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Supporting Information for

The combined influence of bare surface soil moisture and roughness on SAR backscatter is decoupled in high-dimensional analytic space constructed by generalized regression neural networks

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Table S1

Introduction

This supporting information provides the table to describe in situ soil moisture and roughness measurements in each sampling site and the corresponding SAR backscatter coefficients for the total 147 sampling plots.

Table S1 Description of soil moisture (M_V), correlation length (L), and RMS height (S) from ground measurements of 147 sampling sites, full-polarized backscattering coefficients (σ_{vv}, σ_{hh}, σ_{hv}, σ_{vh}) extracted from Radarsat-2 scene corresponding to those ground measurement sites.

Site ID	Latitude (E)	Longtitude (N)	S (cm)	L (cm)	M_V (vol.%)	σ_{hh} (dB)	σ_{vv} (dB)	σ_{hv} (dB)	σ_{vh} (dB)
1	40.778	107.189	0.91	46.41	17.341	-8.26	-9.69	-15.59	-16.45
2	40.778	107.174	0.84	25.31	20.560	-11.70	-13.20	-17.85	-17.55
3	40.778	107.164	0.8	8.73	17.093	-13.39	-13.56	-18.50	-17.90
4	40.778	107.150	0.82	46.31	18.112	-7.14	-6.08	-17.68	-17.28
5	40.777	107.139	0.38	17.39	22.557	-12.78	-11.09	-21.92	-21.73
6	40.776	107.118	1.05	35.35	20.567	-12.55	-12.80	-26.95	-26.99
7	40.774	107.104	0.78	26.39	21.635	-7.42	-7.44	-19.07	-18.82
8	40.774	107.079	0.5	44.3	19.102	-12.27	-13.34	-20.02	-19.47
9	40.771	107.061	0.87	5.04	15.875	-11.74	-11.77	-23.85	-24.76
10	40.770	107.052	0.77	27.51	15.217	-7.75	-8.07	-20.79	-20.53
11	40.764	107.034	0.59	17.98	15.881	-10.58	-10.30	-21.93	-22.18
12	40.742	106.969	0.69	11.48	15.766	-10.09	-12.31	-19.99	-19.51
13	40.763	106.932	1.32	18.49	15.056	-10.92	-9.53	-21.72	-21.88
14	40.772	106.960	0.49	6.4	17.863	-11.68	-11.63	-25.45	-25.57
15	40.773	106.971	0.48	2.74	18.910	-10.27	-9.45	-22.86	-23.70
16	40.766	106.996	0.42	1.87	18.980	-9.09	-12.47	-17.99	-18.10
17	40.780	106.994	1	22.91	20.721	-9.01	-8.59	-19.63	-19.82
18	40.785	107.004	0.46	5.47	25.711	-10.80	-9.98	-20.63	-20.47
19	40.789	107.015	0.53	41.03	18.281	-8.77	-9.23	-20.67	-20.89

20	40.797	107.031	0.89	9.7	14.881	-12.31	-11.99	-23.49	-24.08
21	40.800	107.059	0.55	41.89	18.496	-6.73	-7.58	-21.70	-20.95
22	40.811	107.074	0.47	7.91	23.317	-9.27	-10.50	-22.50	-23.76
23	40.824	107.092	0.98	29.8	17.190	-9.14	-8.50	-20.24	-20.45
24	40.838	107.117	0.66	14.88	16.398	-13.25	-12.68	-28.61	-29.95
25	40.834	107.139	0.43	4.48	18.739	-11.95	-10.94	-22.71	-23.97
26	40.814	107.142	0.6	2.88	16.685	-9.88	-10.64	-26.47	-27.00
27	40.797	107.143	0.81	26.65	16.078	-8.41	-9.53	-22.71	-22.60
28	40.799	107.157	1.33	26.99	16.617	-12.75	-13.44	-21.94	-21.57
29	40.848	107.128	1.02	9.74	23.209	-8.40	-8.13	-17.29	-16.53
30	40.876	107.130	0.97	17.46	17.483	-7.54	-8.64	-15.92	-15.76
31	40.862	107.103	0.78	11.31	19.125	-8.37	-8.86	-20.97	-21.17
32	40.856	107.097	0.61	22.78	14.843	-11.90	-11.57	-21.26	-21.59
33	40.852	107.082	1	28.87	21.293	-8.15	-8.12	-17.60	-16.96
34	40.844	107.076	0.99	6.71	18.216	-10.63	-10.39	-17.59	-17.83
35	40.837	107.057	0.65	11.54	18.438	-13.70	-13.77	-26.13	-25.72
36	40.800	106.920	0.79	17.24	20.871	-8.44	-10.45	-19.12	-19.47
37	40.829	107.044	0.78	26.06	19.514	-7.70	-7.30	-19.13	-19.29
38	40.823	107.034	0.8	24.53	16.314	-9.35	-9.32	-19.95	-19.23
39	40.826	107.022	0.45	19.9	19.431	-9.81	-8.94	-18.23	-18.72
40	40.835	107.014	0.85	19.96	16.859	-11.79	-11.43	-26.68	-26.60
41	40.833	107.002	0.37	28.47	18.561	-11.72	-11.33	-21.52	-22.19
42	40.854	106.990	0.39	42.98	12.587	-15.19	-15.31	-28.71	-30.73
43	40.855	106.965	0.75	36.53	20.242	-6.96	-6.99	-22.81	-22.53
44	40.847	106.973	0.49	31.62	21.211	-8.66	-8.06	-26.28	-26.18
45	40.841	106.979	0.62	16.42	10.181	-7.34	-8.58	-16.71	-16.72
46	40.836	106.978	0.51	19.05	19.466	-7.84	-9.50	-16.53	-15.87
47	40.827	106.978	0.9	13.4	16.161	-9.80	-11.38	-19.09	-18.99
48	40.816	107.013	0.62	42.01	17.291	-12.44	-9.57	-18.85	-18.58
49	40.808	106.963	0.61	6.72	17.487	-5.88	-11.70	-17.43	-17.20
50	40.815	106.961	0.99	25.65	18.343	-10.08	-10.87	-21.78	-21.73
51	40.822	106.981	0.39	3.46	17.728	-6.38	-6.82	-23.76	-23.80
52	40.831	106.967	0.91	31.61	14.851	-12.68	-12.18	-24.21	-25.64
53	40.836	106.951	0.74	32.26	20.449	-10.21	-10.48	-24.83	-25.51
54	40.832	106.952	0.67	11.85	19.956	-10.25	-8.14	-23.56	-22.80
55	40.827	106.949	0.58	19.26	21.133	-11.12	-11.08	-21.69	-21.37
56	40.836	106.944	0.73	10.04	16.597	-7.89	-7.72	-24.40	-24.55
57	40.827	106.941	0.8	36.53	18.593	-10.36	-10.88	-22.65	-22.31
58	40.811	106.944	0.83	6.58	24.641	-12.03	-9.70	-20.55	-20.25
59	40.806	106.941	0.94	25.27	18.119	-8.55	-8.07	-22.52	-21.84
60	40.794	106.947	0.7	14.49	22.107	-6.58	-6.12	-22.51	-22.15
61	40.789	106.939	0.79	38.49	17.579	-8.51	-7.36	-21.24	-22.56
62	40.787	106.932	0.42	8.44	20.924	-8.90	-9.04	-23.06	-23.42
63	40.784	106.922	0.26	25.41	18.509	-5.64	-6.72	-21.06	-21.00

64	40.789	106.922	0.57	12.31	18.510	-8.17	-7.61	-23.19	-21.91
65	40.793	106.924	0.34	15.05	20.932	-9.06	-8.16	-18.81	-18.57
66	40.797	106.937	0.27	26.49	21.609	-11.30	-11.01	-19.97	-21.03
67	40.809	106.921	0.76	2.98	18.384	-5.88	-11.66	-23.48	-22.88
68	40.816	106.921	0.88	36.54	19.236	-11.36	-11.26	-21.88	-21.11
69	40.821	106.921	0.64	3.31	15.997	-10.90	-11.15	-23.19	-22.23
70	40.823	106.916	0.88	9.51	18.264	-6.50	-9.06	-19.60	-20.17
71	40.824	106.913	1.33	31.88	18.965	-11.06	-10.62	-21.47	-21.33
72	40.824	106.909	0.77	34.38	17.628	-8.55	-6.98	-22.57	-23.67
73	40.825	106.907	0.85	39.23	18.622	-8.87	-9.40	-22.97	-23.69
74	40.830	106.907	0.72	7.67	15.267	-8.53	-8.16	-21.72	-21.92
75	40.833	106.907	0.75	5.97	19.418	-11.71	-12.39	-22.50	-22.89
76	40.833	106.909	1.43	15.04	16.595	-12.46	-13.11	-24.18	-24.59
77	40.837	106.908	1.05	6.34	18.636	-9.80	-9.66	-23.71	-23.50
78	40.839	106.907	0.44	4.6	18.067	-11.22	-11.88	-25.43	-25.11
79	40.835	106.914	0.86	13.91	20.433	-13.03	-13.84	-27.09	-24.23
80	40.828	106.917	0.73	13.57	20.080	-12.32	-11.37	-25.59	-26.19
81	40.829	106.926	0.54	6.66	24.871	-6.84	-7.60	-21.90	-21.89
82	40.837	106.922	0.64	13.36	17.884	-7.46	-7.01	-22.60	-23.06
83	40.843	106.911	0.94	16.31	19.631	-9.49	-10.41	-23.13	-22.59
84	40.843	106.914	0.84	68.59	17.169	-9.91	-10.19	-23.53	-23.26
85	40.844	106.926	1.05	15.68	17.877	-11.58	-10.86	-22.37	-21.78
86	40.846	106.926	0.95	40.49	14.625	-10.05	-9.64	-23.55	-24.32
87	40.849	106.923	0.87	49.03	22.962	-11.66	-11.58	-25.52	-25.49
88	40.851	106.926	1.07	31.87	19.361	-6.73	-8.63	-20.88	-20.32
89	40.853	106.931	1.21	36.45	16.569	-5.94	-7.15	-16.67	-15.97
90	40.854	106.935	0.5	5.75	17.091	-7.55	-8.13	-19.90	-20.02
91	40.853	106.941	1.32	10.32	17.517	-11.15	-10.92	-25.05	-26.03
92	40.852	106.945	0.68	54.88	17.396	-10.45	-10.55	-18.31	-17.66
93	40.849	106.944	0.73	40.88	17.346	-6.39	-6.39	-22.60	-23.97
94	40.845	106.943	0.55	15.87	16.639	-7.45	-7.04	-23.15	-24.69
95	40.843	106.945	0.49	38.36	17.733	-6.90	-6.44	-19.27	-18.69
96	40.843	106.953	0.93	37.02	16.962	-11.56	-12.99	-25.04	-26.31
97	40.857	106.970	1.02	29.09	19.279	-8.56	-12.77	-20.69	-21.68
98	40.862	106.978	0.67	21.9	16.782	-10.42	-11.78	-23.13	-23.05
99	40.864	106.984	1.02	18.07	16.754	-10.69	-11.37	-24.91	-25.44
100	40.869	106.994	0.48	3.02	20.040	-8.96	-8.14	-25.32	-25.04
101	40.867	106.993	1.1	56.72	16.362	-11.38	-11.04	-22.43	-23.16
102	40.863	106.992	0.91	2.63	14.141	-10.64	-11.63	-24.27	-25.15
103	40.860	107.000	0.59	7.47	15.780	-13.53	-13.62	-24.64	-25.09
104	40.860	107.002	1.68	34.55	16.912	-10.30	-8.76	-13.51	-13.82
105	40.861	107.005	0.55	48.26	22.245	-12.45	-10.60	-20.65	-21.29
106	40.859	107.014	1.15	23.41	12.213	-10.82	-9.52	-23.65	-23.24
107	40.856	107.004	0.94	18.39	15.187	-6.68	-8.16	-21.45	-21.89

108	40.851	107.013	0.82	45.37	20.741	-10.63	-10.81	-21.32	-21.05
109	40.847	107.019	1.46	70.82	13.292	-14.79	-13.69	-23.71	-24.53
110	40.842	107.007	0.85	21.46	13.201	-8.42	-8.98	-23.54	-22.60
111	40.847	107.029	0.64	30.18	18.776	-9.08	-9.10	-21.24	-21.64
112	40.858	107.022	0.88	7.58	10.842	-11.94	-11.13	-25.37	-26.24
113	40.863	107.028	0.72	16.06	15.646	-9.05	-10.03	-22.69	-22.91
114	40.854	107.036	0.54	36.53	19.147	-7.48	-9.44	-22.11	-21.76
115	40.850	107.043	0.66	12.77	19.885	-10.72	-11.12	-21.95	-21.56
116	40.849	107.056	1.28	32.2	16.271	-8.60	-7.35	-24.67	-25.58
117	40.854	107.071	1.06	15.62	14.553	-5.75	-5.92	-20.69	-20.47
118	40.859	107.074	0.7	14.14	16.629	-11.21	-10.36	-23.64	-22.58
119	40.858	107.062	0.93	8.12	16.104	-8.64	-11.50	-17.77	-17.23
120	40.863	107.062	0.53	28.71	19.661	-9.71	-9.74	-23.14	-22.48
121	40.868	107.076	0.54	34.01	18.635	-7.29	-6.96	-21.52	-21.89
122	40.876	107.057	0.7	36.57	14.798	-8.49	-7.56	-23.59	-23.55
123	40.877	107.041	0.58	1.92	12.975	-10.48	-13.08	-22.31	-22.78
124	40.873	107.010	0.67	21.1	17.259	-6.60	-6.09	-19.59	-19.27
125	40.869	106.999	0.68	13.57	19.990	-6.38	-7.49	-22.40	-23.60
126	40.880	107.075	1.09	26.99	15.573	-8.65	-8.29	-23.44	-23.12
127	40.883	107.098	0.5	28.35	14.224	-9.18	-8.43	-22.01	-22.62
128	40.884	107.080	0.93	10.58	19.437	-7.62	-7.16	-18.75	-18.37
129	40.884	107.076	1.07	21.84	17.199	-7.80	-8.48	-20.50	-20.31
130	40.890	107.075	0.74	38.65	18.984	-4.85	-6.08	-23.52	-24.24
131	40.890	107.064	0.44	42.34	19.901	-8.90	-6.42	-21.80	-21.26
132	40.889	107.050	1.48	40.54	19.062	-8.08	-8.08	-18.06	-17.77
133	40.876	107.032	0.82	38.32	20.713	-10.42	-10.39	-17.17	-17.23
134	40.882	107.030	0.97	5.83	18.653	-8.36	-9.03	-22.28	-22.59
135	40.893	107.029	0.77	44.25	16.303	-9.83	-10.51	-22.64	-22.77
136	40.893	107.020	0.85	16.51	17.130	-9.84	-10.41	-24.36	-25.42
137	40.893	107.011	1.48	29.24	20.342	-5.04	-10.23	-16.54	-16.67
138	40.891	107.006	1.01	11.06	16.839	-9.23	-7.56	-27.56	-27.76
139	40.891	107.002	1.03	34.03	14.198	-11.31	-12.09	-18.95	-19.56
140	40.892	106.999	0.96	10.69	16.644	-10.51	-11.16	-21.77	-22.23
141	40.892	106.997	0.42	5.59	20.660	-10.19	-9.56	-22.19	-22.24
142	40.887	107.004	0.66	26.91	13.772	-10.10	-9.71	-24.64	-25.31
143	40.861	106.954	1.03	19.58	18.839	-10.30	-10.43	-15.54	-15.19
144	40.874	106.955	0.7	53.22	16.331	-8.88	-9.02	-26.51	-25.54
145	40.883	106.955	0.86	45.01	19.251	-7.05	-8.12	-19.60	-20.47
146	40.898	106.958	0.85	50.61	14.659	-8.81	-9.33	-25.25	-24.76
147	40.909	106.952	0.68	47.29	22.997	-8.44	-8.37	-23.45	-23.06

Ground measurement was carried out under the soil temperature of 10.4 ℃. And soil textures are composed of 8.27% clay, 40.44% sand, and 51.29% silt.