(1) Page 7, Eq. (1). It's better to define V_p first before it appears in your manuscript.

Answer: Thank you. We have revised it. Please see the 'Revised manuscript with changes marked'.

(2) Page 8, line 115. Please be attention with your writing. It should be 'As suggested by Jakob et al. (2012) and Kang and Kim (2016)'.

Answer: Thank you. We have revised it.

(3) Page 8, line 122. I think it's better to add a reference to support your statement that 'the moderate slope gradient and frictional resistance would decrease the kinetic energy of travelling mass'.

Answer: Thank you. We have added one citation to support our statement.

(4) Page 8, line 129, Eq. (2). Please clarify what h stands for? It is mean flow depth or the maximum flow depth? And also the debris-flow velocity, v.

Answer: Thank you. h represents the deposit depth on buildings, and v is the flow velocity at the maximum discharge. We have added the definitions to Eq. (2) of the 'Revised manuscript with changes marked'.

(5) Page 8, line 134. Same question that you need to define Q_p and then use Q_p to represent a physical parameter.

Answer: Thank you. We have defined Q_p before the introduction of Eq. (3).

(6) Page 9, line 145. I think the final equation of P_t is missing, which is represented by debris-flow volume and channel gradient.

Answer: Thank you. We have provided the final equation of P_t in section 2.3 since Pt still needs further development to link it to influence factors so that we can establish a prediction model to estimate potential impact pressure in the future.

(7) Page 12, line 220. Please explain that how you estimate the impact pressure of 30 kPa to the damaged buildings? Additionally, how do the authors define that 'buildings stay undamaged'? Do you mean there is no damage to the building wall and the structure ? Do you involve the furniture or household appliances and equipment into your analysis since they also belong to properties.

Answer: Thank you. We used Eq. (2) to estimate the impact pressure caused to buildings during field investigations because we h and v can be calculated easily based on the estimated deposition volume of a debris-flow event on the accumulation fan. ρ_{df} is decided as 2000 kg/m³ in our study. In this case, we can estimate the impact pressure that buildings had suffered during an event. Additionally, we defined 'undamaged' as no damage of structure and walls. We agree with the statement that furniture or

household appliances also belong to properties. But in our study, we mainly focused on the damages of building structures, which occupies majority of possible economic loss. Of course, further studies are needed to involve furniture and household appliances into economic loss analysis.

(8) Page 16, line 263. Is there a difference between the maximum flow depth (h) here and the flow depth in Eq. (2) ? Please be clear with the definitions in your manuscript.

***Answer**: Thank you. They are different, and the maximum flow depth here indicates the flow depth that occurred during the flowing and deposition processes of an event. We have used h_{max} to define this parameter. Please see line 263 of the 'Revised manuscript with changes marked'.*

(9) Page 16, Line 265. Please indicate that whether the height of building is involved into the elevation calculation.

***Answer**: Thank you. The height of a building was not involved into calculations in our study. However, we are also aware that the different stories in a building may suffer different damages by a debris-flow event, which could promote the establishment of a more comprehensive and reliable evaluation matrix. Nevertheless, this cannot alter the fact that our proposed physical vulnerability matrix has further improved the vulnerability assessment of a building caused by a future debris-flow event. Of course, we will keep working on the improvement of this evaluation matrix to let it to be achievable of a more reliable damage evaluation.*

(10) Page 18, line 290. Please indicate the ratio of a training set and validation set.

***Answer**: Thank you. We have clearly indicated the ratio of a training set and validation set. Please see the 'Revised manuscript with changes marked'.*

(11) Page 20, line 327. Please indicate the satellite image that you used to extract the buildings since readers need to know the resolution of your satellite images, which may cause uncertainty of physical vulnerability estimation.

***Answer**: Thank you. As indicated in section 2.1.2, Gaofen-2 (GF-2) satellite images were used in this study to extract the buildings. This satellite can capture panchromatic (black and white) images with a spatial resolution reaching 0.8 m and multispectral (color) images with a spatial resolution up to 3.2 m. Therefore, the resolution of satellite images used for buildings identification is 0.8 m. We have clearly indicated the name of satellite used for building extractions. Please see the 'Revised manuscript with changes marked'.*