

Interactive comment on “Periodic Glacial Lake Outburst Floods threatening the oldest Buddhist monastery in north-west Nepal” by J. Kropáček et al.

Anonymous Referee #1

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Review of "Periodic Glacial Lake Outburst Floods threatening the oldest Buddhist monastery in north-west Nepal" by Kropacek et al (2014).

General comments

The manuscript combines remote sensing methods and hydraulic modelling for analyzing outburst floods that have affected the Halji Village, Nepal since 2004. The work addresses a relevant topic and provides data about the timing of floods originated from a supraglacial lake in a high mountain region. The manuscript also shows the utility of the Structure From Motion Approach in detailing capturing the complex topography of

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glaciers.

The paper falls within the scope of NHESS and present an interesting case of study. However, one of the main paper contributions (the assessment of the flood hazard at the Halju Village) is undermined by the use of a hydraulic model which is not described in detail and has not been widely used/discussed in flood scientific literature, hampering a critical analysis of the model and the flood modelling results. The paper also fails in relating data of glacier thinning and retreat (which are well documented in the text) with the lake formation and possible outburst initiation mechanisms. Thus, the paper requires moderate to major revisions before publication.

Specific comments

Introduction

Page 6939-Line 24: The GLOF acronym was already defined in the abstract. Please restructure the phrase and delete "Glacial Lake Outburst Flood".

Page 6940-Line 3: A more pertinent reference than the Mergilli's et al (2011) work, concerning the GLOF timing, is the following paper "Ng F, Liu S. 2009. Temporal dynamics of a jökulhlaup system. Journal of Glaciology 55(192): 651–665". Please refer to this work.

Page 6940-Line 15 and 16: Delete "substantial part of" or include supporting data.

Page 6940-Lines 22 and 23: Replace "thus represents a serious threat" by "thus could represent a threat" since there is not enough supporting evidence.

Page 6940-Lines 26: Delete "The main".

Page 6941-Lines 7,8,9,10,11: This paragraph better fits in the methods section. Please reformulate or delete the phrase.

Page 6941-Lines 14 and 15: The complete year listing looks awkward. Better write "Between 2004 and 2014 six GLOFs occurred (in 2004, 2006, 2007, 2008, 2009 and

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2011)" or similar.

Page 6941-Lines 19 and 20: Use magnitude or intensity but not both terms since they are not interchangeable.

Page 6941-Line 22: Replace "eye-witness to the event" by "eye-witness of the event".

Page 6941-Line 24: Since the GLOF is a continuum process better say the "the glacier flood evolved into a debris flow" and not "the glacier flood triggered a debris flow".

Page 6941-Line 25: Delete "at some places".

Page 6941-Line 26: Replace "were considered" by "were taken".

Page 6942-Line 10: This phrase is difficult to understand. You could replace "to cause the flood subsequent to a sudden drainage" by "to cause the reported floods".

Page 6942-Line 16: Replace "turned out to be drastically limited" by "is limited".

Material and Methods

Page 6942-Lines 20 and 21: Replace "By Enhanced Thematic Mapper Plus (ETM+)" by "By the Enhanced Thematic Mapper Plus (ETM+) sensor".

Page 6943-Line 2: Delete "a robust base for".

Page 6944-Line 5: Please comment on the error margin of the formula and its empirical/physical basis. Check the following work " Ng, F., and H. Björnsson (2003), On the Clague-Mathews relation for jökulhlaups, *J. Glaciol.*, 49, 161–172.

Page 6944-Lines 14,15 and 16: A detailed explanation of the model is required since it has not been widely used/discussed in flood scientific literature. As the model is based on the Manning–Strickler formula, and hence uses data of the hydraulic radius, flood extents in flat areas (like where the Halji Village is located) are not well represented due to the lack of cross sectional area. This fact is acknowledged in the FloodAreaHPC manual. Thus, modeled flood extents could be unrealistic in the Halji Village under-

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mining the modelling effort. Please justify the use of this model and prove that it can realistically model the outburst flood extent (e.g. comparing the model results with past floods and giving an estimation of the error).

Page 6945-Line 5: The SRTM data was collected in February 2000 not in 1999. Please correct in all the text.

Page 6945-Line 6: Replace "Geodetic glacier mass balances.....were" by "Geodetic glacier mass balance.... was" since it cover only the 1999-2013 period.

Page 6945-Line 7: Please specify the version of the SRTM used.

Page 6945-Line 16: This sentence is not clear please reformulate.

Results

Page 6945-Line 25: Define the ELA acronym.

Page 6946-Line 9: Delete "in".

Page 6946-Line 5: Replace "was estimated as ranging from" by "ranged from".

Page 6946-Line 10: Make clear earlier in the text that the Halji Glacier is a temperate glacier. This will support the discussion given in this paragraph.

Page 6947-Line 19: Replace "acquired by Thematic Mapper (TM)" by "acquired by the Thematic Mapper (TM) sensor".

Page 6947-Line 20: Replace acquired by Enhanced Thematic Mapper (ETM+) by "acquired by the Enhanced Thematic Mapper (ETM+) sensor".

Page 6948: The section 4.4 cannot be critically analyzed since the reliability of the flood model has not been proven. In fact, was stated in the section 3.3 that the 2011 flood will be compared with the model results but so far this has not been done. In the present form, sections 3.3 and 4.4 are weak, in spite of being a central part of the paper contribution.

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Page 6948-Line 24: Delete "severe" since you are not measuring the flood intensity.

Page 6949-Line 1: Data of glacier thinning and retreat are not well linked in the paper with the GLOF events. Please analyze the data of table 4 (in section 4.5) and discuss (in section 5) the potential relationship between the glacier negative mass balance, the lake development and the GLOFs.

Page 6949-Line 16: This sentence is not clear "The latter value represents the so far strongest flood in 2011". It seems like more than one GLOF occurred in 2011. Please reformulate.

Page 6949-Line 23: Delete "striking".

Page 6950-Line 10: Replace "is also depending" by "also depends on".

Page 6950-Lines 3,4,5: This statement is too broad. You could use, for example, the rate of glacier annual retreat to roughly estimate the date when the lake-basin (and GLOF hazard) could disappear.

Page 6950-Lines 6,7: Is not clear to me what do you mean with "still increase due to thermal dissipation of water". Please clarify.

Page 6950-Lines 12: Replace "no lake" by "no supraglacial lake".

Page 6951-Lines 10: Replace "presented" by "present".

Tables

Table 1: Please specify if the time of the peak discharge is at the glacier or at the village.

Table 4: Replace "Glacier mean elevation and total ice volume changes as well as annual glacier mass balances measured from DEM differencing of SRTM-3 (1999) to Pléiades (2013)" by "Glacier mean elevation, total ice volume change and annual glacier mass balance measured from DEM differencing of SRTM-3 (1999) to Pléiades

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(2013)".

Table 4: Is not clear to me in what units are you measuring the change in glacier volume. Percentage, m³ or km³ are units more frequently used in this context.

Table 5: Replace "Liquid precipitation amount V " by "Volume of liquid precipitation...".

Figures

Figure 1: Please specify the sensor that captured the November 2011 image.

Figure 2: Add "m.a.s.l" after "(3901)".

Figure 3b: Indicate the subglacial pathway or other geographic reference to provide a context to the figure.

Figure 4: Add an inset with a zoom to the area where the lake develops. At the current scale is difficult to see the area of interest.

Figure 5: Replace "was reinforced" by "were reinforced".

Figure 9: Please incorporate the topographic profiles as insets and extend them to cover the whole wide of the village. In this way it will be clear the height difference and distance between the river channel and the populated area.

Figure 9: Specify the coordinate system and make sure that the entire flooded area is clearly shown(e.g. make the village's polygon semi-transparent).

Figure 10: Specify the coordinate system.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 2, 6937, 2014.

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