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Reply

Reply to the Comment by L. P. Li et al.

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We would like to thank the authors of this Comment for doing these additional calculations concerning the non-extensive formulation of the distribution function of landslide volumes/areas that was presented in [1].

We mostly agree with them. Li *et al.* [2] claim that the distribution of the landslide areas is completely determined by three parameters (t, q and b). Since t depends on V_q, their area distribution depends on (V_q, q and b). Such claim is not in contradiction with the area distribution given in [1], in which V_q was simply assumed unitary. In fact there do exist other formalisms of non-extensive Tsallis entropy statistics [3,4] considering non-unitary q-expectation value V_q, which then turns out to be associated with one of the Lagrange multipliers as demonstrated in eq. (8) of Li *et al.* [2]. It is therefore good to see the extension in the non-extensive statistics of landslides made by Li *et al.* We also fit our data using eq. (14) in Li *et al.* [2] and obtain the non-extensive parameter q equal to 1.65 (fig. 1), which shows only a 7% deviation from what we reported in [1].

Most interestingly, by using eq. (14) in Li *et al.* [2] we obtain the b value around 2. The b values in Li *et al.* [2] show relatively large fluctuation, ranging from 1.42 through 2.57. In [1] the value of b was assumed equal to 1.5; such assumption was considered reasonable and consistent with [5]. Li *et al.* [2] demonstrated on a mathematical basis that assuming b as constant could produce some contradictory results in terms of the jointly estimates of V_q and a. We however argue that large uncertainty could be raised as a penalty in fitting t and b (see table 1 in [2]). Note that both parameters are related to V_q. Also, as recognized by the authors of this Comment, the landslide volume is very difficult to measure, and also the literature has documented different relationships between area and volume [5]. $V \sim A^{1.5}$ seems to us reasonable in terms of dimension analysis. Nevertheless, the four options proposed by Li *et al.* at the end of their Comment are all concerned with the volume, which is basically "immeasurable."

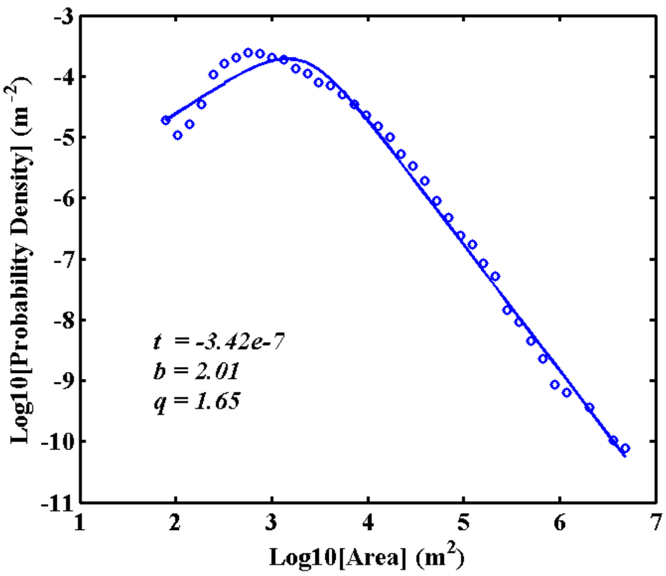

Fig. 1: (Colour on-line) Observed probability density function (open circles) of Taiwanese landslides triggered by the 1999 $M_L = 7.3$ Chi-Chi earthquake. The solid curve represents the best-fitting curve by eq. (14) in [1].

Li *et al.* also find a further complication in our non-extensive formulation of the landslide area distribution, because *p(V)* has not a rollover, contrarily to *p(A)*. They, then, say that the justifiability of the deduced *p(A)* should be rejected because a rollover clearly appeared in

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the real substantially complete dataset of shallow debris slides investigated in the recent paper by Jaiswal and Van Westen [6]. Firstly, the case examined in [6] deals with shallow debris slides, while in our paper we analysed the set of earthquake-triggered landslides. Secondly, quoting Jaiswal and Van Westen [6], "the probability density distribution of landslide volumes can either show a negative power-law distribution for all range of volumes or show a distinct roll-over or a flattening of curve for small volumes and the roll-over for small landslide volumes could be real and not an artefact due to the sampling discrepancies". In fact, in [6] several yearly datasets showed clearly a power-law distribution for all ranges of volumes. Such conclusion derived from the analysis of rainfall-induced landslides does not invalidate the absence of a rollover in the $p(V)$ as deduced by the non-extensive formulation of the landslide volume distribution. In fact, Jaiswal and Van Westen just say that if a rollover exists, it is very likely that this is real and not an artefact, but they do not say that the rollover always exists.

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