

Supplementary Materials: Gap-Filling of Landsat 7 Imagery Using the Direct Sampling Method

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Figure S1. Mean realizations and the zoomed images for the nine test cases conducted over R1 (desert). “Actual” is the actual image. “U-” and “B-” represents univariate and bivariate simulation. “D1”–“D4” represent the input images used for filling gaps, and “U-D0” is the univariate simulation without using additional training image. The areas marked with red square in the mean realizations are magnified to the right of each pair.

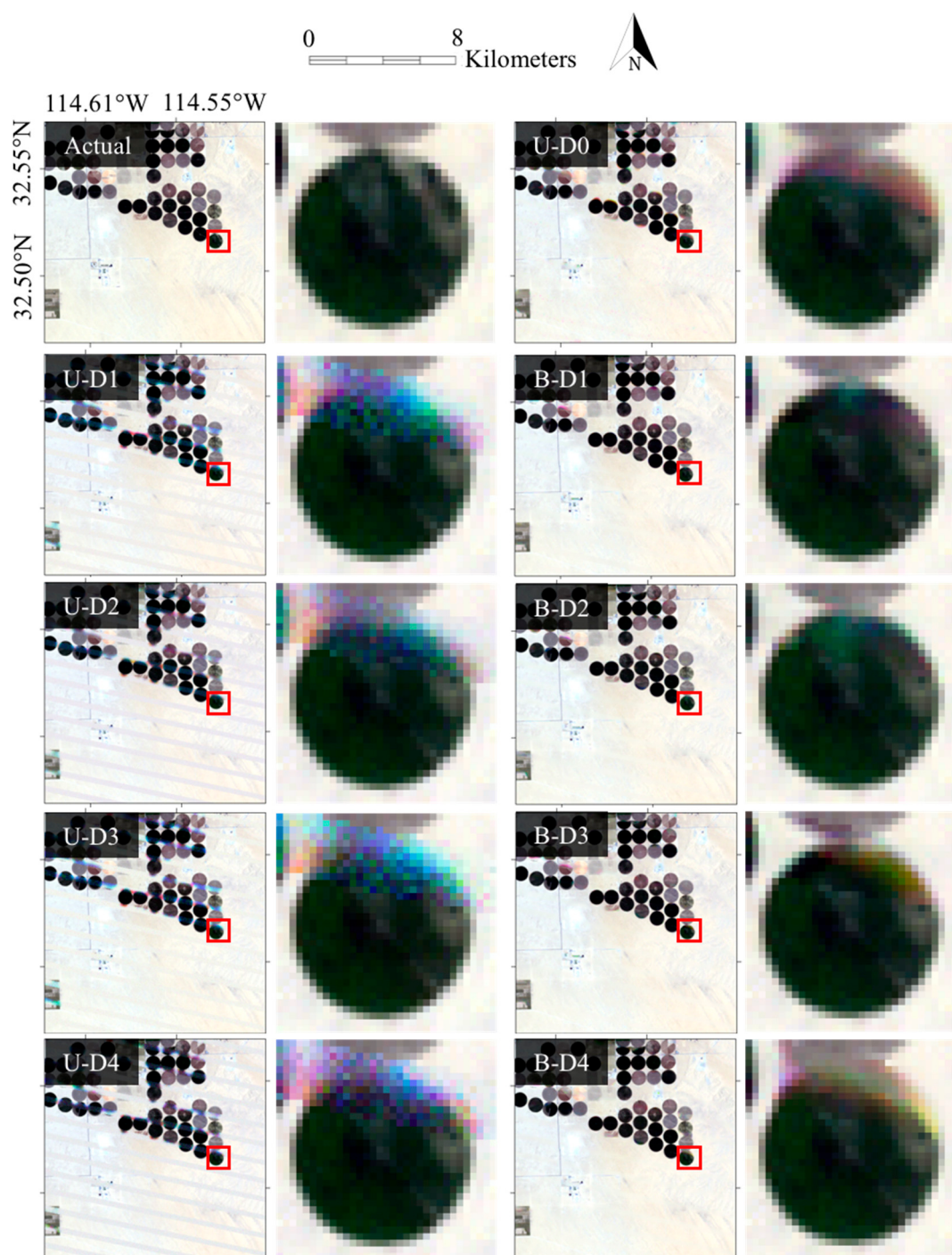


Figure S2. Mean realizations and the zoomed images for the nine test cases conducted over R2 (sparse agricultural). “Actual” is the actual image. “U-” and “B-” represents univariate and bivariate simulation. “D1”–“D4” represent the input images used for filling gaps, and “U-D0” is the univariate simulation without using additional training image. The areas marked with red square in the mean realizations are magnified to the right of each pair.

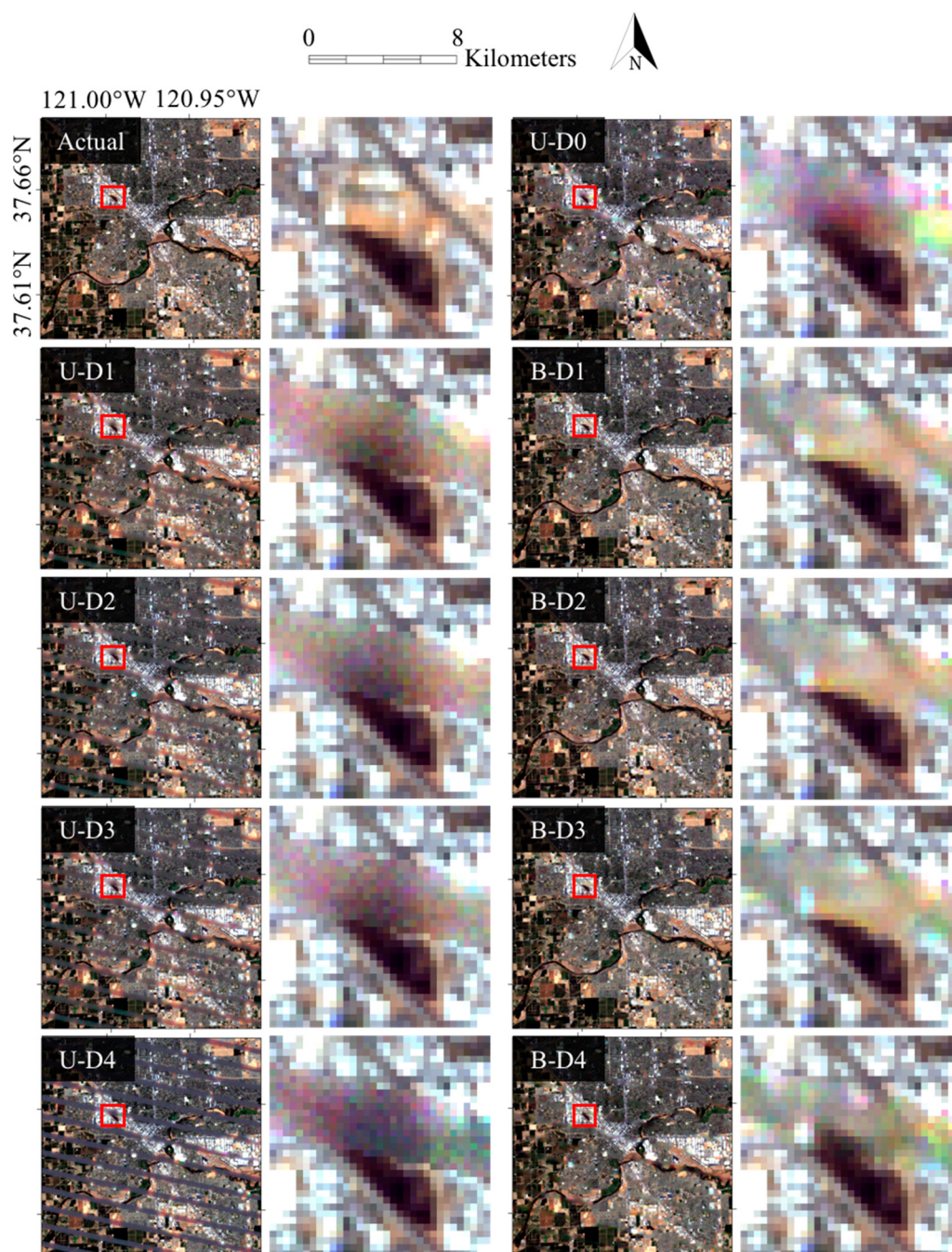


Figure S3. Mean realizations and the zoomed images for the nine test cases conducted over R4 (urban). “Actual” is the actual image. “U-” and “B-” represents univariate and bivariate simulation. “D1”–“D4” represent the input images used for filling gaps, and “U-D0” is the univariate simulation without using additional training image. The areas marked with red square in the mean realizations are magnified to the right of each pair.

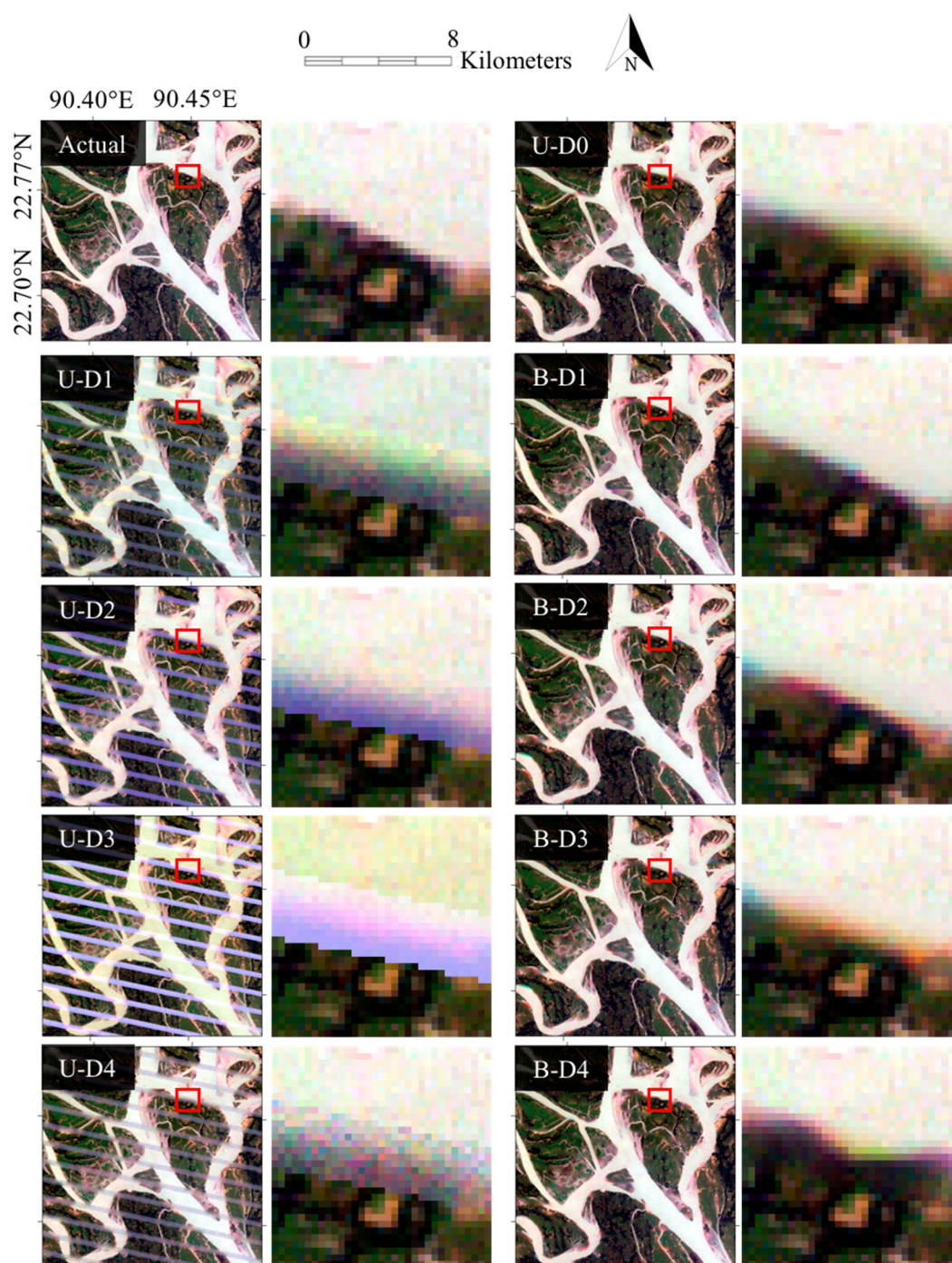


Figure S4. Mean realizations and the zoomed images for the nine test cases conducted over R5 (braided river). “Actual” is the actual image. “U-” and “B-” represents univariate and bivariate simulation. “D1”–“D4” represent the input images used for filling gaps, and “U-D0” is the univariate simulation without using additional training image. The areas marked with red square in the mean realizations are magnified to the right of each pair.

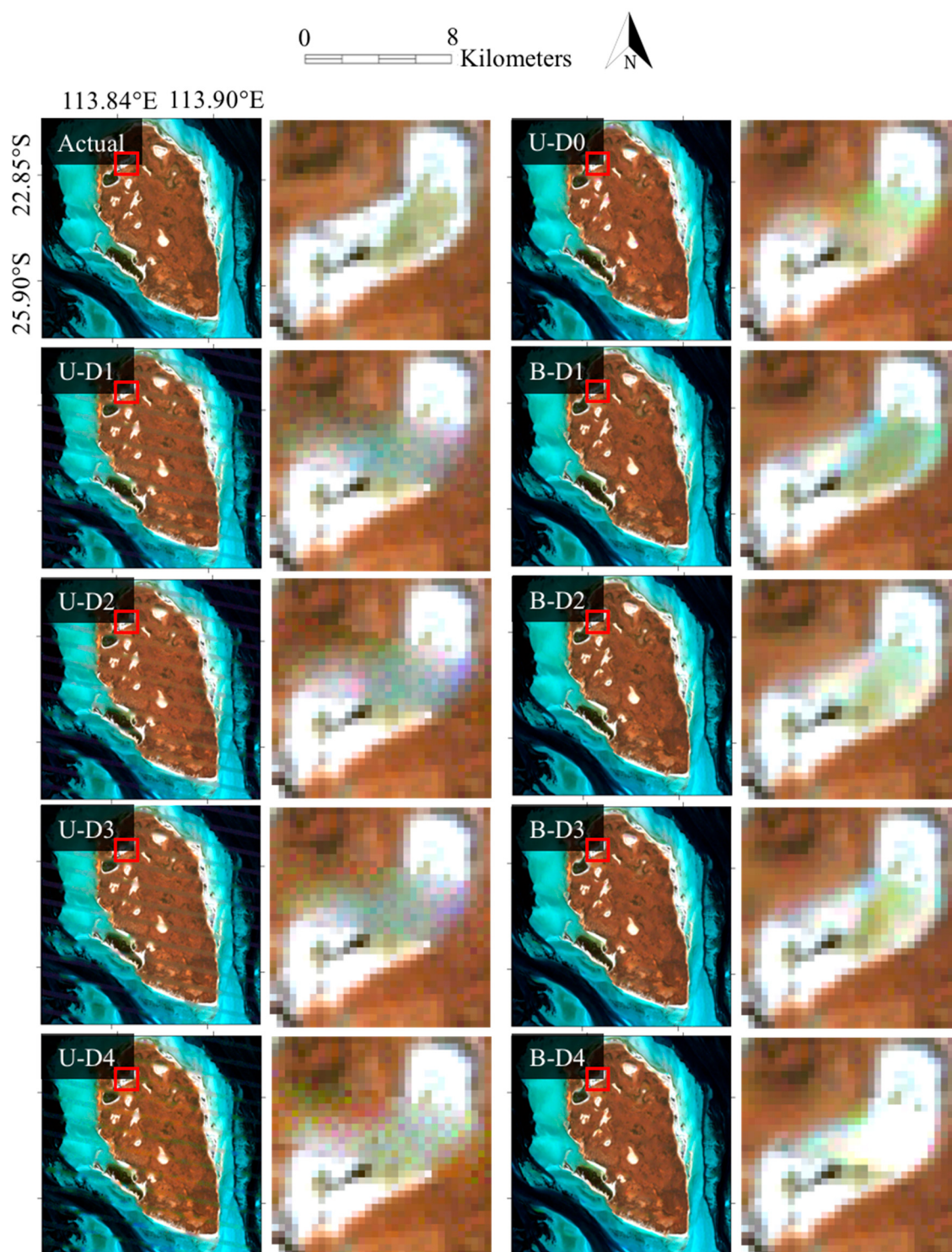


Figure S5. Mean realizations and the zoomed images for the nine test cases conducted over R6 (coastal area). “Actual” is the actual image. “U-” and “B-” represents univariate and bivariate simulation. “D1”–“D4” represent the input images used for filling gaps, and “U-D0” is the univariate simulation without using additional training image. The areas marked with red square in the mean realizations are magnified to the right of each pair.

Table S1. Statistical indices of tested cases of R1 (desert).

		Univariate					Bivariate			
		U-D1	U-D2	U-D3	U-D4	U-D0	B-D1	B-D2	B-D3	B-D4
RMSE	B1	0.0063	0.0040	0.0050	0.0039	0.0028	0.0026	0.0023	0.0023	0.0024
	B2	0.0060	0.0046	0.0055	0.0046	0.0032	0.0031	0.0026	0.0026	0.0029
	B3	0.0080	0.0083	0.0089	0.0098	0.0061	0.0055	0.0045	0.0045	0.0049
	B4	0.0111	0.0119	0.0122	0.0113	0.0080	0.0069	0.0056	0.0055	0.0055
	B5	0.0135	0.0155	0.0165	0.0145	0.0112	0.0097	0.0079	0.0079	0.0084
	B7	0.0117	0.0136	0.0140	0.0130	0.0099	0.0086	0.0072	0.0072	0.0078
MSA (°)		7.7439	0.6713	0.6880	0.7728	0.7292	0.4133	0.4146	0.3736	0.3760
rRMSE	B1	0.0400	0.0252	0.0315	0.0239	0.0168	0.0160	0.0140	0.0141	0.0147
	B2	0.0265	0.0199	0.0243	0.0197	0.0139	0.0132	0.0112	0.0112	0.0124
	B3	0.0204	0.0209	0.0224	0.0246	0.0154	0.0139	0.0115	0.0114	0.0124
	B4	0.0230	0.0243	0.0252	0.0232	0.0164	0.0141	0.0113	0.0111	0.0112
	B5	0.0223	0.0254	0.0268	0.0236	0.0185	0.0159	0.0129	0.0129	0.0139
	B7	0.0223	0.0266	0.0275	0.0257	0.0196	0.0170	0.0142	0.0142	0.0155
R ²	B1	0.5218	0.3180	0.3688	0.3304	0.6296	0.6727	0.7499	0.7457	0.7250
	B2	0.4903	0.3789	0.1689	0.3390	0.6688	0.7064	0.7898	0.7887	0.7459
	B3	0.2974	0.1951	0.1007	0.2073	0.5625	0.6505	0.7613	0.7630	0.7211
	B4	0.3284	0.1509	0.1103	0.2291	0.6084	0.7122	0.8138	0.8191	0.8212
	B5	0.2937	0.0840	0.0380	0.1884	0.4999	0.6337	0.7567	0.7579	0.7257
	B7	0.2598	0.0564	0.0317	0.1139	0.4552	0.5952	0.7196	0.7169	0.6687
MdAPE (%)	B1	3.5936	1.6779	2.3940	1.4593	0.9893	1.0034	0.9490	0.9623	0.9758
	B2	2.1411	1.3464	1.7337	1.3233	0.8358	0.8273	0.7391	0.7315	0.7551
	B3	1.3016	1.2832	1.3818	1.6116	0.8442	0.8153	0.7072	0.7031	0.7571
	B4	1.4011	1.4729	1.5093	1.3972	0.8467	0.8122	0.6723	0.6534	0.6534
	B5	1.3016	1.5458	1.6460	1.4247	0.9536	0.8958	0.7584	0.7546	0.8032
	B7	1.3727	1.6239	1.6593	1.5654	1.0481	0.9841	0.8447	0.8550	0.9050

Table S2. Statistical indices of tested cases of R2 (sparse agricultural).

		Univariate					Bivariate			
		U-D1	U-D2	U-D3	U-D4	U-D0	B-D1	B-D2	B-D3	B-D4
RMSE	B1	0.0166	0.0146	0.0177	0.0162	0.0092	0.0063	0.0061	0.0063	0.0067
	B2	0.0212	0.0196	0.0217	0.0213	0.0134	0.0083	0.0078	0.0081	0.0091
	B3	0.0273	0.0275	0.0269	0.0321	0.0213	0.0135	0.0126	0.0134	0.0152
	B4	0.0255	0.0257	0.0287	0.0272	0.0159	0.0165	0.0138	0.0157	0.0161
	B5	0.0349	0.0349	0.0365	0.0334	0.0226	0.0173	0.0163	0.0179	0.0191
	B7	0.0359	0.0367	0.0384	0.0373	0.0261	0.0174	0.0167	0.0187	0.0211
MSA (°)		7.7439	0.6713	2.6282	2.8689	2.8024	2.9240	1.4394	1.1522	1.0922
rRMSE	B1	0.1179	0.1012	0.1252	0.1115	0.0541	0.0402	0.0374	0.0398	0.0417
	B2	0.1425	0.1243	0.1414	0.1358	0.0817	0.0510	0.0462	0.0498	0.0540
	B3	0.1865	0.1906	0.1826	0.2230	0.1708	0.0886	0.0797	0.0867	0.0977
	B4	0.0712	0.0743	0.0815	0.0746	0.0449	0.0450	0.0398	0.0429	0.0452
	B5	0.1232	0.1209	0.1257	0.1174	0.0858	0.0636	0.0574	0.0676	0.0722
	B7	0.2253	0.2195	0.2244	0.2444	0.2015	0.1138	0.0974	0.121	0.1313
R²	B1	0.7326	0.7932	0.6915	0.7332	0.9107	0.9577	0.9601	0.9577	0.9513
	B2	0.7970	0.8289	0.7883	0.7891	0.9167	0.9682	0.9717	0.9697	0.9620
	B3	0.8816	0.8837	0.8864	0.8404	0.9284	0.9710	0.9748	0.9714	0.9637
	B4	0.6488	0.6612	0.5870	0.6400	0.8576	0.8456	0.8924	0.8620	0.8531
	B5	0.7821	0.7920	0.7787	0.7907	0.9032	0.9431	0.9499	0.9391	0.9312
	B7	0.8663	0.8777	0.8624	0.8462	0.9226	0.9655	0.9683	0.9603	0.9499
MdAPE (%)	B1	2.2889	2.0064	2.2431	2.2406	1.2276	1.0444	1.0555	1.0782	1.0996
	B2	2.4620	3.5265	2.1754	3.2317	1.3371	1.0407	1.1157	1.0264	1.0506
	B3	2.7125	3.8442	2.3681	4.5318	1.3272	1.0761	1.1895	1.0367	1.0989
	B4	2.2502	2.8157	3.3833	2.6313	1.1531	0.9587	1.0368	0.9281	0.9845
	B5	2.4952	2.6746	2.9748	2.8106	1.2971	0.9949	1.0361	1.0017	1.0581
	B7	3.5482	5.2609	4.9552	3.2793	1.6328	1.2322	1.2808	1.2343	1.3164

Table S3. Statistical indices of tested cases of R4 (urban).

		Univariate				Bivariate				
		U-D1	U-D2	U-D3	U-D4	U-D0	B-D1	B-D2	B-D3	B-D4
RMSE	B1	0.0221	0.0227	0.0231	0.0252	0.0211	0.0110	0.0119	0.0122	0.0147
	B2	0.0261	0.0267	0.0276	0.0306	0.0248	0.0132	0.0141	0.0146	0.0182
	B3	0.0323	0.0326	0.0332	0.0389	0.0324	0.0175	0.0179	0.0187	0.0270
	B4	0.0477	0.0492	0.0493	0.0516	0.0411	0.0234	0.0248	0.0271	0.0335
	B5	0.0506	0.0513	0.0523	0.0578	0.0489	0.0282	0.0293	0.0302	0.0437
	B7	0.0471	0.0475	0.0484	0.0532	0.0454	0.0267	0.0270	0.0279	0.0409
MSA (°)		7.7439	0.6713	6.9521	7.0505	7.0751	7.5489	6.1185	3.7867	3.9062
rRMSE	B1	0.1451	0.1508	0.1505	0.1742	0.1348	0.0722	0.0768	0.0790	0.1015
	B2	0.1894	0.1904	0.1912	0.2039	0.1803	0.0939	0.0985	0.1029	0.1380
	B3	0.2978	0.2972	0.2963	0.3176	0.2894	0.1496	0.1468	0.1565	0.2391
	B4	0.2073	0.2076	0.2017	0.1945	0.1903	0.0959	0.1049	0.1115	0.1362
	B5	0.3715	0.3756	0.3759	0.3685	0.3936	0.2165	0.2615	0.2375	0.2852
	B7	0.5126	0.5089	0.5021	0.4759	0.5262	0.2675	0.2803	0.2920	0.4718
R ²	B1	0.4308	0.3951	0.3811	0.2560	0.4661	0.8585	0.8328	0.8240	0.7418
	B2	0.4092	0.3886	0.3584	0.2553	0.4477	0.8487	0.8246	0.8113	0.7035
	B3	0.4966	0.4906	0.4700	0.3341	0.4882	0.8521	0.8446	0.8304	0.6469
	B4	0.2841	0.2567	0.2983	0.3870	0.4549	0.8260	0.8062	0.7663	0.6404
	B5	0.3931	0.3803	0.3721	0.3211	0.4234	0.8117	0.7946	0.7838	0.5470
	B7	0.3965	0.3884	0.3786	0.3136	0.4289	0.8052	0.7996	0.7853	0.5416
MdAPE (%)	B1	8.7942	8.9823	9.1389	9.8029	6.8291	4.0431	4.2509	4.4193	5.5861
	B2	11.2560	11.5093	11.8979	13.4183	8.7963	5.1438	5.4064	5.6074	7.3044
	B3	14.2250	14.4039	14.6955	18.2542	12.7727	7.2041	7.5368	7.7675	10.8046
	B4	10.1362	10.4370	10.8049	12.3593	7.2944	4.3664	4.8554	5.2029	6.5681
	B5	13.0518	13.1802	13.4025	15.2268	12.0474	7.1339	7.2970	7.5515	10.1562
	B7	17.4997	17.6302	18.0013	20.3796	15.7637	9.2562	9.4757	9.8133	13.2866

Table S4. Statistical indices of tested cases of R5 (braided river).

		Univariate				Bivariate				
		U-D1	U-D2	U-D3	U-D4	U-D0	B-D1	B-D2	B-D3	B-D4
RMSE	B1	0.0091	0.0162	0.0314	0.0101	0.0047	0.0037	0.0044	0.0047	0.0047
	B2	0.0086	0.0099	0.0203	0.0104	0.0062	0.0049	0.0055	0.0058	0.0062
	B3	0.0109	0.0126	0.0229	0.0131	0.0082	0.0065	0.0077	0.0079	0.0084
	B4	0.0343	0.0347	0.0396	0.0352	0.0317	0.0207	0.0211	0.0225	0.0278
	B5	0.0258	0.0272	0.0279	0.0271	0.0236	0.0154	0.0159	0.0157	0.0199
	B7	0.0184	0.0195	0.0193	0.0201	0.0151	0.0115	0.0119	0.0115	0.0145
MSA (°)		7.7439	0.6713	6.4810	7.5932	10.2106	7.3161	4.8107	3.3544	3.5420
rRMSE	B1	0.0831	0.1514	0.2895	0.0923	0.0390	0.0312	0.0372	0.0393	0.0394
	B2	0.0914	0.1105	0.2326	0.1106	0.0611	0.0478	0.0537	0.0563	0.0604
	B3	0.1578	0.2043	0.3865	0.1989	0.1092	0.0848	0.0976	0.1008	0.1083
	B4	0.3109	0.3107	0.3629	0.2791	0.2588	0.1178	0.1194	0.1265	0.2020
	B5	2.7951	3.1693	3.0152	2.9062	1.7539	0.6917	0.5701	1.0898	1.4972
	B7	29.0479	32.9453	36.8776	32.7958	20.4528	13.4620	11.7716	11.6549	21.4117
R²	B1	0.7322	0.6210	0.0046	0.7258	0.8864	0.9286	0.8987	0.8856	0.8832
	B2	0.8006	0.8198	0.6305	0.7501	0.8805	0.9253	0.9040	0.8942	0.8784
	B3	0.7391	0.7637	0.5906	0.6691	0.8366	0.8977	0.8595	0.8524	0.8294
	B4	0.8593	0.8646	0.8523	0.8570	0.8758	0.9477	0.9453	0.9374	0.9045
	B5	0.8239	0.8153	0.8165	0.8085	0.8501	0.9359	0.9316	0.9340	0.8934
	B7	0.6497	0.6241	0.6331	0.5917	0.7640	0.8632	0.8527	0.8614	0.7822
MdAPE (%)	B1	6.5622	13.2961	29.5022	7.1074	1.8064	1.6657	1.7730	1.8510	1.8449
	B2	5.2202	7.1131	18.4440	7.5096	2.5005	2.1433	2.2538	2.3410	2.5008
	B3	9.0660	11.1577	24.4021	12.0061	4.4175	3.5939	3.9685	4.2151	4.4789
	B4	12.2417	12.9670	15.7625	10.1733	6.3822	5.2520	5.3364	5.6182	6.2350
	B5	13.9971	15.8221	16.1082	16.0283	9.8109	7.6567	7.8131	7.8797	8.8956
	B7	22.5586	25.9927	27.0626	26.9987	14.8140	12.1933	12.6551	12.7465	14.7971

Table S5. Statistical indices of tested cases of R6 (coastal area).

		Univariate					Bivariate			
		U-D1	U-D2	U-D3	U-D4	U-D0	B-D1	B-D2	B-D3	B-D4
RMSE	B1	0.0142	0.0143	0.0147	0.0169	0.0121	0.0066	0.0068	0.0071	0.0085
	B2	0.0198	0.0207	0.0208	0.0222	0.0173	0.0088	0.0089	0.0094	0.0113
	B3	0.0284	0.0295	0.0276	0.0248	0.0234	0.0112	0.0113	0.0123	0.0148
	B4	0.0297	0.0304	0.0322	0.0311	0.0275	0.0137	0.0143	0.0164	0.0235
	B5	0.0359	0.0378	0.0369	0.0473	0.0360	0.0165	0.0173	0.0185	0.0220
	B7	0.0324	0.0320	0.0340	0.0428	0.0319	0.0149	0.0149	0.0177	0.0192
MSA (°)		7.7439	0.6713	5.2476	5.5860	5.9100	6.3513	4.7875	2.3158	2.3782
rRMSE	B1	0.0945	0.0915	0.0949	0.1102	0.0740	0.0432	0.0441	0.0469	0.0543
	B2	0.1453	0.1563	0.1496	0.1769	0.1109	0.0621	0.0637	0.0675	0.0774
	B3	0.3478	0.3486	0.3466	0.2170	0.1600	0.0876	0.0925	0.0941	0.1075
	B4	0.3617	0.4112	0.3924	0.3995	0.5653	0.1563	0.1723	0.1838	0.3600
	B5	11.4647	13.7821	10.1868	13.1600	17.3044	4.9087	4.8500	4.8340	5.0239
	B7	32.0493	39.9349	39.9951	59.3157	65.0636	14.9407	14.8874	14.7929	15.8904
R ²	B1	0.8226	0.8163	0.8190	0.7247	0.8575	0.9581	0.9558	0.9506	0.9298
	B2	0.8581	0.8414	0.8475	0.8038	0.8779	0.9686	0.9673	0.9632	0.9471
	B3	0.8240	0.8176	0.8156	0.8492	0.8658	0.9695	0.9683	0.9623	0.9459
	B4	0.9534	0.9463	0.9465	0.9487	0.9546	0.9885	0.9875	0.9835	0.9666
	B5	0.9489	0.9409	0.9383	0.9140	0.9397	0.9874	0.9860	0.9839	0.9775
	B7	0.9267	0.9207	0.9102	0.8939	0.9142	0.9815	0.9813	0.9733	0.9688
MdAPE (%)	B1	5.3681	5.4533	5.5785	6.3599	2.6013	2.2206	2.2432	2.3787	2.4472
	B2	7.9134	8.7516	8.7407	9.5635	3.6238	2.7784	2.8008	3.0015	3.2794
	B3	15.7539	16.5432	15.8976	11.8909	6.3320	4.3366	4.5517	4.6980	5.3372
	B4	11.1494	8.5445	11.0919	11.1417	9.9442	4.9647	4.9653	4.9653	4.9653
	B5	31.4152	23.9368	29.9288	24.4007	27.8503	18.5648	18.5648	18.5648	18.5648
	B7	33.6655	32.2267	55.5885	40.0054	42.3307	29.2171	29.2171	29.2200	29.2200



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