

Interactive comment on “Constraining ecosystem carbon dynamics in a data-limited world: integrating ecological “common sense” in a model-data-fusion framework.” by A. A. Bloom and M. Williams

Anonymous Referee #2

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The manuscript by Bloom and Williams proposes to include known model parameter relationships in a data assimilation framework in addition to observations. They claim that in a data-poor context these additional constraints will reduce parameter uncertainties. In general I agree with this statement. However, in my opinion the ecological and dynamic constraints (EDCs) that the authors introduce as a novelty are simply part of the prior information we possess for these parameters. I would suggest that the authors highlight this in the manuscript.

The manuscript is well written and presented, but I think some improvements and clar-

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ifications are required (see specific comments below).

Specific comments:

In order to obtain a unique solution in an ill-posed problem additional constraints are required. This is also known as regularization. Within the Bayesian framework prior parameter information are usually included in form of a covariance matrix, which can include correlations between parameters. The authors mention in the introduction that such correlations limit the possible parameter configuration, but in their example they simply assume no prior knowledge other than the parameter ranges. This seems to be an odd choice, because it means that all values within the given range are equally likely and parameters are independent, which is clearly not the case. The parameter space has not been restricted and it is therefore not surprising that additional information in form of ECDs add large constraints to this problem. I am wondering if this would also be the case if a different prior parameter distribution (i.e. Gaussian) with a defined covariance matrix would have been chosen in the first place. I see the ECDs complementary to the knowledge we include in terms of prior distribution and covariance matrix and not as a replacement.

A number of ECDs are formulated to constrain the parameters and states and it would be interesting to know their individual contribution, i.e. which ECD provides the largest constraint.

Minor comments:

P12738,L2 + P12739,L 14: EDC has already been introduced in the abstract and introduction (P12737,L18)

P12744,L15 + L20: repetition “We create 40 synthetic experiments ...”

P12745, Eq.(16): What is \sim been used for?

P12759, L1: space between 8 and daily

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