Hydrology and Earth System Sciences Discussions

Interactive comment on "Using the MESH modelling system for hydrological ensemble forecasting of the Laurentian Great Lakes at the regional scale" *by* A. Pietroniro et al.

A. Pietroniro et al.

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Response to reviewer Salvatore Manfreda

> The present paper describes a very interesting environmental modelling system that allows to couple different models with the ultimate objective to produce operational forecasts. Of particular interest, is also the fact that this product will be available on the web as an open source system. The study was conducted on the Laurentian Great Lakes basin testing the ability of the system to predict streamflow and snow water equivalent over this area.

> The paper is clearly written and deserves to be published on this journal. Personally,

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I would prefer if the paper is shortened considering that there are many parts where the reader is distracted from the content of the paper. In particular, the authors spend so much time describing in extreme details all the data input requirements of the modelling system and in comparison the modelling results loose its central role. Also, several paragraphs are useless for the scope of this paper.

> For instance, the paragraph describing CaPA product can be deleted since this data was not used in this paper .

The authors agree and the section describing CaPa has been removed. A reference to the CaPa program was retained since it is part of the development of our modelling system and framework.

> I have a number of minor comments that, hopefully, may assist in enhancing the readability of the paper.

A general remark, figures probably requires a little work of editing. For instance, the inset of figure 2 is confusing as it is, The authors agree and have removed the inset. We feel that all readers will be able to aware of where the Great lakes are located and the inset is not required.

> titles in figure 9 do not have the same sizes (compare "Lake Ontario" with "Lake Erie"),

The authors agree - this figure has been re-drafted

> figure 6 should be bigger since it is very difficult to distinguish the flow directions and finally none of the labels of figures 6 can be read.

An attempt to correct this has been made

> Figure 10 seems somewhat incomplete. I suggest including a legend describing the meaning of each line and also change the colour for the predictions.

The caption in Figure 10 was changed and the figure was divided into 2 separate

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figures. The changes are noted below.

Figure 10 - Deterministic lake level estimates from the WATFLOOD simulation for August 2003. The grey solid lines represent measured lake levels, the dashed grey line is the 5-day moving average. The black line is the WATFLOOD simulation

Figure 11 - Ensemble lake level estimates from the WATFLOOD simulation for August 10, 2003. The grey solid lines represent measured lake levels, the dashed grey line is the 5-day moving average. The black lines are the WATFLOOD ensemble simulation

Figure 12 - Ensemble lake level estimates from the WATFLOOD simulation for August 14, 2003. The grey solid lines represent measured lake levels, the dashed grey line is the 5-day moving average. The black lines are the WATFLOOD ensemble simulation

> Figure 15 and 17, specify the units used for the map on the palette as in figure16

The captions have been changed to clarify.

> 3. Simulations of WATFLOOD show that the model tends to slightly overestimate the streamflow. If this is true, why do we observe an underestimation of the lake's water level (see figure 9)?

The simulation results only show a small portion of the basin. As there were 155 stations to validate it was not possible. The text in that section was adjusted to try and highlight that we have both under and overestimation errors in the model.

> 4. The citations in the text should be formatted according HESS requirements. The correct citation style is: (Helliwell, 1965; Fejer et al., 1981).

We followed the HESS (EGU) template for Latexand this is out of our control We would be pleased to re-work the text with the assistance of the editor if this is a problem.

> 5. There is any reference for the parametrization used for the vegetation characteristics such as the leaf area index, vegetation fraction and root depth? It is not clear what really means that those parameters change according to a pre-established table

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(Page 2487 - line 22).

This was clarified. The text was changed to include : "These a priori estimates of parameters are based on a number of years of testing and evaluation in the Canadian version of the ISBA land-surface scheme."

> 6. Honestly, I think that is obvious that GRUs with the exactly the same characteristics (vegetation, initial soil moisture, etc.) and under the same atmospheric forcing have the same runoff response (see page 2489 - 14:17). Is there something I'm missing or this sentence is useless?

We think it is obvious too; however, we feel that readers don't necessarily understand that the parameterization of GRUs is identical throughout the domain. This statement simply reinforces the point. We would prefer to keep this in provided the editor agrees.

> 7. Is it necessary to provide all the details about the model WATFLOOD? It wouldn't be better just to refer to the previous work of Kouwen et al. (1993). Also, there is a repetition in the text regarding the WATFLOOD routing model requirements at page 2488 - lines 17:18 and page 2490 - lines 23-24.

This section was reduced.

> 8. It seems too vague the say ". . .requiring minimal changes to the model parameters..." (page 2491-line 8:9). Can you be more specific?

The authors are referring to previous modelling studies where the model was calibrated. In this case the parameters were successfully transferred to the Great Lakes basins. The phrase was changed to :

"All of these land cover classes have been used in other WATFLOOD model testing at much smaller scales and different locations. The land-based parameters required minimal change for use with the entire Great Lakes basin."

> 9. Please refrase the paragraph at page 2493 - lines 11:16 and go to the point.

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This section has been clarified

> 10. It seems to me that the dashed lines (indicating the starting date of the forecast) of the two graphs at the bottom of Figure 10 are not in the right place. Probably, it is just a formatting problem.

This was fixed.

> 11. I didn't find any comment regarding figure 13a and b in the text.

We noted a numbering error in the text. We referred to figure 12 c and d when it should have been figure 13 c and d.

> typing errors. > 1. Page 2489 - line 10: change in "A more suitable approach. . .".

fixed

> 2. Page 2495 - line 4: leave some space after the comma ". . ./snowdepth), it is the region. . .".

fixed

> 3. Page 2495 - line 12: change to ". . .one observation is taken every. . .".

fixed

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