# Supplementary Material

**Table S1.** Criteria to calculate morphometric parameters in the urban subbasin.

| Number | Morphometric parameter | Mathematical equation | Variable description | References |
|---|---|---|---|---|
| | | **Geometry and shape** | | |
| 1 | Perimeter (P) | Length of the drainage subbasin boundary | | Horton [33] |
| 2 | Subbasin Length ($L_b$) | The maximum length of the subbasin measured parallel to the main drainage line | | Horton [33] |
| 3 | Total Area (A) | The total area of the basin | | Horton [33] |
| 4 | Subbasin Width (W) | $W = \frac{A}{L_b}$ | A = Subbasin area (km²)<br>$L_b$ = Subbasin length (km) | Horton [33] |
| 5 | Form factor (Kf) | $Kf = \frac{A}{{L_b}^2}$ | A = Subbasin area (km²)<br>$L_b$ = Subbasin length (km) | Horton [33] |
| 6 | Circularity Ratio ($R_c$) | $Rc = \frac{4\,\pi\,A}{P^2}$ | P = Subbasin perimeter (km)<br>A = Subbasin area (km²)<br>π = Mathematical constant | Miller [35] |
| 7 | Gravelius compactness coefficient ($G_c$) | $Gc = \frac{P}{2\sqrt{\pi A}} = \frac{0.28 \times P}{\sqrt{A}}$ | P = Subbasin perimeter (km)<br>A = Subbasin area (km²)<br>π = Mathematical constant | Gravelius [37] |
| | | **Drainage network** | | |
| 8 | Stream order (U) | Hierarchical ordering | | Horton [34] |
| 9 | Stream length ($L_u$) | Length of the mainstream | | Horton [34] |
| 10 | Stream number ($N_u$) | The total number of streams | | Horton [34] |
| 11 | Drainage density (D) | $D = \frac{\sum Lu}{A}$ | $L_u$ = Stream length (km)<br>A = Subbasin area (km²) | Horton [34] |
| 12 | Stream frequency ($F_s$) | $Fs = \frac{Nc}{A}$ | $N_c$ = Total number of streams<br>A = Subbasin area (km²) | Horton [34] |
| 13 | Coeficient of torrentiality ($C_t$) | $Ct = \frac{N_1}{A}$ | $N_1$ = Total number of first-order streams<br>A = Subbasin area (km²) | Strahler [38] |
| 14 | Mean slope of the mainstream (Smed) | $Smed = \frac{Bh}{Lu}$ | $B_h$ = Subbasin relief (km)<br>$L_u$ = Stream length (km). | Miller [35] |
| 15 | Time of concentration ($T_c$) | $Tc = (0.87\ \frac{Lu^3}{Bh})^{0.385}$ | $B_h$ = Subbasin relief (km)<br>$L_c$ = Length of the main channel in km | Kirpich [39] |
| | | **Relief aspects** | | |
| 16 | Subbasin relief ($B_h$) | The vertical distance between the lowest and highest points of the subbasin (m) | | Schumm [36] |
| 17 | Hypsometric curve | Area and elevation are plotted as functions of the total area and the total elevation of the subbasin | | Schumm [36] |

**Table S2.** Comparison between DEM and GCP obtained for altimetric ($RMSE_z$) and planimetric ($RMSE_{xy}$) accuracies.

| Points | Data (GCP) | | | Data (DEM) | | | Differences | | |
|---|---|---|---|---|---|---|---|---|---|
| | $y_{PCT}$ | $x_{PCT}$ | $z_{PCT}$ | $y_o$ | $x_o$ | $z_o$ | $\Delta x$ | $\Delta y$ | $\Delta z$ |
| 1 | 2,739,468.26 | 257,766.46 | 96.831 | 2,739,468.25 | 257,766.39 | 98.03 | 0.072 | 0.013 | 1.199 |
| 2 | 2,739,476.18 | 257,743.76 | 96.663 | 2,739,476.18 | 257,743.73 | 97.64 | 0.032 | −0.005 | 0.977 |
| 3 | 2,739,373.49 | 257,755.63 | 96.708 | 2,739,373.49 | 257,755.62 | 92.88 | 0.007 | 0.002 | −3.828 |
| 4 | 2,739,425.62 | 257,860.27 | 96.476 | 2,739,425.62 | 257,860.26 | 95.92 | 0.007 | 0.001 | −0.556 |
| 5 | 2,739,366.67 | 257,823.20 | 96.379 | 2,739,366.66 | 257,823.20 | 96.29 | 0.000 | 0.007 | −0.089 |
| 6 | 2,739,325.19 | 257,841.66 | 95.122 | 2,739,325.18 | 257,841.65 | 95.87 | 0.008 | 0.007 | 0.748 |
| 7 | 2,739,244.71 | 257,832.73 | 94.814 | 2,739,244.7 | 257,832.72 | 95.78 | 0.008 | 0.008 | 0.966 |
| 8 | 2,739,227.59 | 257,807.40 | 95.118 | 2,739,227.59 | 257,807.39 | 95.74 | 0.010 | 0.001 | 0.622 |
| 9 | 2,739,188.57 | 257,871.05 | 89.460 | 2,739,188.57 | 257,871.04 | 93.09 | 0.009 | 0.000 | 3.630 |
| 10 | 2,739,235.57 | 257,892.10 | 86.941 | 2,739,235.56 | 257,892.09 | 89.88 | 0.007 | 0.005 | 2.939 |
| 11 | 2,739,194.40 | 257,960.07 | 77.175 | 2,739,194.39 | 257,960.06 | 77.65 | 0.009 | 0.005 | 0.475 |
| 12 | 2,739,194.40 | 257,960.07 | 77.168 | 2,739,194.4 | 257,960.06 | 77.65 | 0.008 | 0.004 | 0.482 |
| 13 | 2,739,121.95 | 257,945.68 | 79.861 | 2,739,121.95 | 257,945.67 | 80.18 | 0.008 | 0.003 | 0.319 |
| 14 | 2,739,097.32 | 257,983.55 | 74.932 | 2,739,097.32 | 257,983.55 | 75.44 | 0.000 | 0.002 | 0.508 |
| 15 | 2,739,072.41 | 258,014.45 | 71.248 | 2,739,072.41 | 258,014.44 | 72.13 | 0.007 | 0.001 | 0.882 |
| 16 | 2,739,171.19 | 258,011.69 | 71.330 | 2,739,171.18 | 258,011.69 | 71.61 | 0.001 | 0.005 | 0.280 |
| 17 | 2,739,144.04 | 258,091.57 | 65.526 | 2,739,144.04 | 258,091.57 | 65.84 | 0.004 | 0.003 | 0.314 |
| 18 | 2,739,212.72 | 258,116.49 | 71.747 | 2,739,212.71 | 258,116.49 | 72.54 | 0.003 | 0.008 | 0.793 |
| 19 | 2,739,245.83 | 258,084.17 | 71.650 | 2,739,245.82 | 258,084.16 | 72.89 | 0.005 | 0.008 | 1.240 |
| 20 | 2,739,264.46 | 258,062.25 | 72.503 | 2,739,264.45 | 258,062.24 | 73.42 | 0.007 | 0.009 | 0.917 |
| 21 | 2,739,323.75 | 258,008.89 | 75.115 | 2,739,323.75 | 258,008.89 | 76.14 | 0.002 | 0.002 | 1.025 |
| 22 | 2,739,340.40 | 257,934.69 | 78.177 | 2,739,340.4 | 257,934.68 | 80.86 | 0.005 | 0.001 | 2.683 |
| 23 | 2,739,328.47 | 257,911.81 | 84.531 | 2,739,328.46 | 257,911.25 | 84.66 | 0.555 | 0.007 | 0.129 |
| 24 | 2,739,403.12 | 257,884.09 | 89.656 | 2,739,403.12 | 257,884.08 | 89.83 | 0.008 | 0.000 | 0.174 |
| 25 | 2,739,403.12 | 257,884.09 | 89.664 | 2,739,403.12 | 257,884.08 | 89.83 | 0.007 | 0.001 | 0.166 |
| 26 | 2,739,339.49 | 257,662.25 | 87.287 | 2,739,339.48 | 257,662.24 | 88.56 | 0.007 | 0.010 | 1.273 |
| 27 | 2,739,308.55 | 257,697.31 | 84.185 | 2,739,308.55 | 257,697.30 | 84.91 | 0.006 | 0.004 | 0.725 |
| 28 | 2,739,394.12 | 257,733.30 | 91.372 | 2,739,394.11 | 257,733.29 | 93.93 | 0.006 | 0.007 | 2.558 |
| 29 | 2,739,418.55 | 257,794.47 | 97.015 | 2,739,418.54 | 257,794.47 | 96.88 | 0.001 | 0.005 | −0.135 |
| | | | | | | | | ***RMSE$_{xy}$*** | **0.104** |
| | | | | | | | | ***RMSE$_z$*** | **1.472** |