23.09.2019

September 23, 2019

1 Adding a dvcpp.DVSimTVMlog10 code for study on log scale data

In the TVM model, we replace the abundance weight by the metabolism weight. In the derivation, we only take derivative respect to species i. Thus, we can directly replace the abundance $N_{j,t}$ by $B_{j,t}$ to calculate per capita consumption from the length

$$B_i = N_i \cdot B_0(\mu_i)^{9/4}. \tag{1}$$

Now, because the data on log scale resembles a normal distribution better than the actual data, we want to use the length data on log10 scale. However, in the metabolic term Eq. 1, the length should be on the actual scale while out of that term all μs should be on log scale. Thus, we have to implement a new code for this log-transformed data. I suggest we use dvcpp.DVSimTVMlog10 for this code and the modification is only in the metabolic rate term Eq. 1, changing μ_i to $10^{(\mu_i)}$, i.e.

$$B_i = N_i \cdot B_0(10^{(\mu_i)})^{9/4}. \tag{2}$$

because the empirical data is on Log10 scale. All the other parts are just the same as what we have before

$$N_{i,t+1} = N_{i,t} R_0 e^{-\gamma(\theta-\mu_{i,t})^2} \cdot e^{-1/\beta_0 \left(\sum_j e^{-\alpha(\mu_{i,t}-\mu_{j,t})^2} B_{j,t}\right)} \tag{3}$$

$$\mu_{i,t+1} = \mu_{i,t} + h^2 V_{i,t} \left(2\gamma(\theta-\mu_{i,t}) + \frac{2\alpha}{\beta_0}\sum_j(\mu_{i,t}-\mu_{j,t})e^{-\alpha(\mu_{i,t}-\mu_{j,t})^2} B_{j,t}\right) + \eta_{i,t} \tag{4}$$

$$\begin{aligned} V_{i,t+1} = {} & (1-\frac{1}{2}h^2)V_{i,t} + \frac{2N_{i,t}\nu V_{max}}{1+4N_{i,t}\nu}\cdot h^2 \\ & + \frac{1}{2}h^2 V_{i,t}^2 \Bigg[2\gamma(-1+2\gamma\theta^2) - \beta_0^{-1}\sum_j \left(4\alpha^2(\mu_{i,t}-\mu_{j,t})^2 - 2\alpha\right) e^{-\alpha(\mu_{i,t}-\mu_{j,t})^2} B_{j,t} \\ & - \left(2\gamma(2\theta-\mu_{i,t}) + 2\alpha\beta_0^{-1}\sum_j(\mu_{i,t}-\mu_{j,t})e^{-\alpha(\mu_{i,t}-\mu_{j,t})^2} B_{j,t}\right) \\ & \cdot \left(2\gamma\mu_{i,t} - 2\alpha\beta_0^{-1}\sum_j(\mu_{i,t}-\mu_{j,t})e^{-\alpha(\mu_{i,t}-\mu_{j,t})^2} B_{j,t}\right)\Bigg]. \end{aligned} \tag{5}$$