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Integrating topographic continuity and lake recession dynamics for improved bathymetry mapping from DEMs

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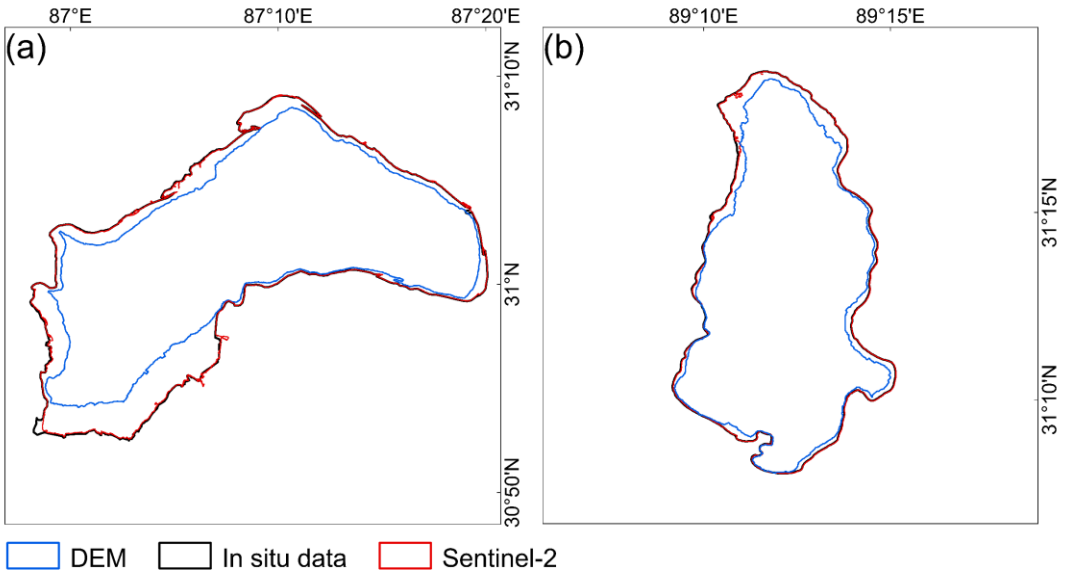

Figure S1. Comparison of lake boundaries derived from different data sources for (a) Angzi Co and (b) Guomang Co. Blue outlines indicate lake extents from DEM data, black outlines represent extents from the in situ dataset, and red outlines represent extents extracted from Sentinel-2 imagery. The boundaries derived from in situ measurements and Sentinel-2 imagery show strong agreement.

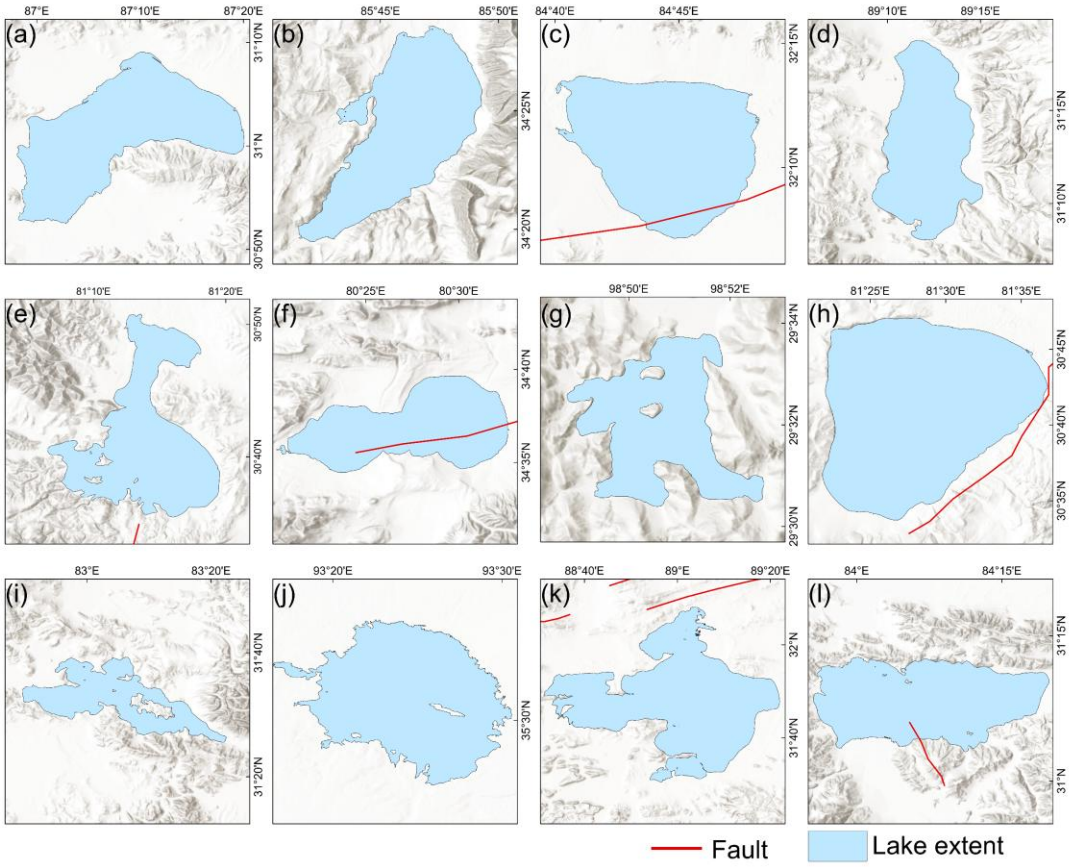

Figure S2. Spatial relationships between major faults (red lines) and the long-axis orientations of the 12 validation lakes: (a) Angzi Co, (b) Buruo Co, (c) Dong Co, (d) Guomang Co, (e) Laang Co, (f) Longmu Co, (g) Mang Co, (h) Mapang Yongco, (i) Ngangla Rinco, (j) Salt Lake, (k) Siling Co, and (l) Taro Co. Fault data were derived from Gao et al. (2023).

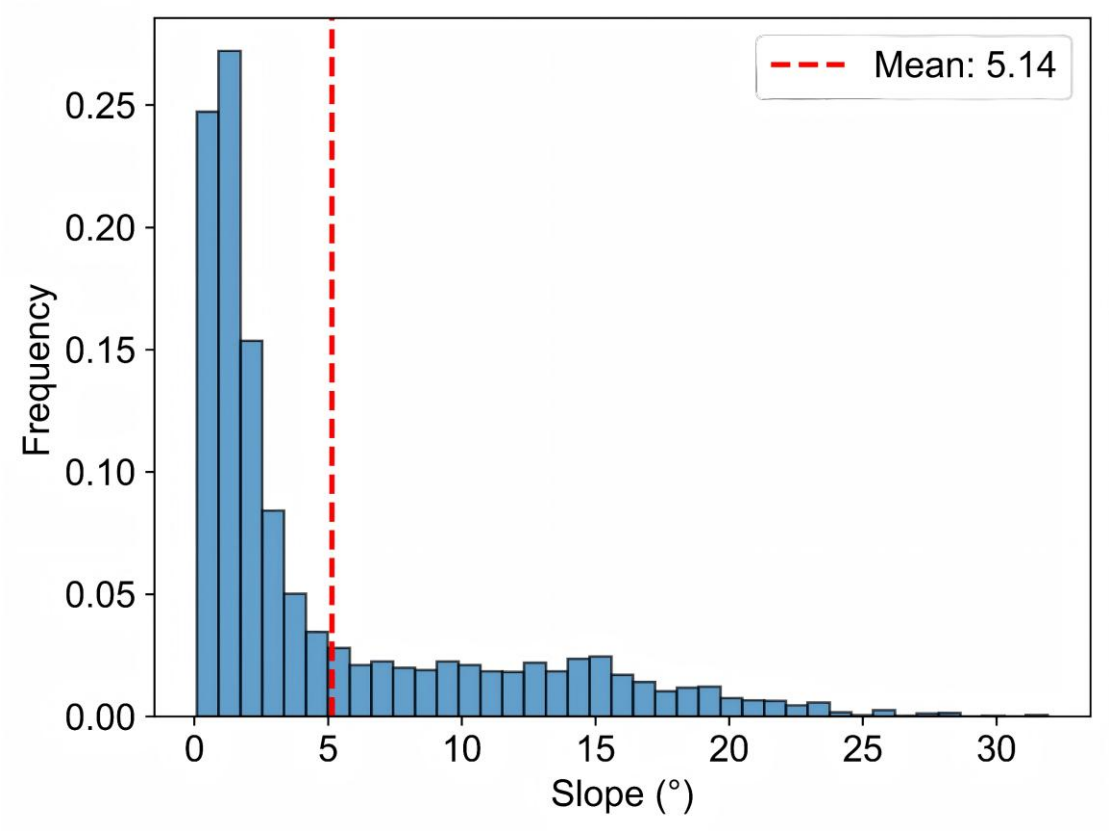

Figure S3. Histogram of shoreline slopes for 4,000 Tibetan Plateau lakes from the HydroLAKES database.

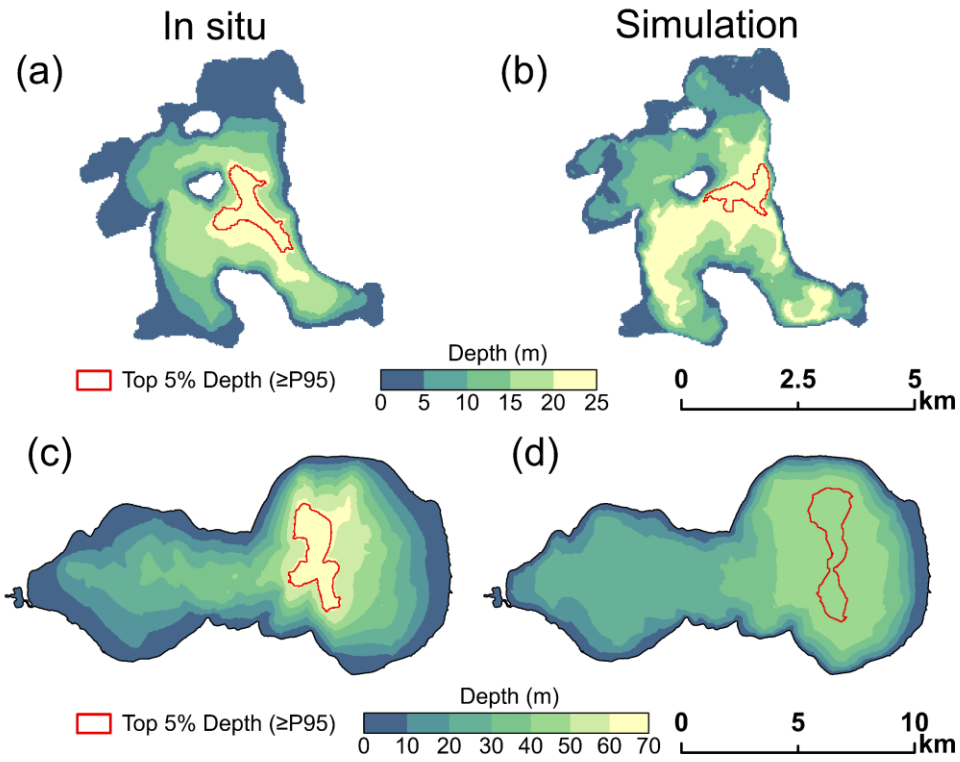

Figure S4. Bathymetric maps derived from the in situ dataset and from our simulations: (a) In situ bathymetry of Mang Co, (b) Simulated bathymetry of Mang Co, (c) In situ bathymetry of Longmu Co, and (d) Simulated bathymetry of Longmu Co.

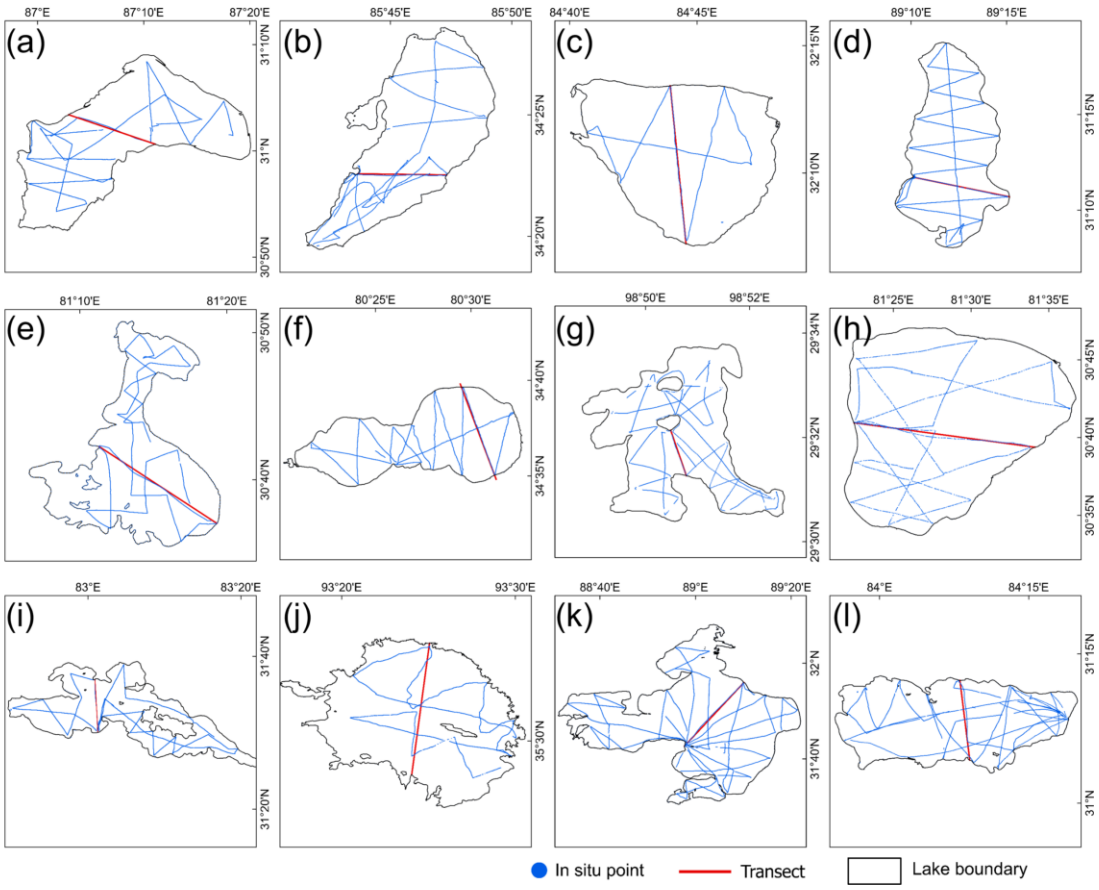

Figure S5. Footprints of the bathymetric survey tracks for (a) Angzi Co, (b) Buruo Co, (c) Dong Co, (d) Guomang Co, (e) Laang Co, (f) Longmu Co, (g) Mang Co, (h) Mapang Yongco, (i) Ngangla Rinco, (j) Salt Lake, (k) Siling Co, and (l) Taro Co. The red line denotes the transect used for validation in **Figure 8**.

Table S1. Comparison of lake maximum depth and water storage between in situ measurements and simulated bathymetric maps derived from ALOS PLASAR.

Lake name	Maximum depth (m)		PE*	Water storage (km³)		PE
	In situ	Simulated		In situ	Simulated	
Angzi Co	18.83	27.47	45.91%	4.81	6.67	38.82%
Buruo Co	100.55	73.52	-26.88%	3.86	3.66	-5.20%
Dong Co	3.99	21.88	448.35%	0.22	1.19	441.62%
Guomang Co	39.49	33.60	-14.92%	1.76	2.33	32.54%
Laang Co	49.20	56.80	15.45%	5.53	6.44	16.44%
Longmu Co	67.52	49.96	-26.00%	2.70	2.98	10.49%
Mang Co	22.28	29.35	31.73%	0.18	0.28	53.04%
Mapang Yongco	79.45	106.20	33.68%	17.20	25.25	46.81%
Ngangla Rinco	74.94	57.18	-23.70%	9.09	15.00	64.93%
Salt Lake	32.78	43.86	33.81%	2.76	3.91	42.08%
Siling Co	52.50	32.57	-37.96%	52.72	30.70	-41.76%
Taro Co	130.95	64.50	-50.74%	28.02	12.26	-56.25%

*PE represents percentage error.

Table S2. Comparison of lake maximum depth and water storage between in situ measurement and simulated bathymetric maps derived from the MERIT DEM.

Lake name	Maximum depth (m)		PE*	Water storage (km³)		PE
	In situ	Simulated		In situ	Simulated	
Angzi Co	18.83	19.65	4.35%	4.81	4.97	3.40%
Buruo Co	100.55	56.76	-43.55%	3.86	3.12	-19.23%
Dong Co	3.99	11.35	184.62%	0.22	0.71	223.27%
Guomang Co	39.49	25.81	-34.64%	1.76	1.53	-13.25%
Laang Co	49.20	53.09	7.91%	5.53	4.92	-11.14%
Longmu Co	67.52	39.30	-41.80%	2.70	2.33	-13.62%
Mang Co	22.28	20.99	-5.79%	0.18	0.12	-33.22%
Mapang Yongco	79.45	90.97	14.51%	17.2	22.38	30.14%
Ngangla Rinco	74.94	32.68	-56.39%	9.09	8.31	-8.56%
Salt Lake	32.78	32.36	-1.29%	2.76	3.57	29.61%
Siling Co	52.50	29.12	-44.53%	52.72	38.36	-27.23%
Taro Co	130.95	88.22	-32.63%	28.02	20.10	-28.27%

*PE represents percentage error.

Table S3. Mean absolute percentage error results used to generate **Figure 9.**

Lake name	Mean absolute percentage error		
	ALOS	**MERIT**	**NASA**
Angzi Co	35.70%	21.24%	22.13%
Buruo Co	33.38%	38.99%	58.52%
Dong Co	291.39%	48.58%	136.51%
Guomang Co	33.09%	29.30%	35.78%
Laang Co	31.75%	36.15%	45.29%
Longmu Co	32.22%	32.62%	34.49%
Mang Co	79.14%	61.31%	75.92%
Mapang Yongco	90.01%	87.99%	61.86%
Ngangla Rinco	162.68%	103.62%	98.15%
Salt Lake	18.22%	9.49%	11.61%
Siling Co	44.36%	22.28%	38.36%
Taro Co	65.19%	49.15%	52.92%

Table S4. Comparison of simulation results across the 12 sample lakes using input data at different spatial resolutions.

Lake name	PE* of maximum depth			PE of water storage		
	ALOS	NASA	MERIT	ALOS	NASA	MERIT
Angzi Co	45.91%	-26.46%	4.35%	38.82%	-3.17%	3.40%
Buruo Co	-26.88%	-28.52%	-43.55%	-5.20%	5.75%	-19.23%
Dong Co	448.35%	59.37%	184.62%	441.62%	94.84%	223.27%
Guomang Co	-14.92%	-6.73%	-34.64%	32.54%	35.14%	-13.25%
Laang Co	15.45%	15.94%	7.91%	16.44%	15.81%	-11.14%
Longmu Co	-26.00%	-20.84%	-41.80%	10.49%	14.12%	-13.62%
Mang Co	31.73%	2.44%	-5.79%	53.04%	16.29%	-33.22%
Mapang Yongco	33.68%	24.82%	14.51%	46.81%	55.22%	30.14%
Ngangla Rinco	-23.70%	-52.37%	-56.39%	64.93%	5.30%	-8.56%
Salt Lake	33.81%	-8.53%	-1.29%	42.08%	29.92%	29.61%
Siling Co	-37.96%	0.96%	-44.53%	-41.76%	2.54%	-27.23%
Taro Co	-50.74%	-24.09%	-32.63%	-56.25%	-3.59%	-28.27%

*PE represents percentage error.

References

Gao, Z.: Seismotectonic map and seismic hazard zonation map of Pan-Third Pole region (1960–2021), National Tibetan Plateau / Third Pole Environment Data Center, https://doi.org/10.11888/SolidEar.tpdc.300783, 2023.