

A Performance Analysis on Soil Dielectric Models over Organic Soils in Alaska for Passive Microwave Remote Sensing of Soil Moisture

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1. Supplementary Figures

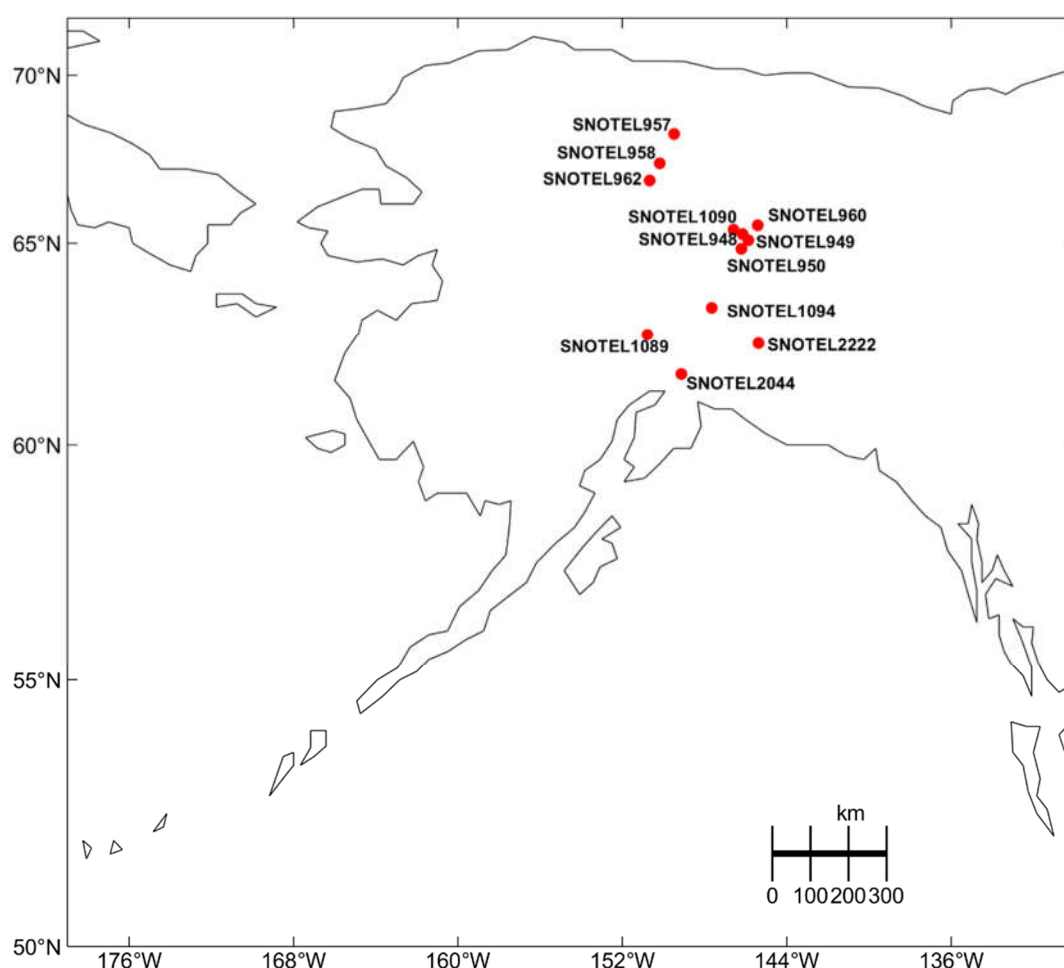


Figure S1. The geographical distributions of all the 12 stations finally used for validation.

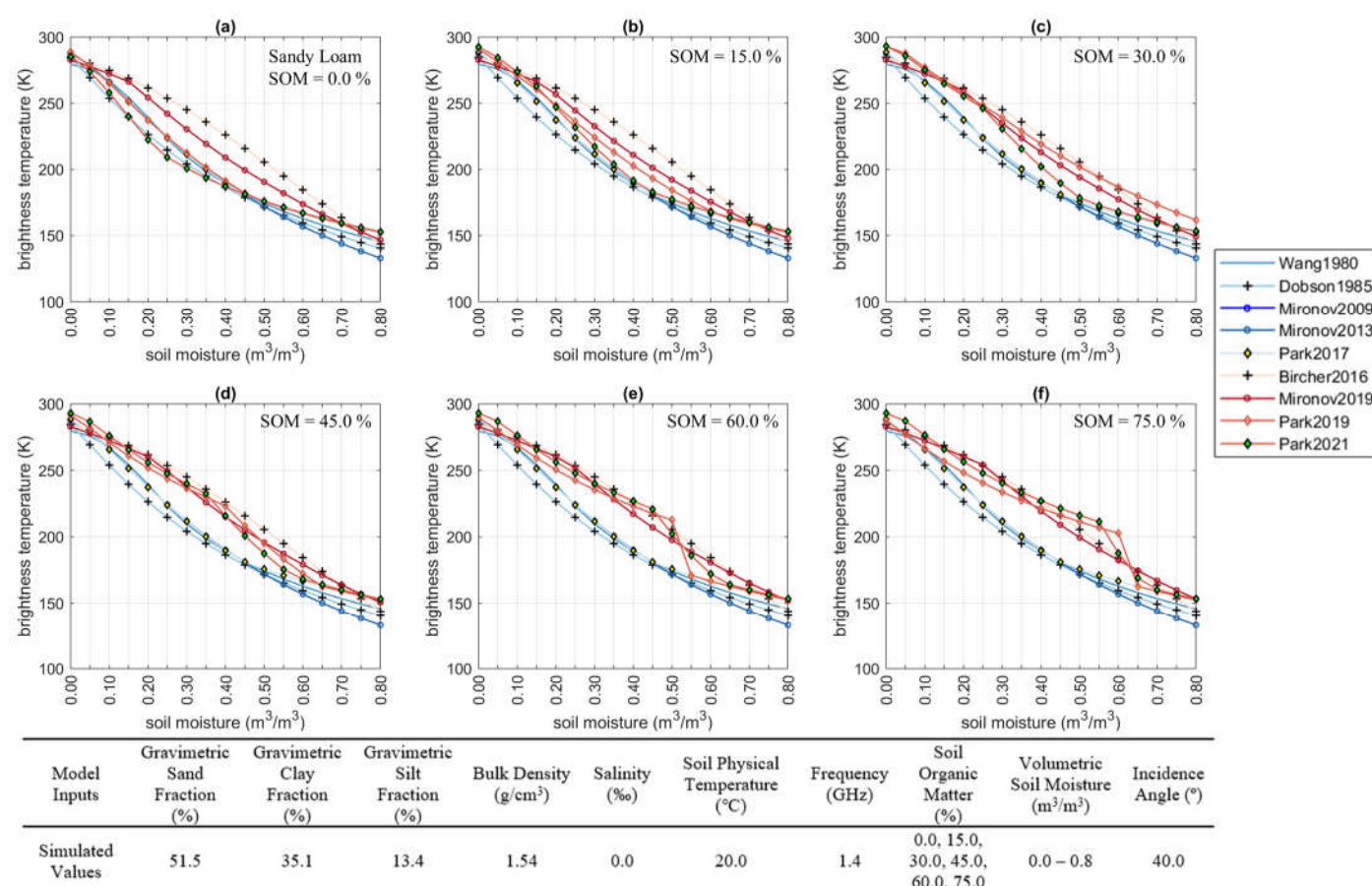


Figure S2. Simulated brightness temperature of a sandy loam with various soil organic matter, and the accompanied table displays all the input values where most of soil parameters are directly taken from the sample of sandy loam used in [1].

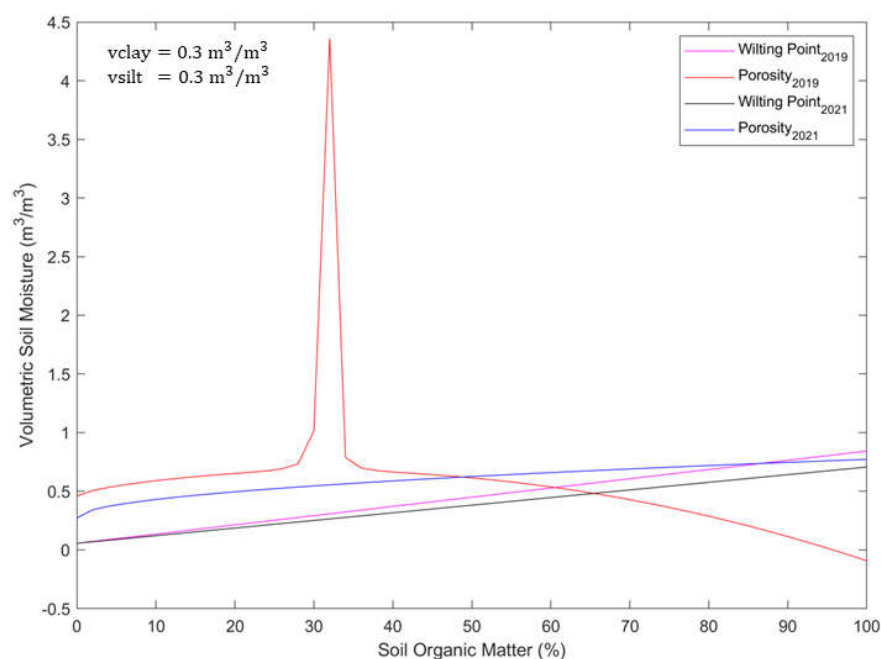



Figure S3. Variations of wilting point and porosity estimated from Park 2019 and Park 2021 with increasing soil organic matter with assumed volumetric textural compositions.

2. Supplementary Tables

Table S1. Detailed information of all in-situ stations investigated in this study.

Index	Station Name	Network	ID	Latitude	Longitude	Available Source	Agreement
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1	Anchor River Divide	SNOTEL	1062	59.86	-151.32	NWCC/ISMN	/
2	Aniak	SNOTEL	2065	61.58	-159.58	NWCC/ISMN	Partially Agreed
3	Atigun Pass	SNOTEL	957	68.13	-149.48	NWCC/ISMN	Partially Agreed
4	Canyon Lake	SCAN	1232	59.42	-161.16	NWCC/ISMN	/
5	Checkers Creek	SCAN	2213	65.40	-164.71	NWCC/ISMN	/
6	Chisana	SNOTEL	1093	62.07	-142.05	NWCC	/
7	Coldfoot	SNOTEL	958	67.25	-150.18	NWCC/ISMN	Agreed
8	Eagle Summit	SNOTEL	960	65.49	-145.41	NWCC/ISMN	Agreed
9	Exit Glacier	SNOTEL	1092	60.19	-149.62	NWCC/ISMN	/
10	Fielding Lake	SNOTEL	1268	63.20	-145.63	NWCC	/
11	Galena AK	SNOTEL	429	64.70	-156.72	NWCC	/
12	Gobblers Knob	SNOTEL	962	66.75	-150.67	NWCC/ISMN	Agreed
13	Granite Crk	SNOTEL	963	63.94	-145.40	NWCC/ISMN	Agreed
14	Gulkana River	SNOTEL	2222	62.41	-145.38	NWCC/ISMN	Agreed
15	Imnaviat Creek	SNOTEL	968	68.62	-149.30	NWCC/ISMN	Agreed
16	Innoko Camp	SCAN	2211	63.64	-158.03	NWCC/ISMN	Disagreed
17	Jack Wade Jct	SNOTEL	1275	64.15	-141.33	NWCC	/
18	Kanaryagak Camp	SCAN	2208	61.36	-165.12	NWCC/ISMN	/
19	Kanut Lake	SCAN	2212	66.18	-151.74	NWCC/ISMN	/
20	Kelly Station	SNOTEL	1175	67.93	-162.28	NWCC/ISMN	/
21	Kenai Moose Pens	SNOTEL	966	60.73	-150.48	NWCC/ISMN	/
22	Little Chena Ridge	SNOTEL	947	65.12	-146.73	NWCC/ISMN	Agreed
23	Lower Mulchatna	SNOTEL	1233	59.82	-156.99	NWCC/ISMN	/
24	May Creek	SNOTEL	1096	61.35	-142.71	NWCC	/
25	McGrath	SNOTEL	785	62.95	-155.61	NWCC	/
26	Mcneil River SGS	SNOTEL	1191	59.08	-154.28	NWCC/ISMN	/
27	Monahan Flat	SNOTEL	1094	63.31	-147.65	NWCC/ISMN	Agreed
28	Monument Creek	SNOTEL	949	65.18	-145.87	NWCC/ISMN	Agreed
29	Moore Creek Bridge	SNOTEL	1176	59.59	-135.21	NWCC/ISMN	Agreed
30	Moose Inc	SCAN	2062	59.68	-151.37	NWCC	/
31	Mt. Ryan	SNOTEL	948	65.25	-146.15	NWCC/ISMN	Partially Agreed
32	Munson Ridge	SNOTEL	950	64.85	-146.21	NWCC/ISMN	Agreed

33	Naknek River	SCAN	2209	58.67	-156.57	NWCC/ISMN	/
34	Nenana	SNOTEL	2081	64.69	-149.91	NWCC/ISMN	Agreed
35	Nuka Glacier	SNOTEL	1037	59.70	-150.71	NWCC/ISMN	/
36	Port Graham	SNOTEL	987	59.35	-151.85	NWCC/ISMN	/
37	Prudhoe Bay	SNOTEL	1177	70.27	-148.57	NWCC/ISMN	/
38	Rocky Point	SNOTEL	973	64.53	-163.42	NWCC/ISMN	/
39	Schor Garden	SCAN	2063	59.68	-151.38	NWCC	/
40	Spring Creek	SNOTEL	2044	61.65	-149.13	NWCC/ISMN	Agreed
41	Summit Creek	SNOTEL	955	60.62	-149.53	NWCC/ISMN	Agreed
42	Susitna Valley High	SNOTEL	967	62.13	-150.04	NWCC/ISMN	Agreed
43	Telaquana Lake	SNOTEL	1266	60.98	-153.92	NWCC	/
44	Tok	SNOTEL	2080	63.35	-142.98	NWCC/ISMN	Disagreed
45	Tokositna Valley	SNOTEL	1089	62.63	-150.78	NWCC/ISMN	Partially Agreed
46	Unalakleet	SCAN	2221	63.91	-160.75	NWCC/ISMN	/
47	Upper Nome Creek	SNOTEL	1090	65.37	-146.59	NWCC/ISMN	Agreed
48	Upper Tsaina River	SNOTEL	1055	61.19	-145.65	NWCC/ISMN	Agreed
49	Weary Lake	SCAN	1234	59.13	-159.09	NWCC/ISMN	/
50	Hozatka Lake	SNOTEL	2210	65.20	-156.64	ISMN	/
51	Ikalukrok Creek	SCAN	/	68.08	-163.00	ISMN	/
52	Point_Mackenzie	SNOTEL	1002	61.39	-150.03	ISMN	/

Table S2. Annual R values between soil moisture retrievals from various dielectric models and in-situ measurements and the SMAP vertically polarized brightness temperature.

Dielectric Models		Mineral Soil Based Models					Organic Soil Based Models				Ground Measurements
Year	N	Wang 1980	Dobson 1985	Mironov 2009	Mironov 2013	Park 2017	Bircher 2016	Mironov 2019	Park 2019	Park 2021	in-situ
2015	9	-0.715	-0.691	-0.716	-0.711	-0.700	-0.715	-0.780	-0.711	-0.709	-0.591
2016	8	-0.714	-0.689	-0.714	-0.711	-0.701	-0.713	-0.779	-0.711	-0.704	-0.502
2017	9	-0.786	-0.763	-0.786	-0.783	-0.774	-0.786	-0.841	-0.784	-0.785	-0.438
2018	7	-0.768	-0.744	-0.768	-0.766	-0.756	-0.769	-0.830	-0.768	-0.763	-0.782
2019	3	-0.591	-0.553	-0.590	-0.588	-0.573	-0.590	-0.695	-0.586	-0.583	-0.373
2020	4	-0.741	-0.722	-0.741	-0.733	-0.725	-0.740	-0.775	-0.734	-0.725	-0.472
2021	4	-0.746	-0.721	-0.745	-0.740	-0.730	-0.747	-0.800	-0.745	-0.737	-0.744
Mean	/	-0.723	-0.698	-0.723	-0.719	-0.709	-0.723	-0.786	-0.720	-0.715	-0.557

where N represents the number of in-situ stations used for the last-column R values, and where the column of the number tagged by bold font represents the dielectric model with the highest negative correlations with the SMAP vertically polarized brightness temperature.

References

- Hallikainen, M.T.; Ulaby, F.T.; Dobson, M.C.; El-Rayes, M.A.; Wu, L.-K. Microwave dielectric behavior of wet soil-part 1: Empirical models and experimental observations. *IEEE Transactions on Geoscience and Remote Sensing* **1985**, 25-34.

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