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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Meteorological factors driven glacial till changing and the associated periglacial debris flows in Tianmo Valley, southeast Tibetan Plateau" *by* Mingfeng Deng et al.

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Comment to Review #2:

1. The acronyms as TM, DF1, DF2, DF3, SPOT should be defined before their use. Moreover, their use in the abstract should be avoided as much as possible. Comment: We've made the change in the manuscript. TM image is taken by the No. 4 or 5 thematic mapper carried on the satellite Landsat which is belong to the USA. Satellite SPOT is short for Systeme Probatoire d'Observation de la Terre belong to France. the SPOT image is taken by this satellite. 2. As runoff generated debris flows, periglacial

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debris flows are triggered by a water stream that entrain sediments and forms a solid-liquid wave. Water stream is the result of one or a combination of three factors: runoff due to rainfall, melting ice and outburst floods. Due to this similarity between runoff generated debris flow, authors should introduce something more about runoff generated debris flows: the runoff generated debris flows initiate when a peaked runoff hydrograph (Kean et al., 2012; Rengers et al., 2016 and Gregoretti et al., 2016) flow over or impact debris deposits entraining solid material forming the so called debris flow (Berti and Simoni, 2005; Cannon et al., 2008; Coe et al., 2008; Gregoretti and Dalla Fontana, 2008, Theule et al. 2012, Hurlimann et al., 2014, Degetto et al., 2015, Hu et al., 2016). Comment: Another kind of failure can take place by the increased water stream that entrain sediments and forms a solid-liquid wave if the channel is charged with loose ravel. This kind of water stream could be the combination of the three factors, including rainfall, melting ice or the overflow when the glacier collapse falling down into the downwards water pool. The runoff can generate debris flows when a peaked runoff flow over debris deposits(Kean et al., 2012; Gregoretti et al., 2016) and pose hydrodynamic forces acting on the surface elements of the debris layer(Tognacca et al. 2000, Gregoretti ,2000; 2005). The concentration of runoff in the channel bottom causes erosion of the debris surface layer and then extends to the layers below with whole or partial mobilization of the bed material. The inclusion of bed material in the water stream generates debris flow (Gregoretti, 2008).

3. The use of rainfall threshold for explaining the effect of the air temperature should better addressed by explaining that first air temperature increase causes melting and as consequence an abundance of stream water. Therefore, respect to runoff generated debris flows, the rainfall needed for providing the exact critical discharge for debris flow triggering is much minus. Comment: The portion of rainfall and air temperature required for debris flows triggering could be negative. Air temperature increase causes melting and water runoff, and the rainfall needed for providing the percolating flows or exact critical discharge for debris flow triggering would be much less. Beside, the required rainfall, like the intensity and duration, may also require other preconditions,

such as the distribution of glaciers and frozen glacial tills and the terrain of the source area

4. Upstream noise (line 116) could be due to slides or rock fall triggered by previous rainfall? Comment: This noise should be come from the glacier collapse or slide while not the initiate of debris flows.

5. Lines 156-163: debris flow are usually triggered by abundant runoff. Abundant runoff is usually provided by convective rainfalls of high intensity and short duration rainfall (Berti and Simoni, 2005; Gregoretti and Dalla Fontana, 2008). This type of rainfall is characterized by an high spatial variability (Gregoretti et al., 2016). The same authors at line 291 state that a convective storm occurred before DF1 while at the Bomi station no precipitation was recorded. Therefore, please justify in another way the use of the Bomi station. (i.e. data from this station can be used for long-period analysis of cumulative annual rainfall). Comment: According to our statistics on rainfall data in the area, the rainfall often enjoys the similar intensity for the long-term rainfall process from Guxiang to Songzong which means the there is no large rainfall gradient between Tianmo valley and Bomi meteorological station; however, for the convective rainfall process, rainfall can take place in a small area. In the manuscript, we try to combined the rainfall data in Bomi and the memory of the local citizen to make sure the rainfall process.

6. Lines 186: DF2 and DF3 should defined before their use. Comment: DF1, DF2 and DF3 has been debris defined in disaster history. 7. Line 208: what is SPOT? Is it the acronym of? Comment: Satellite SPOT is short for Systeme Probatoire d'Observation de la Terre belong to France. the SPOT image is taken by this satellite. We've add this in the manuscript. 8. Line 228: the writer does not understand the unit measurements for the relative glacial retreat provided by equation (1): what is the duration of year n? According to equation (1) D should be 1/n as dimensions (Area/Area = 1). Comment: 'n' in the equation stands for the time interval of the TM image series, and n=3. the relative glacial retreat means the annual glacier retreat for each square kliometres.

According to reviewer 1#, we've delete this equation (l) 9. Lines 300-301: the writer does not understand the meaning of this sentence. Comment: In Figure 9, as the rainfall right before DF1 occurred was not recorded by Bomi metrological station, we added to the rainfall intensity (about 5 mm/h according to the description of the forest guard) before DF1 to account for the storm, which might not reflect the real rainfall process. 10. Lines 330-340: the sentences seem not clear. Comment: We want to make the point that if the water runoff controls the magnitude and frequency of debris flows, larger debris flows could occur before when the larger rainfall process took place. Instead, debris deposits that rainfall or ice melt water can trigger or the water runoff can entrain is regarded as the perquisite. 11. Line 421: this statement (no debris flow occurred) contradicts line 128 (debris flows were triggered). Comment: We might not say this clearly that make the reviews difficult to understand. Line 421 says 'DF1 occurred at the end of a prolonged period of high air temperature, prior to this, there were instances of failure but no large-scale debris flows.' And in line 128, this debris flows(DF2) occurred after DF1 while not prior to DF1. 12. There is a clear dependence of debris flow occurrence on the air temperature, while that on rainfall is minus evident (also because direct rainfall measurements are missing in the triggering areas of examined debris flows). This could be explained by the following consideration: debris flow is generated by runoff and runoff is due to the rainfall precipitated upstream the triggering area. This is the mean reason because two debris flows occurred in September. In that month the areas not covered by snow should have reached the largest extension of the year and therefore, runoff in the downstream area should increase. About rainfalls, these could be subjected to an high spatial variability. Comment: Thanks for the comment and we add some of them in the discussion and conclusion.

Please also note the supplement to this comment:
http://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2016-251/nhess-2016-251-AC2-supplement.pdf

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