

Interactive comment on “Parameter optimisation for a better representation of drought by LSMs: inverse modelling vs. sequential data assimilation” by H el ene Dewaele et al.

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RESPONSE TO REVIEWER #1

The authors thank anonymous reviewer 1 for his/her review of the manuscript and for the fruitful comments.

1.1 [The work is technically sound, scientifically interesting and worthy of publication. However I do suggest some revisions to the text for clarity and readability and beyond these specific revisions recommend further proof reading by the authors, a native English speaker and/or the journals editorial team. Particular attention should be paid

C1

to clarity in the introduction as improvements here would encourage more readers to engage with the paper.]

Response 1.1:

Yes, we will re-read the whole paper. Should a revised version of this paper be accepted in HESS, a copy editing work will be performed.

1.2 [P1 L8 “this parameter is usually unavailable” - slightly awkward, perhaps “this parameter is uncertain”.]

Response 1.2:

Agreed.

1.3 [P1 L23 “supervision” - not sure what is meant by this.]

Response 1.3:

Yes. “There is a need for better supervision of the impacts of droughts” was replaced by “There is a need to monitor the impacts of droughts”.

1.4 [P1 L29 “This quantity...” - this sentence is confusing and could be improved; please bear in mind any non-expert readers (e.g. “field capacity” is jargon which is fine in the paper in general, however ideally the very first paragraph should give strong accessible motivation for the paper]

Response 1.4:

Yes. “at field capacity” was deleted.

1.5 [P2 L18 “Other studies...” - confusing sentence.]

Response 1.5:

Yes. This sentence was reworded as: “Tanaka et al. (2004), Portoghese et al. (2008), and Piedallu et al. (2011), have highlighted the important role of the soil characteristics

C2

(soil texture, rooting depth) on MaxAWC. Soylu et al. (2011) and Wang et al. (2012) illustrated the major impact of MaxAWC on evapotranspiration."

1.6 [P2 L22 Are the units really kg m-2? Total water per volume suggests kg m-3. In any case, I am not sure that information on the units is really necessary here..]

Response 1.6:

Yes. The sentence was reworded as: "While soil properties such as soil texture determine the soil water holding capacity (in kg m-3), information on rooting depth is needed to determine MaxAWC (in kg m-2)."

1.7 [P2 L24 "The lack of..." This paragraph should be revised. The first sentence states a problem – though instead of "a significant issue" could you be more explicit? Following this it would help the casual reader to make it clearer that ECVs & data assimilation are potential solutions to this problem.]

Response 1.7:

Yes. The sentence was reworded as: "The lack of in situ observations of MaxAWC to calibrate and assess LSMs impacts the ability of LSMs to represent drought effects on plants. Using satellite observations and data assimilation techniques could be a solution to this problem".

1.8 [P2 L31 "Besides, data assimilation...". 'Besides' is a strange word to use here..]

Response 1.8:

Yes. "Besides" was deleted.

1.9 [P2 L22 "In particular, the assimilation of LAI..." This is a key piece of motivating research and it would help to make more of it...e.g "Previous work has studied the impact of assimilation of LAI observations and found that...".]

Response 1.9:

C3

Yes. The sentence was reworded as: "Previous work has studied the impact of assimilation of LAI observations and found that it can significantly improve the representation of vegetation growth (e.g. Albergel et al., 2010 ; Barbu et al., 2011, 2014)."

1.10 [P3 L1 "The ISBA LSM..." This paragraph describing some results specific to this model in detail is out of place in the introduction – I suggest removing and incorporating the relevant information in section 3.1..]

Response 1.10:

We think that this paragraph is needed in the Introduction to present the rationale for the present study.

1.11 [P3 L10 "On the other hand, no more than 27%...presented significant correlations". Unnecessary elaborate use of language. A clearer way to put it would be: "On the other hand, only 27%...had significant correlations"..]

Response 1.11:

Yes. The sentence was reworded as: "On the other hand, only 27% of the 45 straw cereals départements (i.e. only 12 départements) had significant correlations".

1.12 [P3 L15 "to retrieve". Retrieve is used throughout but feels like the wrong word. "Estimate" would be more accurate]

Response 1.12:

Yes. Throughout the text, "retrievals" was replaced by "estimates", and "to retrieve" was replaced by "to estimate".

1.13 [P3 L26 "IM and LT. With already a large number of acronyms in the paper, these new acronyms are unnecessary and add to confusion. As a reader I would prefer to continually read "inverse modelling" and "LDAS tuning" method, rather than the acronyms – I found it necessary to remind myself of the meaning of these terms.]

C4

Response 1.13:

Agreed.

1.14 [P4 L9 "They highlighted that". Why do you quote the author talking about their results here whilst describing results yourself elsewhere? Quotations like this is highly unusual and recommend avoiding.]

Response 1.14:

This paragraph was moved to the Supplement.

1.15 [P4 L11 "They give the following scores..." the R2 values are not really informative, unless you also provide information about the spatial scale, time period (annual, monthly, daily?) that the validation was carried across. But overall I think this entire sentence is too much information – I think it is sufficient to say that the product is well evaluated against ground observations and leave it at that. The particularly interested reader can follow the reference.]

Response 1.15:

Yes. This paragraph was moved to the Supplement and replaced by: "The product is well evaluated against ground observations (see the Supplement)".

1.16 [P6 equation 2. This is two equations, please split.]

Response 1.16:

Agreed.

1.17 [P6 L18 "The t superscript stands for time (t)". Adding (t) is unnecessary]

Response 1.17:

Agreed.

1.18 [P6 L19 "The initial time (t=0) is denoted by the 0 superscript." Again, (t=0) is

C5

unnecessary.]

Response 1.18:

Agreed.

1.19 [P6 L21 "The yt term of ...". The description of these equations is slightly out of order. I would move this yt up, where you describe all the terms in the delta x equation of (2). After you have described all the terms in this equation, then add the second equation for K=..., then describe all the terms here.]

Response 1.19:

Agreed.

1.20 [P6 L22 "i.e. the model predicted value of the observation at the analysis time". I am not an expert in data assimilation, but this sounds strange. I assume you just mean "the modelled value at the analysis time". Please reread and ensure that you feel that this whole section is sufficiently precise and clear, particularly for non-experts.]

Response 1.20:

Agreed.

1.21 [P6 equation 3. h (lower case) appears to be undefined. Later on in equation 6 y(x) is used. Either a typo or missing description.]

Response 1.21:

Yes. "h" is now defined as the observation operator.

1.22 [P7 L7 "The standard deviation of errors of GEOV1 is assumed to be 20% of GEOV1 LAI". Why do you make this assumption, do you have any basis? If possible, please explain your reason, or at least help the sceptical reader trust that it is reasonable.]

Response 1.22:

C6

Yes. This sentence was reworded as: "This assumption is based on option 3 presented in Barbu et al. (2011). They showed that this option gives the best simulated LAI over an instrumented grassland site in southwestern France".

1.23 [P8 L12-14 It is not quite clear what you did here, by calculating the average B above a threshold of 90% of its maximum. Why does this limit the impact of model errors? Please explain.]

Response 1.23:

Yes. The following sentences were added in Sect. 3.4: "In drought conditions, modelled Bag can rise to a maximum value and then drop rapidly. Therefore the peak Bag can be dependent on modelling uncertainties and on uncertainties in the atmospheric forcing".

1.24 [P9 Section 3.5.1. This reads like bullet points, please expand to prose. P9 L7 "by minimising this cost function". This makes the optimisation sound more complicated than it is. Preferably explain as simply as possible i.e., "the MaxAWC used in the simulation with the lowest RMSE was selected as the optimal one."]

Response 1.24:

Agreed.

1.25 [Results section generally good, though please re-read for clarity. Discussion: the structure of the section into five questions is appealing – this approach would be improved if you start each subsection with a clear sentence which answers the question. Currently some sections start with dense recapitulation of the methods, or answers to questions different from those which are posed. e.g. 5.1 What is the added value of the LDAS? "The LDAS approach allows sequential integration of LAI observations into the model". Instead: "The LDAS approach leads to more realistic simulations of LAI and Bag. In addition, N does not need to be determined". Overall I would recommend editing of this section to make it more streamlined.]

Response 1.25:

C7

Yes. We reorganised the Discussion sub-sections accordingly.

1.26 [Section 5.6 is mislabelled (or section 5.5 is missing).]

Response 1.26:

Yes. This correction was made.

1.27 [Suggest moving table 1 / 2 to supplementary material, or making a concise version of table 2 for the main paper and moving the rest to supplementary.]

Response 1.27:

Agreed.

1.28 [Figure 1: The caption is slightly confusing to read. For one thing, the colour of the symbols is redundant – they are uniquely determined by their shape, therefore you can precisely just use this to refer to them using just the symbol in the caption. Also, "Colour symbols show the departments presenting a significant correlation..." is confusing, when all the symbols are coloured (arguably, black is a colour). Finally, "empty blue circles" is confusing at first, since many of the circles on the plot are filled with another symbol. Suggest instead just "circles". Overall consider revising and unpacking this caption to make it clearer, and potentially revise the use of colour in the figure. Potentially the figure could be reproduced using just a single colour for all symbols without any loss of precision.]

Response 1.28:

Yes. "yellow down triangle" was replaced by "green down triangle". This improved the readability of Fig. 1.

1.29 [Figure 3: figures too small, would be better if they were placed in a 2x2 panel plot and resized. Figures 4,5,8,9,10,12 could each be placed on a single row with two figures, rather than a single column. Would help fit nicer on a page. Some could also be combined (e.g. 8 & 9, or 11 & 12).]

C8

Response 1.29:

We prefer leaving the Figure layout as is. We think it will facilitate the inclusion of the Figures in the two-column format of HESS.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2017-120>, 2017.