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Interactive comment on "Can ice-cliffs explain the "debris-cover anomaly"? New insights from Changri Nup Glacier, Nepal, Central Himalaya" *by* Fanny Brun et al.

Anonymous Referee #2

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This study evaluated ablation at ice cliff of Changri, debris-covered glacier tongue using UAV-image and dem (and also Preades). They consider the emergence velocity and also evaluated several kinds of errors carefully. They concluded that recent elevation changes at tongue of Changri Glacier is mainly due to lower emergence velocities, not ablation at ice cliffs. In particular, Figure 4 and 5 are very impressive for me, because it's ideal data to analyze ablation process of debris-covered glaciers (Off course we have to consider distribution of emergence velocity). I think this result can be analyzed for other target. I'm looking forward to read other papers. I have some comments as follows. I hope my comments will help to improve your manuscript.

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<Specific comments> Page2 L21 '35 (Sakai et al., 1998)' » Please refer Table 2 in Sakai et al.(2000) p = 256/26=9.8. The value 35 calculated from Sakai et al.(1998) is inaccurate value.

Page 2 L26 'but it has typically been neglected in the calculation of p.' » Which previous study neglected emergence velocity? Please address the references.

Page 2 L26 '5.7–6.4 $\pm$ 3.9 m a$-$1' » 6.4 $\pm$ 3.9 m a$-$1 is the value of mass balance in Nuimura et al.(2011)

Page 2 L28-31 'Emergence velocities will affect the thinning rates of debris-covered ice and ice cliffs equally. But since the cliffs ablate at higher rate, their thinning rate is relatively less influenced than the thinning rate of debris-covered ice. As a consequence, the ratio of the cliff thinning rate divided by the mean tongue thinning rate will overestimate p.' » Those explanation is a little bit ambiguous expression. Please write more clearly.

Page 3 '2 Study area' »There are basic information of study area in Vincent et al.(2016). But, I recommend that ELA around the Changri glacier and altitudes (Max, min) information are necessary, here.

Page 6 L6 I cannot find out the location of cross section in Fig. 1 or 2.

Page 7 section 4.2 and 4.3 Ice cliff is unstable. Sometimes they disappear or newly emerge in one melting season. Are there any ice cliffs diminished or emerged? And you have neglected those ice loss in this study?

Page 8 '4.4.1. Emergence velocity' 'The debris-covered part of the tongue has an area of 1.49 $\pm$ 0.16 km2'(Page3 line 16) The uncertainty is induced assuming that there are 20 m uncertainty in the glacier outline Vincent et al.(2016). I think estimation of the tongue area is difficult. I have never been to the Changri Glacier, therefore, I'm not sure the confidence of glacier outline at the terminus. But, in general, it is difficult to estimate outline of glacier terminus at debris-covered glacier. Then, we have to

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measure ice depths at two cross sections, and calculate emergence velocity between the two cross sections to avoid large error due to glacier area estimation. You can discuss.

Page8 L13-14 ' The maximum net ablation measured with stakes within the period 2014–2016 on the tongue of Changri Nup was chosen as an upper limit equal to 2.22 m a−1' » Please explain why you can choose the maximum net ablation measured with stakes can be assumed to be the maximum emergence velocity.

P13 L3-23 and Fig. 10 ãĂĂIn this discussion, you have compared debris-covered and debris-free glaciers in equilibrium and transient (shrinking) regime. But, your target is ice loss at ice cliff. Almost assumptions are based on part of other studies. Further, I cannot accept some assumptions, Ex. ice flux is same at both debris-covered and debris-free glaciers. Usually, debris-covered glaciers are large, and debris-free glaciers is small. Further, each altitude are different. Then, I think we cannot discuss without the observation of debris-free glaciers.

Reference Sakai A, Takeuchi N, Fujita K, Nakawo M (2000) Role of supraglacial ponds in the ablation process of a debris-covered glacier in the Nepal Himalayas. International Association of Hydrological Sciences, Publication No. 264 (Symposium at Seattle 2000 - Debris-covered glacier), 119-130.

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