RBBGCMuSo: an R package for running the terrestrial ecosystem process model Biome-BGCMuSo

Plan for a manuscript by Ferenc Horváth and Roland Hollós  
16/01/2017

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SCHEDULE:

end of February – final development and testing the R package (version 1)  
end of April – finishing examples, case studies and R ’vignette’  
end of June – first draft by the core authors: Roland, Maša, Dóri, Zoli, Laura … Ferenc  
end of July – revised version of the manuscript (all authors)  
mid August – submit

TARGET JOURNALS:

Methods in Ecology and Evolution (IF: 6.344)  
<http://www.methodsinecologyandevolution.org/view/0/index.html>

ECOGRAPHY (IF: 5.355)  
<http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1600-0587>

Environmental Modelling and Software (IF: 4.207)  
<https://www.journals.elsevier.com/environmental-modelling-and-software/>

R Journal (IF: 1.038)  
<https://journal.r-project.org/>

Summary draft

1. The process-based biogeochemical model Biome-BGCMuSo is used to simulate energy, carbon, nitrogen and water fluxes and stores of highly structured/compartmented terrestrial ecosystems such as deciduous and evergreen forests, grasslands, shrublands and crops controlled by various physical and biological processes under various management regime on a daily time-scale.

2. We briefly review the context and the main points of conceptual background of ecosystem modeling and simulation, than present an R package RBBGCMuSo (Biome-BGC with multi-layer soil module), which provides functions to manage settings of model’s parameters, to run simulations and plot line graphs of various output results (e.g. NEE – Net Ecosystem Exchange) at daily, monthly and yearly time resolution.

3. Three kind of applications of the RBBGCMuSo are reviewed: (i) Simple simulation run, when spinup and normal simulation phases run one after the other with the same site and ecophysiological parameters and management options of the represented ecosystem. (ii) Successive chaining of simulation runs, when ecophysiological parameters of the vegetation, soil characteristics and/or management regime of the land are successively changing. (iii) Setting new combination of parameters to interact with other assessment tools like as sensitivity analysis, model calibration and uncertainty assessment.

4. Three examples are demonstrated, using the data and work flows included in the R package to illustrate the use of functions in different applications.

Key-words:   
biogeochemical model, vegetation, plant functional type, ecophyisologocal parameters, carbon cycling, nitrogen cycing, water cycling, model simulation, NPP – net ecosystem exchange

Introduction [Ferenc]

Conceptual background of modeling and simulations [Dóri]

Plant Functional Type

Ecosystem approach: flux among and storage of compartments

Main features of Biome-BGCMuSo

Chain of spinup and normal simulation run

Challenge of setting multiple parameters

Package description [Roland]

setupMuSo

cleanupMuSo

rungetMuSo

spinupMuSo

normalMuSo

plotMuSo

Related applications

Simple simulation run [Dóri – dry grassland at Bugac, based on HIdy et al. 2016]

Succesive chaining of simulation runs [Laura – maize cropland, crop rotation based on PhD]

Interaction with assessment tools [Roland – sensitivity analysis or Bayes calibration …?]

Case studies, examples

Dry natural grassland at Bugac, Hungary [Dóri – simple simulation]

Maize cropland at Mead, Nebraska, USA [Laura – maize/soybean rotation based on PhD?]

Deciduous broad-leaved forest at Jastrebarsko, Croatia [Maša – sensitivitiy or Bayes …?]

Conclusion [Ferenc, all]

Acknowledgements [Ferenc, all]

References [all]

Supporting information

Appendix S1. A user guide to RBBGCMuSo … R ’vignette’ [Roland]

Appendix S2. R workflow/script and dataset for Bugac case study [Roland, Dóri]

Appendix S2. R workflow/script and dataset for maize/soybean rotatiion case study [Roland,   
 Laura]

Appendix S3. R workflow/script and dataset for Jastrebarsko case study [Roland, Maša]