Supporting Information for "Imperfect slope measurements drive overestimation in geometric cone model of lake and reservoir depth"

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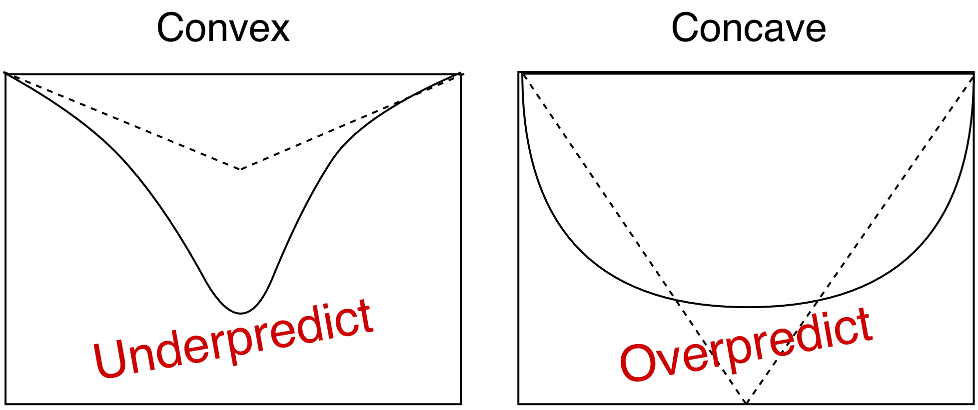

Figure S1. Diagram showing our expectation that slope-based models of lake depth will under predict true depth in convex lakes (left) and over predict true depth in concave lakes (right). Dashed lines represent extrapolated nearshore land slope while solid lines represent the lake bottom.

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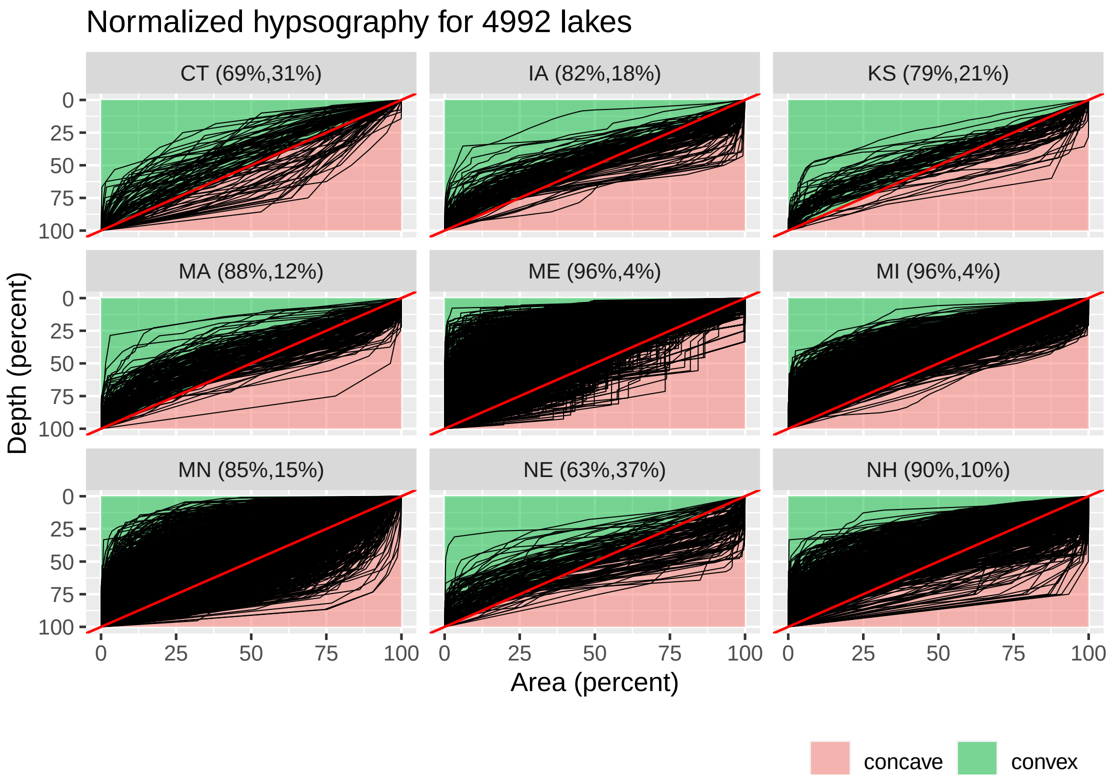

Figure S2. Hypsography classification by state. Numbers on panel labels indicate the percentage of lakes in each state with a convex versus a concave cross-section shape.

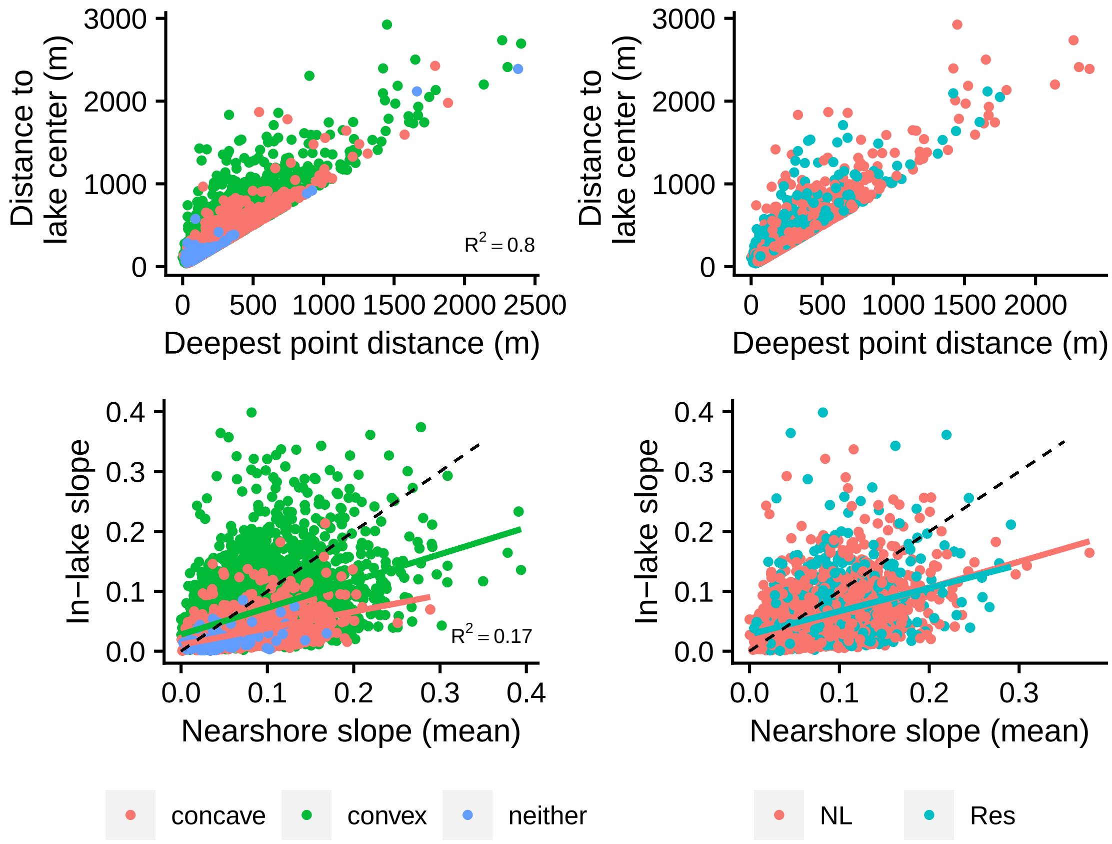

Figure S3. Comparison among lake shape and reservoir classes for A-B) distance to deepest point versus distance to lake visual center and C-D) nearshore slope versus inlake slope. A dashed 1:1 line is shown for comparison. Cross-section shape and reservoir class plots are not identical because not all lakes had a reservoir classification exceeding a 0.75 probability confidence level.

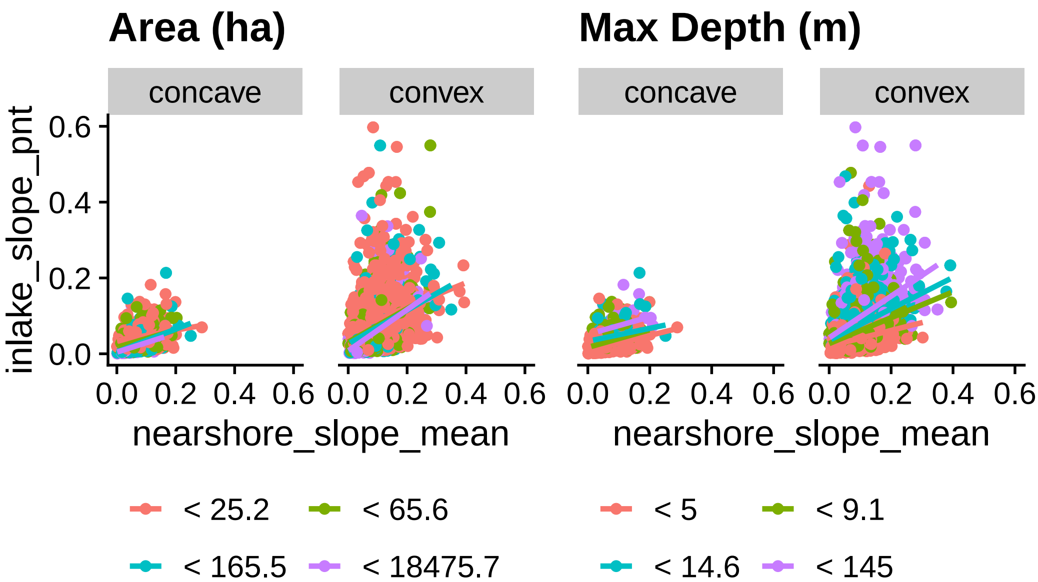

Figure S4. Comparison between in-lake and nearshore slopes in concave and convex lakes of the same size and max depth. Categories are quantile bins (< 25%, 25-50%, 50-75%, and 75-100%).

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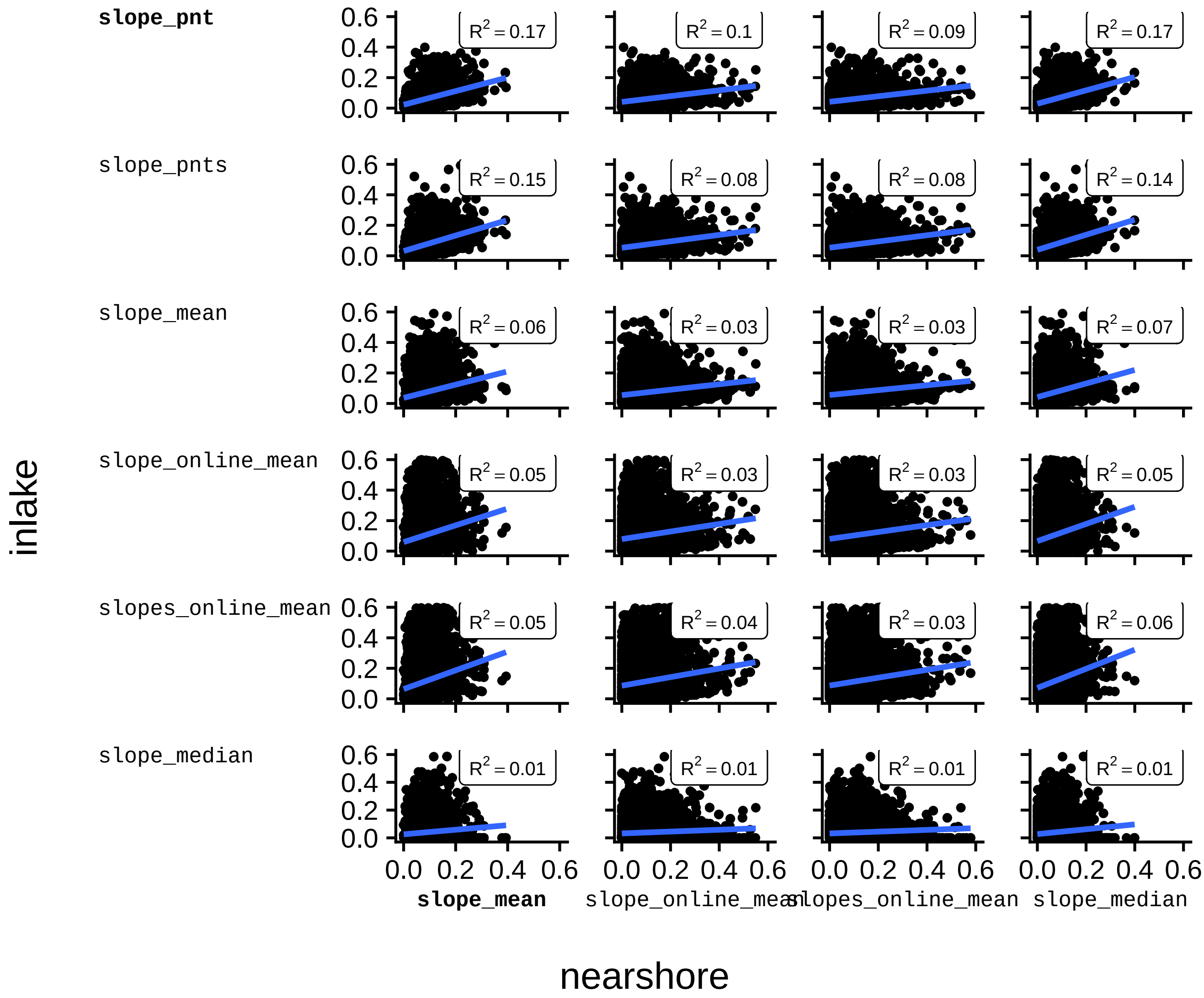

Figure S5. Comparison between in-lake and nearshore slope using different calculation techniques. The techniques used in the main text analyses are bolded and the combination of these techniques (top-left corner) produces the strongest relationship between the two metrics. `slope_mean` is the mean slope of all inlake or nearshore buffer points. `slope_pnts` is the average slope (i.e. `slope_pnt`) of all points at maximum depth. `slope_online_mean` is the mean pixel-to-pixel slope of each pixel lying on a straight line either from the single deepest point to the lake shoreline (in the case of inlake slope) or from the lake shoreline point extending to the buffer exterior (in the case of nearshore slope). `slopes_online_mean` is the same as `slope_online_mean` except it uses all inlake points at maximum depth.

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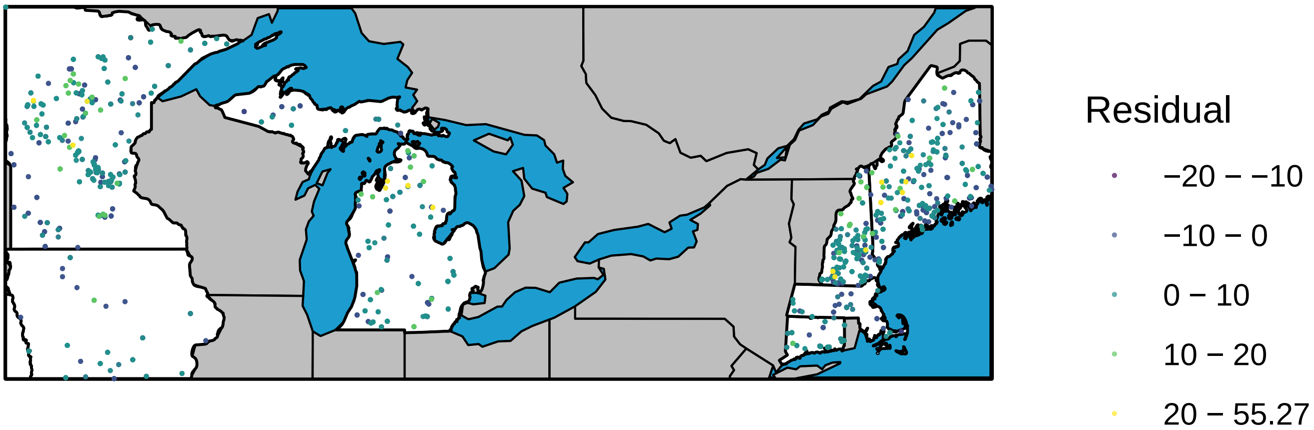

Figure S6. Spatial distribution of depth model residuals.

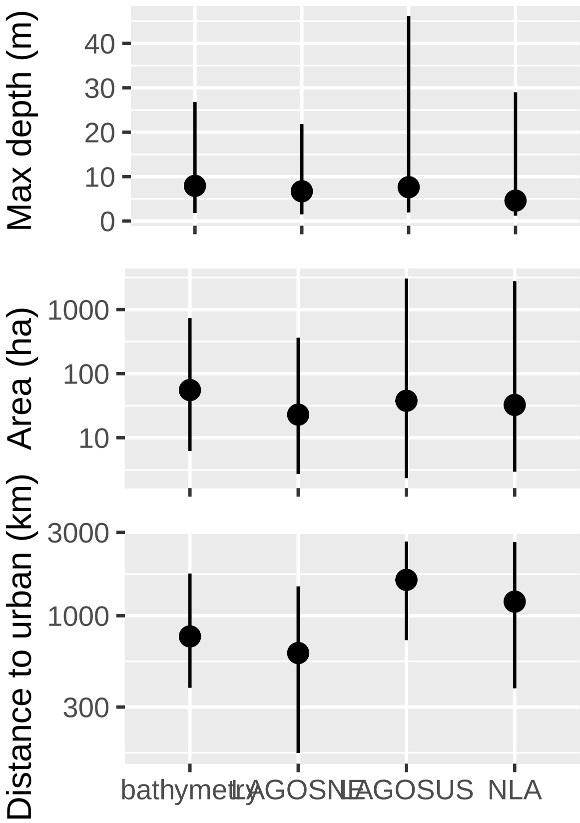

Figure S7. Comparison between characteristics of lakes with bathymetry data against lakes with depth from other sources in the LAGOSUS-Depth product. The distance to urban area metric is calculated using data from the 2018 US Census Urban and Rural Classification.

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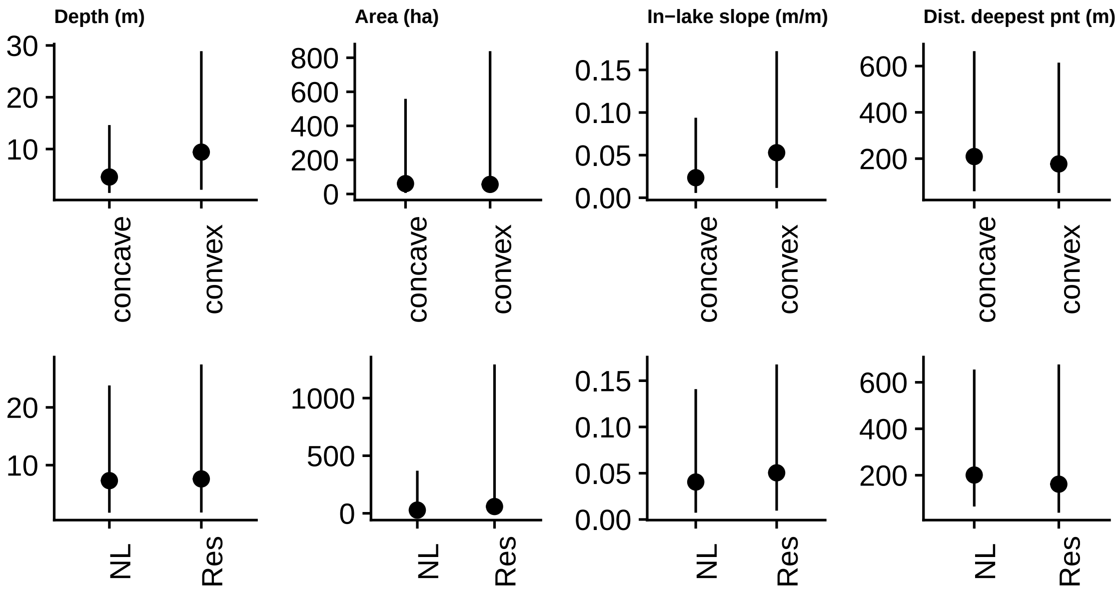

Figure S8. Comparison of lake characteristics according to differences in lake cross-section shape or reservoir status.

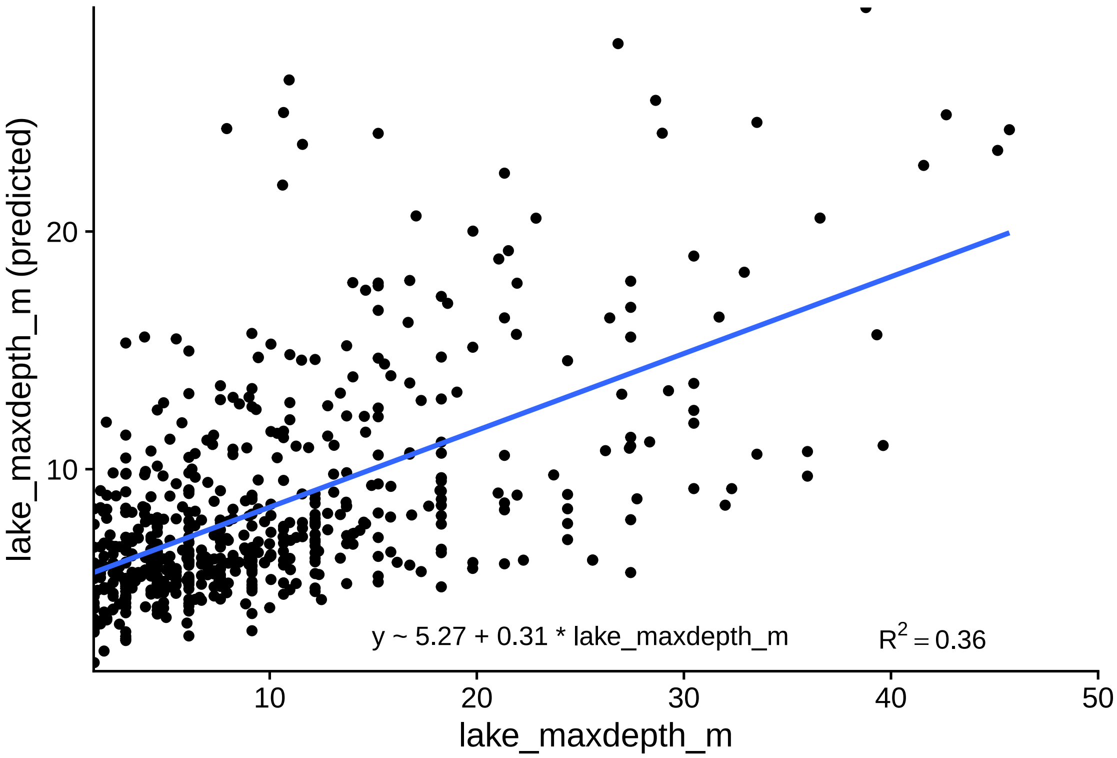

Figure S9. Proxy-proxy model fit showing predicted depth versus measured depth.

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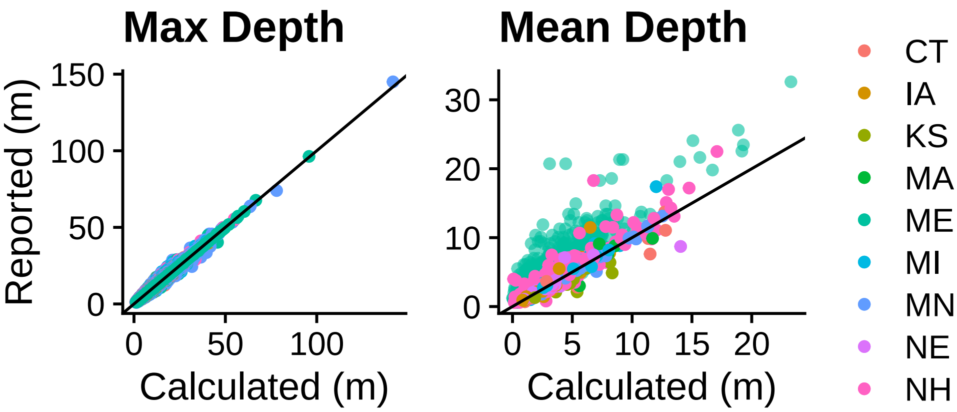

Figure S10. Comparison between reported depth and depth extracted from bathymetry surfaces by US State where reported depths come from the LAGOSUS-Depth product. For this figure, no reported depth values originated from the same source as its corresponding bathymetry-derived value.

Table S1. Model fit and predictive accuracy metrics (RMSE = root mean square error, R^2 = coefficient of determination, MAPE = mean absolute percent error) for the proxy - proxy combination of geometry metrics (see main text Table 1). Each row shows model metrics when proxy and "true" measures are calculated with slight differences from the default (bolded) used in the main text. `slope_mean` is the mean slope of all inlake or nearshore buffer points. `slope_pnts` is the average slope (i.e. `slope_pnt`) of all points at maximum depth. `slope_online_mean` is the mean pixel-to-pixel slope of each pixel lying on a straight line either from the single deepest point to the lake shoreline (in the case of inlake slope) or from the lake shoreline point extending to the buffer exterior (in the case of nearshore slope). `slopes_online_mean` is the same as `slope_online_mean` except it uses all inlake points at maximum depth. `dists_deepest` is the same as `dist_deepest` except distance is calculated for all points at maximum depth.

Inlake slope	Nearshore slope	Inlake distance	RMSE	R^2	MAPE
slope_pnts	slope_mean	dists_deepest	6.2 m	0.38	58 %
slope_pnt	**slope_mean**	**dist_deepest**	**6.4 m**	**0.35**	**59 %**
slope_pnts	slopes_online_mean	dist_deepest	6.4 m	0.32	61 %
slope_online_mean	slope_mean	dists_deepest	6.5 m	0.41	63 %
slope_pnts	slope_mean	dist_deepest	6.7 m	0.44	58 %
slope_online_mean	slope_mean	dist_deepest	6.7 m	0.36	59 %
slope_online_mean	slopes_online_mean	dist_deepest	6.7 m	0.32	66 %
slope_mean	slope_mean	dists_deepest	6.8 m	0.36	59 %
slope_pnt	slopes_online_mean	dists_deepest	6.8 m	0.25	73 %
slope_pnts	slope_online_mean	dist_deepest	6.9 m	0.3	71 %
slope_online_mean	slope_online_mean	dist_deepest	6.9 m	0.32	68 %
slope_online_mean	slope_online_mean	dists_deepest	6.9 m	0.33	65 %
slope_mean	slopes_online_mean	dists_deepest	7 m	0.24	65 %
slope_mean	slope_mean	dist_deepest	7.1 m	0.4	64 %
slopes_online_mean	slope_mean	dist_deepest	7.1 m	0.37	56 %
slope_mean	slope_online_mean	dist_deepest	7.1 m	0.3	69 %
slopes_online_mean	slopes_online_mean	dists_deepest	7.2 m	0.32	63 %
slopes_online_mean	slopes_online_mean	dist_deepest	7.3 m	0.25	64 %
slope_pnt	slope_mean	dists_deepest	7.3 m	0.35	61 %
slopes_online_mean	slope_mean	dists_deepest	7.3 m	0.36	60 %
slope_online_mean	slopes_online_mean	dists_deepest	7.3 m	0.29	58 %
slope_pnts	slope_online_mean	dists_deepest	7.4 m	0.27	64 %
slopes_online_mean	slope_online_mean	dists_deepest	7.4 m	0.33	67 %
slopes_online_mean	slope_online_mean	dist_deepest	7.5 m	0.26	61 %
slope_pnt	slopes_online_mean	dist_deepest	7.5 m	0.33	69 %
slope_mean	slopes_online_mean	dist_deepest	7.6 m	0.26	64 %
slope_pnt	slope_online_mean	dist_deepest	7.7 m	0.27	68 %
slope_pnts	slopes_online_mean	dists_deepest	7.8 m	0.3	65 %
slope_pnt	slope_online_mean	dists_deepest	7.9 m	0.27	67 %
slope_mean	slope_online_mean	dists_deepest	7.9 m	0.31	60 %

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