

(1) Page 5 L82-84 “The formation of terrain in this area ...” Please provide relevant references.

Answer: Thank you. We have provided references to support this sentence. Please see the ‘Revised manuscript with changes marked’.

(2) Page 6 Figure 1. This flowchart outlines the core of your methodology and presents a significant amount of information. However, the current figure lacks clarity. For instance, what do the different colors represent? Additionally, terms such as the GridSearch algorithm, n_estimators, and learning_rate, etc., are not clearly explained, either in the figure caption or elsewhere in the manuscript.

Answer: Thank you. We have improved this flowchart to clearly indicate the functions of different parts. In this figure, different colors represent the different steps in our proposed method. We have clearly indicated the optimal values of these parameters of XGBoost using GridSearch. Please see lines 219-222 of ‘Revised manuscript with changes marked’.

(3) Page 7 Figure 2. It would be clearer for readers if different colors were used to distinguish the debris flow events in each dataset.

Answer: Thank you. We have used different colors to highlight the two datasets in Fig. 2.

(4) Page 8 Eq. 3. How do you determine channel gradient J as it varies along the channel.

Answer: Thank you. It’s true that J changes along the channel. In our study, we focused on the mean gradient of the main channel within a debris-flow catchment, and it is calculated using the equation proposed by IMHE (1994):

$$J = \frac{\left(\sum_{j=1}^m (E_{j-1} + E_j) L_j - 2E_0 L \right)}{L^2}$$

where J is the mean path gradient (%). E_j ($j=1, 2, \dots, j-1$) represents the elevation of each break point in the movement path (m). Elevation was downloaded from the ASF website (<https://search.asf.alaska.edu/#/>) that can provide DEM with a spatial resolution of 12.5 m. L_j is length of each section within the movement path (m). m is the number of sections. E_0 is the elevation of the endpoint of mass movement (m), and L is the length of the travel path (m). The divided sections are presented as below.

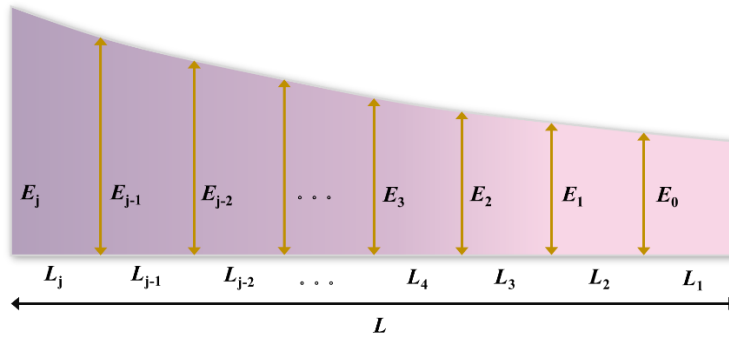


Figure 1. Segments of the travel path

We have added the calculation of J to section 2.1.1 of 'Revised manuscript with changes marked'.

(5) Page 9 L154. The elevation resolution for VD is also 0.8 m?

Answer: Thank you. Sorry for the confusion caused to you. The VD is decided based on the DEM (digital elevation model). We have indicated the calculation of VD in lines 68-70 of the 'Revised manuscript with changes marked'.

(6) Page 12 Eq. 13 and Page 19 L296. How do you obtain the actual value of impact pressure for the calculation of MAPE?

Answer: Thank you. We first estimated the depositional volume of a debris-flow event during filed investigations based on the measured width, runout distance, and deposition depth on the accumulation fan. Then, the Eqs. (2)-(7) were used to calculate the impact pressure to buildings. After that, we established such an evaluation matrix on the basis of the exact damage of buildings, spatial locations between buildings and debris-flow channel, and building structures.

(7) Page 20 L314. Where is the data source of the economic loss?

Answer: Thank you. We have added reference to support this data. Also, it can be found in the study of Ma et al. (2017). (Ma, Y. and Li, C., 2017, April. Research on the debris flow hazards after the Wenchuan earthquake in Bayi Gully, Longchi, Dujiangyan, Sichuan Province, China. In 2017 International Conference on Advanced Materials Science and Civil Engineering (AMSCE 2017) (pp. 166-170). Atlantis Press.)

(8) Page 21 Figure 9. It would be helpful to indicate the precise locations of sub-figures a, b, d, and e within sub-figure c. Why is the color representing buildings brown in sub-figure c, while it is yellow in the other sub-figures?

Answer: Thank you. We have revised this figure, as you suggested. Please see Fig. 10 of the 'Revised manuscript with changes marked'.

Technical corrections:

(9) Page 9 L150. Viscose debris flows should be viscous debris flows?

Answer: Thank you so much for pointing out this mistake. We have revised it.

(10) Page 12 L213. yire should be yipre?

Answer: Thank you. We have revised it.