I found very interesting the tentative of Miles at al. to review the “hydrology of debris glaciers”. The topic is large, probably too much.

Therefore, I hope that many experts will contribute to this discussion.

Personally, I am not expert in everything written here, so I am providing below just my contribution in relation to what I wrote in the recent years.

Suggestions:

Section 2:

Concepts like “The areal extent of glacial debris cover in the Himalayan region is increasing and predicted to expand further (Bolch et al., 2008; Rowan et al., 2015; Thakuri et al., 2014)” should be added in this section.

Line 112: Salerno et al., 2017 found that debris thickness is higher for gentle downstream surface (ablation zone) gradients supposing that this condition favors the accumulation of debris (less gravitational stresses).

Line 149 to 151:

I think that the follow evidences should be treated/included/or discussed:

Recent large-scale geodetic studies based on remotely sensed data have provided evidence that the present-day surface lowering rates of some debris-covered glacier areas in the Hindu-Kush–Himalaya may be similar to those of debris-free areas even within the same altitudinal range (e.g., Kääb et al., 2012; Nuimura et al., 2012; Gardelle et al., 2013; Pellicciotti et al., 2015; Ragettli et al., 2016; Salerno et al., 2017).

Therefore, I think that the effect of debris on the surface mass balance of glaciers remains unclear.

Line 181: I suggest:

Salerno et al., 2017, analyzing a wide population of glaciers with a stochastic approach, found that the debris coverage and thickness are not significantly responsible for the development of supraglacial ponds, the elevation changes, or the shift in SLAs. At this regards they observed that the main morphological factor controlling the debris glacier water balance under stressed climatic conditions is the glacier surface gradient and in particular the surface gradient of the downstream portion of the glacier. From a physical point of view, lower surface gradients are thought to induce reduced glacier ice flow, thus allowing the development of stagnant ice (e.g., Scherler et al., 2011). Under these conditions, consequent lower terminus retreat rates have already been observed (e.g., Bolch et al., 2008; Scherler et al., 2011), as well as the development of supraglacial ponds (e.g., Reynolds, 2000; Quincey et al., 2007; Sakai, 2012; Salerno et al., 2012. In this analysis, Salerno et al., 2017 note that downstream surface gradients over 15° inhibit glacier surface lowering, while the greatest surface lowering is found on downstream surface gradients lower than 5°.

Racoviteanu, A.E., Arnaud, Y., Williams, M.W., Manley, W.F., 2015. Spatial pat-terns in glacier characteristics and area changes from 1962 to 2006 in the Kanchenjunga–Sikkim area, eastern Himalaya. Cryosphere9, 505–523. http://dx.doi.org/10.5194/tc-9-505-2015.

Salerno, F., Thakuri, S., Tartari, G., Nuimura, T., Sunako, S., Sakai, A., & Fujita, K. (2017). Debris-covered glacier anomaly? Morphological factors controlling changes in the mass balance, surface area, terminus position, and snow line altitude of Himalayan glaciers. Earth and Planetary Science Letters, 471, 19-31.

Loibl, D.M., Lehmkuhl, F., Grießinger, J., 2014. Reconstructing glacier retreat since the Little Ice Age in SE Tibet by glacier mapping and equilibrium line altitude calculation. Geomorphology214, 22–39. http://dx.doi.org/10.1016/j.geomorph.2014.03.018.

Line 187-191:

Salerno et al., 2017 show that where supraglacial ponds develop, the glaciers register further surface lowering.

However, other authors consider that the insulating effect of debris cover has a larger effect on total mass loss than the enhanced ice ablation due to supraglacial ponds and exposed ice cliffs (e.g., Hambrey et al., 2008;Vincent et al., 2016).

Vincent, C., Wagnon, P., Shea, J.M., Immerzeel, W.W., Kraaijenbrink, P., Shrestha, D., Soruco, A., Arnaud, Y., Brun, F., Berthier, E., Sherpa, S.F., 2016. Reduced melt on debris-covered glaciers: investigations from Changri Nup Glacier, Nepal. Cryosphere10, 1845–1858. http://dx.doi.org/10.5194/tc-10-1845-2016.

Hambrey, M.J., Quincey, D.J., Glasser, N.F., Reynolds, J.M., Richardson, S.J., Clemmens, S., 2008. Sedimentological, geomorphological, and dynamic context of debris-mantled glaciers, Mount Everest (Sagarmatha) region, Nepal. Quat. Sci. Rev.27, 2361–2389. http://dx.doi.org/10.1016/j.quascirev.2008.08.010.

Personally, I believe (and wrote) about the effects of supraglacial ponds on melt, but other authors less. Therefore I think that, generally, concepts like “Supraglacial ponds are responsible for a large proportion of the melt from DCGs” (e.g., line 382, but anywhere in the paper) should be states as e.g., “many authors currently think……”.

Line 795 Water quality needs probably a separate paragraph.

I think that In this contest from an ecological prospective it is important to reference here the recent paper of Salerno et al., 2016 published on unique data set of twenty years of chemical data coupled on field meteorological data at high elevation in Himalaya. They found that debris glacier retreat likely is the main factor responsible for the observed increase of solute concentrations of proglacial surface waters in the last two decades. The temperature of April is the effective drive of the observed enhanced glacier melting process, the main factor responsible for the observed increase of sulfate concentrations. These chemical variations (sulfate at a higher extent) represent a response of these fragile ecosystems to climate change. Even if these changes do not pose a direct and immediate threat to the biota, they occurred in a limited time span, and significantly modified the average chemical composition of lake water. For these reasons, the lakes and the main factors driving their variability should be regularly monitored in the future, also in relation to the lake role as ecosystem services.

Salerno, F., Rogora, M., Balestrini, R., Lami, A., Tartari, G. A., Thakuri, S., ... & Tartari, G. (2016). Glacier melting increases the solute concentrations of Himalayan glacial lakes. Environmental science & technology, 50(17), 9150-9160.

Minor suggestions:

I suggest to reference the recent work of Tristram et al., 2018. (Tristram et al., 2018. Supraglacial ponds regulate runoff from Himalayan debris-covered glaciers. JGR).

Line 276 and 282: the right reference is Salerno et al., 2017 not Salerno et al., 2015.

Line 797 Please reference as model applied o single glaciers even Soncini et al., 2016.