Reviewer#2

The paper is focused in exploring the key factor and salinity on E. The microclimate factors are well explored buy in regard the salinity with some weakness for two different conditions considered (IF, IC). In general, the paper provides an important technique contribution.

Response: Thank you very much for your positive comments. Your comments do improve our study. The main innovation of this study was quantified the E during ice-covered period (ICP) (lake ice sublimation reaches 175.22±45.98 mm, accounting for 23% of the annual evaporation) by six years of EC observations, and found that use of different models may be more reasonable to E simulate during IFP and ICP, due to the different underlying mechanism. Of course, as a saline lake, considering salinity in the models of E simulation of QHL make it more theoretical to explain E process and reduced the uncertainty of estimation. Thus, we introduced the water activity of QHL to the MT and AD models, and applied it in the MT model for E simulation of IFP during 2003 to 2017, since the JH model was chosen for the ICP. However, due to the lack of time series of lake salinity, the analysis of the difference in the effect of salinity on E between ice-free period (IFP) and ICP is relatively weak.

And we provide a point-to-point response to your comments in bold font below, and show amendment we made in the manuscript in underline font.

(1) 59-61 – The paragraph includes the key and rich knowledge on saline lakes E, but is included only one author, Hamdani et al., 2018.

Response: Thank you for your insightful comments. We have added more relevant references in the reversion. For example, Salhotra et al. (1985) stated the effect of salinity and ionic composition on evaporation in Dead Sea; Hamdani et al (2018) and Obianyo (2019) emphasized the inhibitory effect of salinity on evaporation; and Woolway et al. (2020) reviewed the effect of climate and environmental factors on evaporation in lakes.

(2) 117 – In this line is referred to climate changes for the period 2003-2017, why? Maybe is it correct to refer only to climate variability as it written in the abstract.

Response: Many thanks for your good suggestion, and we changed all climate changes to be climate variability in this revision.

(3) 121 – In title 2.1 would be better split into two chapters

In my opinion the Site description is poorly described, how about the other lake characteristics such as: lake topography, inflow-outflow, stratification, thermal stability, hydrodynamics?

Response: Thank you for your constructive comments. Following your suggestion. We first divided this section into two parts: the section of 'Study area' and 'Site description and energy exchange flux and climate data'. And we also added more information about the lake topography, inflow-outflow, and stratification shown as follows: Surrounding by mountains, the QHL is a typical closed tectonic depression lake, which is fed by five major rivers including Buha, Shaliu, Hargai, Quanji, and Heima Rivers (Jin et al., 2015). The total annul water discharge is approximate 1.56 × 10^9 m^3, of which the Buha River contributes 50% and Shaliu River contributes about one third (Jin et al., 2015). The mean annual Ta, precipitation, and E values between 1960 and 2015 were −0.1 °C, 355 mm and 925 mm, respectively (Li et al., 2016). The seasonal stratification of QHL corresponded to that of a dimictic lake with the spring overturn taking place around May and the autumn overturn appearing around November–December (Su et al., 2019).

(4) 128 – The sentence seems nonconclusive, it does not include any information and Reference.

Response: Thank you for your elaborate comments. We tried to point out the drastic changes of QHL in recent years by this sentence. Thus, to make this information more reasonable, we added two references (Tang et al., 2018; Han et al., 2021) which indicated significant increase in lake surface temperature (with a rate of 0.04 °C yr^{-1} from 2006 to 2016) and area (with a total increase of 3% from 2006 to 2016), and decrease in ice phenology (with a rate of 0.13 days yr^{-1} from 2000 to 2020) in this sentence.

(5) 151 – Why the water temperature (Tl) was measured only at depth till of 3.0 m?

Response: Thank you for your comments. Due to the limitation of the number of temperature observation probes, the Tl was measured with five temperature probes (109 L, Campbell Scientific Inc.) at depths of 0.2, 0.5, 1.0, 2.0 and 3.0 m. Indeed, considering variation of water temperature along with depth, there is some error in replacing the lake temperature by the average temperature of 0~3 m. As we all know, the seasonal stratification of QHL corresponded to that of a dimictic lake with the spring overturn taking place around May and the autumn overturn appearing around November–December. Thus, the Tl decreases with

increasing depth during ice-free period (IFP), while Tl increases with increasing depth during ice-covered period (ICP) (Figure V1). So, Tl used in this study may overestimate during IFP, and underestimate during ICP, which would increase the uncertainty in the effect of Tl on evaporation. We included this discussion in the text.

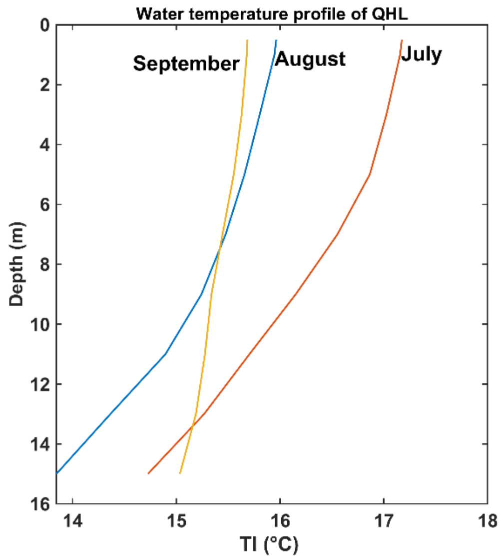

Figure V1: The water temperature profile in July, August and September 2020 of Qinghai Lake (QHL). The Tl data was measured by an automatic observation system on the float at the depth of 0.5, 1.0, 3.0, 5.0, 7.0, 9.0, 11.0, 13.0 and 15.0 m with a temporal resolution of 2 hour during July to September of 2020 in QHL.

(6) 264 – To explore the key factor controlling E, was used two methods to estimate the sensitivity and the importance of each variable. Can you define the difference between the two approaches, or add more literature?

Response: Thank you for your constructive comments and useful suggestion. Partial least squares regression is a method for <u>linear regression</u> between a possibly vector-valued response and a number of predictors, while random forest is a powerful tool for <u>nonlinear regression</u> and exploring the importance of the influence of multiple independent variables on dependent variables based on theory of decision tree. Thus, partial least squares regression and random forest were used to analyze the relationship between E and climate and environmental factors from linear and nonlinear processes, respectively, which has been widely used in the study of hydrological and ecological field. Following your suggestion, we added some more description and literature about the two approaches in this revision shown as following: <u>The two methods analyze the relationship between</u>

E and climate and environmental factors from linear and nonlinear processes, respectively, which has been widely used in the study of hydrological and ecological field (Desai and Ouarda, 2021; Li et al., 2022; Sow et al., 2022).

(7) 362-385 - Was discussed the influence of salinity on E rate. Then E-IF and E-IC rate within the saline lake environment in consequence is one of the interests. I think the literature explains quite enough the salinity influence on E, but this paper attends to describes the within the two different thermal conditions and no results. Is explained that was measured the water activity by 0.97 and applied to the model, that is it (IF, IC ?).

Response: Thank you for your elaborate comments. Yes, this paragraph was used to discuss the application of water activity by 0.97 in the models during IF. Although the application of water activity has little effect on the evaporation value of QHH (a decrease of 3% and approximate 24 mm/yr), we think that it is important to consider the effect of salinity on the evaporation simulation for the explanation of the mechanism in models of saline lakes. Because this influence increases gradually over saline. When the salinity concentrations are 100 g L^{-1} and 300 g L^{-1}, the reductions in evaporation are 3.4% and 31.9%, respectively. Thus, it is more reasonable to consider the effect of salinity on evaporation in saline lakes. Following your suggestion, we clarified our expression in this revision as following: In our study, we measured the water activity of QHL was 0.97 by a salinity of 14.13 g L^{-1}, and applied it to the MT and AD models (the water activity was considering in the MT model for E simulation of IFP during 2003 to 2017, since the JH model was chosen for the ICP), which make it more theoretical to explain E process of saline lakes and reduced the uncertainty of estimation in saline lake E. And we also divided this long paragraph into two parts of '4.2. Responses of lake evaporation to salinity' and '4.3. Responses of lake evaporation to climate variability' in this revision.

(8) In the same long paragraph, is defined the reduced saturated vapor pressure above the water (at a given water temperature, which one?); in other wise, there must be more evaporation, but here is given the opposite definition. This section must be clarified.

Response: Thank you very much for your constructive comments. Actually, the water activity (α) is defined as the ratio of water vapor pressure on the surface of saline and fresh water at the same temperature, which can be shown as following equation:

$$\alpha = \frac{e_{ss}(Ts)}{e_{sf}(Ts)}$$

Where e_{ss} and e_{sf} are the water vapor pressure at the same temperature (Ts), respectively. Because e_{ss} is smaller than e_{sf} at the same temperature, α always less than 1, and Δe would be smaller in saline lakes than that in fresh lakes at the same temperature. Thus, there is less evaporation in saline lakes than that in fresh. The statement is easy to lead to misunderstand, so we have replaced the 'a given temperature' with 'the same temperature' in this reversion.

Dear Editor,

Can you provide the list of paper:

Hamdani et al., 2018

Salhotra et al., 1987

Wang et al., 2019[a]

Response: We will upload these articles along with our response.

References:

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Sow, A., Traore, I., Diallo, T., Traore, M., & Ba, A. (2022). Comparison of Gaussian process regression, partial least squares, random forest and support vector machines for a near infrared calibration of paracetamol samples. Results in Chemistry, 4: 100508.