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Hazard assessment modeling and software development of earthquake-triggered landslides in the Sichuan–Yunnan area, China

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Supplementary materials

1. Descrpition of Xu_{2019} model

In this study, the bayesian probability method and the logistic regression (LR) model are used to establish a new generation of earthquake-triggered landslide hazard model in China (Xu_{2019} model) (Xu et al., 2019). The Xu_{2019} model is produced on the basis of nine earthquake cases, including the 1999 Mw 7.6 Chi-chi earthquake, the 2005 Mw 7.6 Kashmir earthquake, the 2008 Mw7.9 Wenchuan earthquake , the 2010 Mw 6.9 Yushu earthquake , the 2013 Mw 6.6 Lushan earthquake, the 2013 Mw 5.9 Minxian earthquake, the 2014 Mw 6.6 Ludian earthquake, the 2015 Mw7.8 Gorkha Nepal earthquake, and the 2017 Mw 6.5 Jiuzhaigou earthquake. Seven of the nine earthquakes occurred in China. The 2005 Kashmir and the 2015 Nepal seismic events occurred in China's neighboring areas, which can better control the accuracy of the model (Xu et al., 2019). All these earthquake events have detailed and complete coseismic landslide inventories. All landslide inventories include 306435 landslide polygons. Considering the real earthquake landslide occurrence area, the difference of landslide size and the ratio of sliding to non-sliding sample ratio, a total of 5117000 samples are selected. A total of 13 influencing factors are selected for model building which are elevation, topographic relief, hillslope gradient, slope aspect, curvature, slope position, topographic wetness index, land-cover type, vegetation coverage percentage, distance to fault, lithology, average annual precipitation, and seismic intensity. The Bayesian probability method is combined with the LR model to establish a near-real-time model for the probability of earthquake-triggered landslide (Shao et al., 2020; Shao et al., 2021). The weights of each continuous factor and the weight of each class of the classification factor are obtained based on the SPSS software. The model can be applied in near-real-time hazard assessment of earthquake-induced landslides considering the seismic intensity as the triggering factors of landslides.

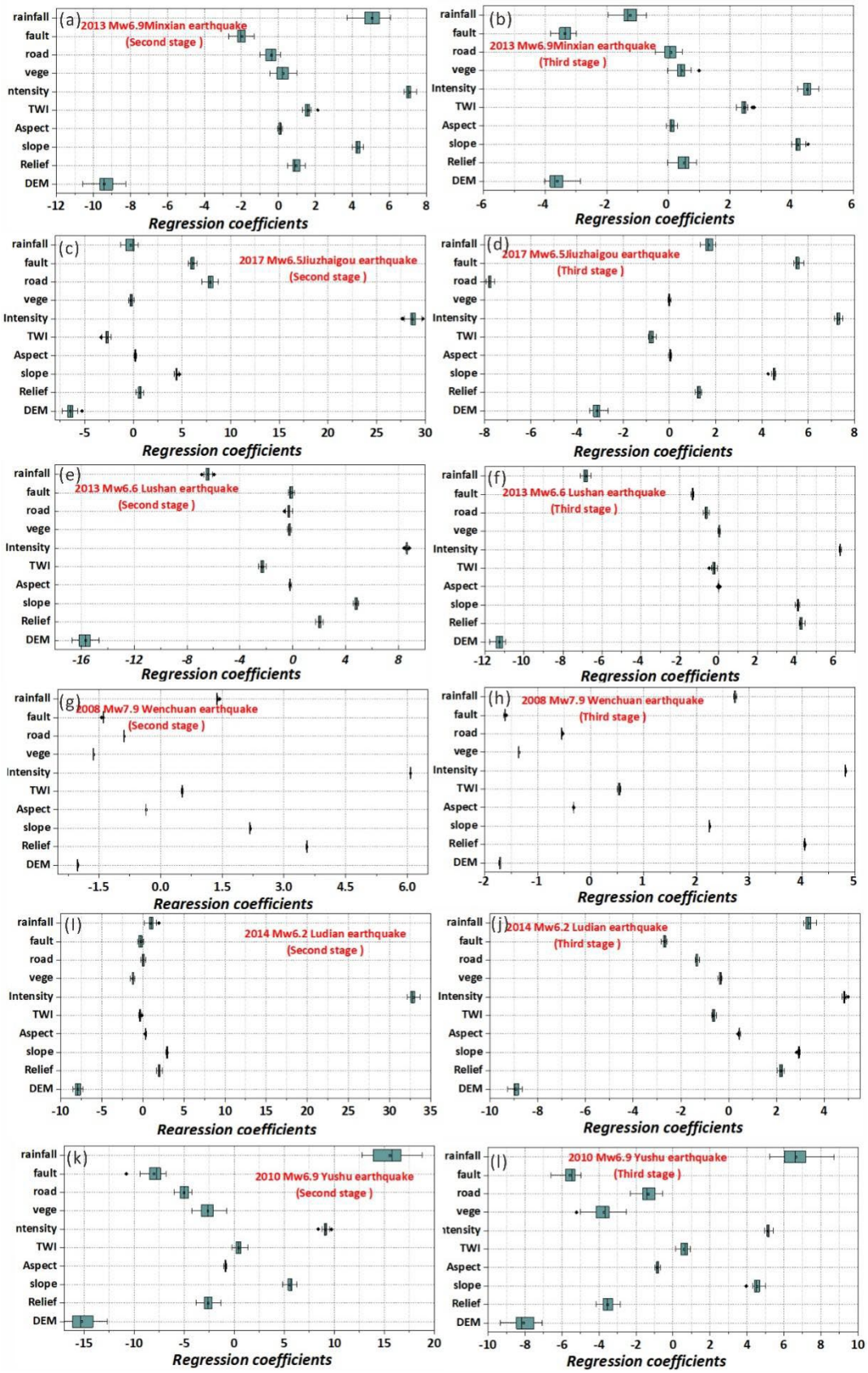

Fig.S1 LR regression coefficients of continuous independent variables of six earthquake events in different stages

Table S1 Predicted landslide area for six earthquake events in different evaluation stages

		2013 Minxian earthquake			**2014 Ludian earthquake**			**2017 Jiuzhaigou earthquake**			**2013 Lushan earthquake**			**2010 Yushu earthquake**			**2008 Wenchuan earthquake**		
		Stage 1	**Stage 2**	**Stage 3**	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 1**	**Stage 2**	**Stage 3**
Area (km^2)	Mean	1.85	1.8	2.2	4.2	7	14.9	8.8	3.3	12.8	30.1	6.4	18.8	2.2	0.8	1.2	1788.3	1045.8	1158.7
	(Std)		(0.04)	(0.04)		(0.07)	(0.1)		(0.05)	(0.11)		(0.07)	(0.13)		(0.03)	(0.03)		(0.84)	(0.8)

Table S2 AUC Results of models validated by the six earthquake inventories in different evaluation stages

		2013 Minxian earthquake			**2014 Ludian earthquake**			**2017 Jiuzhaigou earthquake**			**2013 Lushan earthquake**			**2010 Yushu earthquake**			**2008 Wenchuan earthquake**		
		Stage 1	**Stage 2**	**Stage 3**	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 1**	**Stage 2**	**Stage 3**
AUC value	Mean	0.57	0.92	0.94	0.89	0.87	0.95	0.84	0.95	0.97	0.78	0.84	0.93	0.83	0.94	0.95	0.95	0.95	0.95
	Std	/	0.001	0.001	/	0.005	0.001	/	0.003	0.003	/	0.001	0.001	/	0.001	0.001	/	0.001	0.001

Table S3 Results of models validated by the six earthquake inventories

	2017 Jiuzhaigou earthquake			2014 Ludian earthquake			2013 Lushan earthquake			2008 Wenchuan earthquake			2013 Minxian earthquake			2010 Yushu earthquake		
	Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3
TN	24.9	47.6	41.9	28.2	46.7	34.5	28.1	47.6	41.2	28.2	31.3	23.2	45.9	46.2	45.4	45.3	48.6	47.3
TP	48.1	30.2	49.0	48.1	29.9	49.3	41.9	17.2	43.8	49.2	49.2	49.7	8.2	40.1	42.6	25.4	25.7	37.5
FN	25.0	2.3	8.0	21.7	3.2	15.4	21.8	2.3	8.7	21.7	18.6	26.7	4.0	3.7	4.5	4.6	1.3	2.6
FP	1.8	19.7	0.9	1.8	20.0	0.6	8.0	32.7	6.1	0.7	0.7	0.2	41.7	9.8	7.3	24.5	24.2	12.4

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