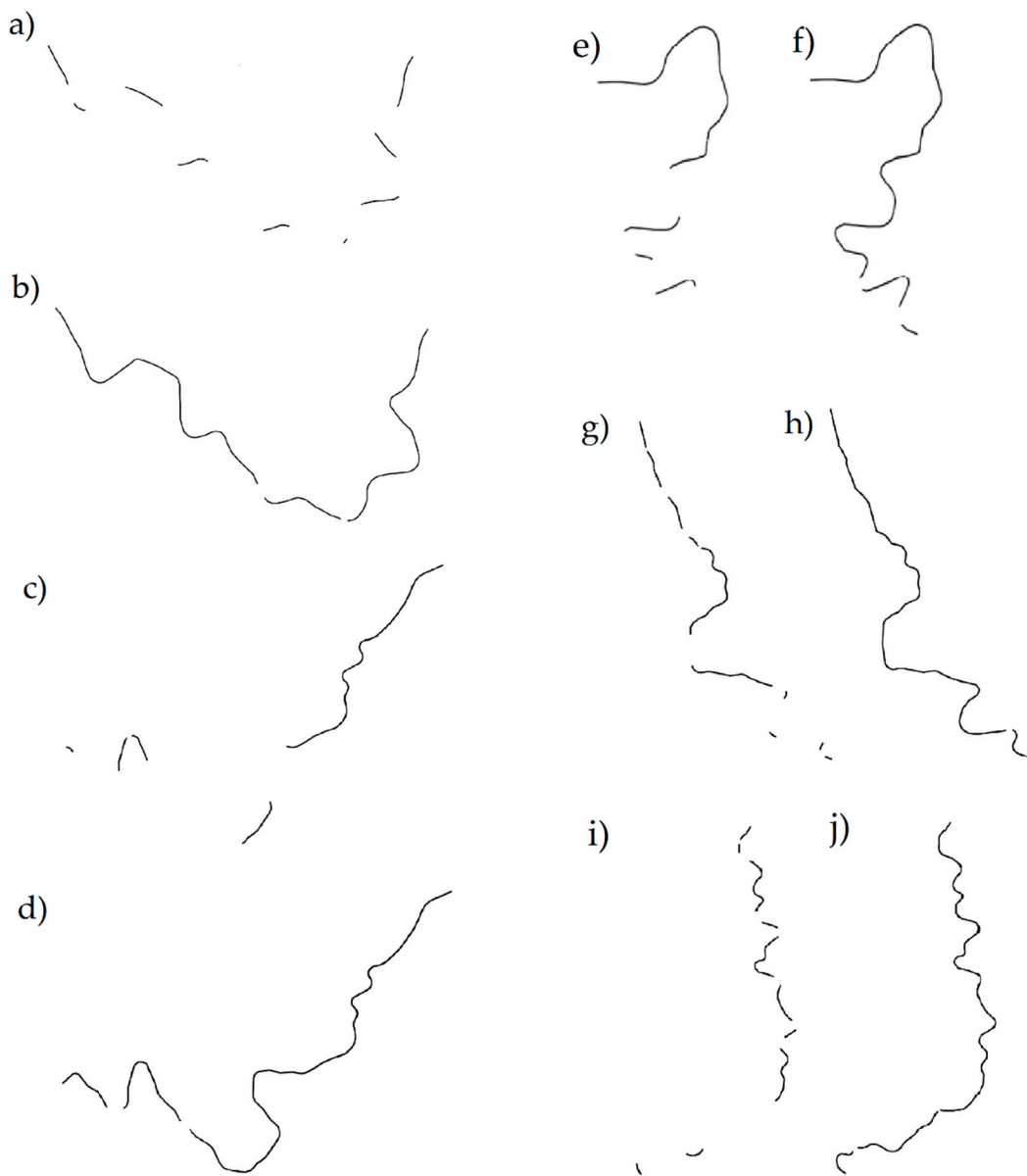
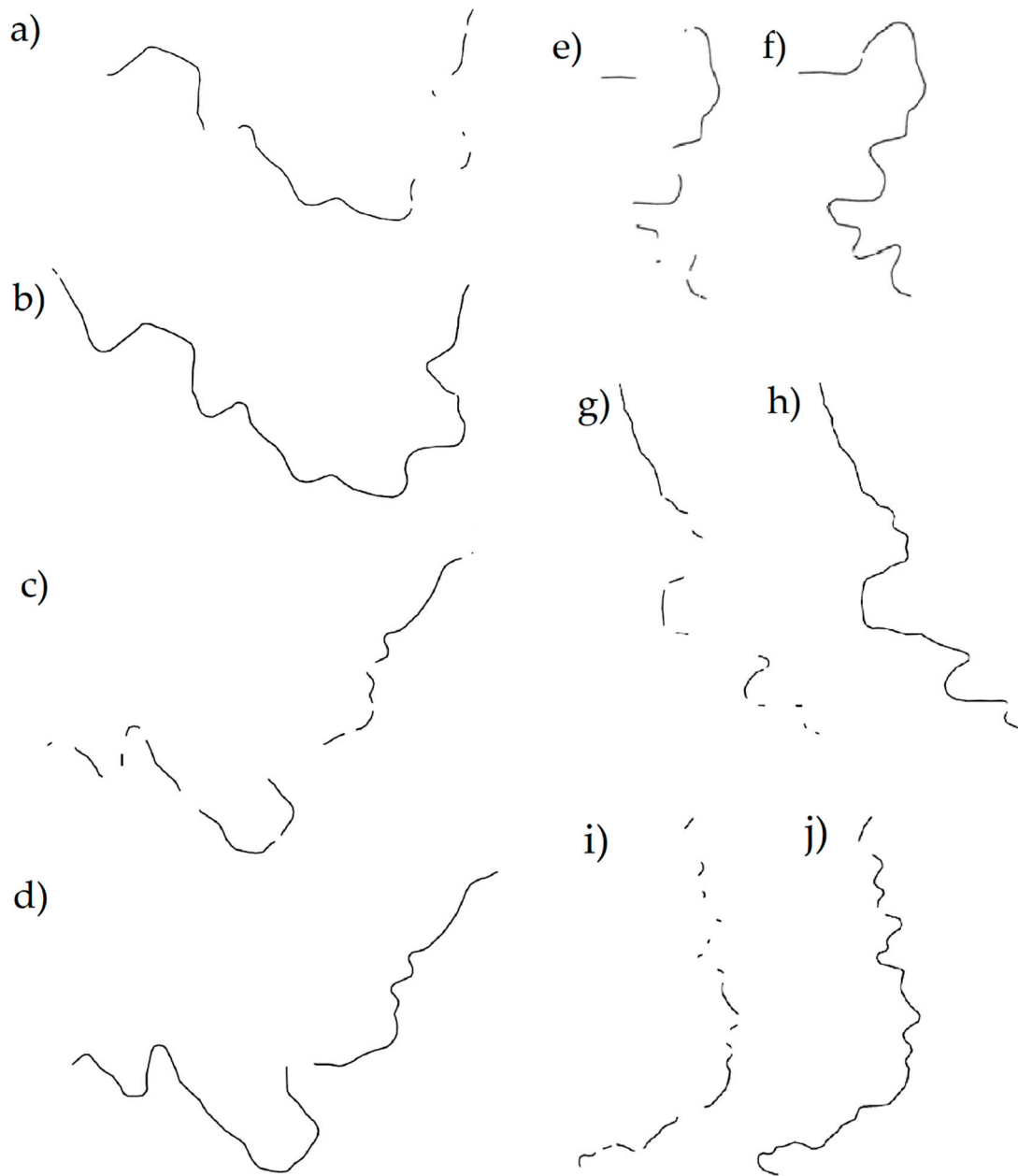


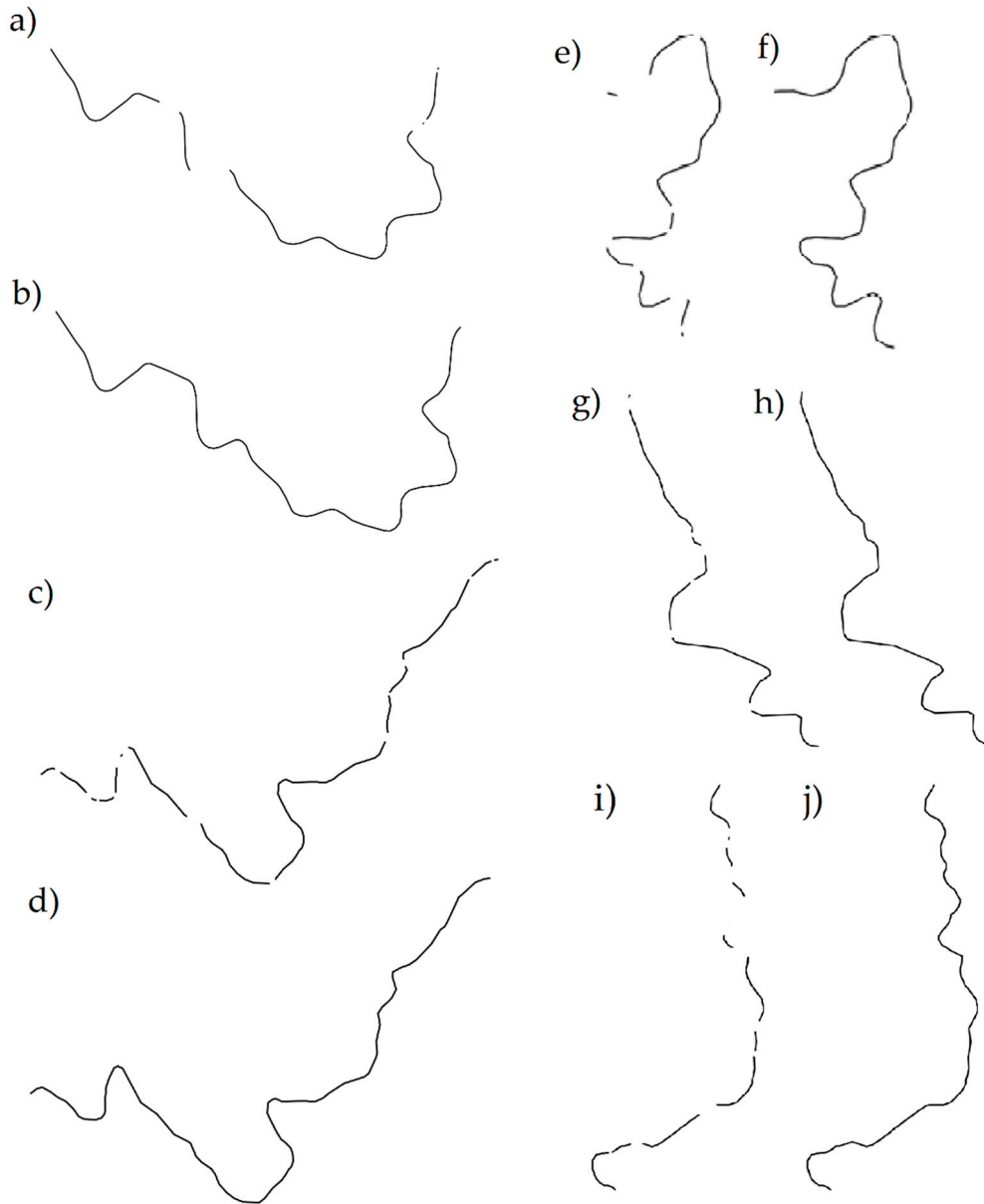
**Figure S1.** Reference map of study road routes using total station: (a) Dangjin, (b) Cheonan, (c) Seosan, and (d) Gongju (▲ GCP, — center line of forest road).



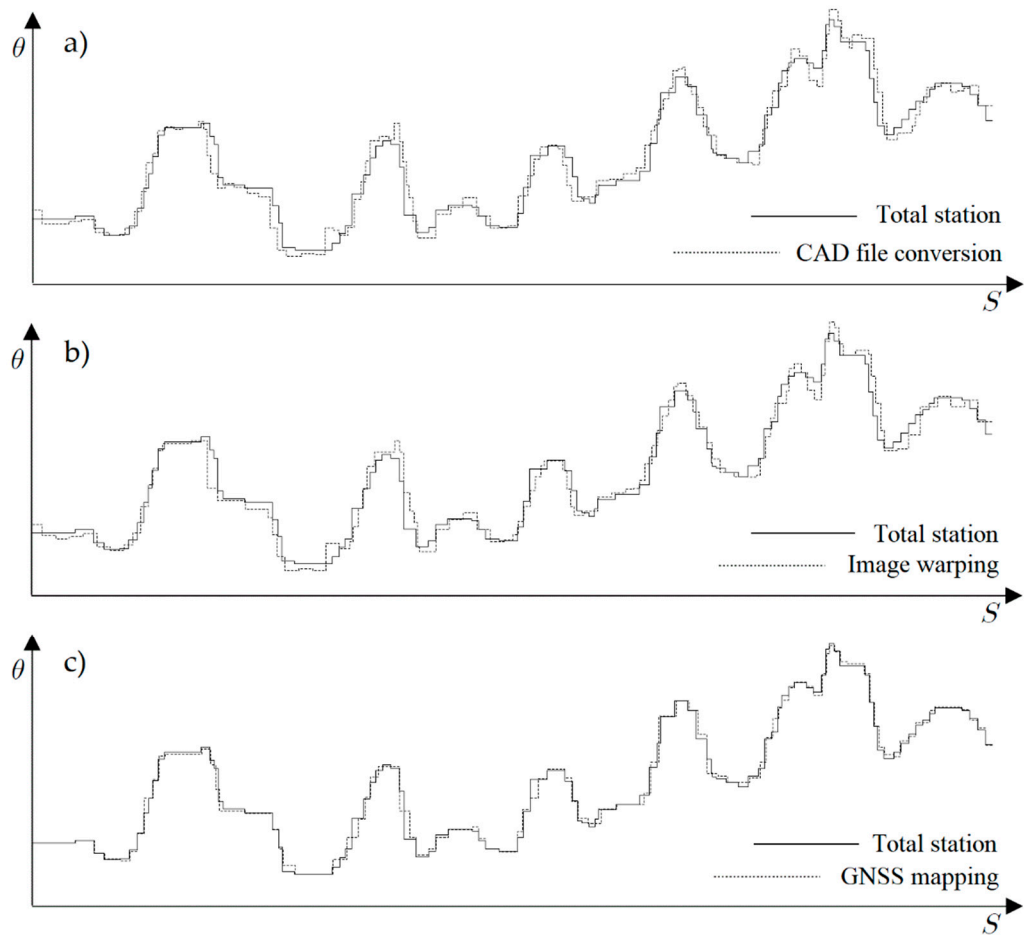
**Figure S2.** Example of buffering analysis between the CAD file conversion and reference map: (a) Dangjin, buffer width is 6 m (40.1%), (b) Dangjin, buffer width is 16 m (96.1%), (c) Seosan, buffer width is 10 m (54.0%), (d) Seosan, buffer width is 24 m (95.1%), (e) Nonsan, buffer width is 8 m (69.7%) (f) Nonsan, buffer width is 18 m (95.0%) (g) Cheonan, buffer width is 6 m (62.8%), (h) Cheonan, buffer width is 22 m (95.2%), (i) Gongju, buffer width is 6 m (54.5%), and (j) Gongju, buffer width is 16 m (95.1%).



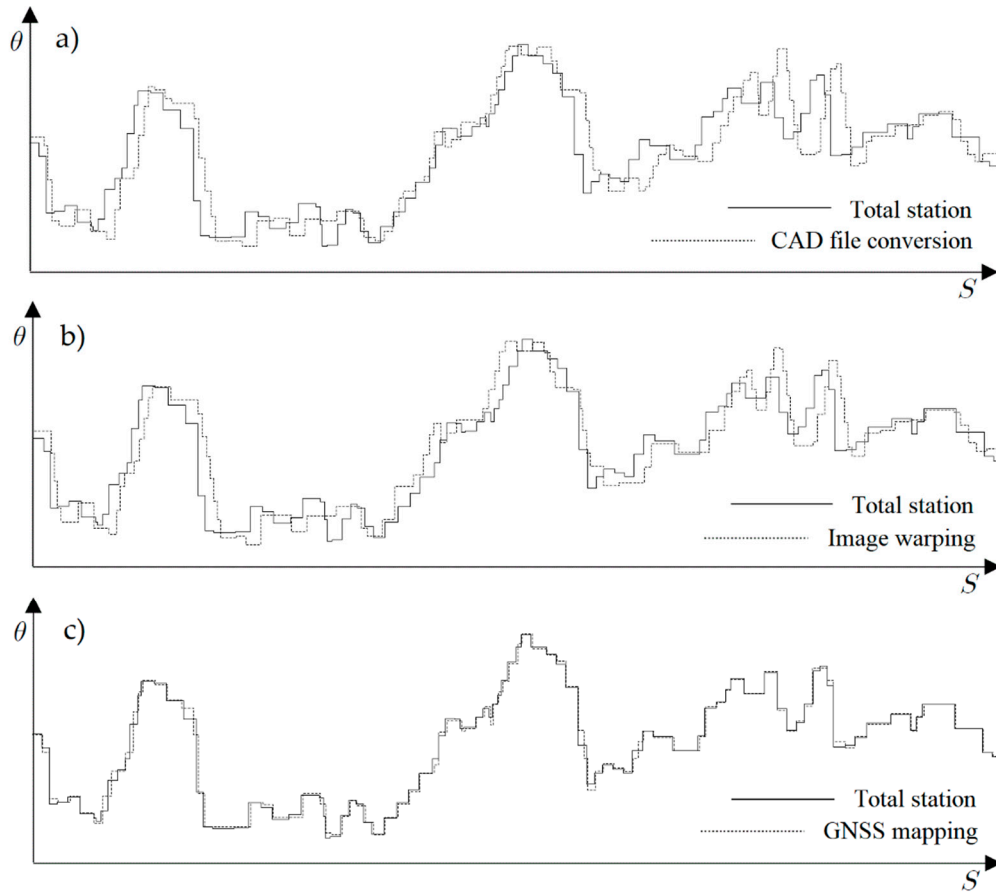
**Figure S3.** Example of buffering analysis between the image warping and reference map: (a) Dangjin, buffer width is 4 m (62.3%), (b) Dangjin, buffer width is 12 m (98.9%), (c) Seosan, buffer width is 6 m (65.7%), (d) Seosan, buffer width is 18 m (96.3%), (e) Nonsan, buffer width is 4 m (58.8%) (f) Nonsan, buffer width is 10 m (97.8%) (g) Cheonan, buffer width is 4 m (51.3%), (h) Cheonan, buffer width is 12 m (96.8%), (i) Gongju, buffer width is 2 m (46.5%), and (j) Gongju, buffer width is 18 m (95.0%).



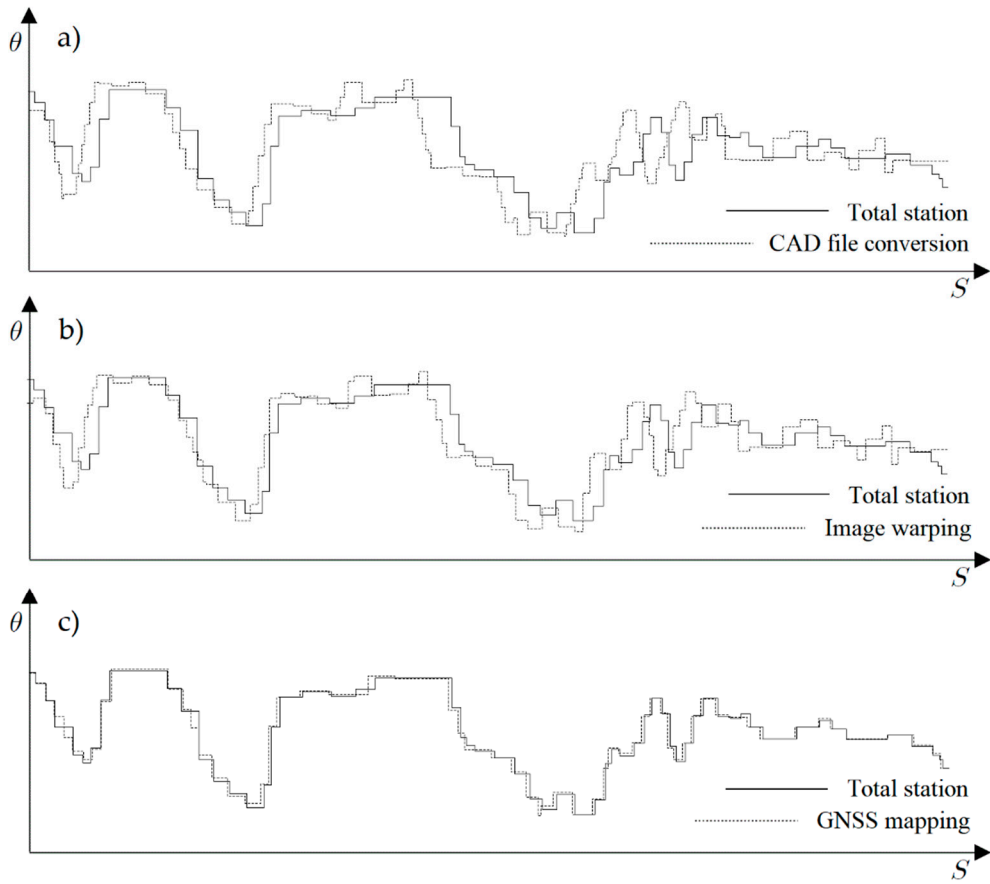
**Figure S4.** Example of buffering analysis between the GNSS mapping and reference map: (a) Dangjin, buffer width is 2 m (85%), (b) Dangjin, buffer width is 4 m (100%), (c) Seosan, buffer width is 1 m (91%), (d) Seosan, buffer width is 4 m (100%), (e) Nonsan, buffer width is 1 m (78%) (f) Nonsan, buffer width is 4 m (100%) (g) Cheonan, buffer width is 1 m (93%), (h) Cheonan, buffer width is 2 m (100%), (i) Gongju, buffer width is 1 m (73%), and (j) Gongju, buffer width is 4 m (100%).



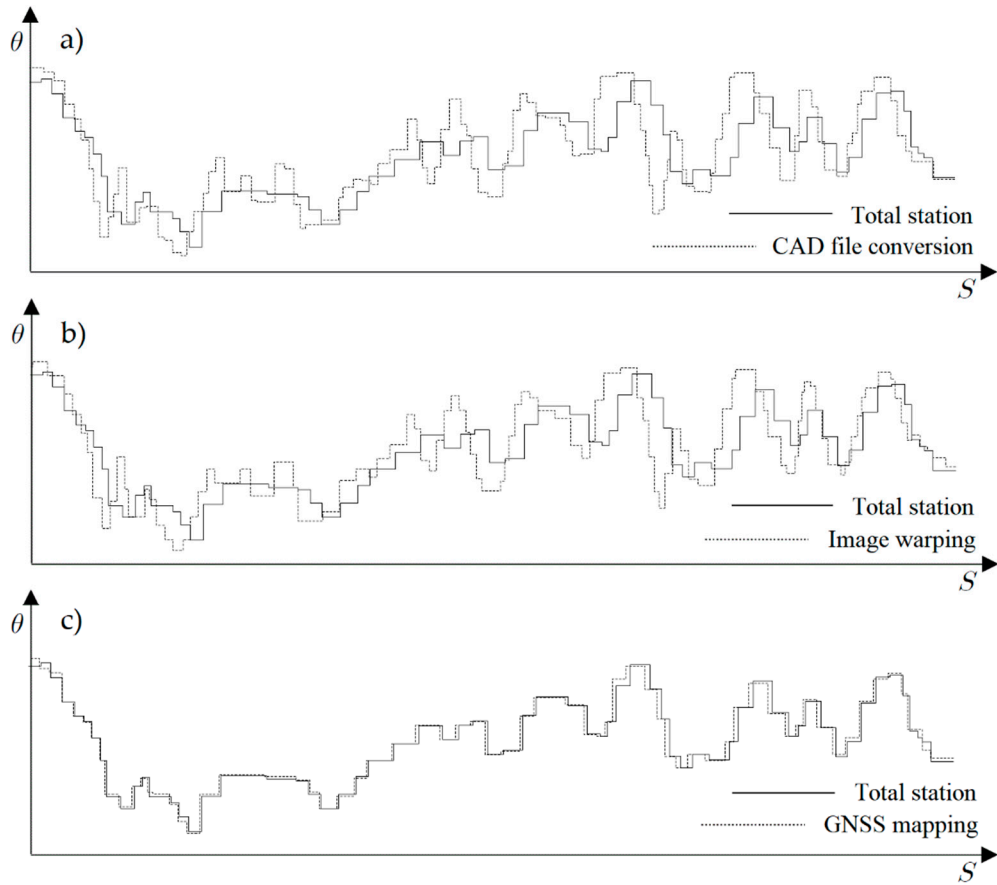
**Figure S5.** Example of turning function analysis between the three mapping techniques and the reference map on Dangjin: (a) CAD file conversion, (b) image warping, and (c) GNSS mapping.



**Figure S6.** Example of turning function analysis between the three mapping techniques and the reference map on Seosan: (a) CAD file conversion, (b) image warping, and (c) GNSS mapping.



**Figure S7.** Example of turning function analysis between the three mapping techniques and the reference map on Cheonan: (a) CAD file conversion, (b) image warping, and (c) GNSS mapping.



**Figure S8.** Example of turning function analysis between the three mapping techniques and the reference map on Gongju: (a) CAD file conversion, (b) image warping, and (c) GNSS mapping.