REVIEW of the revised paper

Coupled machine learning and the limits of acceptability approach applied in parameter identification for a distributed hydrological model

Authors: Aynom T. Teweldebrhan, John F. Burkhart, Thomas V. Schuler, Morten Hjorth-Jensen
Manuscript Number: hess-2019-464

Submitted: **HESSD**

The revised version of the manuscript is a significant improvement over the initial version though I do not agree with some of the responses (see below). The manuscript can be published after minor revision.

I am not fully convinced with the response given by the authors about computational time saved by the emulators. It is not that critical to save computation time for offline simulations. Because calibration or training is generally done one time unless it has to be updated frequently due to significant change in input data distribution. The critical is to save computational time for real time application as mentioned in my comments on earlier version of this manuscript. The proposed method does not provide any benefit over the existing method particularly for real time application. This should be acknowledged at least in the discussion.

Page 4, Line 25: Replace "*The percentage of observations where model predictions fall within the limits*" with "The percentage of the model predictions that falls within the observation error limit"

Page 5, L4: "… *chosen certainty level (e.g. 5-95 %) based on previous experience or literature values.*" Provide references.

Page 3, L 15: prediction error: is this Observation-Simulation or vice versa. It is important to define as error is not absolute (according to response). The response given on page 9 (*Here, the notation e is not absolute and thus the expression $\mu_Q=0, e \leq L_e$ is correct, since a model producing a negative error value of less than the lower observational error bound (which is also a negative value) has 0 degree of membership)p* does not make sense. Let us assume observation Qobs is 100, then according 25% observation error, Le is 75 and Ue = 125. Let corresponding simulation Qsim be 70. According to equation 2, Since Qsim < Le, S(Qsim)=0, this is fine. Now if authors use same notations of Le and Ue in equation 2 and Figure 1 and e = Qsim-Qobs then problem arises for calculating membership of prediction error (See below)

- Case 1: simulation below Le, e.g. Qsim = 70, so e = -30 which is less than Le, so membership = 0
- Case 2, simulation above Le but below m, e.g. Qsim = 80, e = -20, which is also less than Le, so membership = 0
- Case 3, simulation below Ue, but greater than m, e.g. Qsim = 110, e = 10, membership =(125-10)/(125-100)

- Case 4, simulation above Ue, e.g. Qsim = 130, e = 30, membership not 0 because e is not greater than Ue

So notations Le, Ue used in Figure 1 are not same as used in equation 2. In equation 2, notations should be something like this L = Qobs-0.25*Qobs, U = Qobs+0.25*Qobs. Then in Figure 1, it should be Le = L-Qobs and Ue = U-Qobs which will satisfy membership function given in Figure 1. I strongly suggest to use notations of figure of earlier comments in the original version of the manuscript which is also consistent with equation 2.

Table 1: Provide size of S4 on Table 1.