RC5

In this manuscript, the authors use three methods to calculate daily evaporation during summer months (Jun to Sep) at a experimental site in Hungary. The three methods are the FAO Penman Monteith (PM) method, multiple stepwise regression and Kohonen self-organizing (SOM) maps. All methods are provided with observed meteorological time series for the years 2015 to 2020 as input. Simulated values are then compared to the observed evaporation estimates of three evaporation pans. The difference between the three pans is that one is a standard open water pan, one pan is partly filled with sedimentes and one with water living plants. Overall, the Kohonen self-organizing maps yield by far the closest match to observed evaporation estimates for all three pans.

The topic of evaporation estimates is fundamental to land-surface hydrology. For example, the PM method is frequently used to estimated potential evaporatin in hydrologic models. Errors in the PM methods will bias any subsequent hydrologic modeling. Despite the fact, that the topic of the manuscript is of general importance, the structure of the manuscript is poor and needs to increase substantially. One important issue is that I could not find that all findings listed in the abstract and the conclusions mentioned in the abstract are supported by the main text. Additionally, the methods part does not provide all details to follow what the authors did exactly. This does concern the PM method and the SOM method. The re-phrasing of the mentioned sections is in process and see also answers of RC2 and RC3. To complete the M&M section based on the answer of RC3 is as follows: “K-SOM provides an indirect method for the estimation of pan evaporation, that seems necessary to get evaporation of natural ecosystems including lakes. In other words, applying an indirect method, in which the pan evaporation is estimated from other, easily measurable meteorological parameters such as sun radiation, air temperature and relative humidity has of primary importance. This approach has widely been used for pan evaporation projection among others by Kisi et al. (2016) and Lin et al. (2013). Kisi et al (2016) compared the soft computing model K-SOM and multiple linear regression (MLR). The authors demonstrated the superiority of K-SOM over MLR even in the model performance.

The Penman-Monteith model is considered as the international standard for computing potential evapotranspiration and predicting crop water requirement. Penman-Monteith equation (FAO-56) may also be proper method to get pan evaporation with submerged macrophytes. Wang et al. (2021) reported that actual evaporation is important for hydrological research due to its direct impact on the hydrologic processes (water cycle, water resources management). The above authors concluded that to estimate pan evaporation, it is essential to find the proper formulation of Penman-Monteith equation. It may be especially true even in pans with seeded macrophytes. In accordance with composition of lake ecosystems, this is the method in evaporation estimation that implies living organism.”

“To our best knowledge, no similar work has been published previously using the three modelling methods for seeded pan evaporation estimation.” (This last sentence goes to Introduction)

Added references:

Kisi, O., Genc, O., Dinc, S., Zounemat-Kermani, M.: Daily pan evaporation modeling using chi-squared automatic interactiondetector, neural networks, classification and regression tree, Comput. Electron. Agr., 122, 112-117, DOI: 10.1016/j.compag.2016.01.026, 2016.

Lin, G.F., H.Y. Lin and M.C. Wu Development of a support-vector-machine-based model for daily pan evaporation estimation. Hydrol. Process., 27 (22) (2013), 3115-3127
I am convinced that the comparison of evaporation estimation methods for the three pans (in particular Figure 6) are valuable findings that should be reported, but the manuscript needs to be

substantially improved. Thank you!

Most importantly, the authors should decide what their main focus of the study is. Is it the effect of macrophytes on evaporation or is it the different estimation methods? At the moment, this is not clear. I would suggest the former to be the more interesting subject.
The content of the study aim is also under consideration. But the macrophyte's effect in pan evaporation is in the focus. We complete the new aim of the article as follows: "The aim of the study was to investigate the effect of littoral sediment and macrophytes on lake evaporation and not an introduction of a new method in pan evaporation estimation. The previous results in FAO-56 Penman-Monteith equation (Allen et al., 1998), Kohonen self-organizing map techniques (Kohonen, 1982) and multiple stepwise regression are classic methods, highlighted widely by citations in the study. They are the tools in analysing the effect of sediment and macrophytes in pan (lake) evaporation estimation only. The novelty of the paper is the way how the evaporation estimation is carried out. Up to our best knowledge, there are no studies attempting to project the lakes evaporation using traditional A pan measurements, taking the macrophytes- and sediment-related factors into account. Lake evaporation study is missing under such climate conditions as our experimental site."

Abstract:

L. 14ff: I don't think that the statement regarding the correlation of RH is supported by the findings of this study. See my comment below regarding L. 218ff.

We omit the word "stronger"

The conclusion mentioned in the abstract on line 19f is not given anywhere else in the manuscript. It is unclear how the authors come to this conclusion or what they mean with "potential".
We mean potential as possibility. The word potential will be changed in possibility

Introduction:

Section starting at line 52 is a collection of statements that do not follow a apparent logical structure. It is not clear to me what the authors wish to express here.

Re-written Introduction part is: "Evaporation of open water surfaces is usually measured by means of pans endowed with unrealistic properties. These pans are filled with clean tap water and the evaporated water is also replaced with tap water that is not the case in natural ecosystems. In nature, however, there may also be submerged macrophyte living in the open water. These plants presence is essential and affects the chemical and physical water properties including its quality (Yan et al., 2019). Furthermore, the species that are rooted in the sediment can stabilize the sediment by inhibiting its resuspension (Madsen and Cedergreen, 2002; Vymazal, 2013).
Changes in the heat regime of a water body had been reported to result in alterations of macrophyte community composition (Barko et al., 1982), which may affect the temporal appearance and spatial distribution of macrophytes in the future. As a result, due to global climate change, it is important to examine submerged macrophytes in all aspects, including their effect on evaporation. "

Methods:

L. 110f: The data described in Section 2.1 is not sufficient to apply the Penman-Monteith equation. Section 2.1 states that global radiation R_s is measured but Penman-Monteith equation requires net radiation and ground heat flux. How are the latter two derived?

We complete the M&M: “Rn was estimated from global radiation, mean daily temperature, the mean daily vapor pressure, the site latitude and elevation after Allen et al. (2005). A fixed value of 0.23 was applied for the common reed albedo. It was assumed that soil heat flux density was G= 0 on a daily basis. Detailed description of the process can be read in Soós and Anda (2014).”

References:
Allen, R.G., Clemmens, A.J., Burt, C.M., Solomon, K., O’Halloran, T., 2005. Prediction accuracy for projectwide evapotranspiration using crop coefficients and reference evapotranspiration. J. Irrig. Drain. Eng. ASCE 131 (1), 24–36
Anda, A., G. Soos, J. A. Teixeira da Silva, V. Kozma-Bognár 2015. Regional evapotranspiration from a wetland in Central Europe, in a 16-year period without human intervention, Agric. Forest Meteor. 205: 60-72, DOI: 10.1016/j.agrformet.2015.02.010
Soós, G., Anda, A, A methodological study on local application of the FAO-56 Penman-Monteith reference evapotranspiration equation, GEORGIKON FOR AGRICULTURE: A MULTIDISCIPLINARY JOURNAL IN AGRICULTURAL SCIENCES 18, 2, 71-85, 2014.

Results:

L. 187f: There are only four lines describing the results of table 2. This is not well balanced. Either the text needs to be expanded or the table shortened.

To the text completed with: “There was statistically significant difference in evaporation rates of full datasets as well as in case of training and testing datasets between the seeded and classic Class A pan.”
Table 2 will also be re-structured by omitting some of the lines (CV, max and min).”

L. 206f: I am not an expert in self organizing maps. I don't know how to interprete characteristics shown in table 3 and the authors only describe the last two lines in this table.

We add the following to Table 3 explanation: “These are the usual parameter table for K-SOM. The inputs were normalized, the code book is generated, the map size is the dimensions of the component planes (Figure 5), the neighbouring function of the pixels is Gaussian, the shapes of component planes are sheets, the lattices in planes are hexagonal.”

L. 218ff: "Thus, the correlation..." This sentence is confusing to me. First, it should state observed values and not modeled values. Second, it is shown in table 2 that RH is negatively correlated with E_p which is expected. Here, the authors state that red colors in Figure 5 show high correlation. For RH, the values are substantially higher than for any other variable suggesting a higher impact. This suggests to me that the SOM algorithm is not able to reproduce the relationships reported in table 2.

The Fig. 5 is in accordance with results in Table 2. In the two component planes of Fig. 5 (Ep and RH), the red areas of hexagons are on the opposite sides that indicate the negative correlation as it was stated in L218ff. That is in the text: “The component planes also visually confirm the negative correlation between RH and Ep, with high values of the RH resulting in low values of the Ep”

L. 231: I disagree with this statement. How can the authors state that all three methods are close to observed values, when coefficient of determination varies from 0.11 for Penman-Monteith method to 0.97 for self-organizing maps. I think it is fair to state that the Penman-Monteith method is not

able to reproduce the observed values. It is not clear to me whether the authors did apply the Penman-Monteith equation correctly because not all details are provided in the manuscript (see comment above).
This sentence will be omitted. The asked information was completed in M&M. See above

Discussion:

L. 256f: There are results reported in the discussion section. This should be moved to the results section and is not a clear manuscript structure.
We move L 256f to the results

L. 271ff: This section lists findings of other studies but does not provide a discussion of these results against the findings of the present study.
It demonstrates previous results that existed before this study. The conclusion contains the new findings of this study.

Minor comments:

L. 9: There is a misleading typo here: the A should not be capital.

Thank you!

L. 110f: Which equation was used to derive e_s and e_a from RH?

The Tetens equation (Monteith and Unsworth, 2008; Allen et al., 1998; Tetens, 1930) was used for calculating saturation vapor pressure (e_s) as follows:
$e_s=0.6108*\exp(17.27T_a/(T_a+237.3))$, where T_a is the air temperature in ºC. The vapor pressure, e_a was calculated from the relative humidity (RH):
$e_a=(RH/100)*e_s$

References:
Allen RG, Pereira LS, Raes D, Smith M. Crop Evapotranspiration-Guidelines for Computing Crop Water Requirement, Rome, Food and Agriculture Organization of the United Nations, 1998.
Tetens O. Über einige meteorologische Begriffe. Z. Geophys., 1930; 6. 297-309.
Monteith, J.L., and Unsworth, M.H. 2008. *Principles of Environmental Physics*. Third Ed. AP, Amsterdam.

L. 118ff: Section 2.4 is not understandable to readers who are not familiar to SOM. It needs to be rewritten using an easier language. Figure 3 is also very confusing. Also, E_p is mentioned in Figure 3 as input variable, but this cannot be correct. I guess that observed E_p is used during training to compute an error measure.

According to answer RC3, the description of K-SOM will be extended.
Thank you for your suggestion, the observed Ep was used during the training. The Fig. 3 is only schematic representation of K-SOM network architecture. We correct the input of Fig. 3 by omitting the Ep.

L. 139: The sentence regarding the splitting of the data is incomplete.

We complete the sentence

L. 184: Table 1 can be moved to the appendix because it is not central to the goal of the manuscript.
Thank you!