

Interactive comment on “Tracking the impacts of the Aru glacier collapses on downstream lakes” by Yanbin Lei et al.

Linghong Ke

kelinghong@hhu.edu.cn

Received and published: 26 July 2020

General comments

The manuscript “Tracking the impacts of the Aru glaciers collapses on downstream lakes” authored by Lei et al. presents a comprehensive investigation of the giant glacier collapse and its impact on lake shore morphology and bathymetry, lake water budgeting, and lake surface temperature (LST) of downstream lakes. The sudden, giant collapse of the Aru glaciers has attracted wide attention from the scientific and public community (Gilbert et al., 2018; Kääb et al., 2018), while its impact remains largely unresolved. This study, therefore, presents a significant and interesting story of what happened after the collapse, by combining field survey (bathymetry, LST), in-situ hy-

C1

drological and climatological observations, and multi-source satellite observations. The results reveal that downstream lakes experienced significant changes in bathymetry, decreases in surface temperature, and accelerated expansion. Furthermore, quantitative estimation on the contribution of glacier collapse to lake expansion (26.4%) is provided by analyzing the inter-annual changes of lake water storage. The quantitative evaluation is important as that quantitative causal analysis of the lake change on the central TP remains inadequate in current literature. Whereas it has been extensively reported that most lakes on the central TP showed rapid rises in water level due to warming and wetting climate in recent decades (Song et al., 2013; Yao et al., 2018; Zhang et al., 2017). This work is beneficial to advance our understanding of the environmental response of high-altitude lakes to the effect of the changing climate and abrupt cryospheric incidence. Besides, the in-situ bathymetry data provide valuable basis for estimating the water volume of the two lakes and for continued monitoring of water storage changes.

Specific comments

Although the manuscript is generally clear and well-organized, here I raise a few issues in hoping to improve the clarity and to target the research objective better. (1) The organization of the Results part should be adjusted to focus on the evaluation of the glacier collapse influences. In Section 4.1, the description of Aru Co, Memar Co, and their hydrological connection can be moved to the part of the Study area. (2) In Section 4.4, the impact of glacier collapses and meltwater on surface temperature of two downstream lakes were analyzed. From the LST time series, it can be clearly observed that several degrees of temperature difference occurred before and after the collapse. It can be inferred that the LST differences may be revealed in the spatial pattern of MODIS-derived temperature image varying with the distance from the ice mass input place. It is thus suggested to add the maps showing the spatial pattern of LST effect responding to the glacier collapse. (3) The estimation of the collapsed glacier contribution on the lake water storage increase assumes that all of the collapsed ice mass

C2

eventually entered the downstream lakes in the form of meltwater supply. However, the glacier melting in other forms, e.g., evaporation, may need to be discussed.

References:

Gilbert, A., Leinss, S., Kargel, J., Kääb, A., Yao, T., Gascoin, S., Leonard, G., Berthier, E. and Karki, A.: Mechanisms leading to the 2016 giant twin glacier collapses, Aru range, Tibet, *Cryosphere Discuss.*, 1 26, doi:10.5194/tc-2018-45, 2018.

Kääb, A., Leinss, S., Gilbert, A., Bühler, Y., Gascoin, S., Evans, S. G., Bartelt, P., Berthier, E., Brun, F., Chao, W.-A., Farinotti, D., Gimbert, F., Guo, W., Huggel, C., Kargel, J. S., Leonard, G. J., Tian, L., Treichler, D. and Yao, T.: Massive collapse of two glaciers in western Tibet in 2016 after surge-like instability, *Nature Geoscience*, 11(2), 114–120, doi:10.1038/s41561-017-0039-7, 2018.

Song, C., Huang, B. and Ke, L.: Modeling and analysis of lake water storage changes on the Tibetan Plateau using multi-mission satellite data, *Remote Sensing of Environment*, 135, 25–35, doi:10.1016/j.rse.2013.03.013, 2013.

Yao, F., Wang, J., Yang, K., Wang, C., Walter, B. A. and Crétaux, J.-F.: Lake storage variation on the endorheic Tibetan Plateau and its attribution to climate change since the new millennium, *Environ Res Lett*, 13(6), 064011, doi:10.1088/1748-9326/aab5d3, 2018.

Zhang, G., Yao, T., Shum, C. K., Yi, S., Yang, K., Xie, H., Feng, W., Bolch, T., Wang, L., Behrangi, A., Zhang, H., Wang, W., Xiang, Y. and Yu, J.: Lake volume and groundwater storage variations in Tibetan Plateau's endorheic basin, *Geophys Res Lett*, 44(11), 5550–5560, doi:10.1002/2017gl073773, 2017.

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2020-117>, 2020.