

Application of the Holocene Peat accumulation Model to the James Bay peatlands



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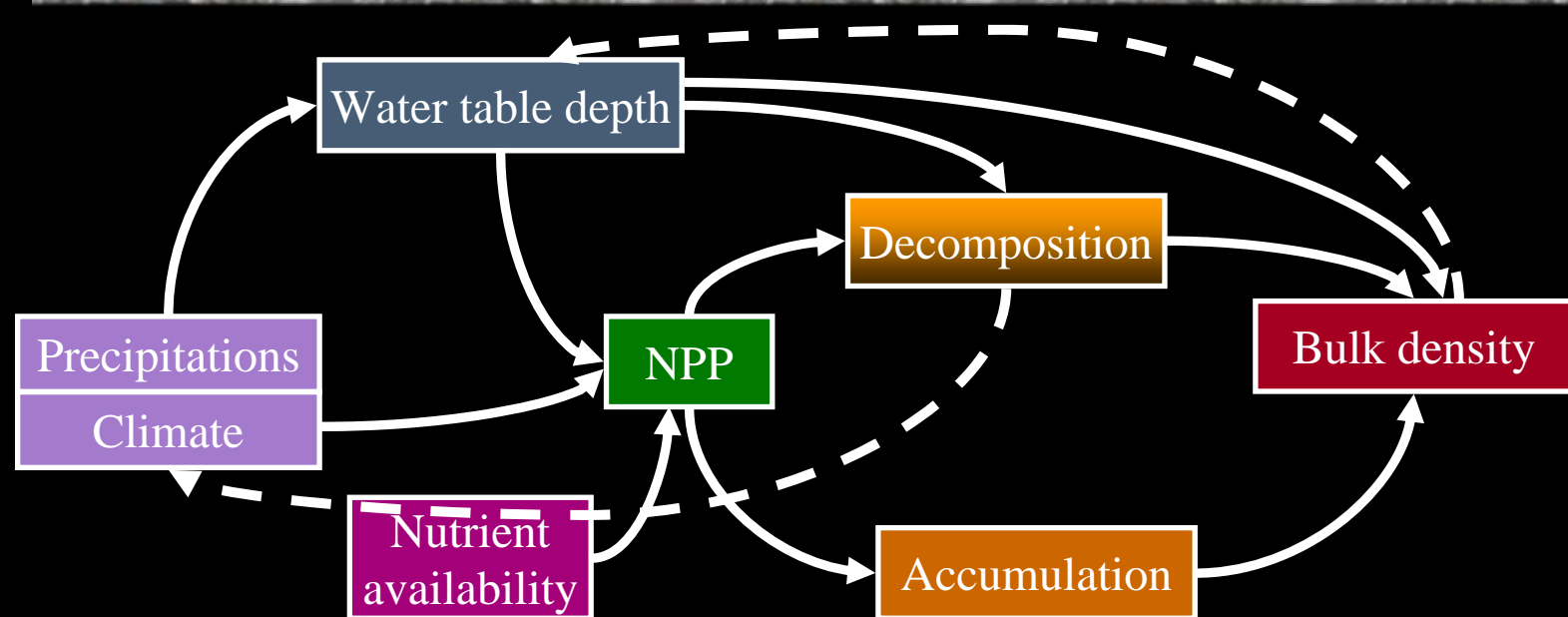
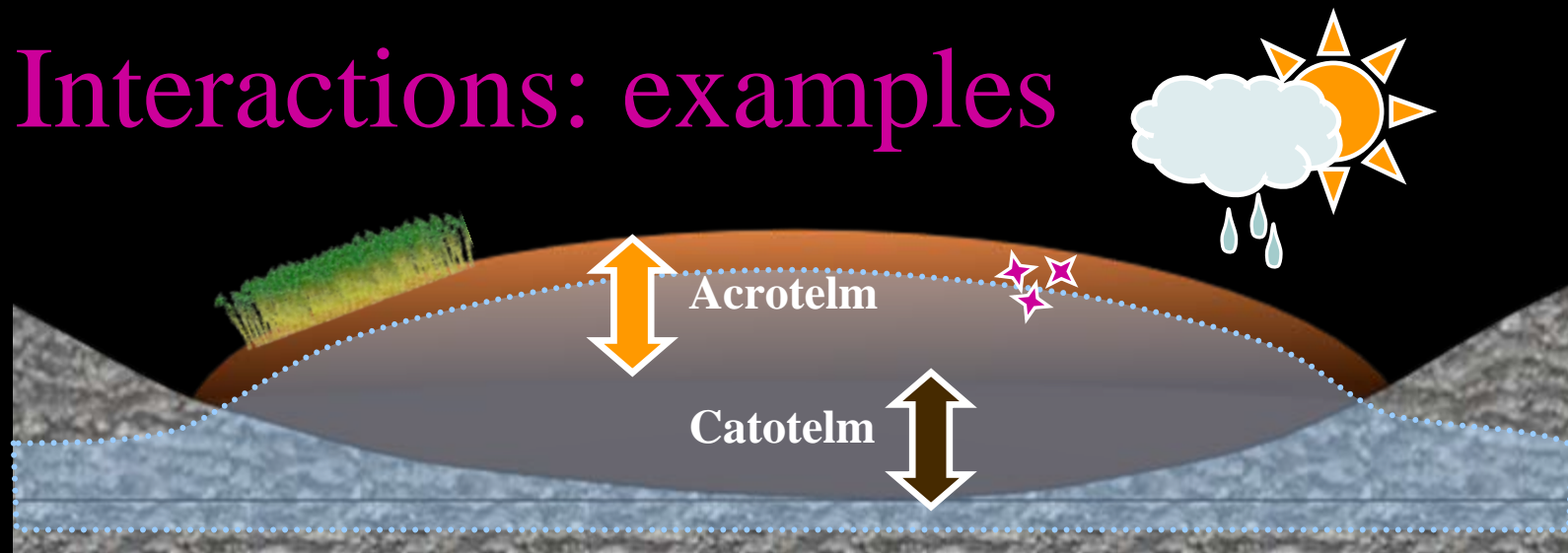
Why modeling ?

- Understand the complex peatland systems
- Quantify the amount of carbon they stored during the Holocene at regional and North American scale
- Determine their sensibility to environmental changes
- Integrate peatlands in the global carbon budget modeling

Peatlands: Complex dynamical systems

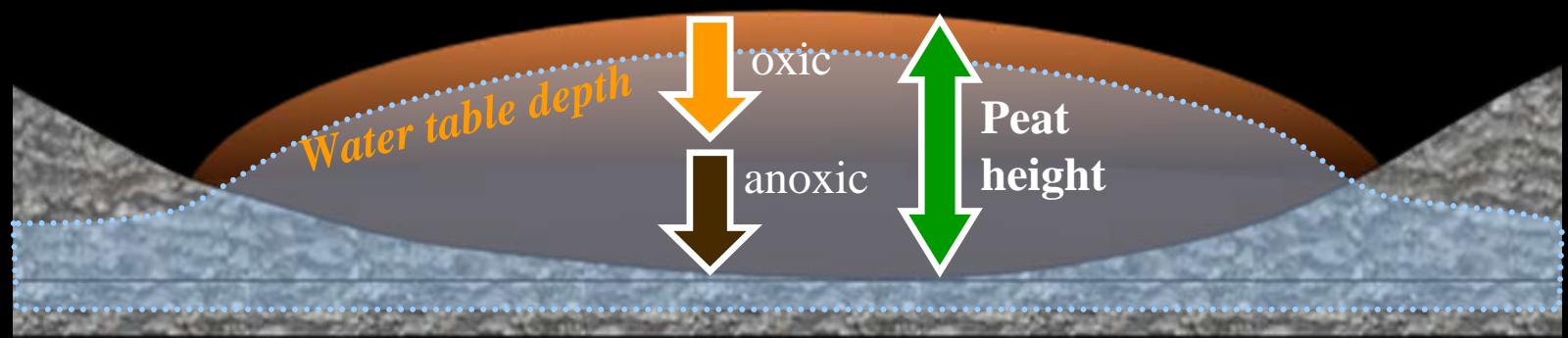
- What do we know about peatlands ?
- Which criteria are common to all peatland types in North America ?
- What environmental factors influence peatlands, and how ?
- What components of the peatland are linked with each other ? How do they impact the system ?

Interactions: examples



Peat Accumulation Model

Hilbert et al. 2000



Structure

- Depends on water table depth
- 2 decompositions rates for oxic and anoxic zones

Outputs

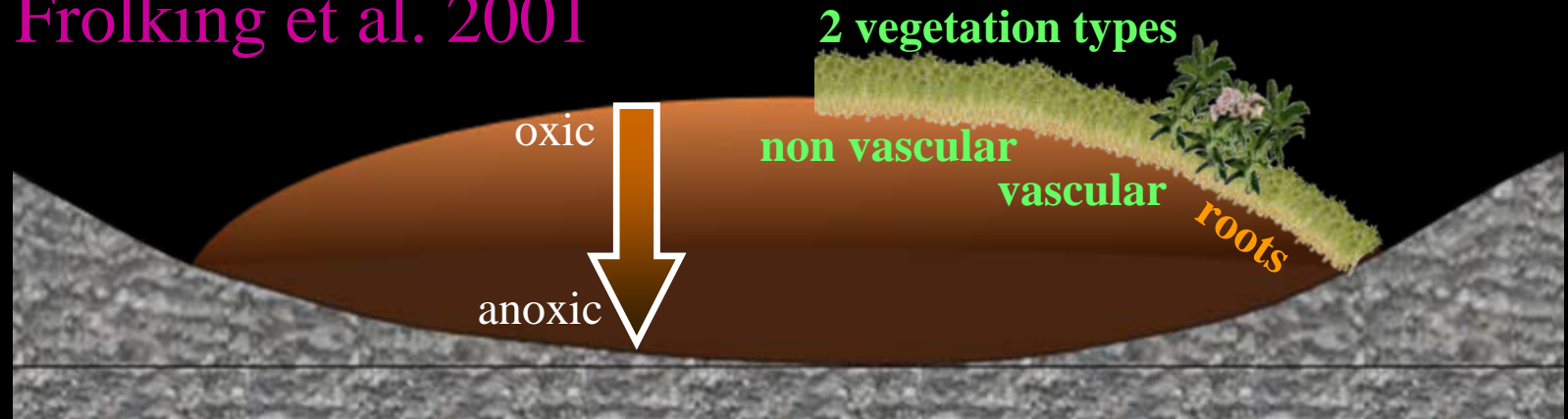
- Peat height
- Water table depth

➔ Simple water-peat dynamics

➔ No carbon calculation

Peat Decomposition Model

Frolking et al. 2001



Structure

- Oxic to anoxic gradient
- Different decomposition ability for each vegetation type
- Decomposition varies with age and litter type
- Roots litter included

Outputs

- Total mass and depth of peat
- Decomposability of peat and mass remaining for each layer



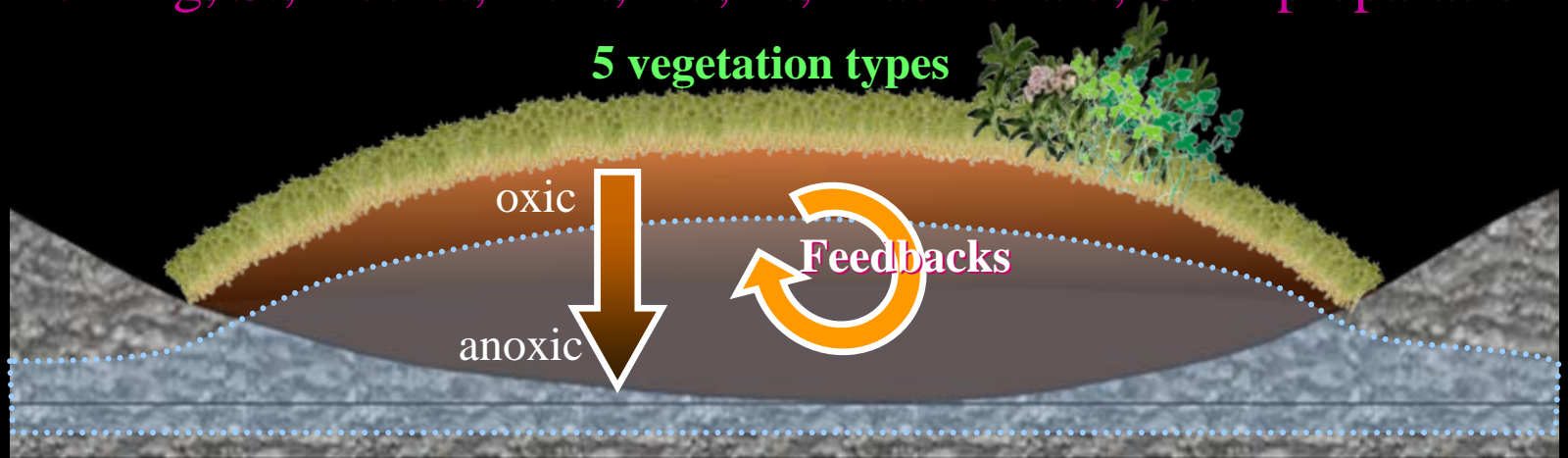
Static decomposition model



Fixed NPP

Holocene Peat Model

Frolking, S., Roulet, N.T., Yu, Z., MacDonald, G. in preparation



Structure

- Based on PAM and PDM
- Dynamical vegetation: NPP varies
- Different litter pools for each vegetation type

Outputs

- Carbon accumulation
- Peat age and depth
- Peat composition
- Water table depth



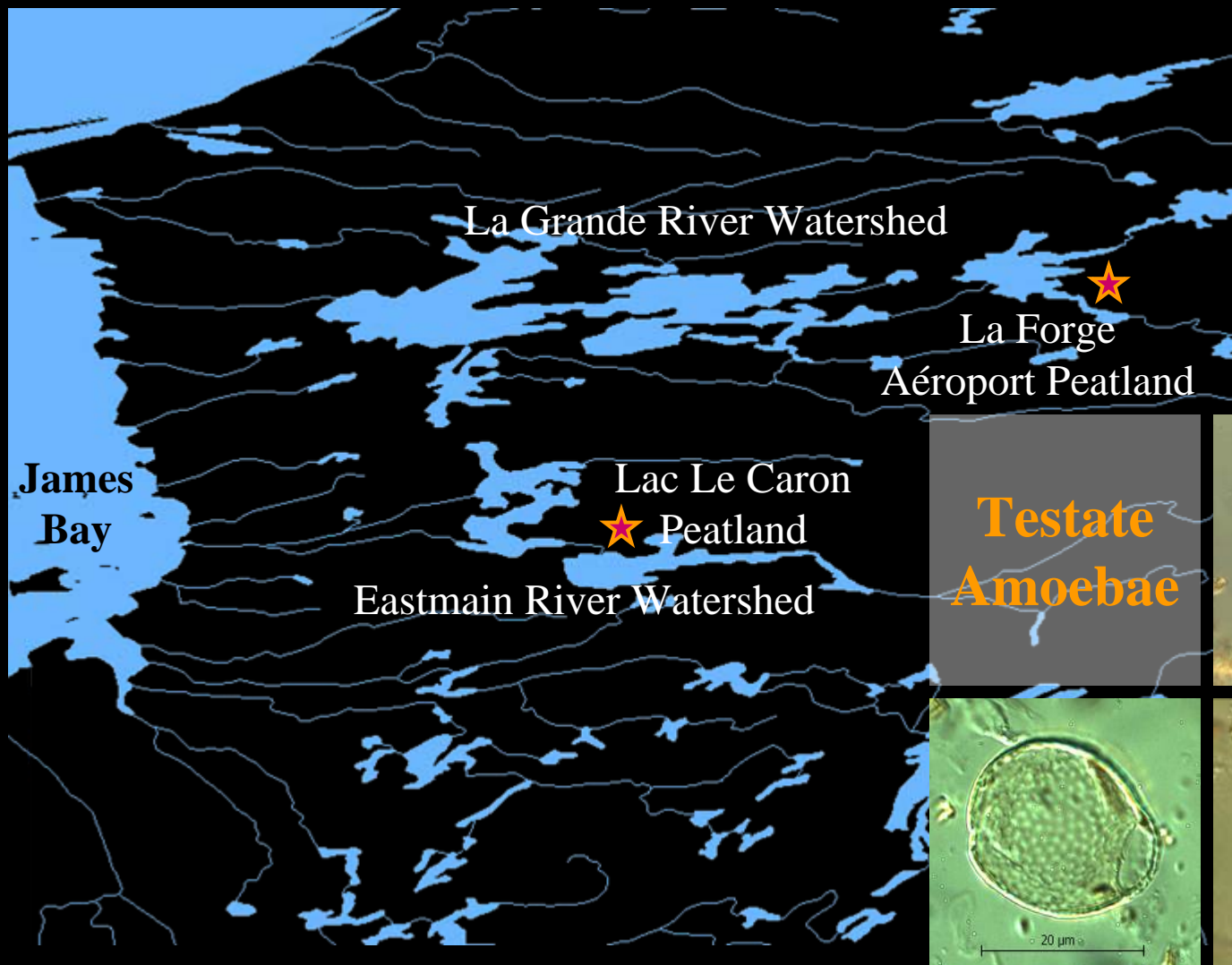
Integrated dynamic model



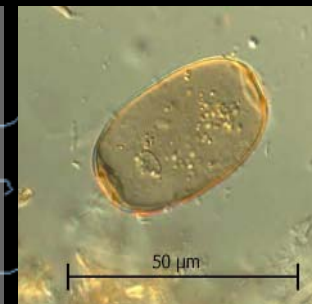
Feedbacks between vegetation, peat properties water table depth, and climate

Evaluation:

Data from the James Bay Lowlands

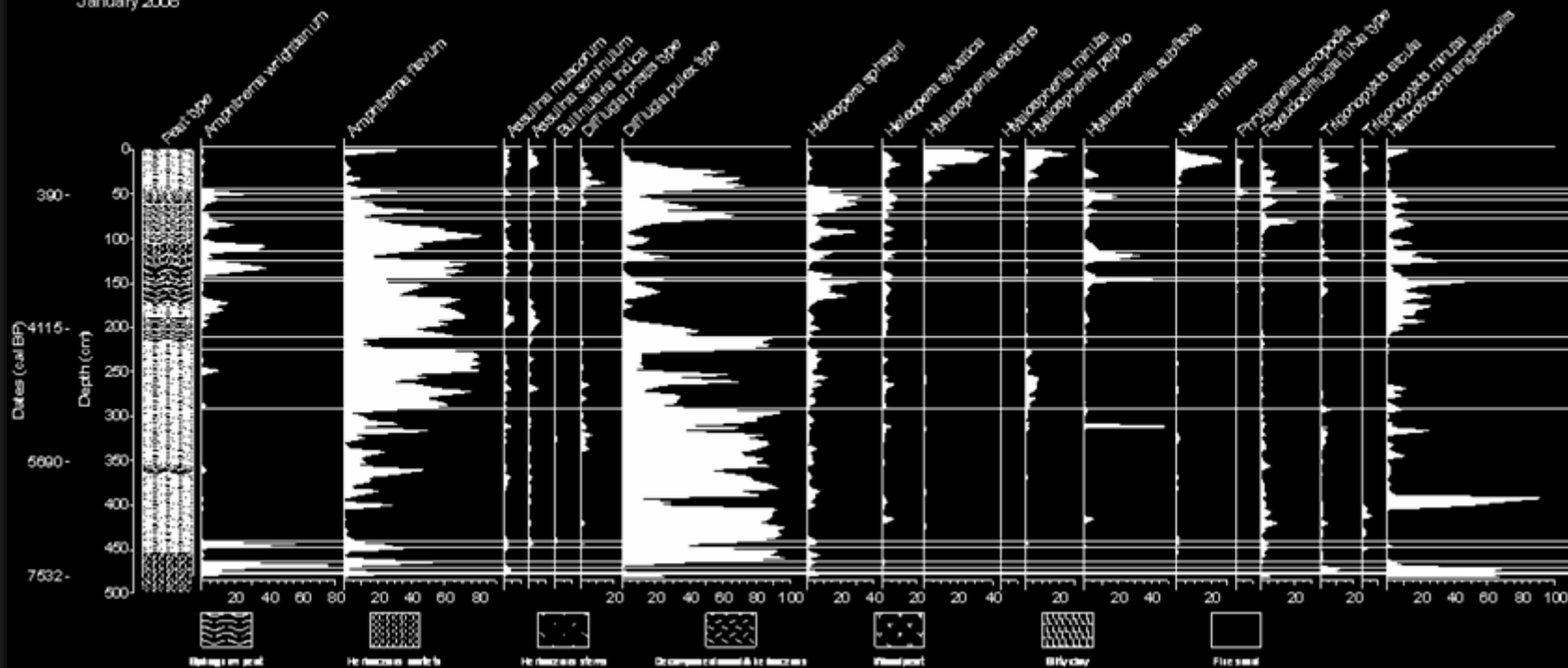


**Testate
Amoebae**



Evaluation: Testate Amoebae

Lac Le Caron testate amoebae percentage diagram
 Analysis: Simon van Bellen
 January 2008



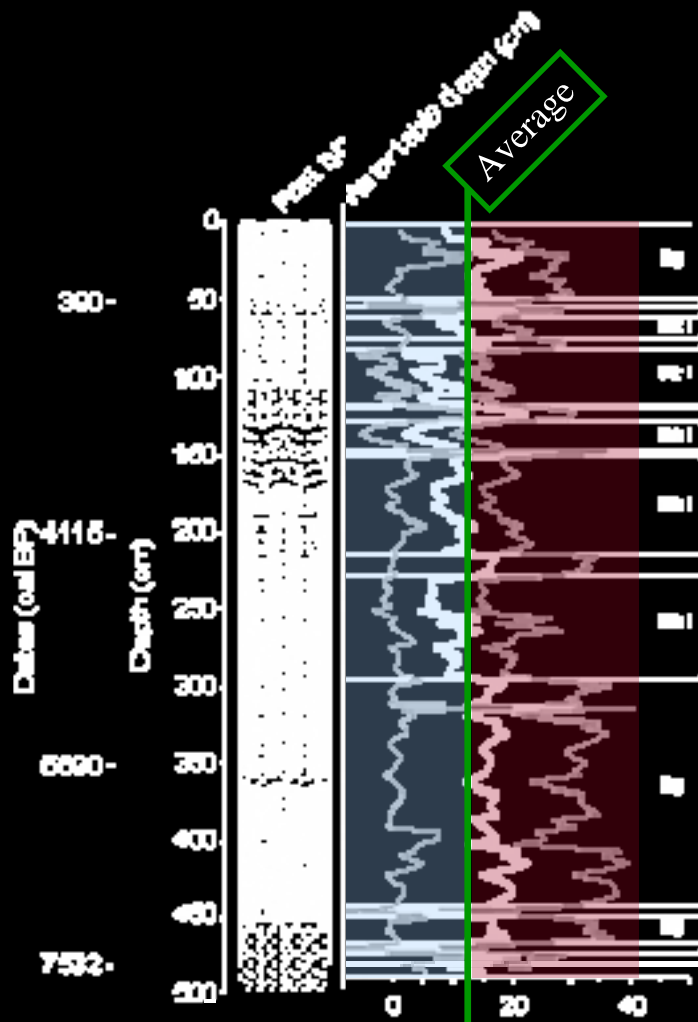
- + Modern Testate Amoebae data base
- + Modern water table depth data base

Booth, R.K. 2007

Transfer function

PALAEO
water table
depth

Evaluation: Water table depth reconstruction



- Water table depth history



Evaluation
of
HPM

Work in progress

- HPM is still in development
- Some model sections have to be completed and/or improved (e.g. fen-bog differentiation, dynamic peat hydraulic properties)
- Evaluations can already be made
 - Use of water table depth reconstructions
 - Sensitivity tests

Questions ?

References

- Booth, R. K. 2007. Testate amoebae as proxies for mean annual water-table depth in Sphagnum-dominated peatlands of North America. *Journal of Quaternary Science*, vol. 23, no 1, 43-57.
- Frohking, S., Roulet, N.T., Moore, T. et al. 2001. Modeling Northern Peatland Decomposition and Peat Accumulation. *Ecosystems*, vol.4, 479-498.
- Frohking, S. and Roulet, N.T. Holocene Peat Model, in preparation.
- Hilbert, D.W , Roulet, N.T., and Moore, T. 2000. Modelling and Analysis of Peatlands as Dynamical Systems. *Journal of Ecology*, vol.88, 230-242.