Nat. Hazards Earth Syst. Sci. Discuss., 3, C2149–C2154, 2015
www.nat-hazards-earth-syst-sci-discuss.net/3/C2149/2015/

Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Setting up the critical rainfall line for debris flows via support vector machines" *by* Y. F. Tsai et al.

Anonymous Referee #1

Received and published: 29 October 2015

The manuscript "Setting up the critical rainfall line for debris flows via support vector machines" by Y. F. Tsai, C. H. Chan, and C. H. Chang aims at improving debris-flow mitigation through critical rainfall line approach. This methods requires 1-classifying debris-flow prone zones into clusters and 2-attribute one critical rainfall line to each group through statistical analysis. This could yield to global, near-real time monitoring systems based only on rainfall data that may help authorities to deal with debris flow hazard.

I found the main idea of the manuscript very interesting, with a great potential for implementation in hazard mitigation systems. It does not require any underlying physical model, which allows quick and efficient cover at the country-scale.

However, I think that this work should benefit from significant improvement before publication in NHESS. I first list a series of global comments in the "Scientific Quality" section; then I move on to more technical aspects in the "Presentation Quality" section.

1-Scientific Quality:

1.1- The overall paper lacks of reference to existing work in the literature. This is critical in the "Introduction" section, with only two references listed. Only one refers to existing work from other research groups. I would advise to improve the introduction section with more precise and reference-supported steps (see a few papers in 2-Presentation Quality).

1.2-The methodology of the study is incomplete. There is no reference to the rainfall data origin. The landslide classification method is unclear. What is the method for debris-flow detection after a rainfall event? Are the data GIS-based? On which basis? There is no discussion about the quality of these input data into the SVM model. Please provide information/reference/discussion supporting that those 8 characteristics are able to explain the debris-flow susceptibility.

1-3-The FCGA method: how was set the number of stream groups? (7). Quantify the semblance/difference between groups using metrics and discuss the results.

1-4-The SVM method: please provide metrics for critical rainfall line choice. The rainfall lines choice for each group (Fig. 7) is not clear nor unambiguous. Please explain the method and discuss the results.

1-5-Discussion/conclusions: The work presented here is mostly qualitative. It requires quantitative result presentation and discussion to support the feasibility of SVM-based critical rainfall line setting. This SVM approach for critical rainfall line has been widely applied to debris-flow prediction (see references provided). To my opinion, the paper has to focus more on its originality and strength: the application of this technique in Taiwan during the post- Chi-Chi earthquake period.

2- Presentation Quality: This section mostly deals with english/typo/clarity of the text. Propositions for modifications are written in italic.

PAGE 5958: L2. "to help preventing" L6. please precise "similar" in a quantitative manner. L11. Please precise the meaning of "structural risk" L17. Please check "yearly often" L19. " Especially after the Chi-Chi earthquake...in the center of Taiwan". Please provide reference. L19. "These tremendous landslides often brought sediment material into the streambed, in the initiation area of debris flow". L21. "will be mobilized by rainfall" L24. "will have". Please provide reference. L25. " This means that the debris flow disasters have been more unpredictable and destructive with the amount of sediment material". Please provide reference. L26. "The numerous landslides triggered .... (Shieh et al. 2009)."

PAGE 5958: L2. "Lowered their .." L3. " Nakamura et al. (2000) also reported a huge... earthquake in Japan." L4. "Almost every landslide during that time induced server debris-flow disasters (Fig. 1)". Please provide reference. L6. " Thus, in order to prevent the disaster of debris flow". Please precise the prevention method underlying. L-. "We aim to set" L8-9. Unclear sentence. " Firstly, 377 debris-flow streams in the center of Taiwan affected by Chi-Chi earthquake were considered." Please precise "affected". L11. "Streams with similar characteristics were then clustered together and support vector machines (SVMs) were applied to setup the critical rainfall line for each debris-flow cluster. " L13. "The experimental results show that SVM method performs well in setting a critical rainfall line for each group of debris-flow." L17. "... Taiwan and caused..." L18. " the blocks of these landslides were up to 2365 units". Please precise "blocks" and "units" L19. "are mostly located" L20. Unclear sentence. "This study focuses on the debris flow streams originating from landslides affected by the Chi-Chi earthquake". L24. (Fig. 2b).

PAGE 5960: L5. " In order 5 to cluster the 377 debris flow streams into different groups" Please explain why different groups are needed for further analysis. L6. Please precise the origin of geographical information, hydrological information, historical data

of disaster and statistical tables. L7. "have to be .." L13. "each stream" L17. "After data normalization, ... can be ... " L25. Please precise the meaning of "structural risk" L27. "be performed"

PAGE 5961: L4. " Since this term measures distance" L7. " This section aims to cluster 377 debris-flow streams into seven groups, via clustering analysis such that streams in each group have similar characteristics." Please precise meaning of "similar" in a quantitative manner. L8. " An efficient clustering algorithm". Please provide proof/reference/metrics of this algorithm and its efficiency. L10. " This approach was employed to group 377 debris flow streams into seven groups". Please explain why seven? Provide metrics or reference. L19. "In this study, a family competition genetic algorithm (FCGA) was used to construct a hierarchical tree of streams."

PAGE 5962: L1. " The concepts of family competition have been successfully applied to solve numerous continuous parameter optimization problems, including protein docking (Yang and Kao, 2000). In the authors' earlier work (Tsai et al., 2001), family competition and EAX were successfully integrated to solve traveling salesman problems (TCPs). Neighbor-join mutation (Tsai et al., 2002) was developed to coordinate with the EAX and thus balance exploration and exploitation." This paragraph is not directly relevant to the issue of this manuscript. Please cite only appropriate references such as "Further detail about family competition and efficiency can be found in .... + references". Please complete the references with relevant works from other research groups than the authors one. L6. "The method used in this study combines family competition , Neighbor-join mutation and EAX." L9. " The experimental results revealed that the FCGA is a promising method for constructing the optimal tree of streams." Please present the results first. Then conclude on the FCGA efficiency. L11. " Figure 3 presents the seven groups of 377 debris flow streams." Please provide metrics on the figure/text (distance between groups, etc). L12. "each group" L13. " Each groups all exhibited different trends in their characteristics and the characteristics in the same group were similar." Please provide quantitative information to support

that statement. L17 " a possible mean" L17. " As a result, this method represents a possible means of establishing a critical rainfall line for debris flow streams in each group". Please precise the meaning/underlying assumption. L18-19. " The critical rainfall lines of each groups could be set according to the characteristics." Please detail. L25. Please precise "structural risk" L27 "be performed"

PAGE 5963: L3. "This study intends to establish the critical rainfall line of debris flow via SVM." L5. "In this study" repetition of study two times L6. " The hyper-plane separating the vectors into two parts is then searched for, according to the occurrence of debris flow(Fig. 4)". L9. " However, two problems are frequently encountered during the process of classification." L10. Please rephrase in a clearer manner. " Figure 5 shows the two problems, it is likely that there are many hyper-planes existed in the multidimensional space, or it does not have any hyper-plane could separate the training data into two parts exactly." L13-25. Please provide references and rewrite this paragraph in a more concise way.

PAGE 5964: L16. Please discuss the risk of "false alarms" with this classification. And the risk of debris flow without alarm. How to balance the two issues?

PAGE 5965: Nakamura et al. (2000) reference is missing.

PAGE 5970: Figure 1 please improve resolutions/provide vector.

PAGE 5975: Figure 7. Please improve the legend, which is vague. Please change the dot size on figures. Please change blue point to another color, more visible on the green area.

Please consider literature, such as (non-exhaustive):

Wan-jie Liang, Da-fang Zhuang, Dong Jiang, Jian-jun Pan, Hong-yan Ren, Assessment of debris flow hazards using a Bayesian Network, Geomorphology, Volumes 171–172, 15 October 2012, Pages 94-100, ISSN 0169-555X, http://dx.doi.org/10.1016/j.geomorph.2012.05.008

X. Yao, L.G. Tham, F.C. Dai, Landslide susceptibility mapping based on Support Vector Machine: A case study on natural slopes of Hong Kong, China, Geomorphology, Volume 101, Issue 4, 1 November 2008, Pages 572-582, ISSN 0169-555X, http://dx.doi.org/10.1016/j.geomorph.2008.02.011.

Zhou, W., & Tang, C. (2014). Rainfall thresholds for debris flow initiation in the Wenchuan earthquake-stricken area, southwestern China. Landslides, 11(5), 877-887. doi:10.1007/s10346-013-0421-5

Jianqi Zhuang, Peng Cui, Gonghui Wang, Xiaoqing Chen, Javed Iqbal, Xiaojun Guo, Rainfall thresholds for the occurrence of debris flows in the Jiangjia Gully, Yunnan Province, China, Engineering Geology, Volume 195, 10 September 2015, Pages 335-346, ISSN 0013-7952, http://dx.doi.org/10.1016/j.enggeo.2015.06.006.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 3, 5957, 2015.