Addendum to
The Soil Moisture Active Passive Experiments (SMAPEx) Plan

SMAPEx-1, July 5-10, 2010

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Content

1 Overview

This document outlines the changes to the SMAPEx general experiment plan which took place during the SMAPEx-1 experiment, July 5-10, 2010. Any aspect not mentioned here is to be assumed unchanged from the original workplan (Rocco Panciera, Jeffrey Walker, Dongryeol Ryu,Douglas Gray and Thomas Jackson, "The Soil Moisture Active Passive Experiments (SMAPEx), 2010-2011", Experiment Plan, June 2010).

The first SMAPEx experiment was succesfully conducted in early July. A total of 30 hours of flight were conducted across a 6 days period (July 5-10), with ground sampling happening on 5 days (July 6-10). Favourable weather conditions allowed observations of moderately wet winter conditions in the range 0.15-0.25v/v, with an approximate dynamic range of 0.05-0.10v/v during the field experiment. Vegetation condition were mild, with crop and grass biomass in the range 0-1kg/m^2.

Data from SMAPEx-1 are currently being processed and will be made available on the SMAPEx web site.

2 Updates

2.1 Air Monitoring

Flights mostly followed the plans outlined in the workplan. However, they suffered some slight changes in schedule due mainly to meteorological conditions (fog lifting late in the morning). Changes to the original flight plans (Table 5-4 in the experiment plan) are listed in Table 2-1

Table 2-1. Changes to SMAPEx flight plans during SMAPEx-1

Date (AEST)	Flight Type	Comments
5/07	Transect	• Transect flight conducted late afternoon (take-off at 2:15pm, landing at 4:30pm) due to forecast fog in the evening. • No PLMR as purpose was to compare PLIS and PALSAR.
6/07	Regional & Multiangle	• Take-off at 10:45am due to fog, landing at 5:45pm • No post-flight PLMR calibration (sunset approaching) • Only middle run (run 2) for post-flight PLIS calibration done (sunset approaching)
7/07	Target YB	• Take-off at 10:25am due to fog, landing 2:30pm
8/07	Regional & Multigangle	• Take-off at 11:00am due to fog, landing 5:00pm
9/07	Target YA	• Take-off at 10:00am due to fog, landing 2:20pm
10/07	Regional & Multigangle	• Multi-angle flights only in one direction (no azimuth overpass) due to approaching cold front with strong wind and rain • Take-off at 8:30am due to fog, landing at 1:30pm

2.2 SMAPEx Semi-permanent Network

Table 2-2 updates Table 4-2 of the experiment plan for the 24 soil moisture sites in terms of land cover and vegetation type observed during SMAPEx-1. Data availability for the campaign period is also shown.

Table 2-2. Land cover conditions and data availability for the SMAPEx semi-permanent monitoring sites during SMAPEx-1. Changes with respect to Table 4-2 of the experiment plan are highlighted in bold blue color.

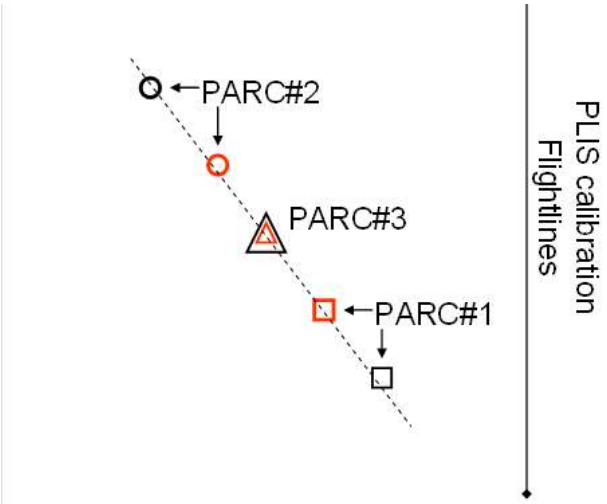
Area ID	Landuse	Vegetation Type	Irrigated	Data availability (All times in UTC)	Comments (All times in UTC)
YA1	**Fallow**	**Stubble**	No	All sensors: 28/06 – 12/07	
YA3	Grazing	Perennial grass	No	All sensors: 28/06 – 12/07	Patch of lush grass around sensors
YA4a	Cropping	Barley	Recently, not currently	All sensors: 28/06 – 12/07	Base of hydraprobe 1cm below surface due to flood irrigation sediment
YA4b	**Fallow**	**Stubble**	No	All sensors: 28/06 – 12/07	Ploughed on 6/07/10
YA4c	Cropping	Wheat	Recently, not currently	All sensors: 28/06 – 12/07	
YA4d	**Fallow**	**Bare**	No	All sensors: 28/06 – 12/07	Few dead stalks on ground
YA4e	Grazing	Perennial grass	No	Not downloaded yet	Probes in wet dip. To be moved
YA5	Grazing	Perennial grass	No	All sensors: 28/06 – 12/07	
YA7a	**Fallow**	**Stubble**	No	All sensors: 28/06 – 12/07	Hydraprobe partially out of the ground (due to insects)
YA7b	**Fallow**	**Stubble**	No	All sensors: 26/06 – 12/07	
YA7d	**Fallow**	**Stubble**	No	No Data	Logger malfunction
YA7e	**Fallow**	**Grass**	No	All sensors: 28/06 – 12/07	
YA9	Grazing	Perennial grass	No	All sensors: 28/06 – 12/07	
YB1	Grazing	Perennial grass	No	Data not downloaded yet	
YB3	**Fallow**	**Stubble**	No	All sensors: 28/06 – 12/07	Hydraprobe partially out of the ground (due to insects)
YB5a	Grazing	Perennial grass	No	• Hydraprobe: only soil moisture and soil temperature logged (28/06 to 11/07/10, 7:30am) • Temp sensors:28/06 – 12/07	Hydraprobe ripped off the ground by cows at 11/07/10, 7:30am)
YB5b	Grazing	Perennial grass	No	All sensors: 28/06 – 13/07	
YB7b/YB5d	Grazing	Perennial grass	No	All sensors: 28/06 – 13/07	
YB5e	Grazing	Perennial grass	No	All sensors: 28/06 – 13/07	
YB7a	Grazing	Perennial grass	No	All sensors: 28/06 – 13/07	Base of hydraprobe 0.5cm below surface sediment
YB7c	Grazing	Perennial grass	No	All sensors: 28/06 – 13/07	Base of hydraprobe 0.5cm below surface sediment
YB7d	Grazing	Perennial grass	No	All sensors: 28/06 – 13/07	
YB7e	Grazing	Perennial grass	No	All sensors: 28/06 – 13/07	Base of hydraprobe 1cm below surface sediment
YB9	Grazing	Perennial grass	No	• All Hydraprobe and 1cm temperature sensor data unreliable • 2.5 and 5cm temperature sensor data: 28/06 – 13/07	Hydrprobe and 1cm temperature sensor off the ground (due to cows)

2.3 PLMR Calibration

The water temperature and salinity buoy at Lake Wyangan was positioned at -34.2202 S, 146.02118 E.

2.4 Polarimetric Active Radar Calibrators (PARCs)

The final locations of the PARCs are listed in Figure 2-1 below. All PARCs were oriented facing East.



Calibration Configuration	PARC#1	PARC#2	PARC#3
Regional	146.4307	146.4264	146.4286
	-34.6311	-34.6275	-34.6293
Target	146.4296	146.4274	146.4286
	-34.6302	-34.6284	-34.6293

Figure 2-1. (Figure top left) Schematic of PARCs locations at the Yanco Agricultural institute during SMAPEx-1 (Black symbols indicate regional configuration, red symbols target configuration); (Table) lists the coordinates of the PARC for each configuration, and (Figure right) view of the PARCs from PARC#2 towards south-east

2.5 Passive Radar Calibrators (PRCs)

The final locations of the PRCs are listed in Table 2-3. Figure 2-2 shows photos and diagram of the locations.

Table 2-3. Coordinates and characteristics of the PRCs locations during SMAPEx-1. (*) co-located with the supplementary station YS4.

PRC#	Latitude	Longitude	Orientation	Land use
TR1*	-34.9763	146.3082	East	Grazing land, perennial grass
TR2	-34.7224	146.0902	East	short wheat (5cm height), flood-irrigated
TR3	-35.9675	146.0007	East	Bare soil, flood-irrigated

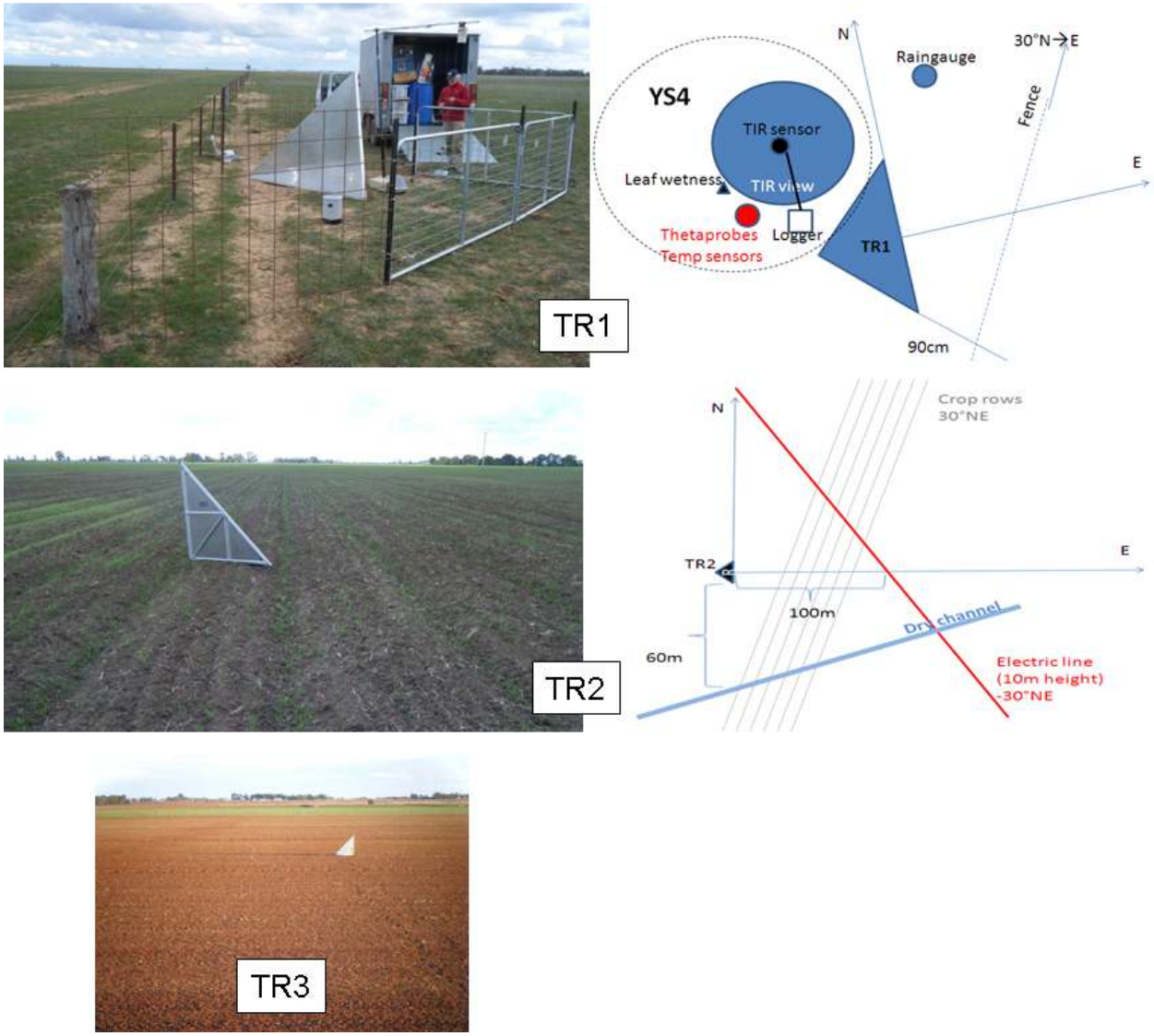


Figure 2-2. Photos and diagrams of the PRCs location during SMAPEx-1. NOTE: TR3 was in flat open field without any obstacle in sight, therefore no diagram is shown.

2.6 Supplementary Monitoring Stations

The four supplementary stations were located in the areas indicated in Figure 6-2 of the experiment plan. The land cover type covered are also those originally planned except for station "YS3" which was moved from barely to lucerne crop. This was due to the very early growth stage of barely in the study area, which at less than 5cm can be assumed be very similar to the wheat already monitored at YS1. The actual coordinates and land cover conditions are listed in Table 2-4. Snapshot of the sites are given in Figure 2-3.

Table 2-5 provides a summary of the sensors installed at each station and the data available. Some problems were encountered with the supplementary stations:

- The thermal infrared sensors installed at YS1 and YS3 required two channel output on the logger, therefore limiting the number of temperature sensors to 3. It was therefore decided to eliminate the 5cm temperature sensors, since 0-5cm soil temperature data are already available at all the SMAPEx semi-permanent stations;
- The thermal infrared sensors installed at YS1 and YS3 were not logged due to a problem with the logger scheme. Only data for YS1 and 9/07-10/07 were recovered;

- The new version of the Thermalert installed at YS2 was discovered to have smaller precision than the old version.

Table 2-4. Coordinates of the supplementary monitoring stations and land cover conditions during SMAPEx-1

Station ID	Latitude	Longitude	Land use
YS1	-34.7235	146.0884	short wheat (5cm height), flood-irrigated
YS2	-34.0106	146.0091	Stubble, 30cm height
YS3	-34.0106	145.0151	Lucerne, 20cm height
YS4	-34.0097	146.0082	Grazing land, perennial grass

Table 2-5. Instruments and data availability of the supplementary monitoring stations during SMAPEx-1

Station ID	Sensors	Data availability	Comments
YS1	1 x Thermal infrared (apogee)	9/07-10/07	Logger problem
	2 x Thetaprobes (0-5, 20-25cm)	01/07-10/07	20-25cm thetaprobe horizontal. 0-5cm vertical
	3 x Soil temperatures (2.5, 15, 40cm):	01/07-10/07	
	1 x Raingauge	01/07-10/07	
	1 x Leaf Wetness	01/07-10/07	
YS2	1 x Thermal infrared (Thermalert new)	01/07-10/07	Poor precision
	2 x Thetaprobes (0-5, 20-25cm)	01/07-10/07	20-25cm thetaprobe vertical in refilled soil (undisturbed soil too hard). 0-5cm thetaprobe vertical
	3 x Soil temperatures (2.5, 15, 40cm):	01/07-10/07	
	1 x Raingauge	01/07-10/07	
	1 x Leaf wetness	01/07-10/07	
YS3	1 x Thermal infrared (Apogee)	None	Logger problem
	2 x Thetaprobes (0-5, 20-25cm)	01/07-11/07	20-25cm thetaprobe vertical in refilled soil (undisturbed soil too hard). 0-5cm thetaprobe vertical
	3 x Soil temperatures (2.5, 15, 40cm):	01/07-11/07	
	1 x Raingauge	01/07-11/07	
	1 x Leaf wetness	01/07-11/07	
YS4	1 x Thermal infrared (Thermalert old)	30/06-13/07	
	2 x Thetaprobes (0-5, 20-25cm)	30/06-13/07	20-25cm thetaprobe horizontal. 0-5cm vertical
	4 x Soil temperatures (2.5, 5, 15, 40cm):	30/06-13/07	
	1 x Raingauge	30/06-13/07	
	1 x Leaf wetness	30/06-13/07	

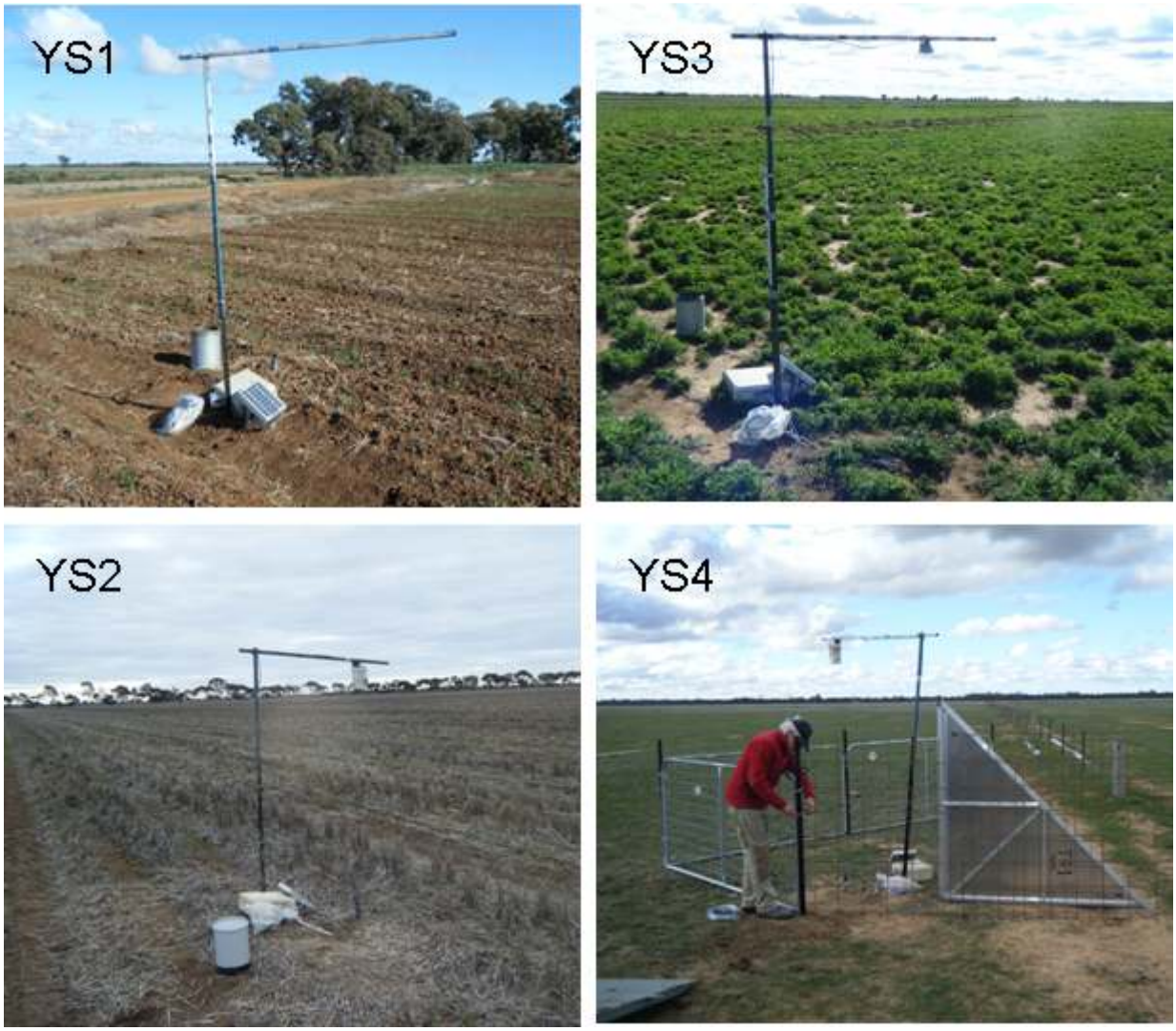


Figure 2-3. Photos of the supplementary monitoring station sites during SMAPEx-1.

2.7 Spatial Vegetation Monitoring

The vegetation sampling approach was affected in both scope and schedule with respect to the original plan due to various factors, including metereological condition (fog and clouds) limiting the time window available for vegetation reflectances and LAI measurements and insufficient manpower. Although the dominant vegetation types for the study area were covered, it was found unfeasible to collect 5 measurements for each dominant vegetation type. Instead, for most vegetation type 1-3 measurements were taken (Note: 1 vegetation measurements is here intended as 1 destructive sample, 5+ LAI reading, 25 CROPSCAN multispectral radiometer reading, vegetation height and observations on crop row spacing and crop row direction where applicable).

Table 2-6 provides a summary of the vegetation measurements collected in each of the six focus areas.

Note: No laboratory observation of LAI was performed on the destructive samples

Table 2-6. Summary vegetation and surface roughness sampling during SMAPEx-1. (*) area sampled across different days. (+) Only CROPSCAN measurements taken.

Area	Vegetation type	Nr. measurements		
		Vegetation	Roughness	Date
YA4*	Fallow	3	3	06/07
YA4*	Barley	3	3	06/07
YA4*	Bare Soil+	3	1	06/07
YA4*	Mix wheat/fallow	1	1	10/07
YA4*	Wheat	1	1	10/07
YA4*	Improved pasture	1	1	10/07
YB7	Pasture	3	3	07/07
YB5	Pasture	3	3	07/07
YD*	Oats 1	3	3	07/07
YD*	Oats 2	1	1	09/07
YD*	Canola	3	3	09/07
YD*	Lucerne	3	3	09/07
YD*	Cereal grain	3	1	09/07
YD*	Mix lucerne/grass	1	1	10/07
YC	Pasture	3	3	08/07
YA7	Cereal grain	1	1	10/07

2.8 Surface Roughness Sampling

Surface roughness sampling followed, with few exceptions, the vegetation sampling schedule and approach, as both were performed by the vegetation team. a summary of the surface roughness measurements is provided in Table 2-6. Note that 1 roughness measurements correspond to 6 1-m long profiles as explained in the experiment plan in section 7.5.

The protocol for surface roughness sampling was slightly changed from that outlined in section 7.5 of the workplan:

1. Note in the roughness sampling form the time and date, the Sample ID, the local time, the focus area ID, the coordinates (from GPS), the land cover type, the vegetation type, the row direction (if crops), the orientation of the roughness measurements (N-S or E-W determined using the compass) as well as the name of the person sampling.
2. Select an area for a 3-m roughness transect (N-S or E-W). Assure that the sun will be at your back when taking roughness photos. Place the roughness profiler temporarily slightly behind and parallel to this intended transect. Clear vegetation if necessary from the proposed transect. Place two pieces of 2”x4” wood (shorter piece on top of longer piece with forward edges aligned) in front of each of the roughness profiler feet.
3. Place the thin white metal rod (used to hold pins in place when the profiler is in storage mode) between the two stacks of wood (aligned near back edge of wood

stacks), and then use the compass to align this white rod exactly N-S or E-W depending on the transect. Once this rod is aligned to the true transect, lift the profiler over and in front of the white rod so that its feet now rest on the two stacks of wood and the profiler is parallel to the white rod.

4. Make sure that all the profiler pins touch the soil surface. The pins MUST NOT be inserted into the ground or be resting on top of vegetation.
5. Level the middle bar horizontally using the level provided.
6. Take a photograph (# 1) of the profiler clearly showing the level of all pins. Note the photo identification number in the roughness sampling form.
7. Lift the profiler back off the wood stacks to behind and parallel to the transects, being careful not to move the wood, and shift the profiler over 1 m so that its left foot is now behind the right wood stack (left and right defined from perspective of photograph). Pick up the wood from the old left foot position and place it in front of the right foot of the profiler in its new position. Place the white rod on the wood stacks, align with compass, and repeat procedure in Step #3-#6 above to take photograph #2.
8. Repeat step # 7 for photograph #3 of the transect. Note that the 3 photographs for the 3-m transect are always taken left to right (as you face the profiler with the camera).
9. Repeat steps #2-8 for the 3,1-m long profilers in the perpendicular direction.

NOTE: this protocol keeps the three 1-m parts of the transect on the same compass line, but produces small gaps in the 3-m long transect between photographs #1and #2, and between photographs #2 and #3, equal to the width of the wood (a little less than 4") under one of the profiler feet.

2.9 Gravimetric Soil Samples

Gravimetric soil samples were collected as planned, except on July 6 when Team B took only 1 HDAS reading per gravimetric sample instead of 3.

2.10 UTC time

Not all data were recorded in UTC time during SMAPEx-1. It was in fact opted to keep some dataset in local time for consistency with daily activities. Table 2-7 lists the time reference used for each SMAPEx-1 dataset

Table 2-7. Time reference used for different SMAPEx-1 datasets. UTC=Coordinated Universal Time; EST=Easter Standard Time (UTC+10hours)

Dataset	Time reference
Airborne data	UTC
HDAS systems	UTC
SMAPEx Semi-permanent network	UTC
SMAPEx additional network	UTC
OzNet Permanent Network	EST
Soil gravimetric samples	EST
vegetation samples, LAI and reflectances	EST
Surface roughness measurements	EST