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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.

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We thank referee 1 for his thorough reading of the manuscript and for useful comments. In our response below we have addressed all comments. Together with this response we submit a revision of the manuscript which accounts for the changes decsribed here.

1   Tables references

All tables references have been checked and corrected.

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[Discussion paper]

2   Range of parameters

The range of parameters in Table 1 have been corrected, they correspond to what is used in Bloom and Williams (2015).

3   Ecological constraints

Our implementation of the EDCs leads to a set of 29 inequalities denoted EDC_1 to EDC_{29}, we omitted to take into account the carbon pools growth constraints in the original manuscript.

In the original manuscript we chose to provide only a heuristic description of the inequalities, the complete description of which can be found in Bloom and Williams (2015). We thought that although justified for the sake of self consistency, detailing the EDCs did not bring any insight into the question addressed here and increased significantly unnecessary mathematical notation. Nonetheless we acknowledge the comment made by referee 1 and we have made substantial changes to section 2.2 to incorporate a complete description of the EDCs, running from line 123 to line 180 in the revised manuscript.

4   Other comments

A discussion section has been added to the manuscript to address the remaining comments.

Global scale experiments are discussed in reference to Rayner et al. (2005) and CC-DAS. The work of Kemp et al. (2014), which directly relates to what we discuss in our paper, is also cited. Although this preliminary work is not reported in our manuscript

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the three approaches presented in Kemp et al. (2014) were evaluated for the preparation of the manuscript, and our conclusion was different: in our case incorporating the EDCs by adding a penalty term to the cost function was the most successful approach to constrain unresolved parameters and, most importantly in our case, to allow for a better uncertainty quantification.

We also refer to Ziehn et al. (2012) for their comparison between MCMC method and 4DVAR in CCDAS. A MCMC method is used in Bloom and Williams (2015), and in Safta et al. (2015), added in reference to the revised manuscript, a detailed analysis of MCMC for DALEC is performed. A comparison between MCMC and 4DVAR was beyond the scope of this paper, our intention was rather to establish 4DVAR as a suitable method for DALEC and the EDCs. Nonetheless a comparison between 4DVAR and fully non-linear methods is necessary, it is one of the aspects of our current work.

Finally we mention our current work on a hydrid ensemble-variational method. This approach provides an adjoint-free formulation of the variational problem and show promising results in the context discussed in the manuscript. This work is part of a paper in preparation.

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