SMAPEx-1 & SMAPEx-2:

An Overview

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SMAPEx Monitoring Strategy

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Flight Description

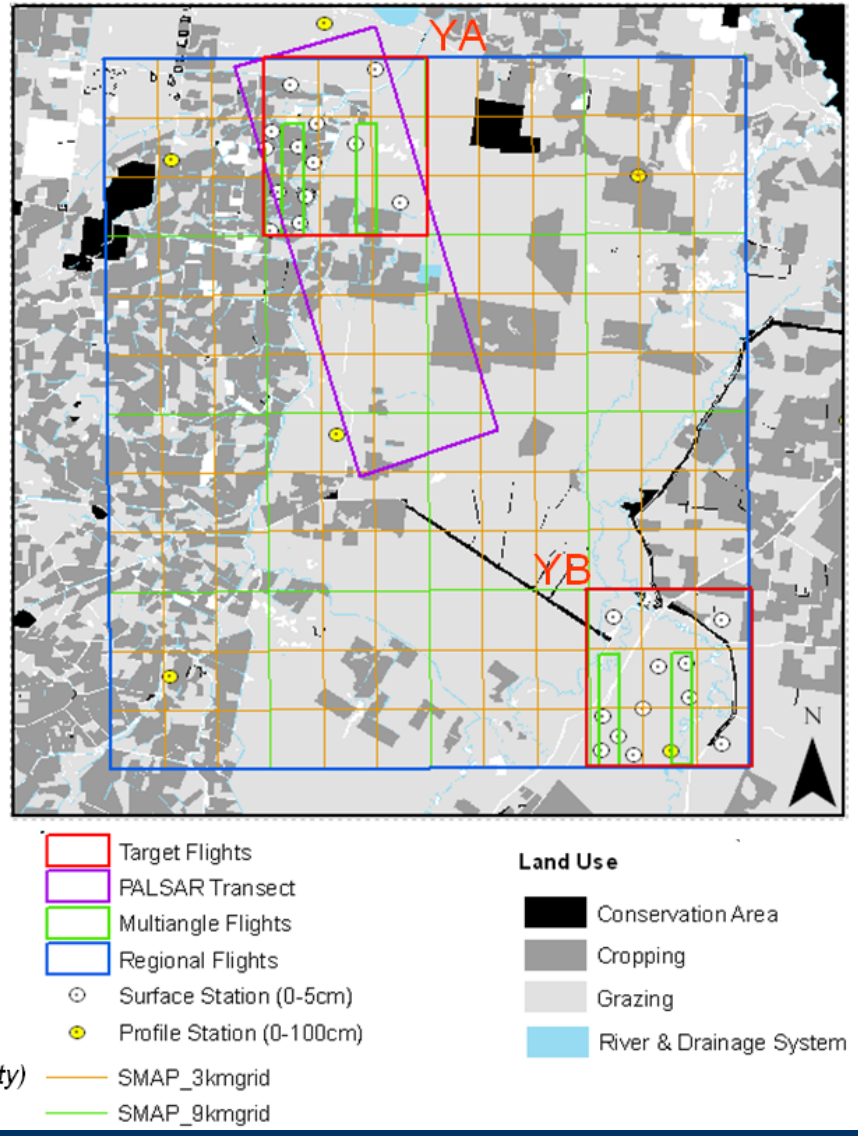
Flight Type	Aim	Altitude (AGL)	Coverage	Ground Resolution
Regional	Active/Passive retrieval	10,000ft	36km x 38km	1km (P)/10m (A)
Multiangle	Effect of incidence and azimuth angle on radar	10,000ft	1km x 6km (2 strips)	1km (P)/10m (A)
PALSAR Transect	Comparison PLIS vs PALSAR	10,000ft	8km x 22km	1km (P)/10m (A)
Target	Radar algorithm development	1000ft	9km x 9km	100m (P)/10m (A)

Weekly Flight Schedule

Flight Type	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Regional		7.30-10.20+		7.30-10.20+		7.30-10.20+
Multi-angle		10.20-13.30		10.20-13.30		10.20-13.30
Transect*	21.40-23.20					
Target			AREA YB 7.30-11.10+		AREA YA 7.30-11.10 +	

**PALSAR overpass at 10:30pm of Monday (Exact day of PALSAR transect flight will change for each campaign accordingly to PALSAR overpass*

+ Sunrise at 7.24am (EDT), start mapping at 8:15am (i.e., 45min after sunrise for Skye data reliability)



SMAPEx Monitoring Strategy

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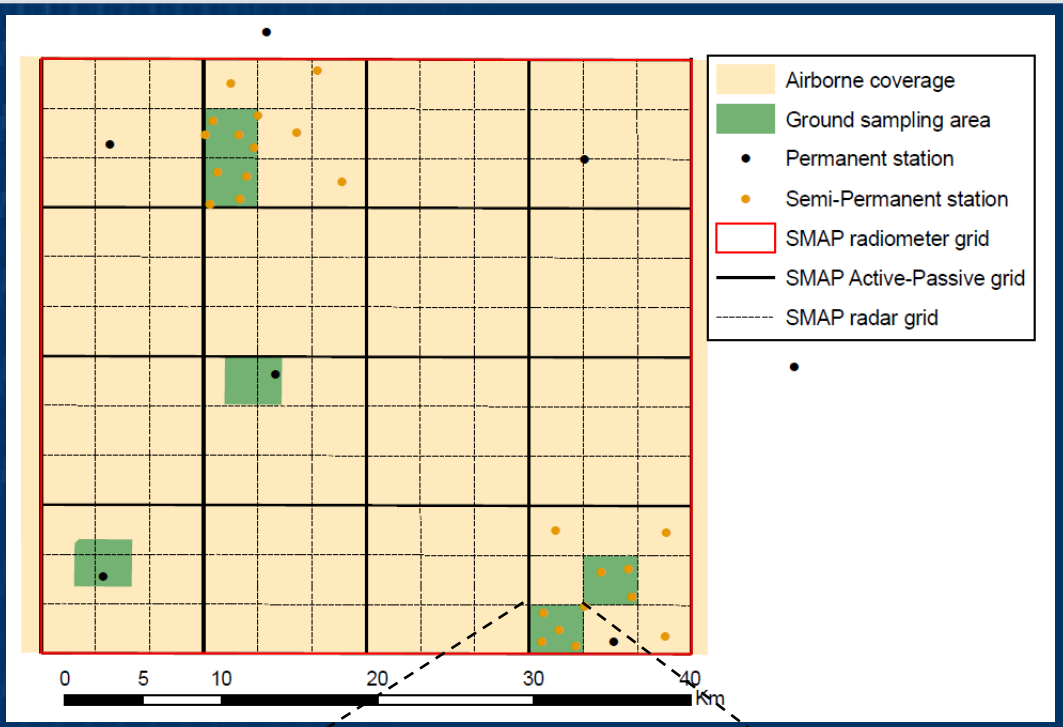
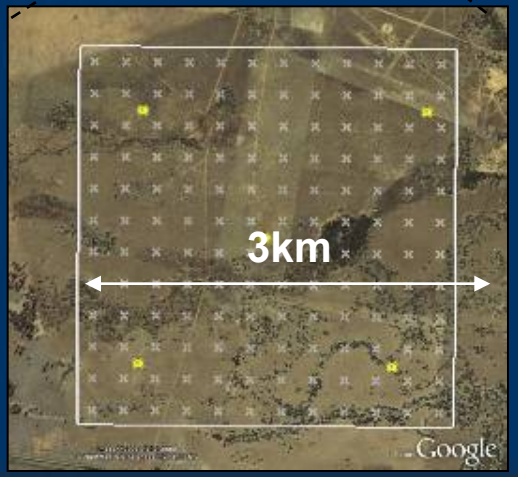
- Ground validation data
  - Continuous soil moisture at 29 sites
  - Continuous TIR/soil temperature at 4 sites
  - Six 3km x 3km focus areas
    - Soil moisture @ 250m spacing (Regional days)
    - Soil moisture @ 50m spacing (Target days)
    - Surface roughness @ 3 sites per dominant vegetation type
    - Vegetation biomass, water content, LAI, reflectance @ 5 sites per dominant vegetation type





Seasonal Cycle

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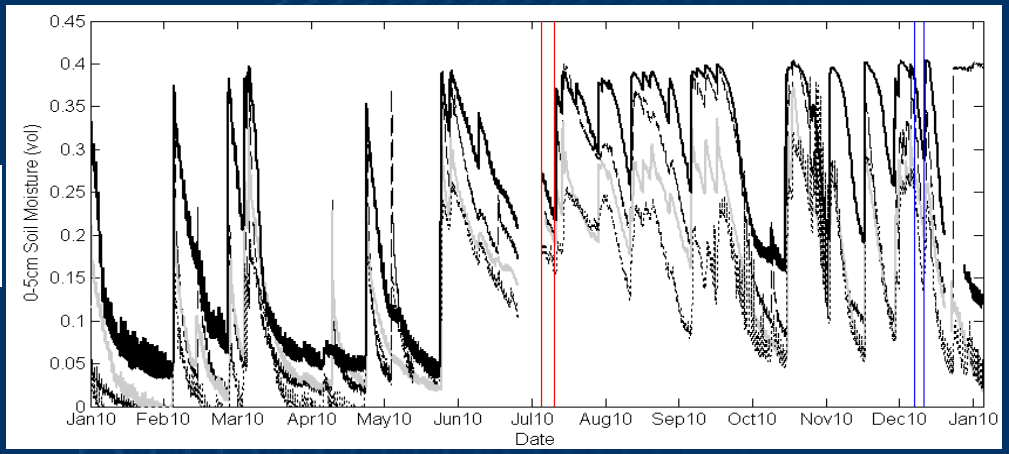
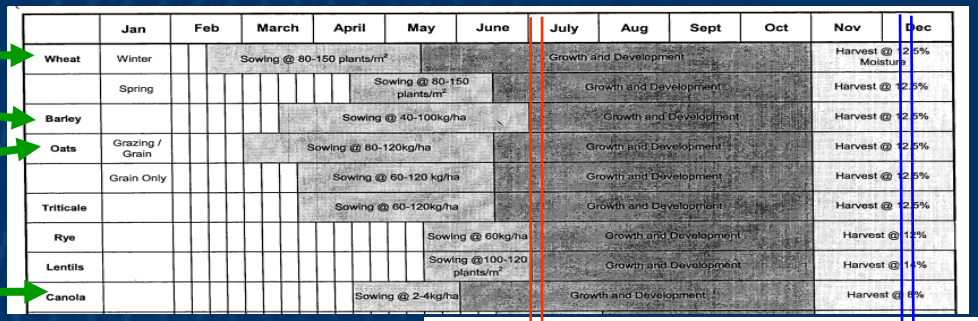
- Soil Moisture

SMAPEx-1: July 5-10
SMAPEx-2: December 4-8

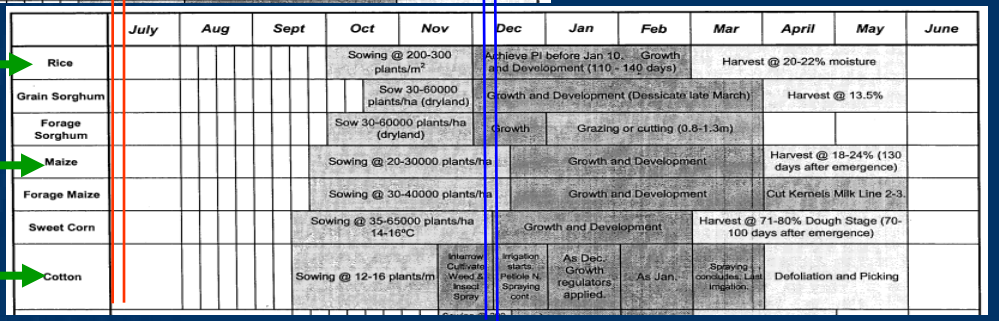


- Crop growth stage

wheat
barley
oats
canola



rice
maize
cotton



SMAPEx-1

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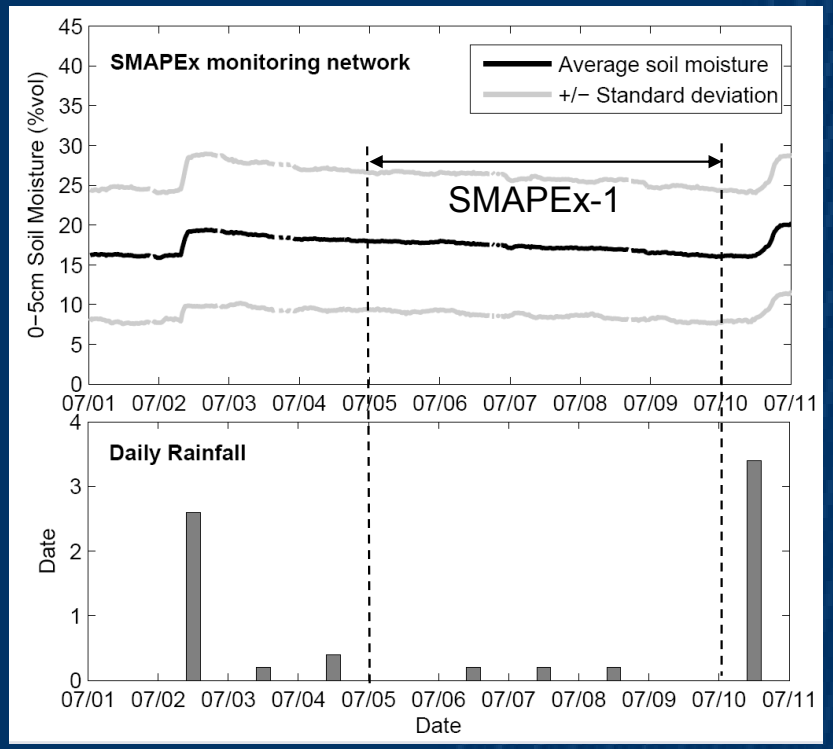

SMAPEx-1 Monitoring

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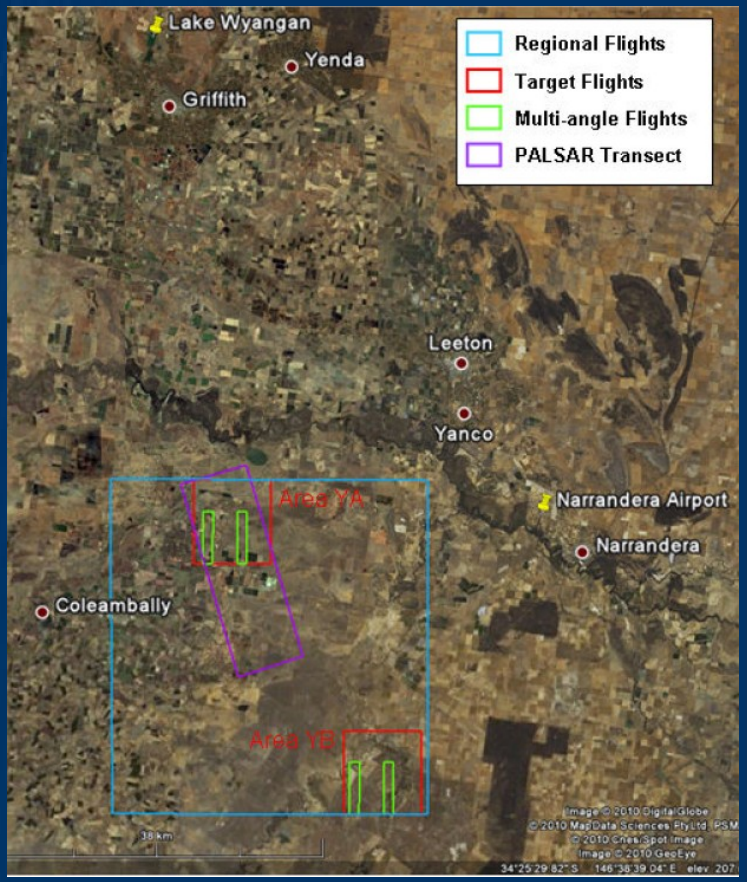
Date	Flight Type	Aim	Comments
5/07	Palsar Transect	Comparison PLIS/PALSAR	• Flight conducted late afternoon due to forecast fog in the evening. • No PLMR
6/07	Regional - Multiangle	SMAP pixel observation Incidence angle effect on σ	• Take-off at 10:45am due to fog
7/07	Target YB	High resolution mapping	• Take-off at 10:25am due to fog
8/07	Regional - Multiangle	SMAP pixel observation Incidence angle effect on σ	• Take-off at 10:00am due to fog
9/07	Target YA	High resolution mapping	• Take-off at 10:00am due to fog
10/07	Regional - Multiangle	SMAP pixel observation Incidence angle effect on σ	• Take-off at 8:30am due to fog • Multi-angle only in one direction due to strong wind and rain



SMAPEx-2

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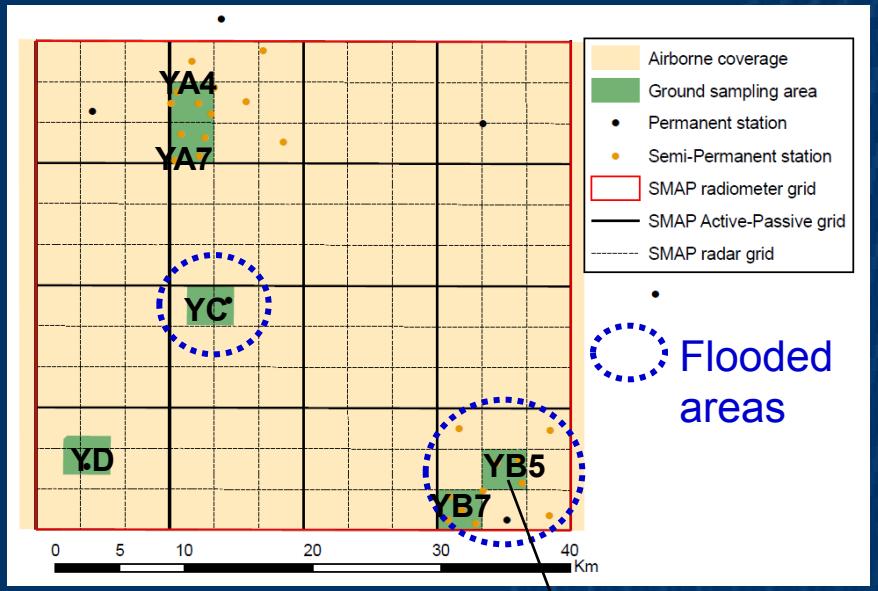
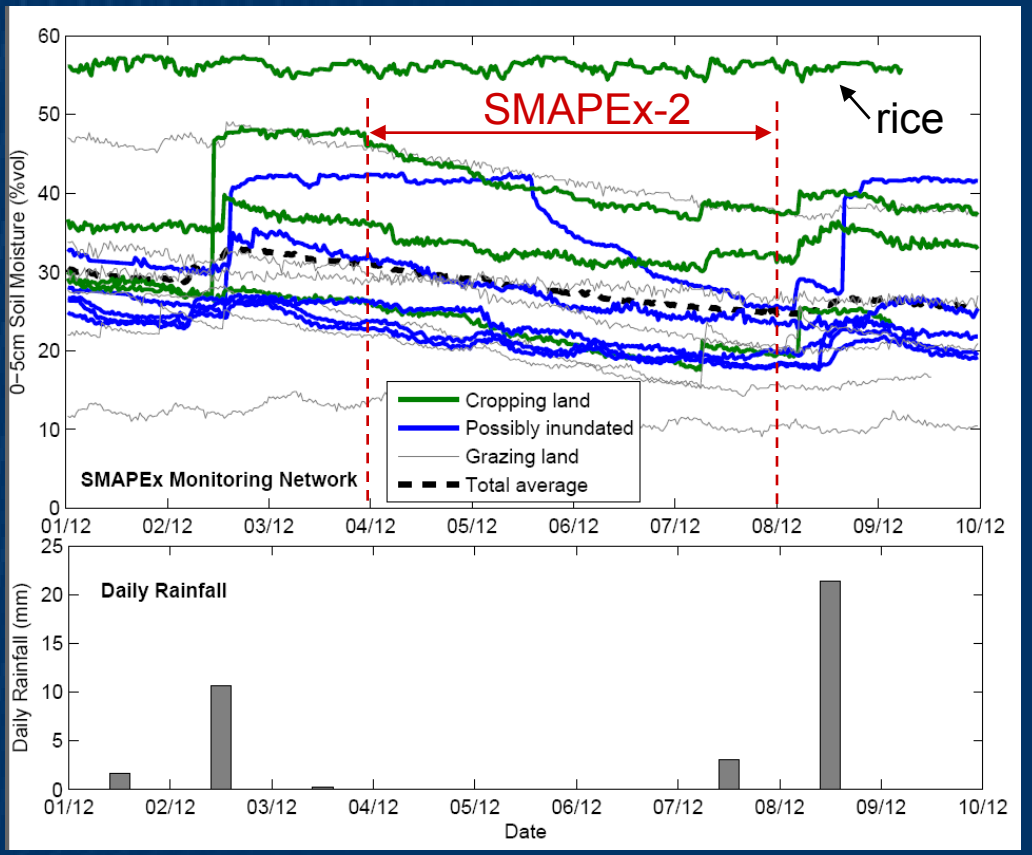
- Extensive flooding





SMAPEx-2 Monitoring

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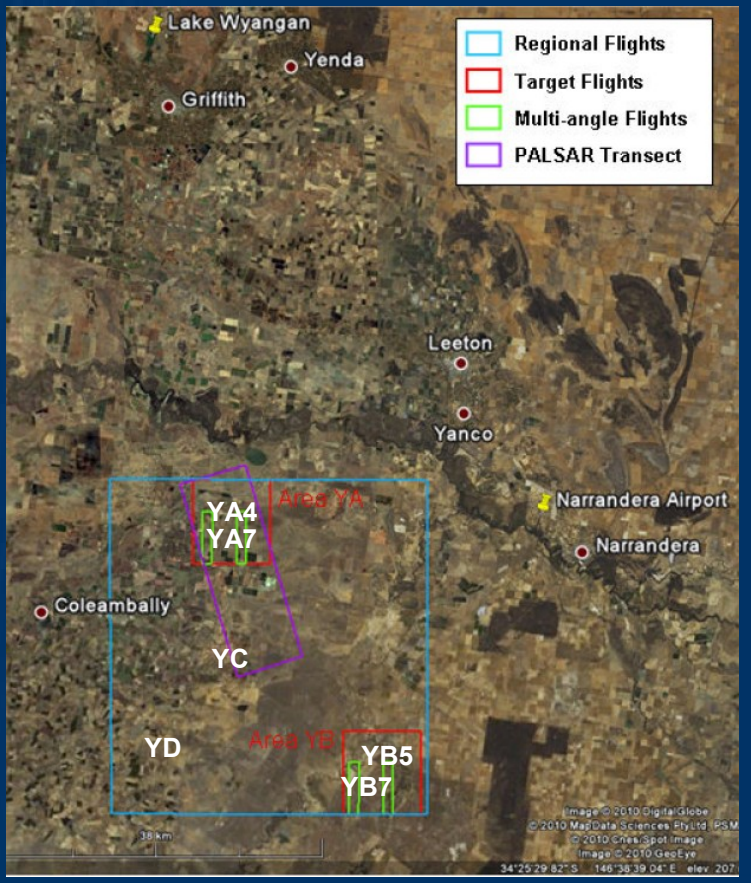
- Changes in monitoring strategy
  - No Target YB flight
  - No ground sampling of YB7
  - Reduced YC and YB5 sampling

Date	Flight	Aim	Comments	Ground
4/12	Regional	SMAP pixel observation	• PLIS right antenna only hh	YA4 **YC (82%)**
5/12	Target YA	High resolution mapping	• PLIS right antenna only hh • Digital camera operating	YA4
6/12	Regional	SMAP pixel observation	• PLIS right antenna only hh • Digital camera operating	YD **YB5 (97%)**
7/12	Multi-angle	Incidence angle effect on σ		YA4 (77%)
	Multi-azimuth	Azimuth angle effect on σ		
	PALSAR Transect	Comparison PLIS/PALSAR		
8/12	Regional	SMAP pixel observation		YA7 (73%)



Regional Flights

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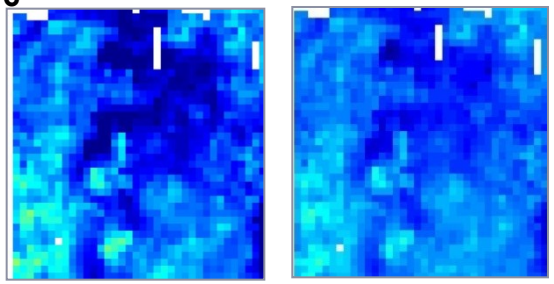
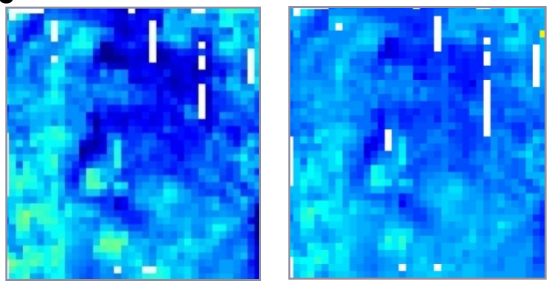
- PLMR

SMAPEx-1

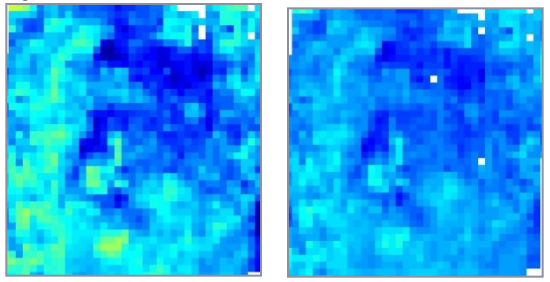
July 6 — Tb-H | Tb-V

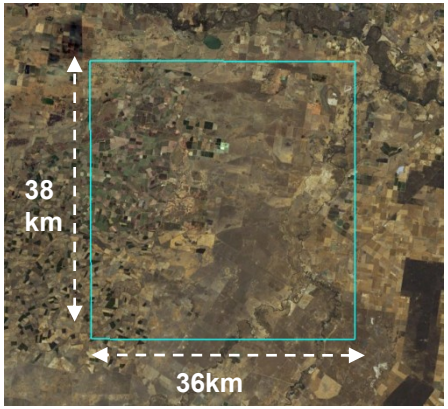


July 8



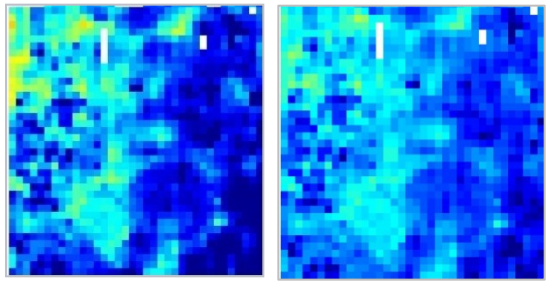
July 10



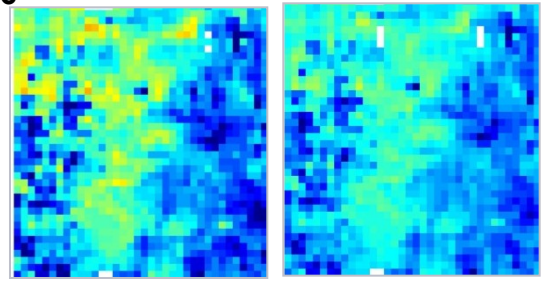


SMAPEx-2

Dec 4 — Tb-H | Tb-V

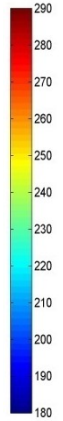


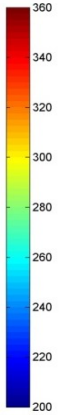
Dec 6



Dec 8

Work in progress… | *Work in progress…*





Target Flights

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- PLMR

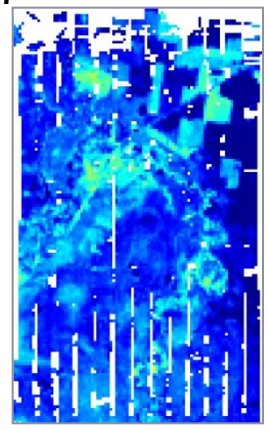
SMAPEx-1

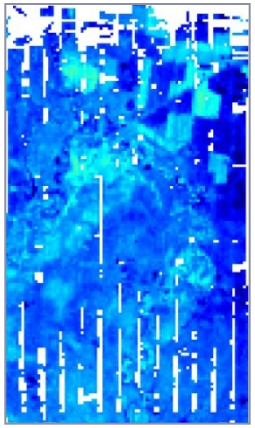
SMAPEx-2

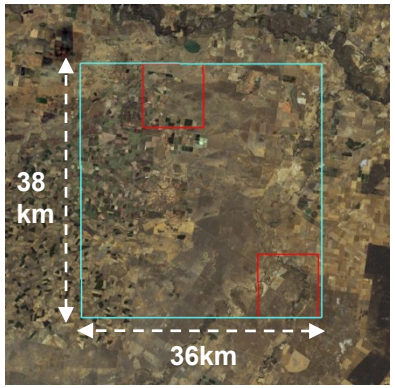
July 7

Tb-H

Tb-V



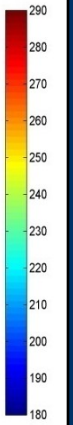




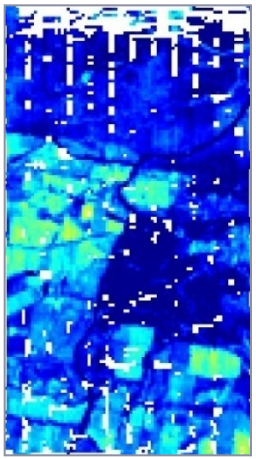
Tb-H

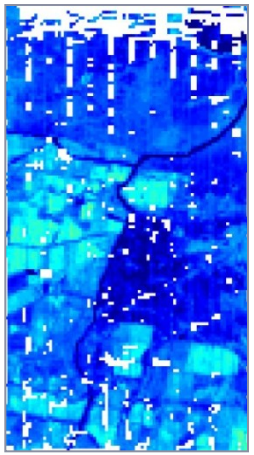
Tb-V

Tb-H
[K]

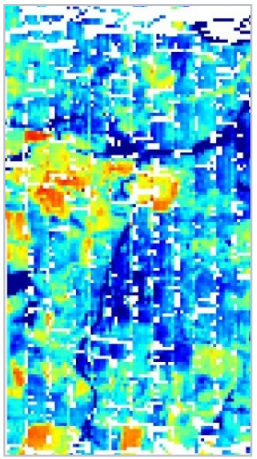


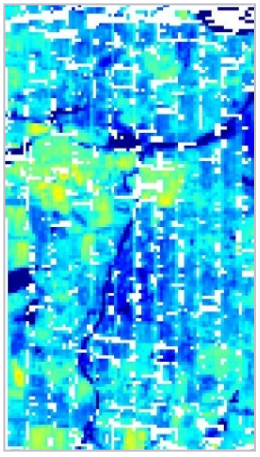
July 9



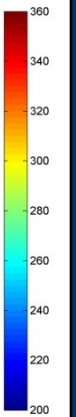


Dec 5





Tb-V
[K]



Airborne Data

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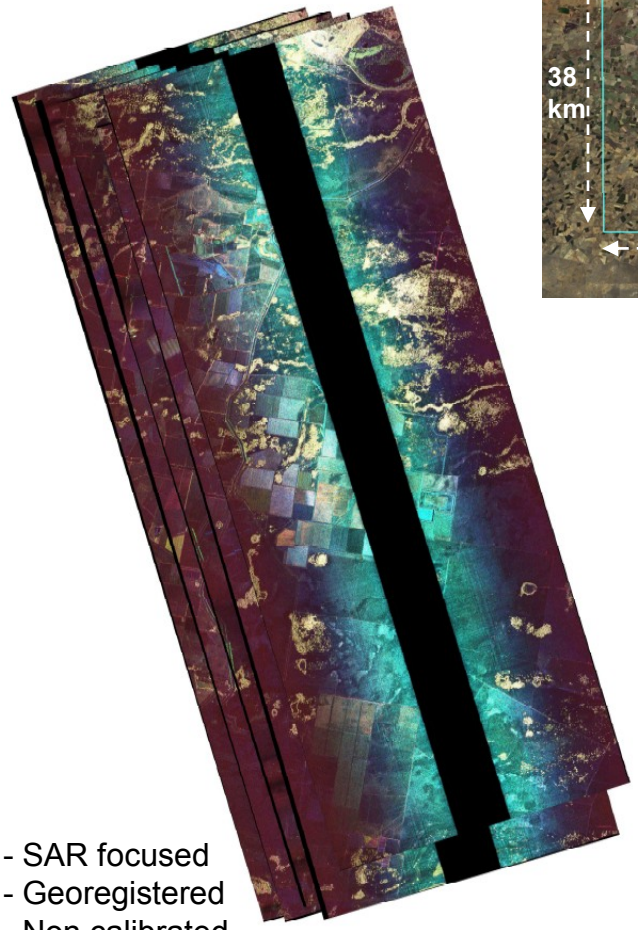
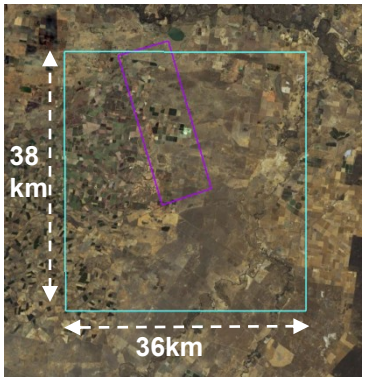
- PLIS, SMAPEx-1,July 5

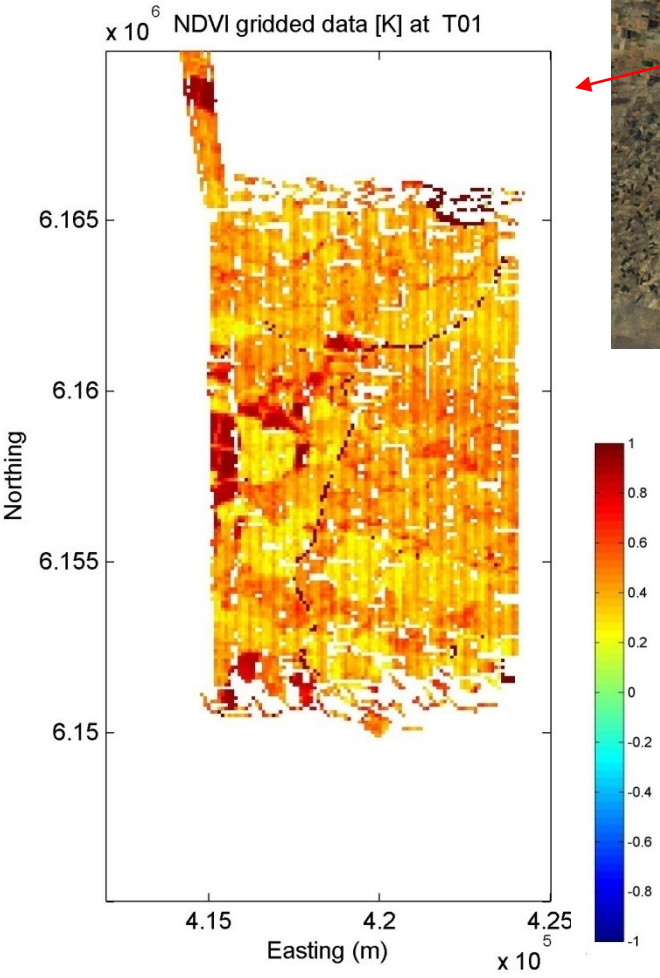
PALSAR Transect

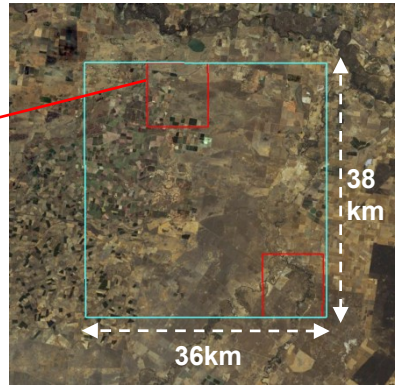




- SAR focused
- Georegistered
- Non calibrated
- Different polarisation combinations for RGB bands

- VIS/NIR/SWIR, SMAPEx-2, Dec 5





SMAPEx-1: Soil Moisture Data

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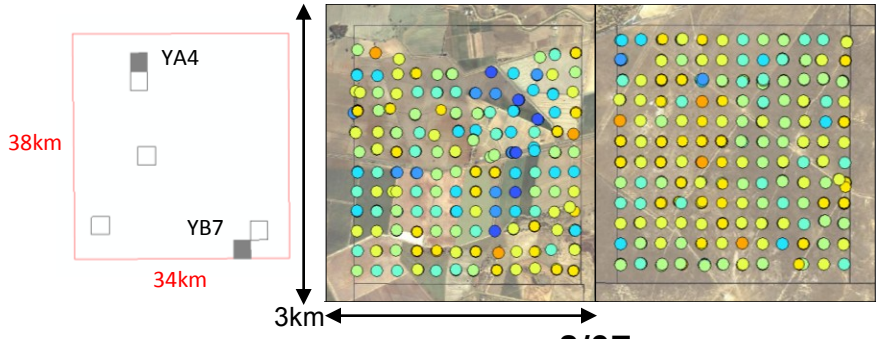
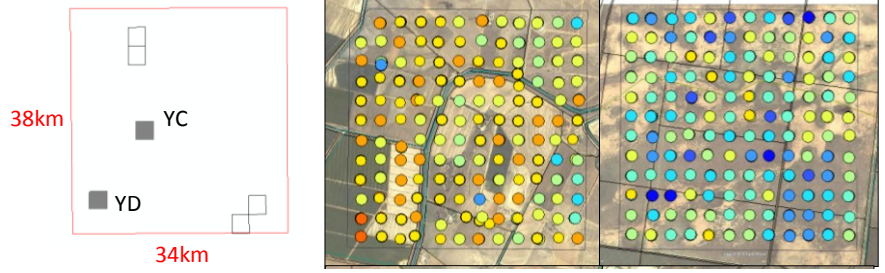
250m Sampling

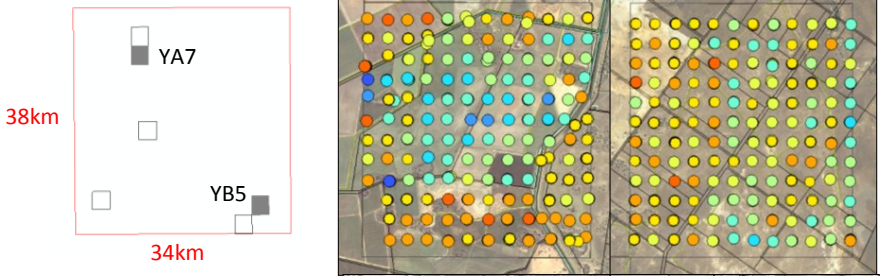
6/07



8/07

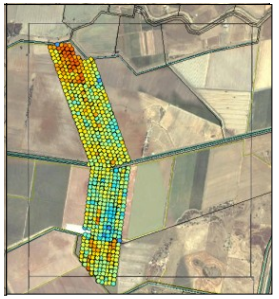


10/07

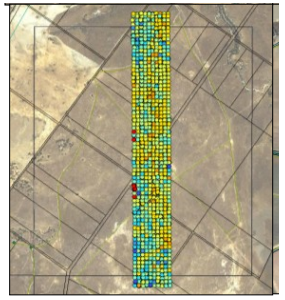


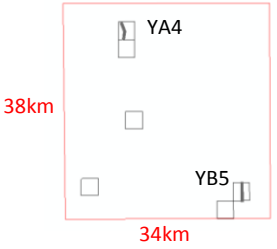
50m Sampling

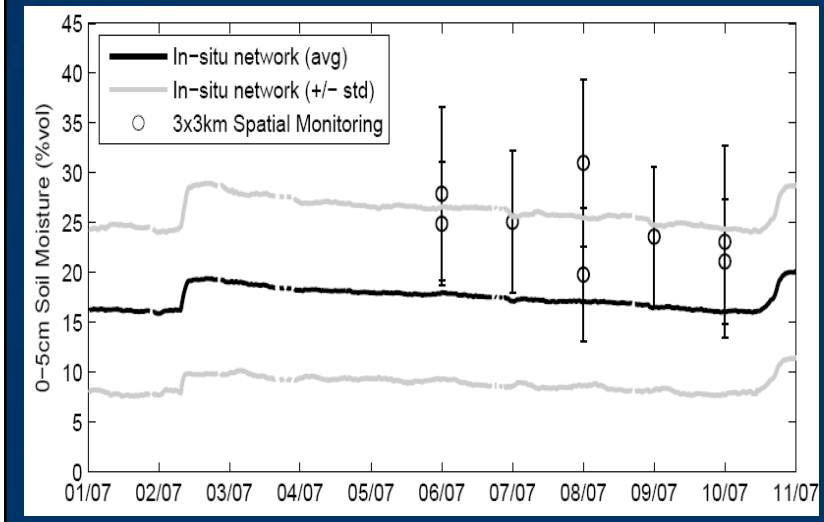
7/07



9/07







SMAPEx-2: Soil Moisture Data

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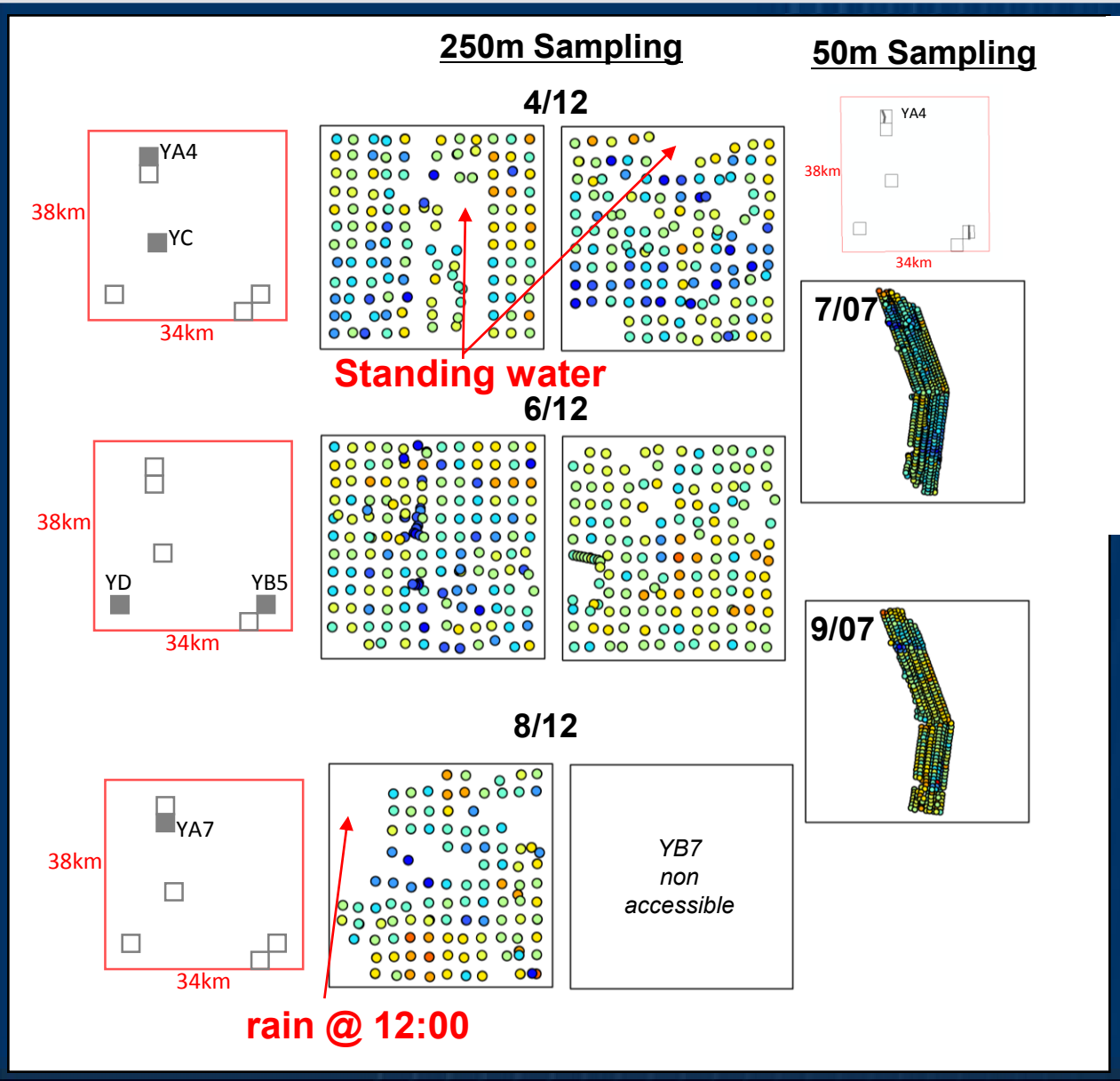

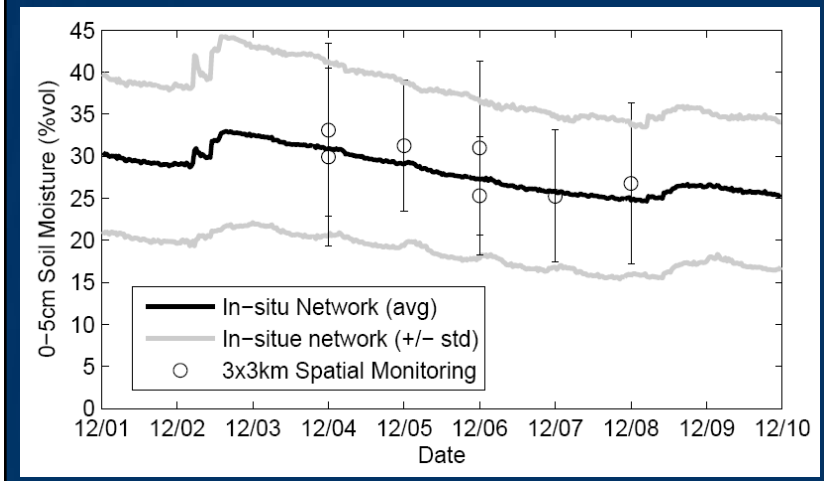

Ancillary Data

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- Vegetation destructive sample, LAI, reflectances

	Nr. of Samples	
Vegetation type	SMAPEx-1	SMAPEx-2
Barley	3	5
Wheat	1	5
Oats	4	4
Pasture	10	23
Maize	3	510(st)+7(leaf)
Canola	3	
Lucerne	4	
Cotton		5
Rice		2
Straw	-	2
Cereal grain	4	-
Bare Soil	3	-
Fallow	3	-
Mix wheat/fallow	1	-

- Surface roughness

	Nr. of Samples	
Vegetation type	SMAPEx-1	SMAPEx-2
Barley	3	3
Wheat	1	5
Oats	4	2
Pasture	10	13
Maize	1	3
Canola	3	
Lucerne	3	
Cotton		3
Cereal grain	1	-
lucerne/grass	1	-
Bare Soil	1	-
Fallow	3	-
Mix wheat/fallow	1	-

1x vegetation = 1x destructive sample + 5x LAI + 25x reflectance

1x roughness = 3x 1-m profile (N-S) + 3x 1-m profile (E-W)

SMAPEx-2: Vegetation Sampling

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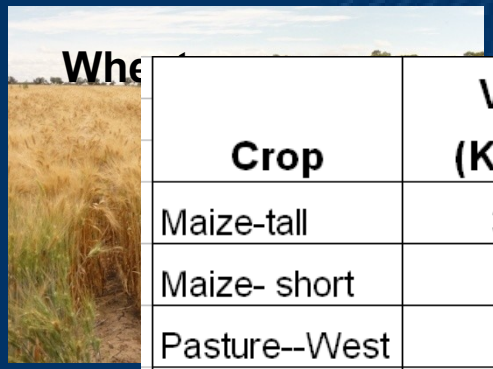

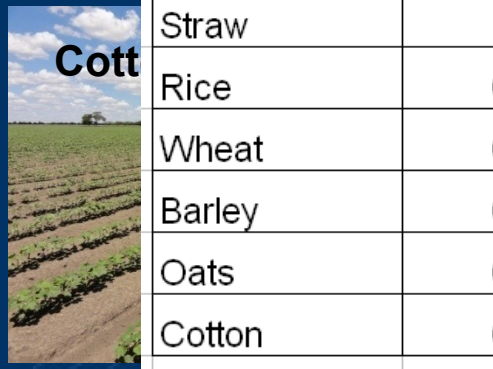

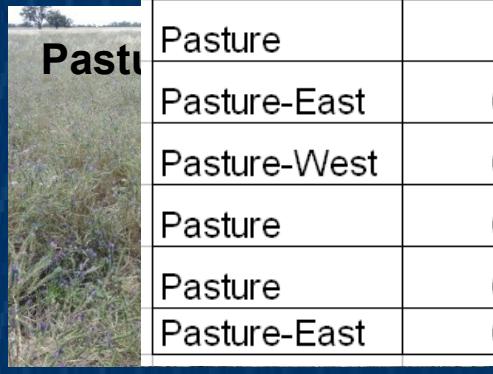

Crop	VWC (Kg/m^2)	Plant Height (cm)
Maize-tall	3.95	170.0
Maize- short	1.38	89.6
Pasture--West	1.16	112.5
Straw	1.11	9
Rice	0.77	31.0
Wheat	0.36	85.6
Barley	0.24	42.6
Oats	0.23	53.3
Cotton	0.21	16.8
Pasture	1.63	140.0
Pasture-East	0.71	55.0
Pasture-West	0.38	62.5
Pasture	0.19	100.0
Pasture	0.15	93.0
Pasture-East	0.02	42.5

Ancillary Data

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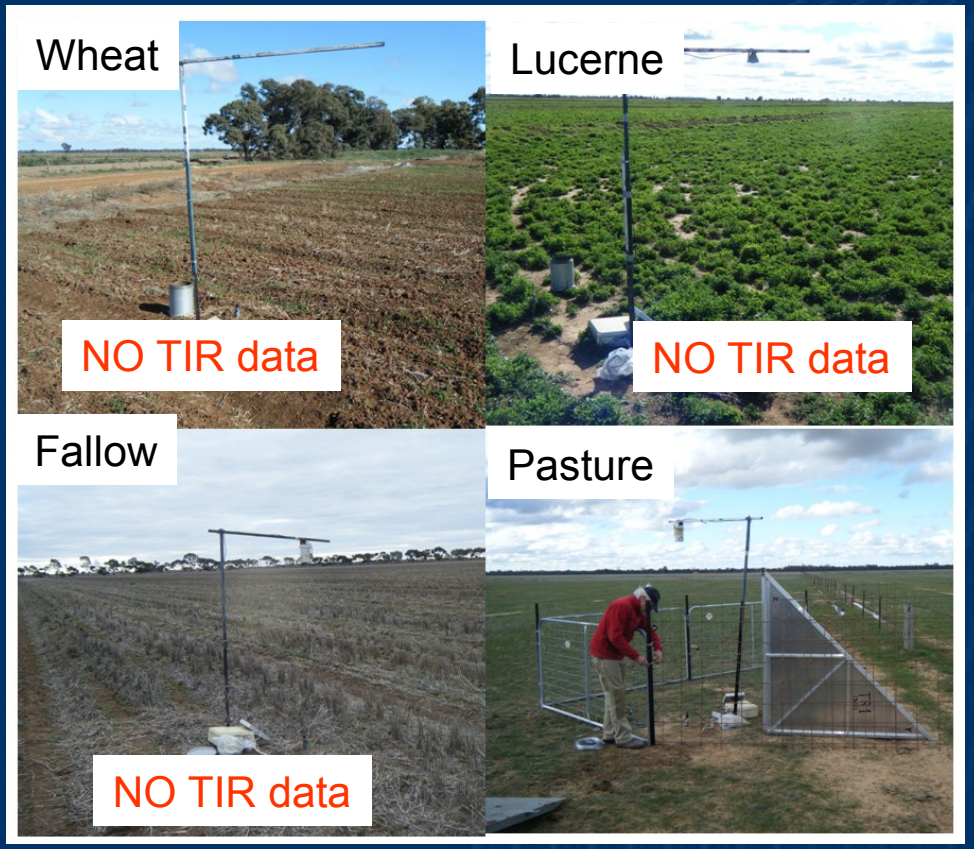
- Thermal IR, profile soil moisture (0-25cm) & soil temperature (0-40cm), dew, rainfall

- SMAPEx-1



- SMAPEx-2

SMAPEx-2: Additional Data

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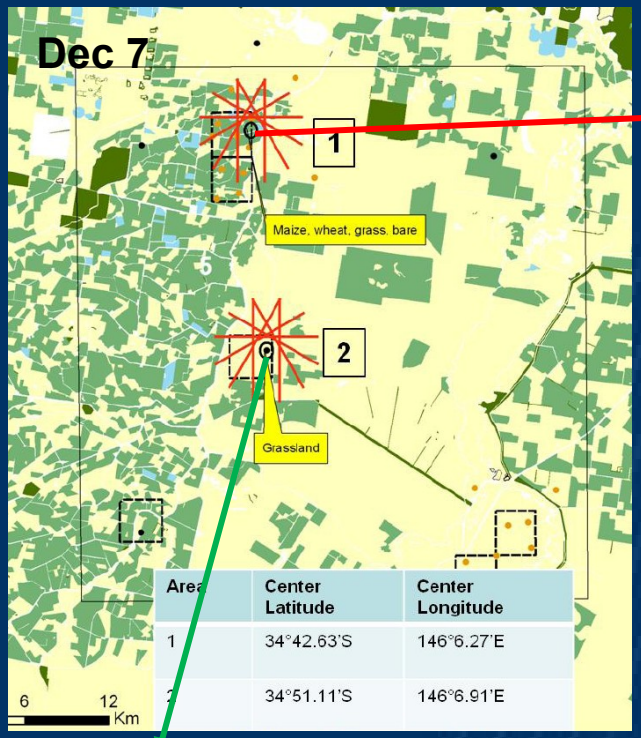
- Multi-azimuth flights



Area	Center Latitude	Center Longitude
1	34°42.63'S	146°6.27'E
2	34°51.11'S	146°6.91'E

- Radar scaling overpasses
  - Effect of resolution on radar obs.
  - Multi-resolution radar images (5m, 50m,150m)

- Ground mapping of standing water
  - Retrieval of standing water in satellite footprints
  - 9 inundated areas boundaries mapped using GPS tracking
  - Extension: $10m^2$– $0.2km^2$

SMAPEx Data and Archive Status

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		SMAPEx-1		SMAPEx-2	
	Dataset	Processing	Website	Processing	Website
Air	PLMR	Processed	Mid-march 2011	Work in progress	Early April 2011
	PLIS	Work in progress	(*)	Raw Data	(*)
	Skye VIS/NIR/SWIR	Work in progress	March 2011	Raw Data	Mid-April 2011
	Thermal IR	Raw Data	March 2011	Raw Data	Mid-April 2011
	Aerial Photo	Raw Data	March 2011	Raw Data	Mid-April 2011
Ground	Soil moisture (SMAPEx network)	Processed	www.oznet.org.au	Processed	Early April 2011 @ www.oznet.org.au
	Soil moisture (HDAS)	Processed	Mid-march 2011	Processed	Early April 2011
	LAI	Processed	Mid-march 2011	Processed	Early April 2011
	CROPSCAN	Processed	Mid-march 2011	Processed	Early April 2011
	Vegetation destructive samples	Work in progress	Mid-march 2011	Processed	Early April 2011
	Surface roughness	Work in progress	Mid-march 2011	Raw Data	Early April 2011
	Thermal IR (monitoring sites)	Raw Data	Mid-march 2011	Raw Data	Early April 2011

(*) PLIS data availability dependent on timeline and/or issues during geo-registration and calibration

The Way Forward: SMAPEx-3

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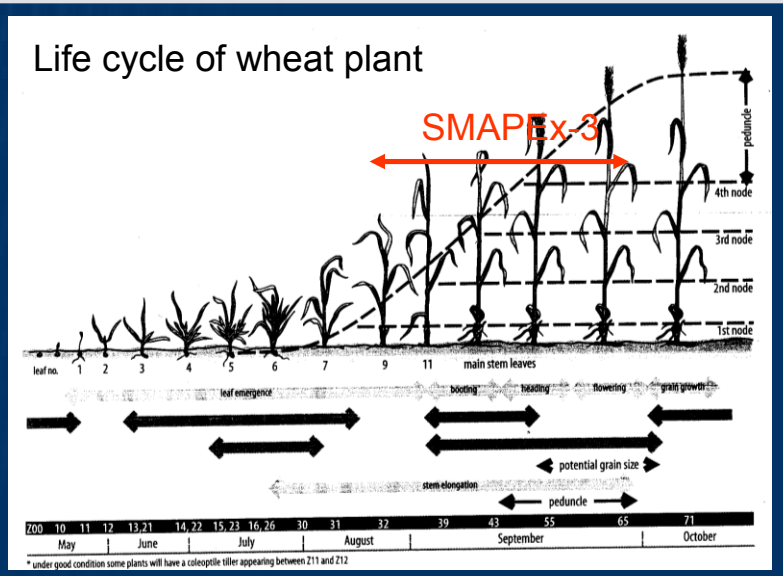
- Focus on change detection techniques
  - 3-weeks campaign to capture crop growth phase
  - regional monitoring with 2-3 days “revisit”



- Radar soil moisture retrieval (Superscience)
  - detailed vegetation structure sampling
  - additional soil moisture sampling
  - monitoring of forest (airborne soil moisture & vegetation)
  - airborne LIDAR and hyperspectral for validation of radar retrieval of vegetation parameters

Participants: SMAPEX-1

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