

MicroLow 1.0 ReadMe

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1. Hardware and Software Requirement

MicroLow 1.0 is written and can be executed in the free open source computing environment and programming language R, which is available for download on the web (<http://www.r-project.org/>). MicroLow 1.0 uses the adaptive time-step solver “lsoda” from the deSolve package (Soetaert et al., 2010) **which must also be installed**. On a standard desktop computer running R, the model usually takes less than 1 min to simulate 10 years of succession.

2. Download MicroLow 1.0

A package named “MICROLOW_1.0_source”, containing the source code of MicroLow 1.0 and validation data is available at https://github.com/jbradley8365/MICROLOW_1.0_SOURCE.

The package contains:

The entire “MICROLOW_1.0_source” folder should be copied to a local computer such that the directory is:

“/Users/jamesbradley/Documents/RFolder/MICROLOW_1.0_source/” **or** the folder paths contained in ‘execute_MICROLOW_1.0.R’ script should be modified (*setwd*, *path*, *pathte*) according to where the folder is copied to.

3. Description of files

This section provides a brief description of all files present in the folder “MICROLOW_1.0_source”. This should be read alongside the following publication for clarity on variables, parameters, balance equations etc.:

Bradley, J. A., Amend, J. P., LaRowe, D. E., (2018) Microbial dormancy and maintenance in marine sediments through deep time. *Geobiology*.

MICROLOW_1.0_source contents:

ReadMe.docx / ReadMe.pdf

ReadMe guide to model source code and execution.

execute_MICROLOW_1.0.R

Model source code, .R script.

Biomass.dat

Validation date.

Column 1: Sediment age (thousands of years)

Column 2: Cellular biomass carbon concentration ($\mu\text{g C cm}^{-3}$) at drill hole U1370, IODP Expedition 329, converted from cell abundance provided in D'Hondt et al. (2015) (see paper for details).

Corg.dat

Validation date.

Column 1: Sediment age (thousands of years)

Column 2: Particulate Organic Carbon (POC) concentration ($\mu\text{g C cm}^{-3}$) at drill hole U1370, IODP Expedition 329, converted from weight % measurements provided in D'Hondt et al. (2015) (see paper for details).

4. Model Operation

In R, specify working directory to appropriate path e.g.:

"Users/jamesbradley/Desktop/RFolder/MICROLOW_1.0_SOURCE/"

Open *execute_MICROLOW_1.0.R* script and execute in console (note: package "deSolve" (Soetaert et al., 2010) must be installed).

5. Output

Model output is created as variables within a dataframe 'out'. By default, output is not saved locally, however this can be done by using a command such as:

```
write.table(out_list[[1]],file=paste("out","nominal.csv",sep="_"),sep="," ,row.names=FALSE)
```

The dataframe "out" contains the model results, with output provided for every thousand years simulated.

Variable	Description
time	Model run time, thousands of years
B1	B_1
B2	B_2

B3	B_3
B4	B_4
Corg	POC
c_Cons_Corg_Growth_B1	POC consumed by B_1 for growth, cumulative
c_Death_total	Death of B_{1-4} , cumulative
c_M_total_Corg	Exogenous maintenance of B_{1-4} , cumulative
c_M_total_bio	Endogenous maintenance of B_{1-4} , cumulative
c_M_total	Total maintenance of B_{1-4} , cumulative
c_M_B1_bio	Endogenous maintenance of B_1 , cumulative
c_M_B1_Corg	Exogenous maintenance of B_1 , cumulative
c_Cons_Corg_total	Total consumption of POC, cumulative
c_Growth_B1	Growth of B_1 , cumulative
c_Death_B1	Death of B_1 , cumulative
c_B1_D	Deactivation of B_1 , cumulative
c_B2_A	Activation of B_2 , cumulative
c_Death_B2	Death of B_2 , cumulative
c_Death_B3	Death of B_3 , cumulative
c_Death_B4	Death of B_4 , cumulative
c_B2_D	Deactivation of B_2 , cumulative
c_B3_D	Deactivation of B_3 , cumulative
c_B3_A	Activation of B_3 , cumulative
c_B4_A	Activation of B_4 , cumulative
c_M_B2_bio	Endogenous maintenance of B_2 , cumulative
c_M_B3_bio	Endogenous maintenance of B_3 , cumulative
c_M_B4_bio	Endogenous maintenance of B_4 , cumulative
years	Years simulated
rate_Cons_Corg_Growth_B1	Rate of POC consumed by B_1 for growth (year^{-1})
rate_Death_total	Rate of death of B_{1-4} (year^{-1})
rate_M_total_Corg	Rate of exogenous maintenance of B_{1-4} (year^{-1})
rate_M_total_bio	Rate of endogenous maintenance of B_{1-4} (year^{-1})
rate_M_total	Rate of maintenance of B_{1-4} (year^{-1})
rate_M_B1_bio	Rate of endogenous maintenance of B_1 (year^{-1})
rate_M_B1_Corg	Rate of exogenous maintenance of B_1 (year^{-1})
rate_Cons_Corg_total	Rate of consumption of POC (year^{-1})
rate_Growth_B1	Rate of growth of B_1 (year^{-1})
rate_Death_B1	Rate of death of B_1 (year^{-1})
rate_B1_D	Rate of deactivation of B_1 (year^{-1})
rate_B2_A	Rate of activation of B_2 (year^{-1})
rate_Death_B2	Rate of death of B_2 (year^{-1})
rate_Death_B3	Rate of death of B_3 (year^{-1})
rate_Death_B4	Rate of death of B_4 (year^{-1})
rate_B2_D	Rate of deactivation of B_2 (year^{-1})
rate_B3_D	Rate of deactivation of B_3 (year^{-1})
rate_B3_A	Rate of activation of B_3 (year^{-1})
rate_B4_A	Rate of activation of B_4 (year^{-1})
rate_M_B2_bio	Rate of endogenous maintenance of B_2 (year^{-1})
rate_M_B3_bio	Rate of endogenous maintenance of B_3 (year^{-1})
rate_M_B4_bio	Rate of endogenous maintenance of B_4 (year^{-1})
Theta_S	θ_S
Theta_M	θ_M
Btotal	Total biomass (B_{1-4})

References

Soetaert, K., Petzoldt, T., and Setzer, R. W. (2010). Solving Differential Equations in R: Package deSolve. *J. Stat. Softw.* 33, 1–25.