Hydrology and Earth System Sciences Discussions

Hydrol. Earth Syst. Sci. Discuss., referee comment RC10
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Comment on hess-2022-96

Anonymous Referee #10

Referee comment on "FarmCan: a physical, statistical, and machine learning model to forecast crop water deficit for farms" by Sara Sadri et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2022-96-RC10, 2022

The study is about a short-term prediction of water available for a crop production in Canada: a new FarmCan model (tool) is suggested for prediction of a set of variables needed for farmers. FarmCan allows the forecasting up to 14 days for the evapotranspiration [potential evapotranspiration] and the soil moisture content [root soil moisture content] on the basis of the remote sensing products (available operationally), the short-term forecast for the precipitation and a farm specific information like location, crop type, etc. The manuscript discusses the results of application of the FarmCan for the prediction of the water demand for the crop production at four farms located in Canada. The FarmCan tool implements methods of the machine learning technique; the model is training and running on the data covering the period of 2015 - 2020.

In my opinion, the manuscript requires a major revision in order to better show the progress achieved and originality of findings obtained by the authors. I would suggest extending the introduction by explaining the diversity of the methods (models) applied in short-term forecasts for the agricultural needs with focus on their disadvantages and gaps. It is now not clear what gaps were filled with the newly developed FarmCan model/software/tools.

It seems that many references are missing, and it makes it difficult to understand whether authors developed this particular method or just implemented the existing method into the developed software (FarmCan model). There are too many abbreviations in the text, and many of them are given without explanation; and it makes reading the text difficult. I would suggest putting all notations into the table in the Annex.

The text includes many specific terms often used by modelers (ie. dynamic, static variables or “the hindcast”) which were leaving without the explanations; it makes understanding of the text difficult to the wider scientific community. I am suggesting to present the results more in Tables instead of duplicating the figures (Fig. 7 and 8, and the

subfigures in Fig. 9).

In my opinion, the manuscript requires a major revision. I am wondering if the manuscript with the description of developed software is relevant for HESS: https://www.hydrology-and-earth-system-sciences.net/about/manuscript_types.html. This manuscript will probably better fit to the requirements of the Geoscientific model development journal.

Specific comments:

Lines 2-21: I would suggest removing the notations from the text of the abstract. It is better to introduce them later in the text and/or place them in the special section. Check the abbreviations MSWEP, R2, RMSE KGE: they are given without the explanation.

Line 23, …FAO…: I would suggest to always give first the explanation of any notation that will be used further in the text.

Line 46: what are "the crop stress models"? How do they differ from the crop-water model (line 43) and plant hydraulic model?

Line 52: the reference to ML is needed.

Line 60: Does it mean that you developed the software (FarmCan) allowing using a specific set of available data and methods implemented? Is it relevant for HESS?

Lines 61-62: I would suggest removing the repetition of the abbreviations if they were already introduced in the previous text.

Lines 78-79: Please, provide the numbers while describing the climatology of the region (length of winter and summer seasons, [annual/growing period] amount of precipitation, relative humidity, etc.).

Lines 84-85: The notations first used in the text must be explained for readers (RISMA and NASA).

Table 1: I would suggest providing the numbers for the precipitation rounded to tens of mm (i.e 122.45 -> 122).

Line 95: please give the reference providing the amount of precipitation in Table 1.

Lines 117: The notations first used in the text must be explained for readers (SMAP?).

Line 125: Please explain what is “a dynamic parameter”?

Line 135: Please, check the reference (A1…

Lines 140-143: Check where the definition of the abbreviation GEOS is given first.

Line 156: the abbreviation P was previously explained in the text, there is no need to repeat it here.

Line 163: Remove L. in reference to Chen and …

Line 165: Please, explain the abbreviation MSWX first time found here.

Line 167: What does “... MSWX product (?) ... ” mean?

Line 207: Please give the reference with the RF method description (algorithms)?

Line 233: Pearson correlation analysis is first time mentioned in the text. Please give the reference for it.

Line 243: (I. Sevevi…) -> (Sevevi..)

Line 243: please explain what is “a transition time” or exclude this term from the text.

Line 255-256. I would suggest not using the term “climatology” when discussing statistics estimated from the 5-year period.

Line 258: “from 400-1200 mm” -> from 400 to 1200 mm

Lines 255-268: The numbers are only given for the precipitation in the growing period while the “hydrological variables” are promised in the name of the paragraph.

Lines 260, 264: please use the names instead of abbreviations.

Figure 4: I would suggest adding the explanation of all abbreviations used in the plots. Also, please remove the term “climatology” from the notation to the figure.

Figure 5: Please, add the unit for X,Y variables and the explanation of the abbreviations used in the figure.

Fig. 6: What is 8-day variability analysis? It was not given in the section of methods?

Table 3: In my opinion, the information in table 3 is better given in the text, and I suggest removing the table.

Line 303: I would suggest using specific terms (like “the hindcast”) without their explanation.

Figure 7: I would suggest rounding predicted values for PET, ET, P and NI: like P=30.46 mm -> P=30 mm since the precision of the modeled value never becomes better than the observed (measured) value. The precipitation is usually measured with the precision of 1 mm; if the precision of the observed precipitation is better than 1 mm, please provide the description of the measuring technique or the reference describing it.

Figure 8: In my opinion it is better to give the results in Table. The explanation of the results is very poor.

Table 4: I would suggest giving the results for the KGE together with other estimates (R2 RMSE).

Figure 9. I would suggest showing the plots only for one farm, and the rest of the results are better shown in the table. What [2020] is meaning in the figure caption?

Line 326: It seems that the section with the discussion is missing. In this section newly obtained findings are discussed in comparison with already known facts. I would suggest discussing the effectiveness of the developed model/software FarmCan for the short-term forecasting (up to 14 days) of four variables in terms of its computational costs and accessibility to the sources of input data. Do you know any other models/software/methods allowing the short-term prediction of PER, NI, etc? What are the advantages of FarmCan compared to the existing models?

Line 376: I would suggest adding the information on the data and code availability for the results shown in this study. This information is missing.