

Evaluation of the Holocene Peat Model with Data from a Boreal Peatland of the James Bay Lowlands, Quebec, Canada

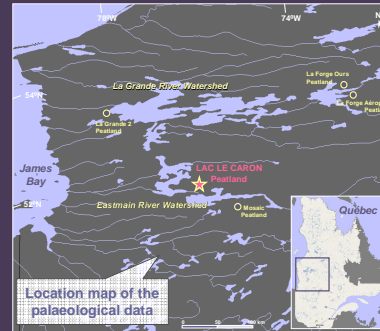
Quillet, A.^{1,2}, Garneau, M.^{2,3}, Froliking, S.⁴, Roulet, N. T.⁵, van Bellen, S.^{1,2}, Ali, A.^{2,6}, Booth, R. K.⁷ and Peng, C.¹

¹ Institut des Sciences de l'Environnement, Université du Québec à Montréal (UQAM), QC, Canada; ² GÉOTOP, UQAM, QC, Canada; ³ Département de Géographie, UQAM, QC, Canada; ⁴ Complex Systems Research Center, University New Hampshire, NH, USA; ⁵ Department of Geography and McGill School of Environment, McGill University, QC, Canada; ⁶ Centre de Bioarchéologie et d'Écologie, Université de Montpellier 2, France; ⁷ Earth & Environmental Science Department, Lehigh University, PA, USA
✉ quillet.anne@courrier.uqam.ca

SUMMARY
The aim of this study is to evaluate the capacity of the Holocene Peat Model (HPM, see poster 423)¹ to reproduce peatland dynamics. Several field work campaigns delivered a large amount of data covering different ecotypes from the James Bay region. The analysis of one of these cores taken in Lac Le Caron bog delivered descriptions of the age-depth profile, the bulk density, the testate amoebae assemblages and the plant macrofossils assemblages of the core. These data allows the assessment of the model in three ways: (1) by a simple comparison of the observed vs. simulated age-depth profiles, (2) by forcing the model with a water table depth reconstruction (deducted from testate amoebae assemblages) and (3) by forcing the model with bulk density data. The results show that the water budget of the model as well as the bulk density have a great influence on the simulations and on the peatland development pattern itself. This will be the subject of further work. In order to achieve the evaluation of HPM, the simulations will be tested against other sites data from the James Bay region.

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Location map of the palaeological data



Lac Le Caron Peatland

Photo: Pierre Manning/ Hydro Québec

Peatland characteristics	
▫ Raised bog	
▫ Sphagnum dominated peatland	
▫ Hummocks-hollows complex, few large pools	
▫ Maximum peat thickness	525 cm
▫ Age at the deepest point	7850 BP
▫ Elevation	247m
▫ Average annual climatic conditions	-2°C 640 mm

FIELD DATA

Analyses of a central peat core including:

- Troëls-Smith description
- Bulk density (1cm analysis interval, a.i.) and organic matter content
- ¹⁴C and ²¹⁰Pb dating
- Plant macrofossils analyses (4cm a.i.)
- Analysis of testate amoebae (2-4cm a.i.)
- Water table depth reconstruction from the testate amoebae assemblages with a transfer function¹

Photo: Simon van Bellen

METHODOLOGY

In order to proceed to the evaluation of the Holocene Peat Model (HPM)¹, some sensitivity analyses have been performed. They show that water table depth and bulk density parameters are very sensitive. We thus propose here to:

- (1) Compare the simulations of the HPM with the age-depth model from the peat profile
- (2) Force the HPM with the water table depth reconstructed from testate amoebae analyses².
- (3) Force the HPM with the bulk density data from the peat profile
- (4) Compare the simulation results with each-other and with palaeoecological data.

Some testate amoebae (A) *Corythion-Trinema* type (B) *Amphitrema flavum* (C) *Nebela barbata*

Photos: Caroline L'Heureux

HOLOCENE PEAT MODEL

Schematic description of the Holocene Peat Model (HPM)¹

The aim of the HPM is to simulate the transient changes in carbon accumulation and decomposition of the northern peatlands since their early stages. HPM takes into account feedbacks between vegetation, peat properties, water table depth and climate.

Outputs

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

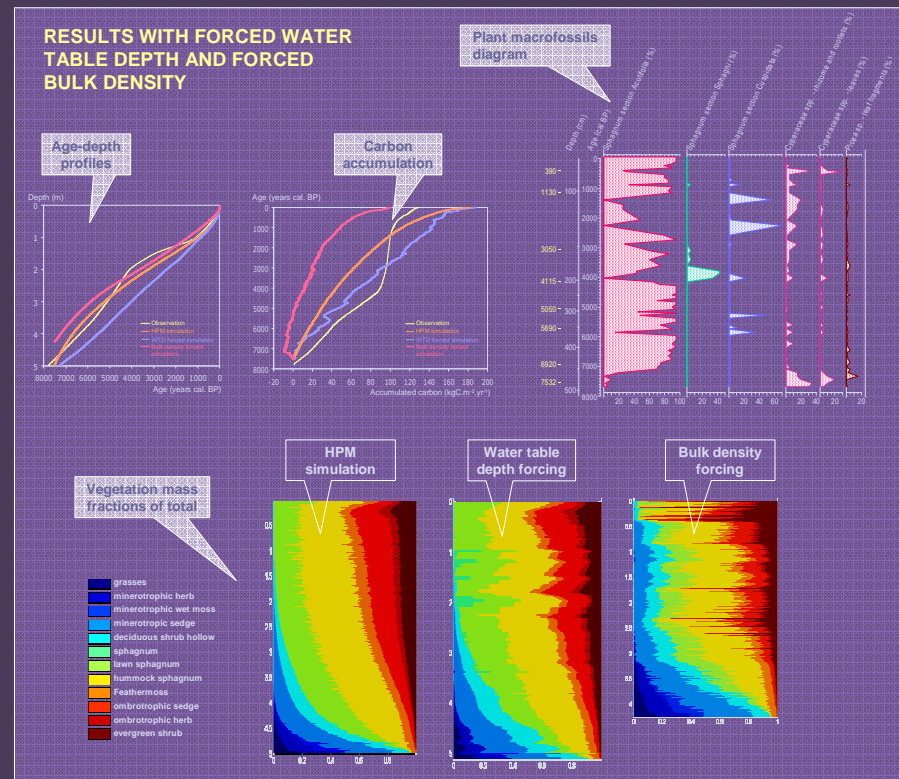
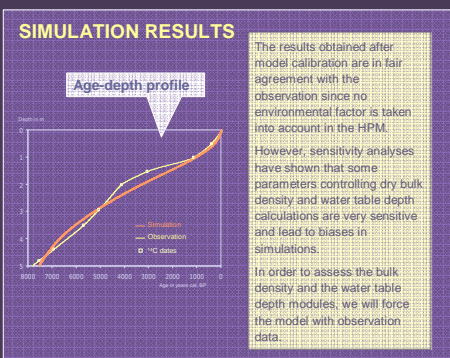
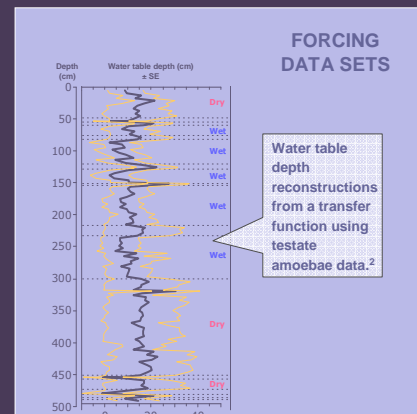
12 vegetation types

Oxic to anoxic decomposition gradient

Water budget

Feedback

roots



CONCLUSIONS

- The simulations show biases in the peat accumulation regime
- The simulated carbon accumulation shows a pattern that is not observable in reality: carbon accumulation can be negative
- The forcings also lead to discrepancies in the representation of vegetation and in particular in the representation of wet species
- It is to be noticed that the changes in the vegetation distribution are much slower in the simulation than in reality

FUTURE WORK

- The results present different pattern of development that arise a lot of systematical questions. They will be further investigated in order to improve the model simulation
- Several other boreal and subarctic sites will be included in the evaluation (see location map) to assess the geographical representativity of the HPM

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REFERENCES

¹ Froliking, S.; Roulet, N. 2008. A new model of long-term, coupled dynamics of carbon and water in northern peatlands. *Eos Trans. AGU*, vol. 89, no 53, Fall Meet. Suppl., Abstract B138-0423.

² 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, 45-57.