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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Thermal regime, energy budget and lake evaporation at Paiku Co, a deep alpine lake in the central Himalayas" *by* Yanbin Lei et al.

Anonymous Referee #1

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This paper reported the seasonal changes of lake water profile, lake levels, surface heat budget, and evaporations by three years in-situ observation data. They showed very interesting characteristics representing lake environment in southern edge of the TP, that gives us the hints to understand basic processes of heat/water budget of mountain lakes under Indian monsoon climate. As authors introduced in the introduction, lakes on the TP are changing. It is very important to reveal that how the global environment change could modify the lake environment through land-atmosphere interaction. The contents showed basic timelines of observed data with estimated heat budget and evaporation amount, and natures could be easily captured by figures. However, many key mechanisms are discussed by speculations without in-depth examina-

tion/comparisons to previous studies in the TP. This is because the study did not set clear objectives. Therefore, the title is also uncoordinated. For instance, do authors concern about the lake area (level) changes of Paiku Co ? Figure 10 shows that lake level show small seasonal variation (within 1m), but do you think this is critical? Or, authors investigated large evaporation rate instead of previous studies? Readers can not understand how the Fig. 10 differs from other lake or even from ground in the TP. If the HESS request level of paper as scientific article instead of "report", I would like to suggest that paper needs fundamental revisions with clear objectives and results based on additional in-depth analysis.

For the lake dynamics by means of hydrometeorology, following points need to be examined. 1) Water temperature profiles were almost homogeneity during Oct.- June (non-monsoon season), and author explained by "fully mixing" without any analysis. Please proof it physically using surface wind speed and variability conditions and water mixing theory. It is curious that such mixing occurred suddenly. In the central TP, large diurnal wind changes are found in winter due to the coupling of upper strong STJ and boundary layer development. Any relation to the seasonal change of atmospheric circulation ? 2) Seasonal change of water level should be explained by seasonal change of water budget, including precipitation, river runoff/inflow and surface water inflow. Even there are lack of areal in-situ measurements, some parameters could be estimated by previous studies or literature. This also links to Av calculation as mentioned in 3). I could not see precipitation records, but the Rn sequence demonstrated that rain season is not clear compare to southern Himalayas and central plateau. If the impact of monsoon is small with fair/non-freeze weather, location of the lake may represent local dry climate behind the Himalayas where lee-side subsidence prevails, and that would characterize evaporation rate at Paiku Co. 3) To consider the heat budget of the lake, especially for the condition of thermocline, advection of cold (snow/glacier-melt) water associated with river/surface inflow need to be considered. This paper only compares the heat budget at water surface, and conclude the evaporation as a ley parameter to affect lake level seasonality. Is there no effects of glacier melt water (they are illus-

trated in Fig. 1a) or monsoon precipitation inflow to establish lake temperature profile and lake level seasonality? Diurnal change of river level according to the glacier melt is observed by previous studies. There are some indication at the bottom temperature of northern point in Fig. 3b. At L115, please proof that Av can be ignored. Authors should not avoid those issues to analyze if they focus on the water cycle and environmental changes on the TP as introduced in Chapter. 1.

Minor comments are as follows. (sorry that order is not as in the paper)

> There are no previous studies in Paiku Co. ? Need reviews. > Water temperature sensors in the upper profile are shaded? Or, how deep the insolation can penetrate the water at the target lake? > L176ãĂĂSmall water temperature gradient is explained by cold air temperature. This is strange. Air temperature change is due to latent heat from the surface or advection. Enough radiation could increase the water temperature even the air temperature is cold with weak winds. > L175-180 Those are speculations, not results. > L138ãĂĂ“input data were averaged at weekly interval“ãĂĂDoes heat budget screened by the wind direction by instantaneous data then averaged? > Units in Fig. 10 are mm/d, cm and it is m3/s in Table 3. Please unify them to capture accurate water balance. > Title of 3.3 “Lake hydrometeorology” is vague. > L215ãĂĂ“There was a $\sim$1.5 month lag between lake surface temperature and air temperature.” Is not clear. > I could not understand the meaning to show the Fig.6. > L230ãĂĂ“Downward shortwave radiation at Paiku Co had an annual average of 251.8 WÂům-2 (Fig. 7), which is slightly higher than the TP average due to its lower latitude (Yang et al., 2009).” What is the TP average? Effects of Indian monsoon is stronger in southern TP in general, and cloudy weather may reduce the insolation. Or, the observation represent local weather in the valley? > L230-237ãĂĂDiscussions are not clear due to mixture of seasonal change and annual average. Why the rainy season is not clear? > L17, L248„ “a deep lake”. Many discussion attribute the characteristics to the depth of lake without examination. Manly lakes over the TP are shallower than the target lake? Please review that how the depth of lake over the TP characterize the lake temperature condition.

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