Geoscientific
Model Development
Discussions

Interactive comment on "A variational data assimilation system for soil–atmosphere flux estimates for the Community Land Model (CLM3.5)" *by* C. M. Hoppe et al.

Anonymous Referee #1

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This work extends the applications of the 4D-Var data assimilation methodology to obtain improved estimates of the soil-atmosphere energy fluxes. The article is in general well-written, concise, and addresses issues of relevance to the geoscientific model development community.

The manuscript is suitable for publication after a few corrections, as follows:

1. Page 6611, equation (1): I suggest to insert a subscript i to both the observation operator H and the observation error covariance R and modify subsequent references to H and R accordingly. In the paragraph following eq. (1), explain that B is a representation in the data assimilation system of the (unknown) background error covariance

matrix. Insert also a brief justification of why in the present study B has been specified as diagonal. It is well-recognized that proper specification of the background error statistics is a major issue in 4D-Var. See also recent efforts on hybrid ensemble/4D-Var data assimilation at NWP centers.

2. Equation (2): there should be no summation on the first term (J^b x0-gradient)

3. Page 6612:20 I don't get what this means $M_i^* := H'^T$. It should be $M_i^* := M'_i{}^T$. Also, boldface fonts should be used for M_i' and its adjoint.

4. Section 3.2.1 on validation of the adjoint code should be substantiated by incorporating the numerical outcomes from the validation tests. Otherwise, this section has no significance, as all the material presented here is standard.

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