



Supplement of

From typhoon rainfall to slope failure: optimizing susceptibility models and dynamic thresholds for landslide warnings in Zixing City, China

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Table S1 IV, CF and FR values for each conditioning factor.

Conditioning factors	Factor grading	Landslides	IV	CF	FR
Elevation (m)	92~314	81	-0.493	-0.679	0.507
	314~545	255	0.218	0.246	1.279
	545~782	312	0.389	0.493	1.637
	782~1098	57	-0.505	-0.704	0.495
	1098~2033	0	-1	0	0
Slope (°)	0~7.87	91	-0.347	-0.427	0.653
	7.87~15.06	267	0.343	0.420	1.522
	15.06~21.80	219	0.168	0.184	1.202
	21.80~29.44	112	-0.213	-0.240	0.786
	29.44~57.31	16	-0.756	-1.411	0.2440
Aspect	Plan	0	-1	0	0
	North	74	-0.102	-0.109	0.897
	Northeast	67	-0.058	-0.060	0.942
	East	70	-0.120	-0.128	0.800
	Southeast	105	0.116	0.123	1.131
	South	102	0.230	0.261	1.299
	Southwest	96	0.144	0.156	1.169
	West	96	0.039	0.039	1.040
	Northwest	95	-0.071	-0.074	0.929
Plan curvature	-3.73~-0.57	36	-0.275	-0.321	0.725
	-0.57~-0.18	189	0.250	0.287	1.333
	-0.18~0.15	284	0.000	0.000	1.000
	0.15~0.54	156	-0.059	-0.061	0.941
	0.54~3.94	40	0.373	-0.467	0.627
	-3.92~-0.55	19	-0.608	-0.935	0.392
	-0.55~-0.16	114	-0.240	-0.274	0.760
Profile curvature	-0.16~0.17	260	-0.112	-0.119	0.888
	0.17~0.59	253	0.480	0.392	1.480
	0.59~3.76	59	0.276	0.324	1.382
	1.98~4.40	151	-0.393	-0.499	0.607
TWI	4.40~5.54	297	0.245	0.280	1.324
	5.54~6.91	132	-0.011	-0.011	0.989
	6.91~8.69	73	0.046	0.047	1.048

	8.69~13.62	52	0.444	0.587	1.799
	0~800	350	0.333	0.405	1.499
	800~2000	194	-0.011	-0.011	0.989
Distance to road (m)	2000~4500	153	-0.277	-0.324	0.723
	4500~7500	8	-0.857	-1.942	0.143
	7500~9700	0	-1.000	0.001	0.001
	0~800	152	0.147	0.158	1.172
	800~2200	205	0.081	0.085	1.088
Distance to river (m)	2200~4500	218	0.010	0.010	1.010
	4500~8000	101	-0.229	-0.260	0.771
	8000~12800	29	-0.278	-0.325	0.722
	0~2000	64	-0.380	-0.478	0.620
	2000~7000	262	0.062	0.064	1.066
Distance to fault (m)	7000~12000	286	0.305	0.364	1.439
	12000~18000	62	-0.414	-0.535	0.586
	18000~28100	31	-0.398	-0.508	0.602
	-0.20~0.27	2	-0.956	-3.133	0.044
	0.27~0.47	29	-0.446	-0.591	0.554
NDVI	0.47~0.64	108	0.217	0.245	1.278
	0.64~0.76	296	0.015	0.617	1.854
	0.76~0.94	270	-0.255	-0.295	0.745
	-8.46~-2.72	0	-1.000	0.000	0.000
	-2.72~1.27	108	0.250	0.288	1.334
	1.27~2.39	370	0.229	0.261	1.298
SPI	2.39~3.46	180	-0.320	-0.386	0.680
	3.46~7.45	47	-0.356	-0.440	0.644
	Slate	8	-0.856	-1.938	0.144
	Shale	10	-0.798	-1.601	0.202
	Limestone	1	-0.907	-2.376	0.093
Lithology	Sandstone	3	-0.958	-3.179	0.042
	Granite	485	0.198	0.221	1.247
	Rhyolite	198	0.353	0.436	1.546

Table S2 Performance metrics of SVM and LightGBM models across different buffer distances and input methods (Training set).

Buffer Distance (km)	Model	Input Method	AUC	Precision	Recall	F1-score
0.1	SVM	IV	0.831	0.798	0.752	0.774
		CF	0.812	0.781	0.736	0.758
		FR	0.720	0.695	0.668	0.681
	LightGBM	IV	0.919	0.964	0.823	0.843
		CF	0.919	0.867	0.821	0.843
		FR	0.915	0.859	0.818	0.838
0.5	SVM	IV	0.825	0.792	0.743	0.767
		CF	0.820	0.786	0.739	0.762
		FR	0.914	0.873	0.845	0.859
	LightGBM	IV	0.920	0.866	0.825	0.845
		CF	0.920	0.868	0.823	0.845
		FR	0.921	0.881	0.829	0.854
1.0	SVM	IV	0.826	0.794	0.745	0.769
		CF	0.819	0.783	0.741	0.761
		FR	0.721	0.698	0.671	0.684
	LightGBM	IV	0.920	0.867	0.827	0.844
		CF	0.920	0.869	0.825	0.846
		FR	0.916	0.861	0.822	0.841
2.0	SVM	IV	0.826	0.795	0.747	0.770
		CF	0.834	0.801	0.756	0.778
		FR	0.913	0.867	0.851	0.859
	LightGBM	IV	0.920	0.868	0.829	0.848
		CF	0.920	0.870	0.821	0.848
		FR	0.918	0.882	0.831	0.856
5.0	SVM	IV	0.823	0.791	0.741	0.765
		CF	0.883	0.843	0.798	0.820
		FR	0.721	0.697	0.669	0.683
	LightGBM	IV	0.919	0.865	0.831	0.850
		CF	0.918	0.871	0.829	0.850
		FR	0.916	0.862	0.823	0.842

Table S3 Variance Inflation Factor (VIF) analysis for landslide conditioning factors.

Conditioning factors	IV method	CF method	FR method
Elevation (m)	2.34	2.41	2.36
Slope (°)	3.67	3.52	3.88
Aspect	1.89	1.94	12.45
Profile curvature	2.15	2.08	2.33
Plan curvature	1.76	1.82	11.23
TWI	4.23	4.18	4.11
Distance to road (m)	3.45	3.38	4.12
Distance to river (m)	6.78	6.92	10.56
Distance to fault (m)	2.56	2.63	2.41
NDVI	2.91	2.87	3.15
SPI	5.67	5.84	13.89
Lithology	1.98	2.05	1.87

Note: VIF values > 10 indicate multicollinearity issues and variables were excluded from analysis.

IV

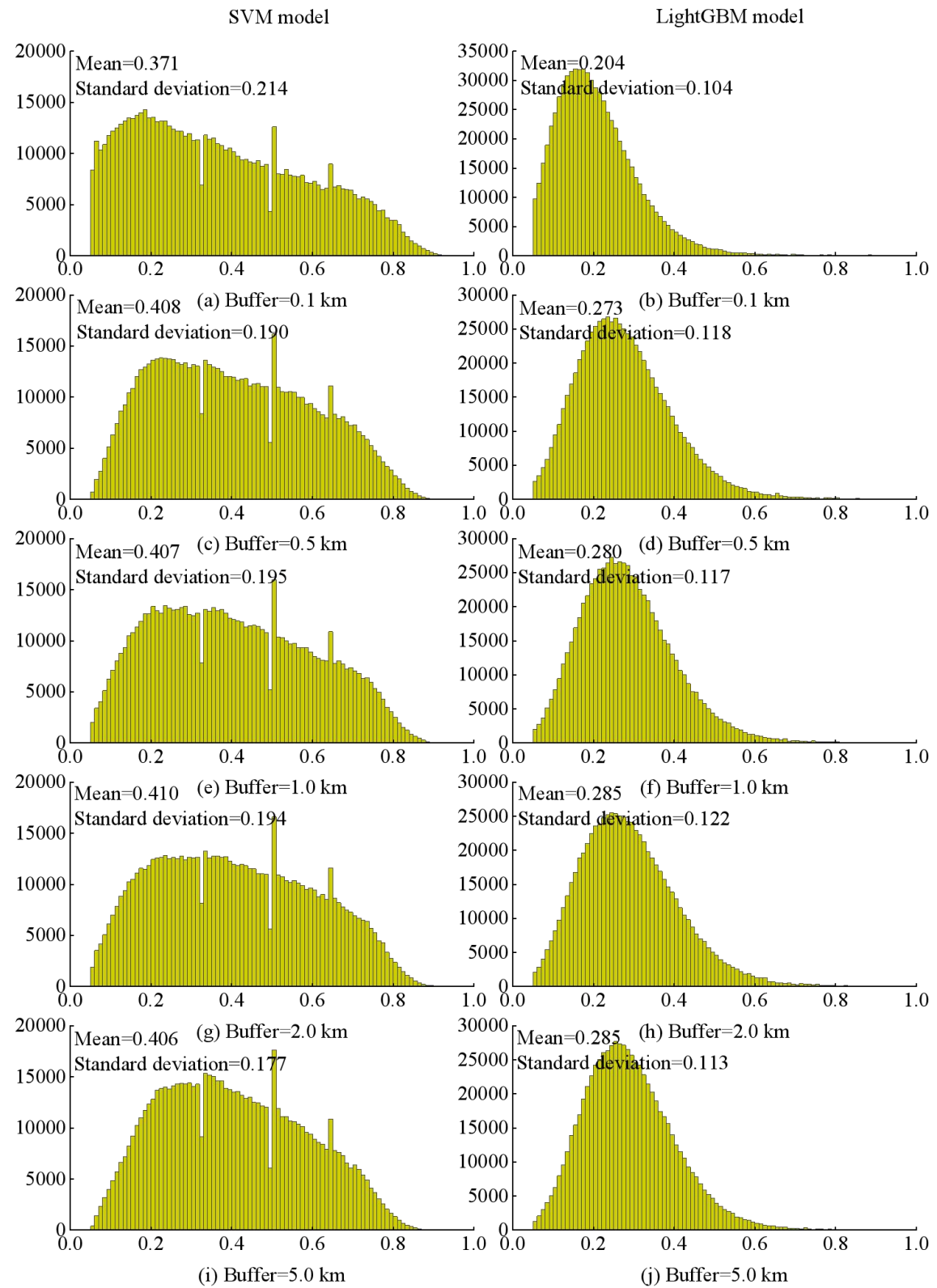


Figure S1 Landslide susceptibility predictions distribution based on IV input variable selection.

CF

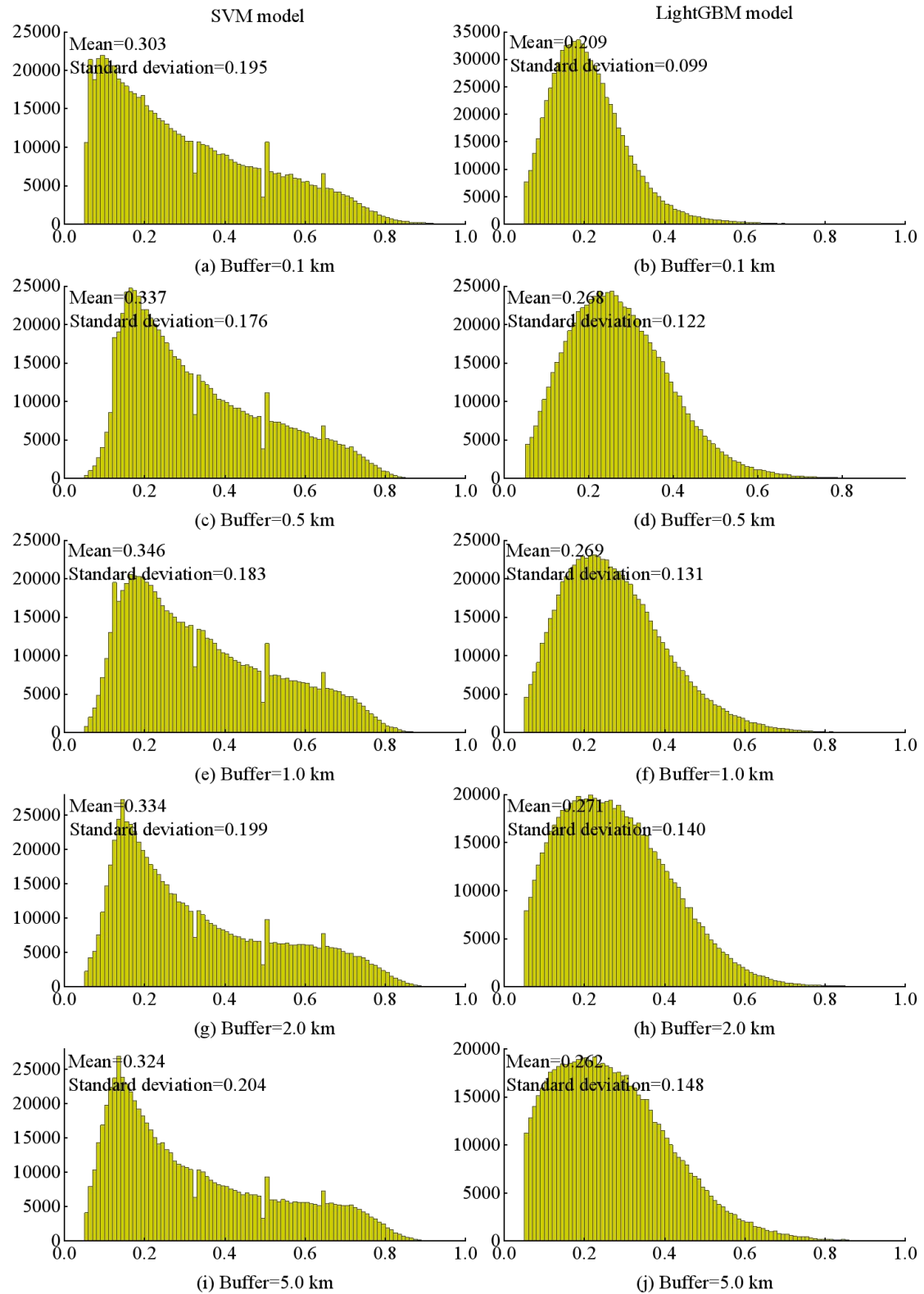


Figure S2 Landslide susceptibility predictions distribution based on CF input variable selection.

FR

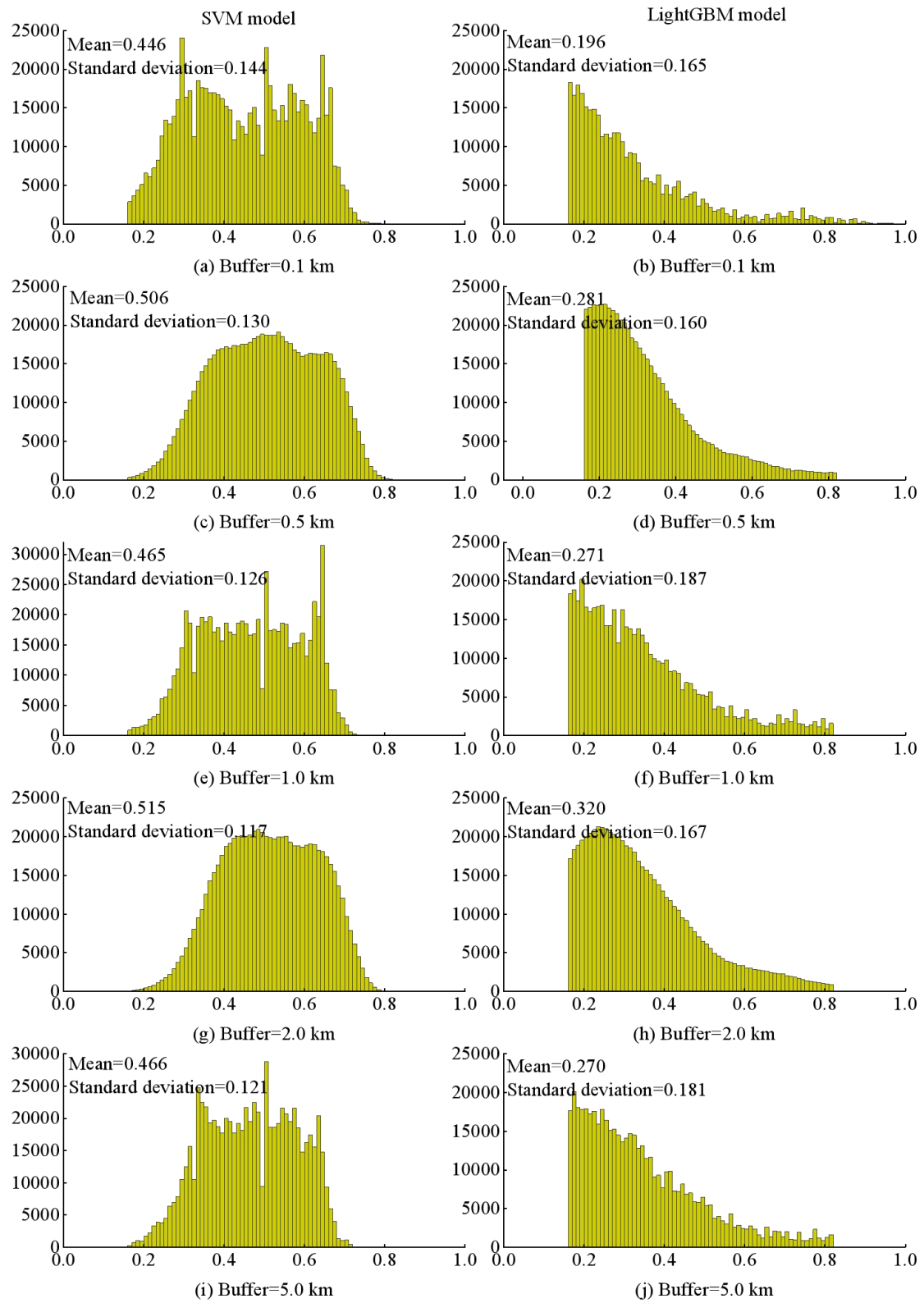


Figure S3 Landslide susceptibility predictions distribution based on FR input variable selection.