

CHAPTER XIII. SURFACE SOIL MOISTURE SAMPLING

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A. INTRODUCTION

The primary purpose for collecting ground observations of surface soil moisture was to provide calibration and verification data for the microwave remote sensing instruments. Sites were selected in an attempt to include a representative sampling of the various soil textures and land cover conditions. In addition, it was desirable to have these sites spatially distributed over the study area (in case of spatially distributed rainfall events). For the sites used to verify the ESTAR it was necessary to fly special flightlines, therefore, it was necessary to try to minimize these lines by using as many sites as possible on a given line.

B. SAMPLING SCHEMES

All of the sites fall into one of two categories; quarter-section (large site) or 30 m x 30 m (small site). In both cases, the data were not geolocated to an accuracy suitable for point by point comparisons. It was intended that the average of all samples from a site be compared to the microwave data.

The small sites were sampled primarily to provide a broader more uniform site data base for the active microwave sensors with very high resolution (approx. 10 m). Most of these sites were located at raingage sites as shown in Figure II-1. In addition, data were also collected near each of the Met sites (the actual instrumentation). At each of these sites, 9 samples were collected on a square grid basis (10 m apart).

The large sites were selected to provide verification for the passive microwave soil moisture estimation algorithms. In most cases these were fields that were at least a quarter-section (0.8 km x 0.8 km) of homogeneous land cover. Within each of these fields, samples eight samples were collected every 100m along each of two transects running parallel to the flightline. The first line was typically 150 m in from a road and the second was located 450 m from the road. This yielded at least 16 samples per site. Some of the sites had unusual geometry that required some modifications. In all cases, the original data notebooks contain diagrams for each site and date.

C. SAMPLING PROCEDURE

A gravimetric soil moisture sample was collected using a specially designed scoop that extracts a 5 cm cube. This sample is then placed in a metal can and sealed.

The can number is then recorded on a schematic map of the site showing its approximate location.

These gravimetric samples were then weighed at the ARS lab to obtain a wet weight. All samples were then dried for 24 hours and weighed again to obtain a dry weight. The gravimetric soil moisture was then computed by dividing the difference between the wet and dry weight by the dry weight less the can tare.

D. RESULTS

Table XIII-1 summarizes the site average soil moistures. These values are volumetric soil moistures computed by multiplying the gravimetric soil moisture by the soil bulk density (see Chapter X). The spatial patterns of soil moisture are closely associated with the soil textures. Figure XIII-1 illustrates this for met sites with different soil textures. In addition, land cover also appears to have an influence as shown in Figure XIII-2. The pattern of temporal change, or the total moisture reduction over the experiment is quite similar for all sites.

E. SOIL TEMPERATURE SAMPLING

Soil temperatures were collected at depths of 5 cm and 15 cm using a metal dial type thermometers as well as digital probes. For the large sites, soil moisture was collected at each gravimetric sampling location. Three samples were collected for each of the small sites. All of the observations were recorded in field notebooks, averages are listed in Table XIII-2. In addition to the soil temperature, surface temperatures were collected for all sampling locations at selected sites using an Everest thermal infrared instrument. These were all large sites and are indicated in Table XIII-3.

Table XIII-1. Washita '92 Site Average 0-5 cm Volumetric Soil Moisture

Volumetric Soil Moisture								
SITE	June 10	June 11	June 12	June 13	June 14	June 16	June 17	June 18
AG001	0.295	0.306	0.220	0.248	0.208	0.177	0.144	0.129
AG011	0.293	0.277	0.260	0.221	0.202	0.164	0.142	0.122
AG002	0.287	0.251	0.224	0.214	0.181	0.173	0.150	0.114
AG012	0.319	0.269	0.220	0.207	0.144	0.136	0.119	0.153
AG003	0.252	0.241	0.233	0.209	0.189	0.172	0.120	0.111
AG013	0.207	0.249	0.164	0.172	0.139	0.133	0.127	0.113
AG004					0.088			0.064
MS001	0.294	0.297	0.230	0.202	0.180	0.158	0.123	0.092
MS002	0.434	0.409	0.347	0.316	0.310	0.295	0.268	0.229
MS003	0.177	0.196	0.156	0.155	0.105	0.112	0.095	0.068
MS004	0.245	0.245	0.186	0.214	0.220	0.185	0.172	0.143
MS102	0.445	0.410	0.428	0.406	0.420	0.403	0.398	0.392
MS103	0.238	0.218	0.174	0.207	0.146	0.117	0.116	0.121
MS104	0.325	0.281	0.306	0.304	0.295	0.306	0.254	0.259
RG122	0.394	0.370	0.336	0.305	0.298	0.210	0.212	0.240
RG123	0.361	0.368	0.349	0.354	0.323	0.310	0.303	0.281
RG130	0.258	0.220	0.219	0.161	0.158	0.103	0.077	0.051
RG131	0.346	0.349	0.322	0.292	0.288	0.194	0.165	0.157
RG132	0.239	0.245	0.218	0.201	0.172	0.150	0.138	0.068
RG133	0.211	0.227	0.215	0.201	0.179	0.181	0.111	0.089
RG134	0.095	0.104	0.078	0.081	0.092	0.072	0.051	0.042
RG136	0.390	0.345	0.338	0.304	0.265	0.238	0.173	0.123
RG137	0.428	0.384	0.351	0.308	0.264	0.184	0.156	0.112
RG145	0.374	0.320	0.305	0.304	0.285	0.257	0.207	0.213
RG146	0.295	0.275	0.233	0.260	0.242	0.219	0.184	0.148
RG148	0.305	0.272	0.259	0.276	0.250	0.212	0.183	0.204
RG150	0.384	0.422	0.451	0.434	0.402	0.341	0.355	0.320
RG152	0.373	0.407	0.377	0.402	0.347	0.335	0.333	0.317
RG154	0.261	0.252	0.247	0.220	0.170	0.137	0.131	0.100
RL001	0.377	0.476	0.413	0.353	0.372	0.364		
RL002	0.247	0.235	0.206	0.226	0.200	0.187	0.139	0.106
WS001	0.294	0.243	0.260	0.253	0.217	0.225	0.175	0.170
WS002	0.286	0.236	0.207	0.220	0.183	0.150	0.092	0.088
WW001		0.257	0.210	0.153	0.174	0.098	0.089	0.067
WW002						0.288	0.262	0.252

Table XIII-2. Washita'92 Site Averaged Soil Temperatures

Site	Soil Temperature (Deg. C)															
	June 10		June 11		June 12		June 13		June 14		June 16		June 17		June 18	
	5 cm	15 cm	5 cm	15 cm	5 cm	15 cm	5 cm	15 cm	5 cm	15 cm	5 cm	15 cm	5 cm	15 cm	5 cm	15 cm
AG001	26.2	23.1	26.8	23.3	22.9	24.3	26.7	23.4	27.7	24.3	26.1	24.2	25.7	24.7		
AG002	23.1	22.1	25.4	22.4	27.5	24.0	26.8	23.2	26.6	24.2	25.9	24.5	25.5	24.9	32.6	27.2
AG003	29.0	24.3	21.5	22.4	27.1	24.4	22.4	21.8	29.5	25.2	25.5	24.5	28.0	25.6	27.9	25.8
MS001	30.9	26.1	22.4	22.7	22.9	22.9	24.9	23.9	25.9	25.2	24.2	23.6	25.8	24.2	27.8	25.5
MS002	22.9	21.4	21.8	22.4	22.1	22.2	22.6	22.6	23.1	23.2	23.9	22.6	24.6	24.4	25.1	25.0
MS003	26.7	23.3	23.0	19.4	22.9	20.8	25.1	21.6	23.3	21.8	23.9	21.4	25.1	23.1		
MS004	20.4	18.6	20.1	19.1	21.3	19.6	21.4	18.9	21.9	19.9	23.7	22.3	23.1	21.2	24.1	21.9
MS102	24.7	21.3	21.3	21.3	21.7	21.3	21.7	20.0	22.3	22.0	25.7	23.0	24.3	22.3	24.7	23.3
MS103	24.0	21.3	22.0	20.0	22.0	20.3	21.0	20.0	22.3	20.0	25.7	23.3	26.0	23.7		
MS104	19.0	18.0	20.7	18.7	18.7	18.0	19.0	18.0	20.3	18.7	22.3	24.0	21.7	19.7	21.0	19.7
RG122	25.7	23.0	24.7	21.3	22.3	21.0	20.0	20.0	21.0	21.3	24.7	24.0	22.7	23.0	22.7	22.7
RG123	26.0	23.3	23.0	22.0	24.3	22.7	23.7	22.0	22.3	23.3	33.0	27.0	24.0	24.0	25.7	24.3
RG130	30.3	26.7	29.3	25.3	31.7	27.7	34.0	27.3	30.3	26.3	32.0	26.7	34.3	28.3	37.0	30.7
RG131	32.6	28.0	27.7	23.8	27.7	25.0	35.3	28.7	29.3	26.0	27.7	24.7	39.3	31.3	33.0	28.3
RG132	30.3	26.3	26.3	23.3	26.7	24.7	29.3	25.7	27.0	25.3	28.3	25.7	28.7	26.0	30.0	26.0
RG133	32.0	26.3	25.3	23.0	28.0	23.0	28.7	25.0	28.3	25.7	27.7	25.7	29.3	25.7	29.0	26.7
RG134	34.0	27.0	25.3	23.3	27.0	23.3	27.3	24.0	26.3	24.7	23.7	23.0	29.7	25.7	29.0	25.7
RG136	24.3	21.0	20.0	20.0	20.7	20.3	21.3	20.0	22.0	21.3	25.0	25.0	24.3	23.0	25.7	26.0
RG137	25.7	21.3	21.3	20.7	21.7	21.7	23.7	21.3	23.7	22.3	24.3	23.7	25.7	25.0	27.0	25.3
RG145	22.7	20.3	20.0	20.3	20.0	20.3	20.7	20.0	22.7	22.0	22.3	20.7	25.0	23.0	24.3	23.3
RG146	18.6	18.0	18.7	19.0	18.7	18.7	18.7	18.3	20.3	19.3	23.0	22.0	22.0	22.0	22.7	21.3
RG148	20.2	20.1	20.7	20.7	20.3	20.7	20.3	20.7	22.3	22.7	22.3	21.0	23.0	22.7	23.3	23.3
RG150	25.0	22.7	22.3	22.3	28.0	25.0	28.3	24.7	24.3	22.7	26.3	23.3	23.7	21.7	27.3	23.7
RG152	26.2	23.4	24.7	21.7	25.0	22.3	24.0	21.3	24.3	22.3	24.7	22.7	26.3	23.3	27.7	24.3
RG154	21.5	20.5	20.7	20.7	20.3	20.0	20.7	21.0	24.3	22.7	26.3	24.3	23.3	22.7	23.7	22.7
RL001	24.9	22.6	23.1	22.6	24.4	22.7	25.3	23.1	27.9	26.1	23.2	21.1	23.8	22.1		
RL002	28.7	22.7	20.8	19.5	21.7	19.7	22.0	19.4	22.1	20.4	23.9	21.9	25.1	22.9	24.5	22.9
WS001	23.6	20.4	21.0	19.6	20.0	19.4	21.9	19.9	22.8	20.4	28.3	25.5	30.6	25.2	25.3	22.1
WS002	29.7	23.9	24.4	21.4	22.4	21.6	27.2	23.1	26.8	23.2					31.8	25.3
WW001					27.9	24.4	29.9	24.9	27.9	25.0	25.8	24.1	26.0	24.2	25.5	24.3
WW002			28.1	24.2			29.9	25.1	27.9	24.4	28.2	23.6	30.4		30.2	26.8

Table XIII-3. Washita'92 Site Averaged Surface Thermal Infrared Temperatures

Site	Soil Temperature (Deg. C)							
	June 10	June 11	June 12	June 13	June 14	June 16	June 17	June 18
MS004	27.8	23.1	24.5	26.8	28.5	29.7	29.0	29.9
MS104	28.5	30.6	34.3	34.1	30.5	38.3	35.2	
RL001		32.3	26.0	27.8	31.0			28.6
RL001		32.6	22.9	24.8	27.0	28.5		28.7
WW001				30.5	33.3			
WW002			30.5		33.3			

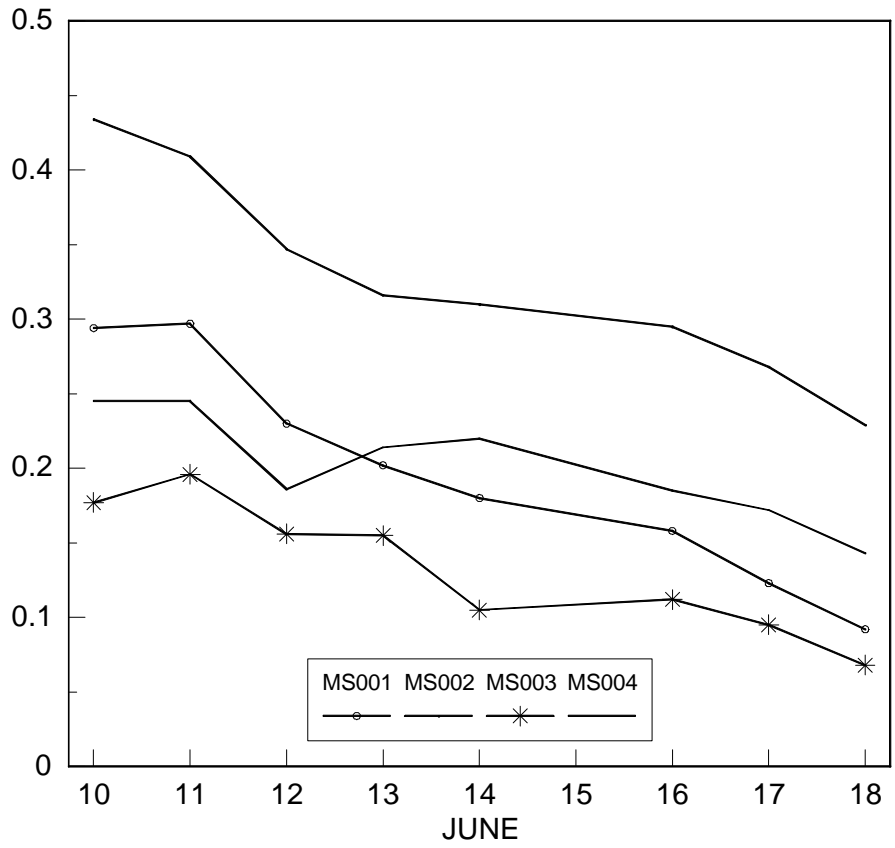


Figure XIII.1. Average 0-5 cm soil moisture at the met sites during Washita'92

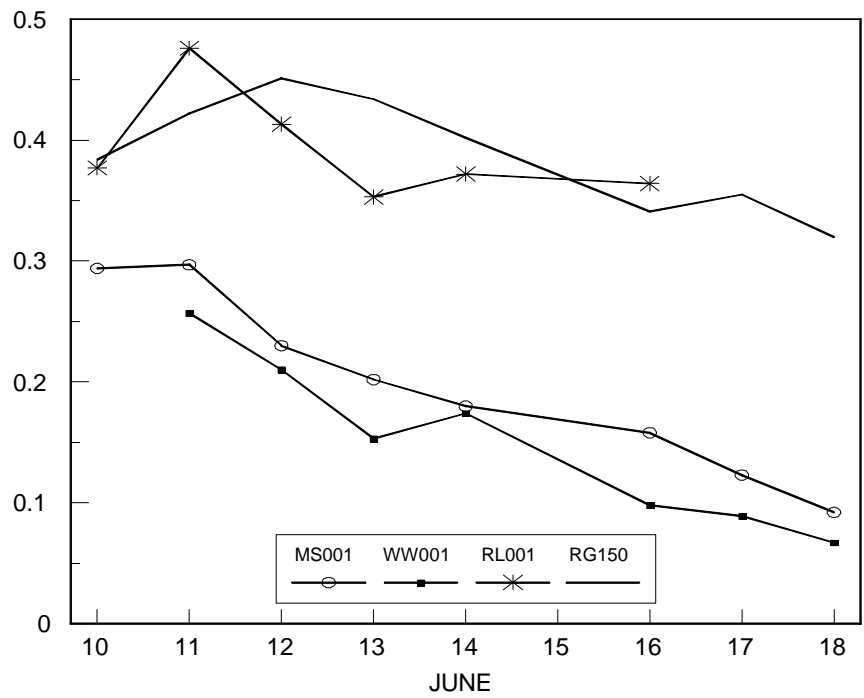


Figure XIII.2. Average 0-5 cm soil moisture at sites located on low altitude line 1 during Washita'92