

The Cryosphere Discuss., referee comment RC1
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Comment on tc-2021-97

Anonymous Referee #1

Referee comment on "Understanding monsoon controls on the energy and mass balance of glaciers in the Central and Eastern Himalaya" by Stefan Fugger et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2021-97-RC1>, 2021

Review on the manuscript entitle "Understanding monsoon controls on the energy and mass balance of Himalayan glaciers"

General comments:

Overall manuscript has provided a comprehensive study of the glacier energy and mass balance for seven sites and further generalized for the whole Himalaya. That may be the reason; the title has come up with Himalayan glaciers. However, this study has focused on the only on the seven glaciers and circled around the Nepal Himalaya and Tibetan Himalaya. So Eastern Himalaya is more appropriate. There is several new information which is really valuable for the understating the summer accumulation type glaciers. One of that is: At all sites, ice melt is the dominant mass loss component, accounting for 65.8% (Changri Nup) to 95.4% (Hailuogou,) of the total mass losses.

Few more general comments, in fact it is query to be generalize.

(i) The manuscript only talks about pre-monsoon and monsoon period, what about post-monsoon? Does it differ from pre-monsoon?.

(ii) There is no discussion about the effect of winter precipitation on the energy and mass balance of the glaciers. Although the manuscript deals with understanding monsoon controls on energy balance and mass balance, but winter precipitation has equal control over the energy and mass balance.

Section wise comments:

L2: "large temperature amplitudes" make it simpler like large temperature ranges.

L5-6: This sentence, I would like to see at the end of the introduction, where citation of work may validate it.

L7: 'Himalayas' it is for curiosity on using 'The Himalayas' instead 'The Himalaya'. I am actually not sure which one is better.

L 19: "dirty-ice glaciers", somewhere it was mentioned as thin debris, so does the dirty-ice glaciers are the same ?. If so then thin debris is mostly lies over the patches or around the higher elevation. Whereas, it has mentioned here as dirty-ice glaciers, which what I understand is that the whole glacier has dirty-ice only.

L 21: (Yang et al., 2017), please check.

L28: "Karakoram, Pamir and Kunlun ranges in the east". I think it should be 'west'.

L55-57: This has no information except to show that these researchers have published work on debris-covered glaciers. L62-63: In continuous to the pervious comments. Here are some other references having in situ observations on the central Himalayan glaciers with the perspective of debris cover and thickness influences on ice melt (Shah et al., 2019 and Pratap et al., 2015).

L73-75: this whole paragraph, I dint see any sense before to define the objectives of this study.

L87: 'glacierised' I generally practice to use 'glacierized' as per Cogley et al., 2011 (glossary of glacier mass balance and related terms).

L92: Table 2 cited before Table 1, check it with journal style.

L104: This might be the ablation area that has disconnected from the accumulation area. if this is the case then in the Table , the Lirung Glacier's characteristics needs to be revised.

Figure 2: Caption: "(blue bars)" For me the color is aqua and not blue. "area on the x-axis [km²] and altitude on the y-axis [m.asl]", This information isn't shown in the figure. Area (size) of the glaciers is not clear, therefore additions of a scale bar and direction arrow is required. "Black crosses" this sign need to change as at Yala Glacier it entirely covers the glacier. Make it red dot with AWS on the side as a legend.

L134: The figure description is not in order.

L138: 1st if one consider the lirung and yala glaciers with an elevation difference 1000 m asl in the same catchment, and 2nd by including the fully debris covered ablation area and other clean ice , how it can be justify that the mean monthly 2 m Ta is very similar on the both sites. Though, it is an observation (Fig. 3a) but just to rethink.

L192: "surface temperature Ts". Please elaborate that how Ts was calculated?.

3.2 Mass balance in T&C. if it is the same name used before, i would suggest to use T&C model throughout.

L312: delete 'We vary'

L340: choose other word as it was already used with Tibetan plateau.

Figure 4. Caption and legend.

Measured and Obs., change to single. Black circles seems to be black dot.

Figure 5. (i) what is the reason for using different color scheme for same component. I cannot differentiate the ice melt and sublimation for the LIR glaciers.

I think use of single color like for LAN glacier would be ok.

L481: "applying a Ta lapse rate of 0.6°C/100m" What about the change of values of other forcing variables with the change in elevation?

L585-89: More things are also to be considered for realistic simulation, for example avalanches, crevasse, blowing snow, water channel, etc.

Pratap, B., Dobhal, D. P., Mehta, M., Bhambri, R., 2015. Influence of debris cover and altitude on glacier surface melting: a case study on Dokriani Glacier, central Himalaya, India. *Ann. Glaciol.* 56(70), 9-16. doi:10.3189/2015AoG70A971.

Shah, S. S., Banerjee, A., Nainwal, H. C., Shankar, R., 2019. Estimation of the total sub-debris ablation from point-scale ablation data on a debris-covered glacier. *J. Glaciol.* 65(253), 759-769. doi:10.1017/jog.2019.48.