Response to Review #2

We thank the reviewer (Anonymous Referee #2) for the careful reading of our manuscript and the valuable comments. We respond it by numbering the various comments to allow cross referencing. Our responses are in Italics. We also show text from the revised manuscript in quotation mark.

GENERAL COMMENTS

R01: Although the research is based on older type of data and standard techniques for derivation of morphometric parameters, the rockfall analysis is of great interest because it can be further developed to be applied with other types of elevation data (lidar, IFSARE) and provide important, regularly updated maps of rockfall risk areas.

We thank the referee for this comment and we plan to use other types of elevation data (lidar, IFSARE) in our future research.

R02: The paper has many issues with language, making it difficult to understand and review.

We have carefully checked and revised the paper based on the referee comments and recommendations. We have also considered the various suggestions and have accordingly rewritten the manuscript.

R03: p.23 l. 16: Thus, we try to automated classify landform

We have reworded it.

"Thus, we try to automatically classify landform based on the 9-unit slope model which is appropriate to rockfall analysis."

R04: p.27 l. 20 The consideration to decide upon the number of final classification of landform elements and morphometric variable to be employed in the automated landform classification is essential.

We have reworded it.

"Prior to data analysis, fundamental decision should be made in relation to the number of landform class and the selection of morphometric variables to be used."

R05: p.34 l. 6 the depositional process of alluvium does not work in that such area.

We have reworded it. We have also moved and modified page 34 line 2-8 to page 26 line 11.

"The 9-unit slope model was modified by excluding alluvial toe slope and seepage slope for the final landform classification. Channel wall was also modified as lower slope. Since the study area is located in the upper part of Kulon Progo Dome, the depositional process of alluvium does not work in such an area. Seepage slope was merged with interfluves because both are more related to pedogeomorphic process rather than gravitational process."

SPECIFIC COMMENTS: number: page/line

R 06: The first 3 paragraphs in intro can be substantially shortened as they are not relevant p.24 l.23-25 repeats a sentence from introduction

We feel that the first paragraph offers an important lead to the use of topographic maps and DTMs for landform classification and geomorphological mapping. As such we have kept it.

OK. Page 21 line 5-16 (second parapraph) has been deleted.

We kept paragraph 3, because it also offers important lead to the latest development of geomorphological mapping in Indonesia and its relation to disaster analysis. However, we have modified page 21 line 17 as follows:

"*The landform classification based on the genesis (Verstappen, 1983) and (Zuidam 1983) has been widely used in Indonesia.*"

p. 23 l.5-6 introduction: "Traditionally, landform analysis (delineation and classification procedure) is based on the stereoscopic technique of aerial photo and field investigation."

p.24 l.23-25 data and methods: "To portray the susceptible area, geomorphological opinion is commonly used to classify landform through interpretation of aerial photos and field survey. However, subjectivity of investigator hinders application of this method."

Both of which discussed landform classification by using stereoscopic technique of aerial photo and field investigation but p.24 l.23-25 also discussed the subjectivity of manual interpretation in which it gives an important lead to the method (unsupervised landform classification) used in the paper.

R07: p. 25 l.16 contour interval of 12.5 in what units? When was the topographic map produced? Did the rockfalls changed the topography in a way that would not be reflected in an older topographic map? I might have missed it but I don't see information about the resolution of the DTM or was a TIN-based DTM used?

We have reworded p. 25 l. 15-17.

"Five meter resolution of DTM was produced by interpolation, using ILWIS linear interpolation method, from a 1:25.000 Topographical Map 1999 with contour interval 12.5 m and elevation data from DGPS profiling."

We did not consider the effect of rockfall on the topographical and morphological change because multitemporal and high resolution of DTMs are not available in this place.

R08: p.27 first paragraph belongs to intro and methods

We feel that p. 27 first paragraph is an introductory paragraph giving an important lead to the geomorphometric analysis and discussion started from reduction of error to final classification result. As such we kept it.

R09: p.28 l. 16 "rockfall velocity second derivative?" What is meant by second derivative here? (can be easily confused with second order derivative).

We have reworded it.

"Rockfall velocity and energy are secondary derivative of DTM (Lan et al., 2007)."

Secondary derivative means that rockfall velocity and energy are calculated from slope and aspect (calculated using first order derivative).

R10: p.31 l.16 "The landforms which have higher order magnitude are lower slope, colluvial slope and transportational middle slope respectively." - magnitude of what? Volume?

The magnitude of rockfall is represented in this paper by the volume of deposits (e.g. Hungr et al., 1999; Dussauge et al., 2003).

R11: p.32 l 12 - pose > predict? Automated landform analysis and rockfall statistic can pose the likelihood of rockfall

We have reworded it.

"Automated landform analysis and rockfall statistics can estimate the likelihood of rockfall magnitude in a specific landform."

R12: Table 2 is missing units (e.g. slope in % or degrees?)

OK. We have added units on it.

R13: Figures - at least approximate scalebar should be added to figures

OK.

R14: For the curvatures in Fig 3 which color is 0?

Zero value is green. In the RGB color model, it is represented by R=180 G=255 B=145.

Table 2. Class centres for each morphometric variable

Landforms	Slope (%)	PlanC	SPI	SCI	Energy (kJ)	Velocity (m/s)
Interfluve	0	0	1.0	0	0	0
Convex creep slope	6.0	5.0	3.0	5.0	0.5	0.2
Fall face	40.0	-2.0	50.0	5.5	800.0	20.0
Transportational mid. slope	10.0	-1.0	30.0	7.2	1800.0	30.0
Colluvial foot slope	4.0	2.0	15.0	5.0	400.0	10.0
Lower Slope	5.0	2.0	75.0	5.0	0	0
Channel bed	5.0	-5.0	400.0	3.0	0	0
Std/variation	5.79	4.30	158.1	1.4	138.9	3.0

List of Figure Captions