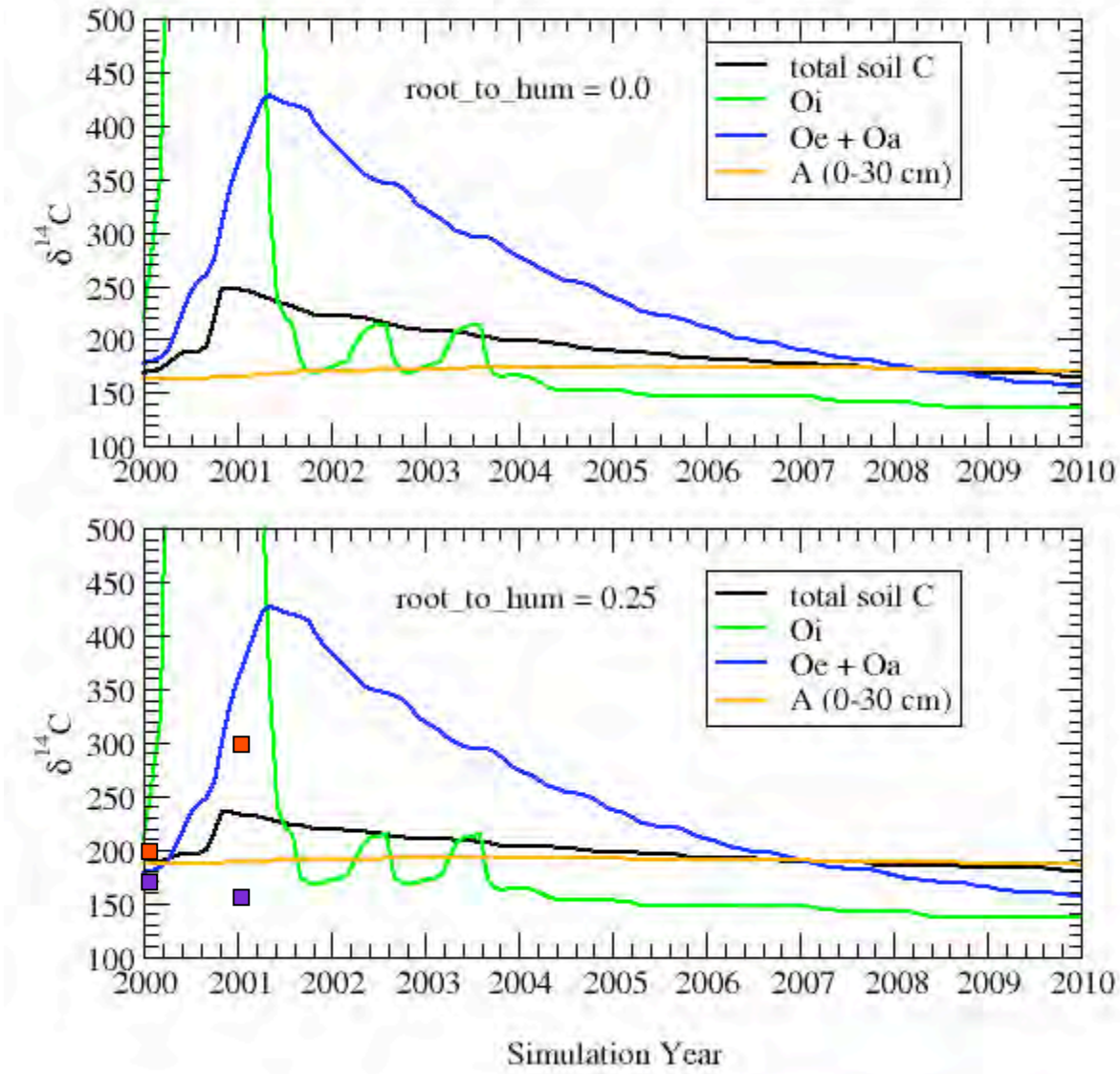
- Rhyzo + Root input = 2.2 t C ha^{-2} y^{-1}
- Leaf input = 2.5 t C ha^{-2} y^{-1}
- Rhyzodeposits not separated from root inputs
- Root to HUM fraction = 0.25
- Clay content = 23.4%
- Climate average used throughout initialization period

Equilibrium Pools

Compartment	Model	WBW
DPM + associated RPM	2.0	2.8
RPM + BIO	9.8	9.4
HUM + IOM	50.7	44.2


Simulated Oi
Simulated Oe+Oa
Simulated
A (0-30)
PR
HR
TVA
WB
Oi + Oe
Oa
00-30 cm
30-60 cm
60-90 cm
0
1000
2000
3000
4000
5000
6000
CARBON STOCKS (g C m-2)

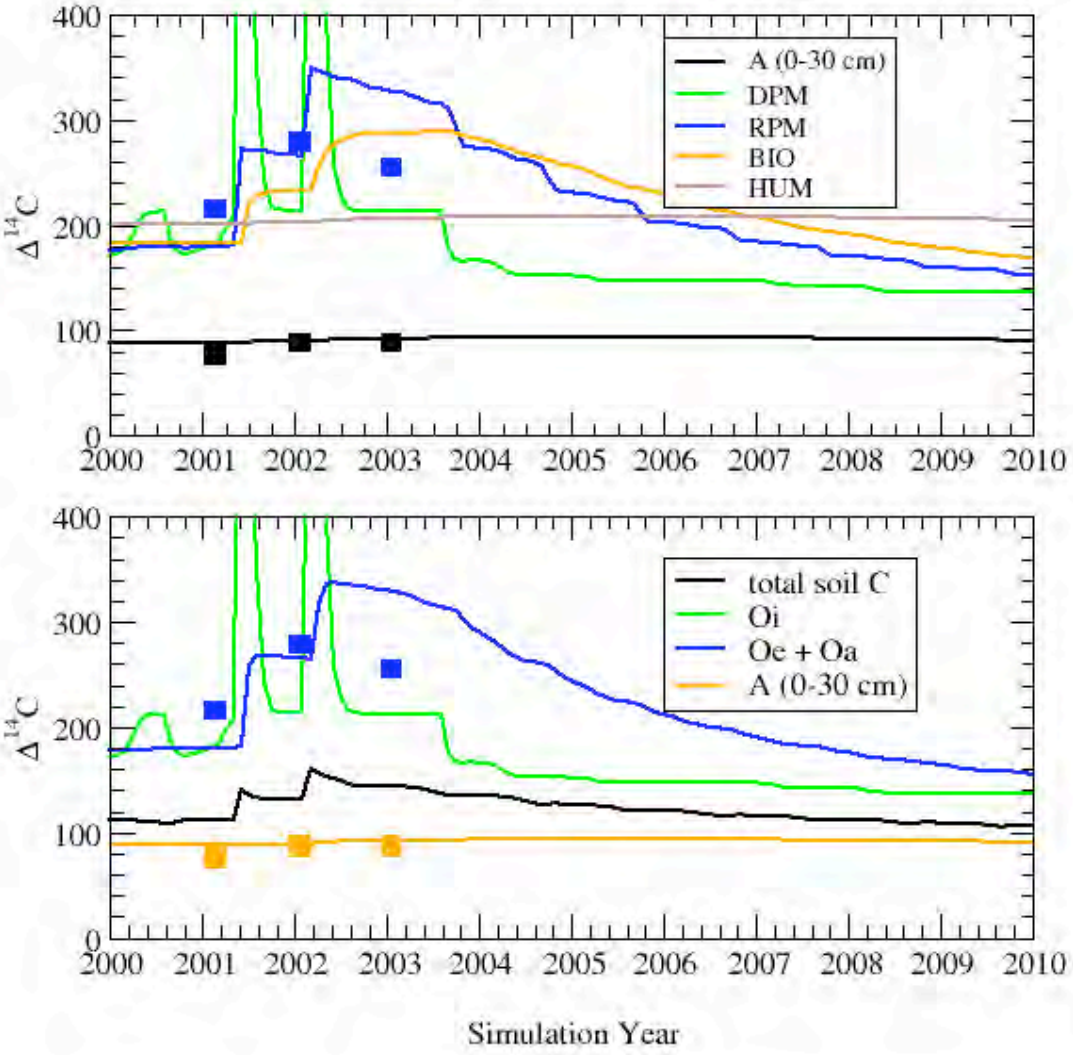
Sensitivity to amount of physical protection



WBW Oe+Oa

WBW A (0-30)

WBW Simulation 2 Years Addition



Questions

- What is the magnitude of root and rhyzosphere inputs?
  - 2.2 t C ha^{-1} y^{-1} required to get correct mass
- What fraction of root inputs are physically protected (represented as HUM)?
  - Currently using 0.25, affects $\Delta^{14}C$ of HUM
  - Amount consistent with mPOM
- Can we infer the the fraction of rhyzo vs. root inputs?
  - Rhyzodeposits => BIO ?
- What is the $\Delta^{14}C$ of recent root inputs?

Does Data Allows More Model Complexity?

- Explicit treatment of litter decomposition separate from soil.
- Respiration fractionation using isotopes offers another useful constraint
- Splitting dynamics of O, A, deeper layers requires additional information
  - Interactions between layers
    - Degree of mixing of POM between O and A
    - Partitioning of root and rhyzodeposits
    - DOC transport becomes more important
  - Environmental controls on rates are different for each layer

SOM Modeling Possibilities

- How isolated are litter and soil layers?
- Interaction between litter layers and soil possible to quantify?
  - DOC
  - Bioturbation
- Aggregate formation and turnover explicitly considered
  - Are we getting enough tracer into A to make useful estimates?
- Are parent material differences providing useful contrasts for generalizing?

Plant Issues

- Temporal sources of C for building tissues
  - Leaves (soluble, insoluble)
  - Roots (spring, fall differences), progress made in root longevity
  - Storage pool(s)
- Temporal sources of C for root respiration
  - Relationship to environmental conditions
  - Relationship to storage pool