

Interactive comment on “Variational Assimilation of Land Surface Temperature within the ORCHIDEE Land Surface Model Version 1.2.6” by H. S. Benavides Pinjosovsky et al.

H. S. Benavides Pinjosovsky et al.

spinjosovsky@gmail.com

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Thank you for your review and for the interest in our work. I make list of answers regarding all your comments and questions. You said in section 3.1 that you use the Gradient algorithm but you do not explain what kind of algorithm it is exactly: is it “Levenberg-Marquardt algorithm”? Regarding the gradient algorithm, a minimiser called M1QN3 is used within YAO. It uses a quasi-Newton technique (the L-BFGS method of J. Nocedal) with a dynamically updated scalar or diagonal preconditioner.

You do not explain well how to estimate the actual control parameter values given the a priori. Indeed, the relationship prior value/actual value determines the covariance matrix B in Eq. (4). The Eq (4) is the most general form of the variational assimilation.

C1

I only give an introduction to this formula, but the estimation of the actual control parameters value are out of the scope of this work.

In your experiments you do not add noise to observation so in this case R is 0 and Eq.(4) is not well defined (division by 0). For that I suggest to add noise to observation and study the robustness of the developed approach as a function of the noise level. The equation 4 is just the general form. In YAO R is by default equal to 0 so users can modify its value when necessary.

Modifications to the manuscript Page 2: It is well known that both approaches provide the same solution at the end of the assimilation period, for perfect and linear models. -> It is well known that both approaches provide the same solution at the end of the assimilation period, for Gaussian variables, and perfect and linear models. Modification taken into account

Page 5, Line 23: index i is forgotten in epsilon Modification taken into account

Page 8, line 32: you said “the second approach was used”. I do not understand what is it “the second approach”. It refers to the type of coding of the modules in the modular graph. Since no detail is given before regarding this point, the phrase will be erased from the manuscript

Page 9, line 11: you said “the initial model”. Same problem, I do not understand. It refers to the reference model, before parameter perturbation

Page 9, line 25: “the parameter prior values were retrieved successfully.” In general, we estimate the actual values and not the prior. The prior is what we know initially before observation. Exactly, but since it is a twin experiment our prior is the target value we want to achieve. The phrase will be changed by: “the assimilation was successfully achieved.”

Page 12, line 24: more difficult it is to find local minima that correspond to the initial control parameters values -> more difficult it is to find global minima that correspond

C2

to the initial control parameters values Modification taken into account

Page 12, line 25: It is difficult to retrieved parameters - -> It is difficult to retrieve parameters Modification taken into account

Page 12, line 26: the assimilation of this variable in order to optimize these parameters is not optimal - -> the assimilation of this variable in order to optimize these parameters is not efficient Modification taken into account

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