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Geoscientific Model Development Discussions
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Interactive comment on "Constraining DALEC v2 using multiple data streams and ecological constraints: analysis and application" *by* Sylvain Delahaies et al.

Anonymous Referee #2

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This manuscript presents the application of an optimization method that uses multiple data-streams and constraints in the optimization of the DALEC ecosystem model. The topic of the manuscript is interesting and most likely it will be a good contribution.

I had two main issues with the current version of the manuscript. First, I have problems understanding the notation used throughout the ms. Second, it was unclear to me why the authors needed to optimize for the initial values of the model. I will elaborate better below.

As far as I know, DALEC can be expressed mathematically as a linear system of first

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order differential equations of the form

$$\frac{dx}{dt} = u + A \cdot x \quad \text{with} \quad x(t=0) = x_0$$

where x is a vector of state variables, u a vector of C inputs to the ecosystem, and A is a matrix containing cycling (turnover) rates in the diagonal, and transfer coefficients among pools in the off-diagonal entries. Linear autonomous systems of this type simply go to a steady-state value x^* independent on the initial conditions x_0 according to

$$x^* = -A^{-1} \cdot u.$$

Without any environmental effects, this model should simply go to this steady-state value, but with environmental perturbations the system should stay in the vicinity of the steady-state, also independent on the initial conditions. It is therefore unclear to me, why do you have to optimize for the initial conditions of the model? Are you using a nonlinear version of DALEC? The discussion starting at line 289 seems to indicate this, but there is not a clear description of the model that clarify what type of nonlinear behavior is included in the version of DALEC used here.

I was also confused by the mix of terms: parameters, state-variables, variables, etc. throughout the manuscript. Due to this ambiguity, I had a hard time understanding sections 3.1 and 3.2. I also had problems with the term h, which was described as a vector of model output in line 142, and as a map in equation (2). Please clarify.

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