

Overview: 8-years of soil moisture cal/val in Australia

Jeffrey Walker

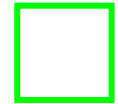
Department of Civil Engineering

+ many others

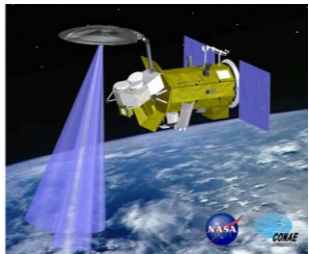
Soil moisture missions (L-band)



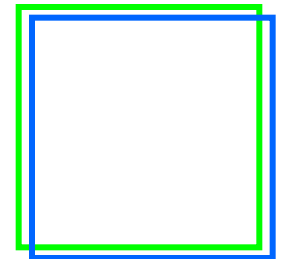
SMOS (Soil Moisture and Ocean Salinity)
launched Nov 2009
40km with 3days repeat; synthetic aperture radiometer



radiometer
radar



AQUARIUS (Ocean Salinity and soil moisture)
launch June 2011
~100km with 7days repeat; “traditional” active passive

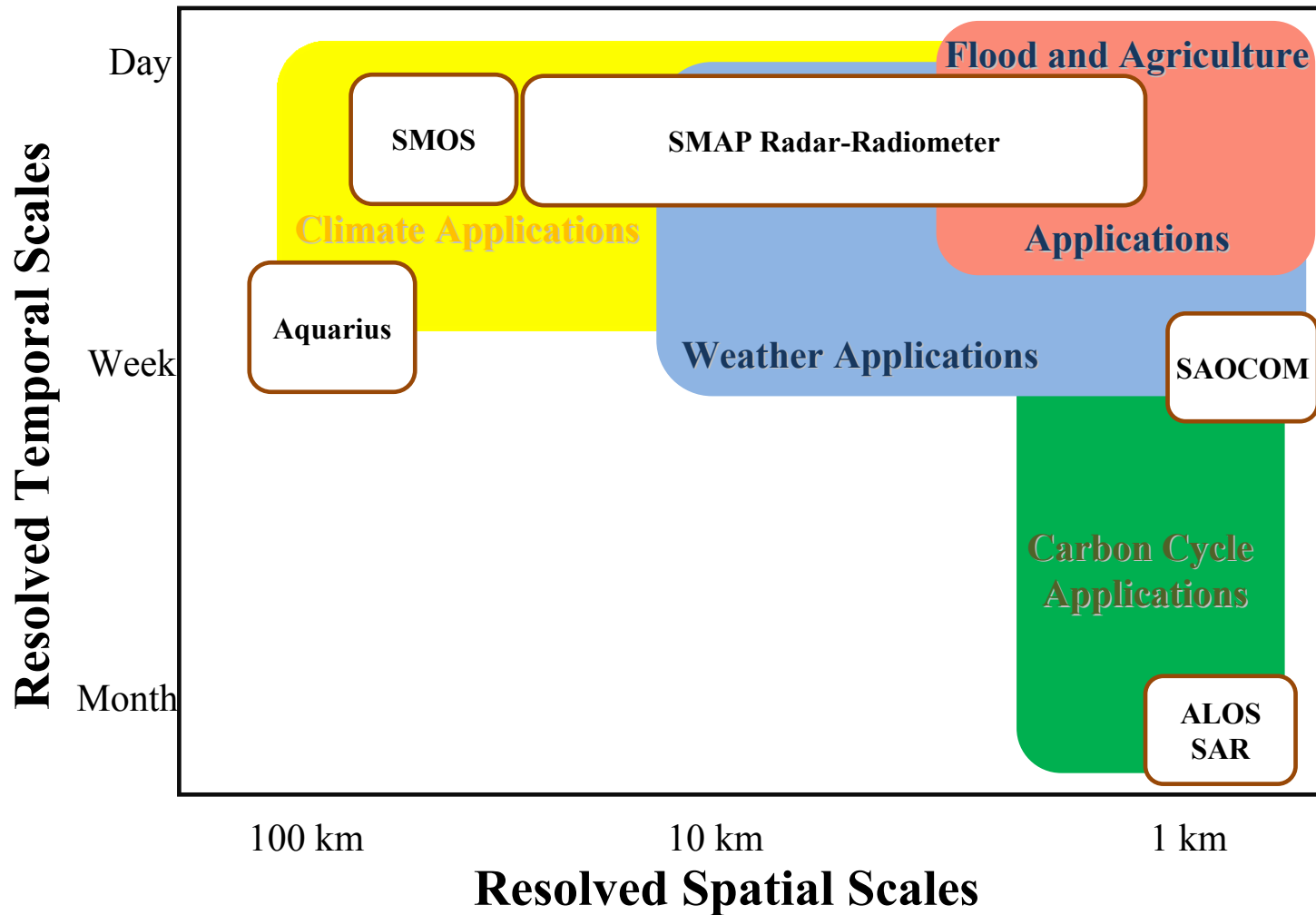


SMAP (Soil Moisture Active Passive)
launch ~2014
40-10km with 3days repeat; high resolution active



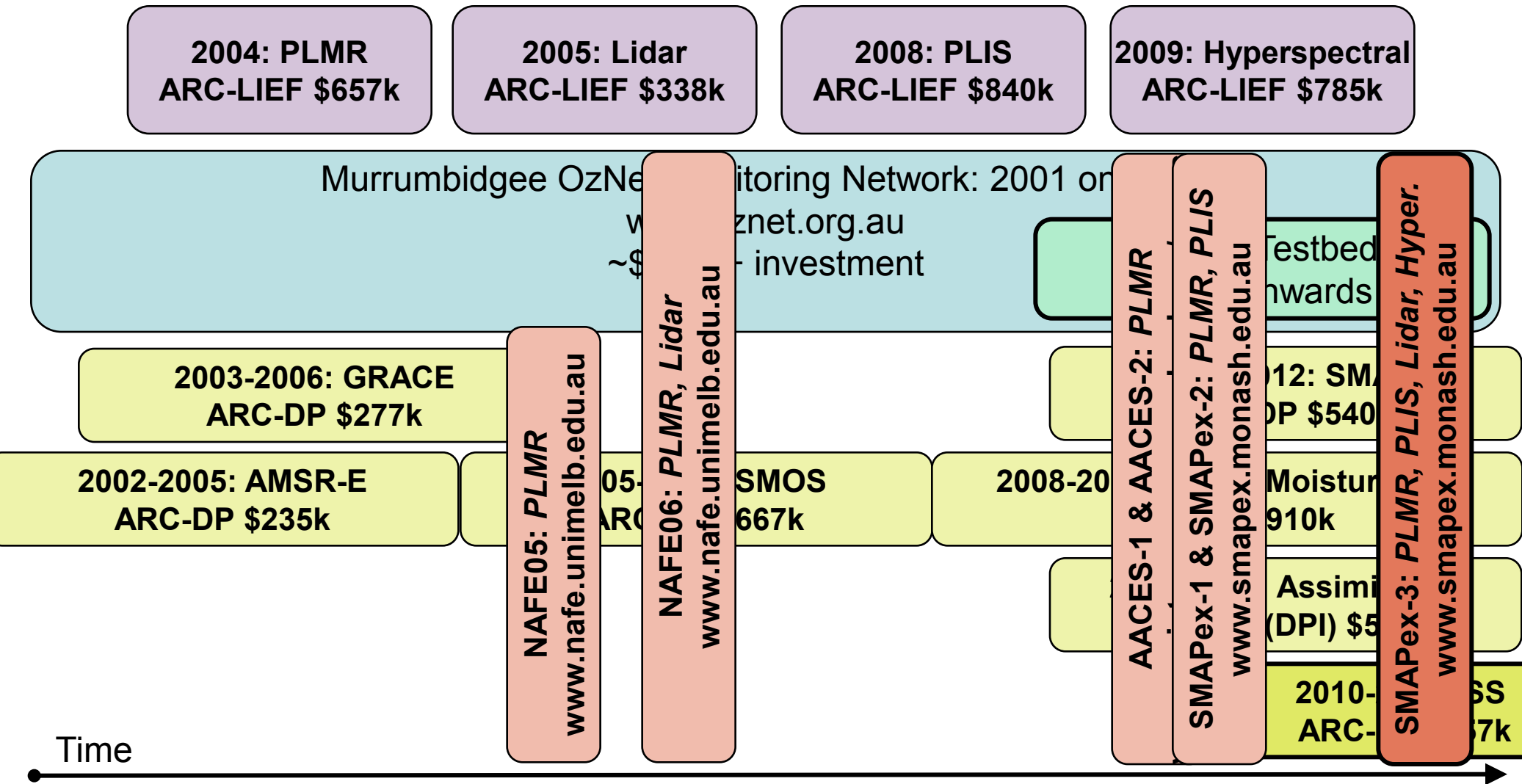
Target accuracy: 4% volumetric for top 5cm soil under moderate vegetation

Soil moisture requirements



*Modified from material supplied by SMAP Science Team

Overview of activities



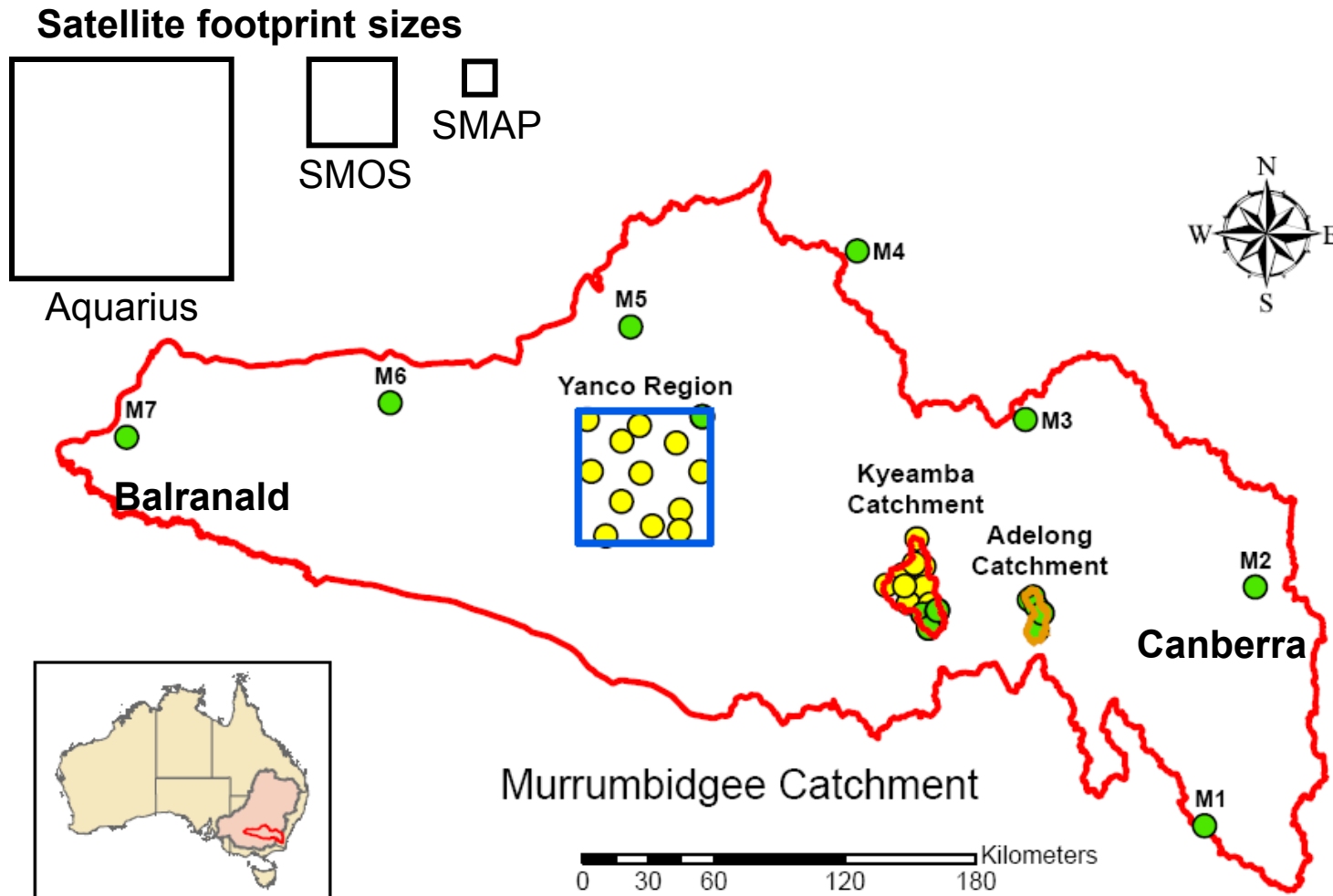
Overview of activities

Murrumbidgee OzNet Monitoring Network: 2001 onwards
www.oznet.org.au
~\$500k+ investment

Time



A ground based soil moisture observatory



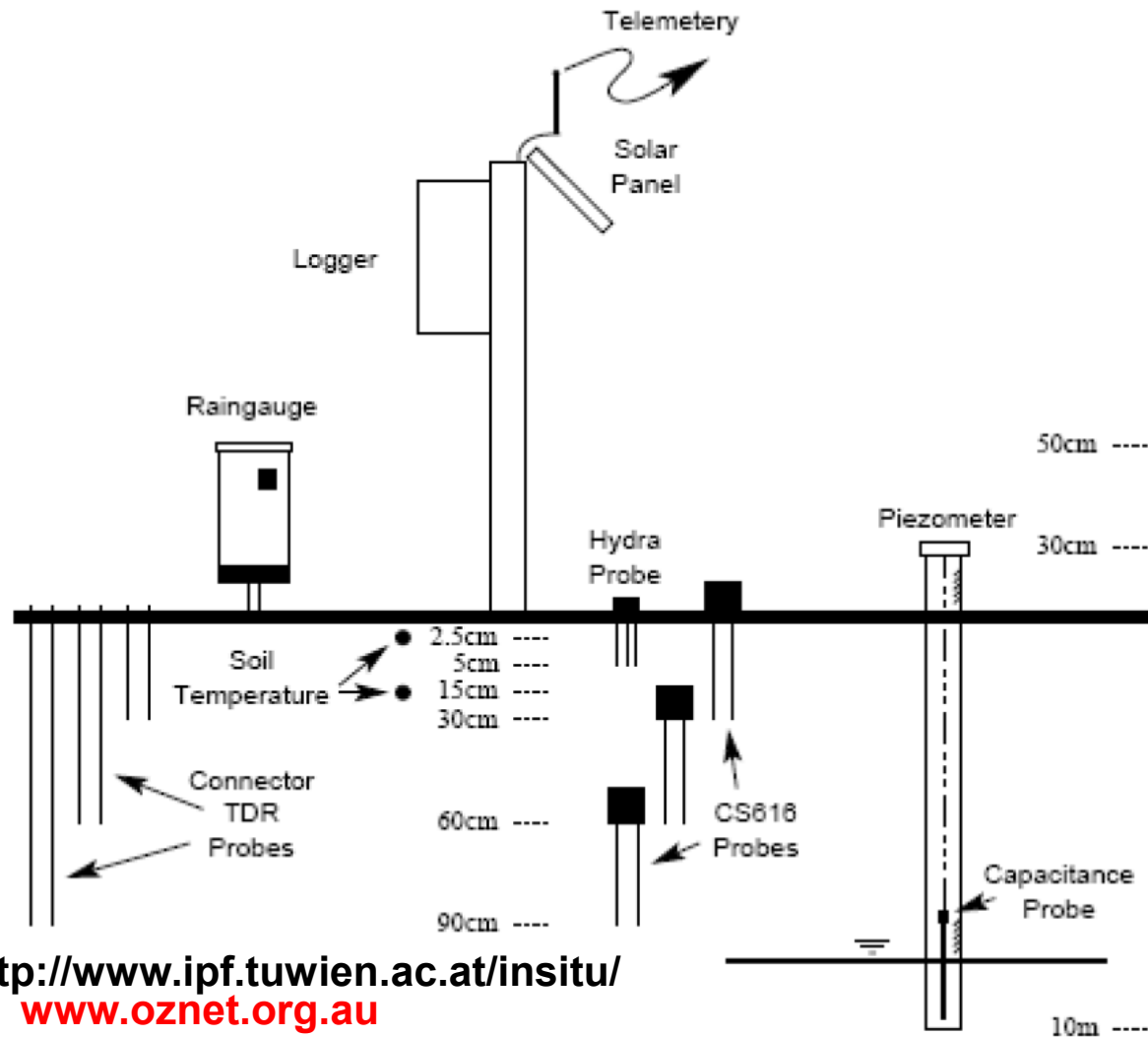
Smith, Walker et al. (In Review) WRR



MONASH University
Engineering

www.monash.edu.au

The OzNet monitoring network

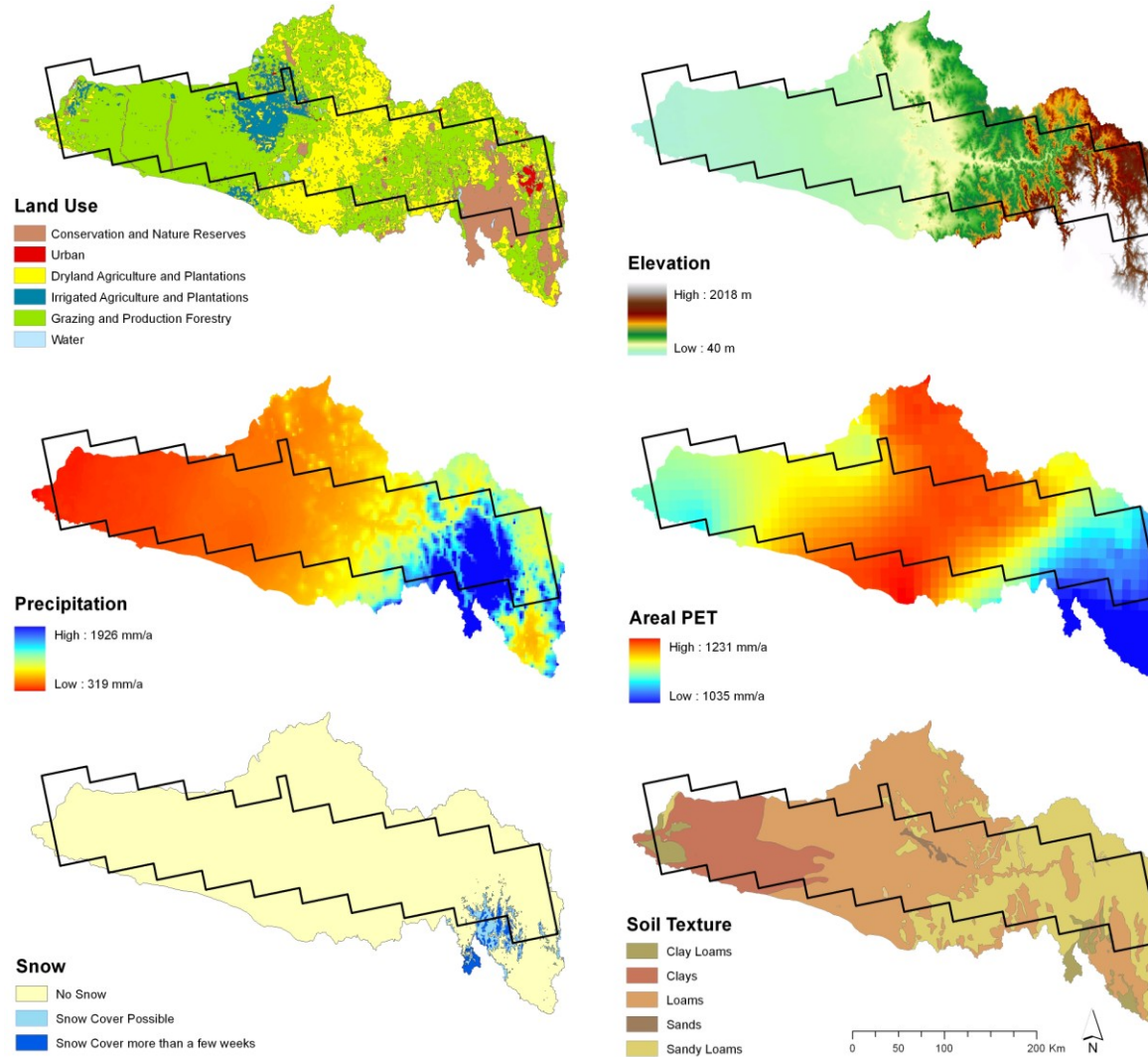


<http://www.ipf.tuwien.ac.at/insitu/>
www.oznet.org.au



www.monash.edu.au

Murrumbidgee: a slice of Australia



Overview of activities

Murrumbidgee OzNet Monitoring Network: 2001 onwards

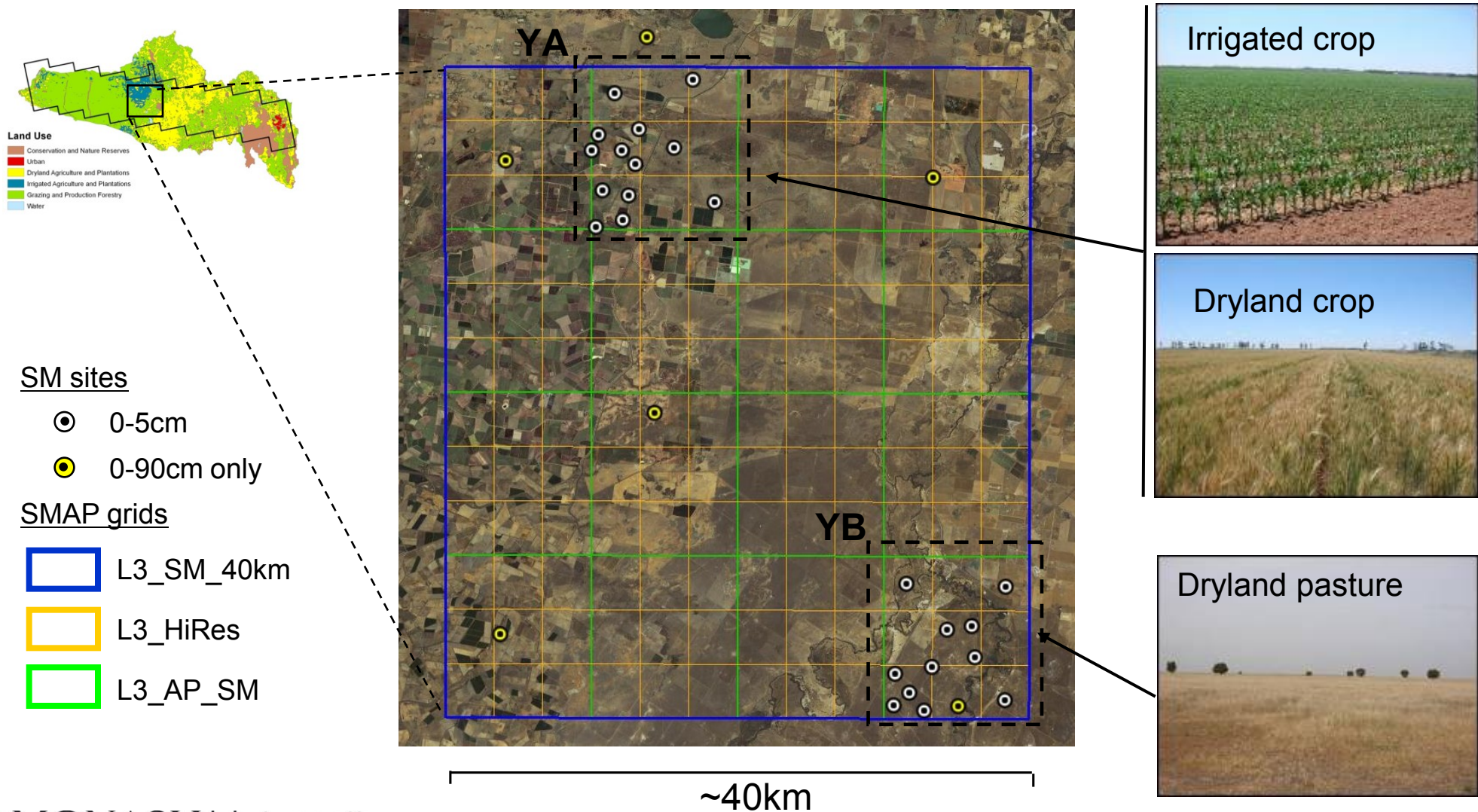
www.oznet.org.au
~\$500k+ investment

SMAP Testbed
2009 onwards

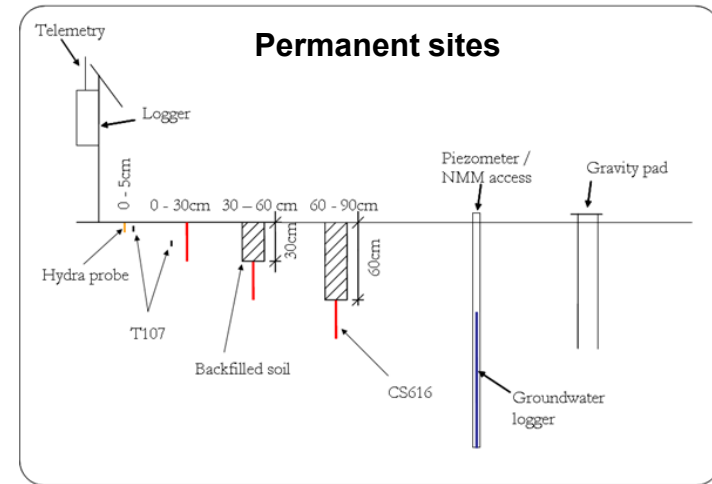
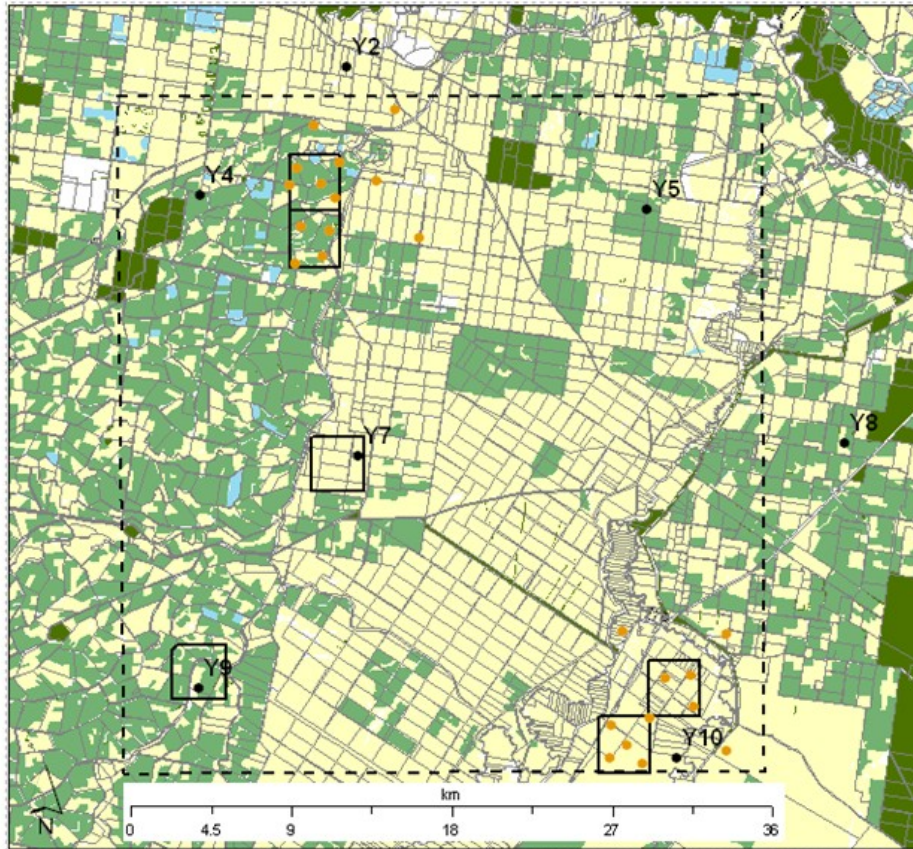
Time



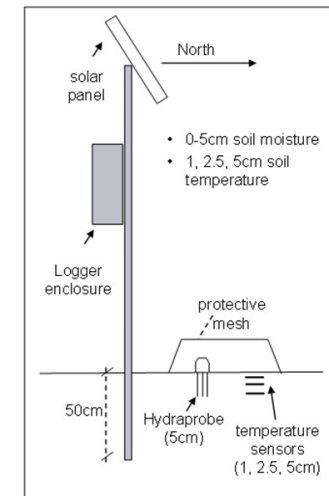
The SMAP test-bed



Monitoring network



Semi-Permanent sites



- Permanent station
 - Semi-Permanent station
 - Ground sampling area
 - Airborne mapping area
 - Lot boundaries
- Land Use**
- Conservation Area
 - Cropping Area
 - Dry Land
 - Horticulture

Overview of activities

**2004: PLMR
ARC-LIEF \$657k**

Murrumbidgee OzNet Monitoring Network: 2001 onwards

www.oznet.org.au
~\$500k+ investment

**SMAP Testbed
2009 onwards**

Time

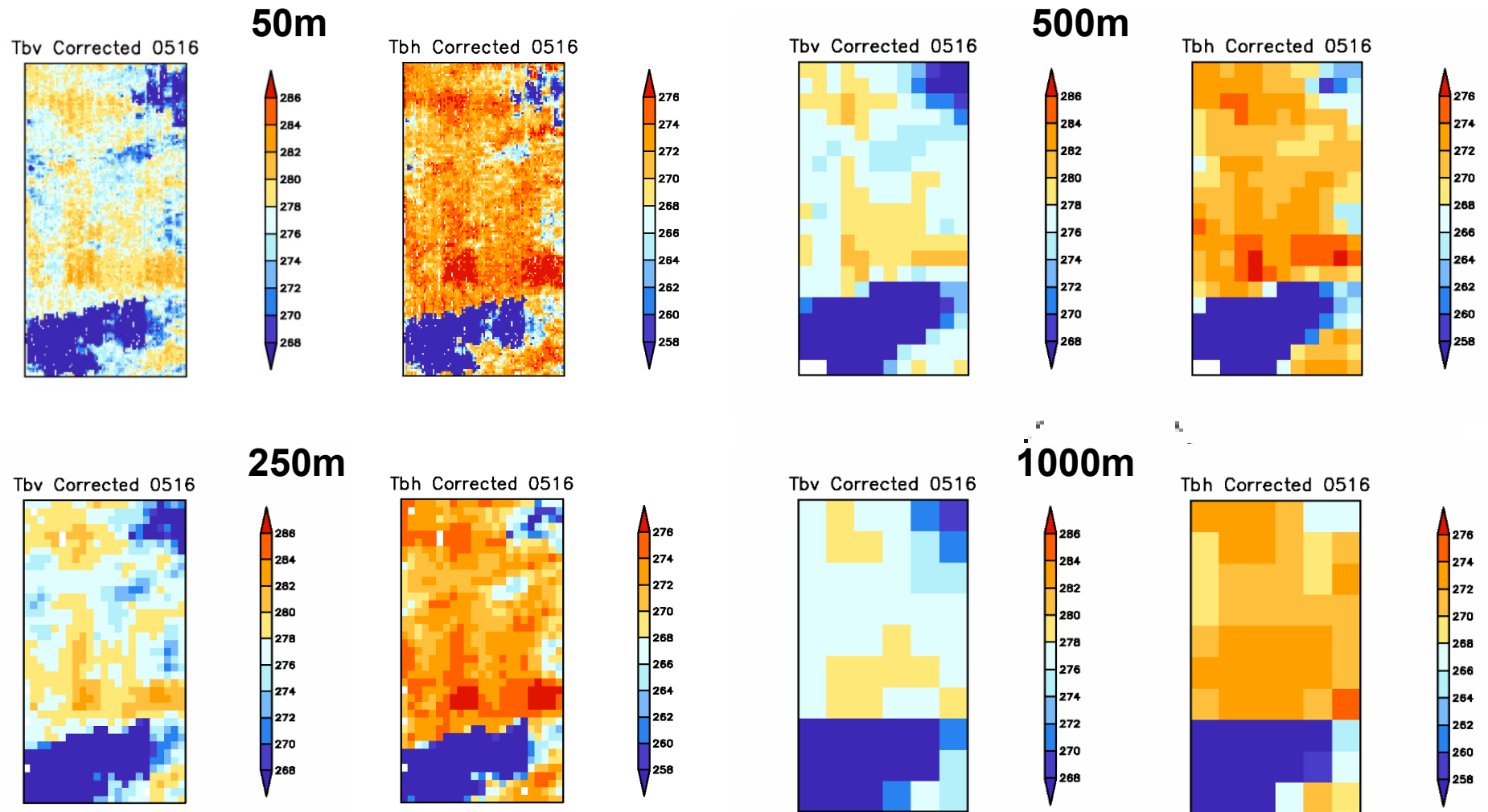


Polarimetric L-band Multibeam Radiometer



L-band Radiometer

Brightness temperature data



Overview of activities

2004: PLMR
ARC-LIEF \$657k

2005: Lidar
ARC-LIEF \$338k

Murrumbidgee OzNet Monitoring Network: 2001 onwards

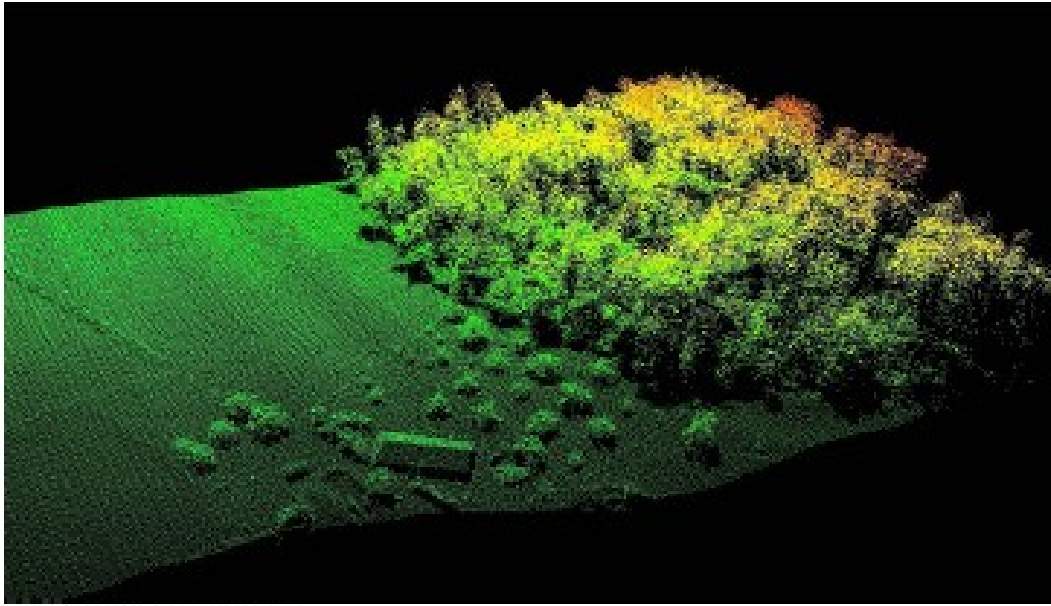
www.oznet.org.au
~\$500k+ investment

SMAP Testbed
2009 onwards

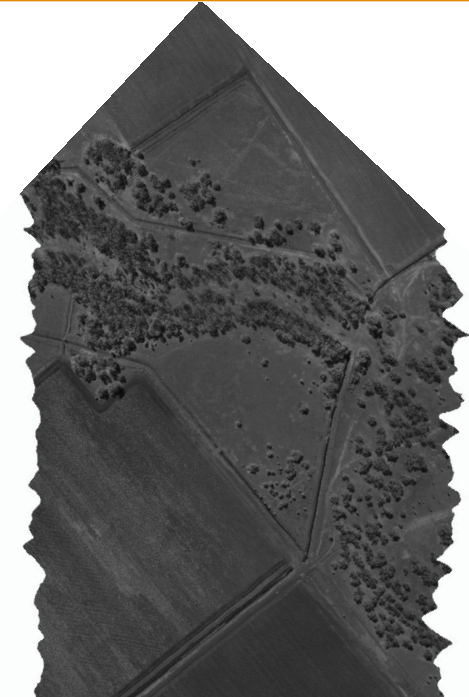
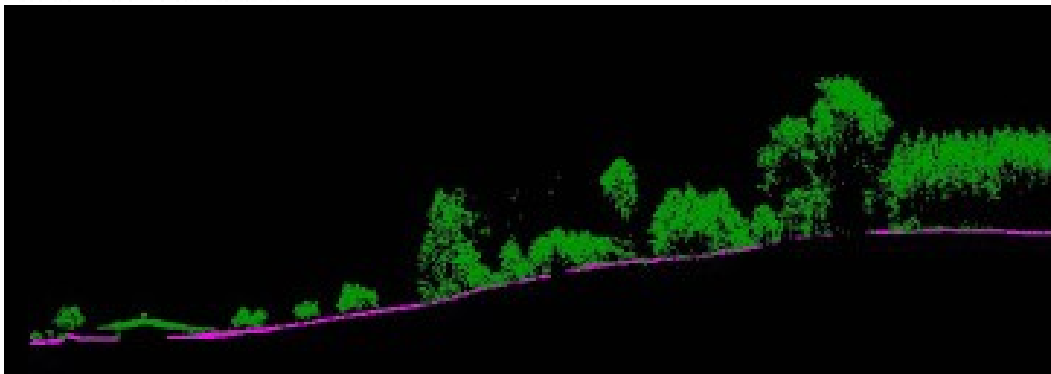
Time



Lidar: Riegl QMS-560



a sequence just after take-off



Full Waveform Laser Scanner



Overview of activities

2004: PLMR
ARC-LIEF \$657k

2005: Lidar
ARC-LIEF \$338k

2008: PLIS
ARC-LIEF \$840k

Murrumbidgee OzNet Monitoring Network: 2001 onwards
www.oznet.org.au
~\$500k+ investment

SMAP Testbed
2009 onwards

Time

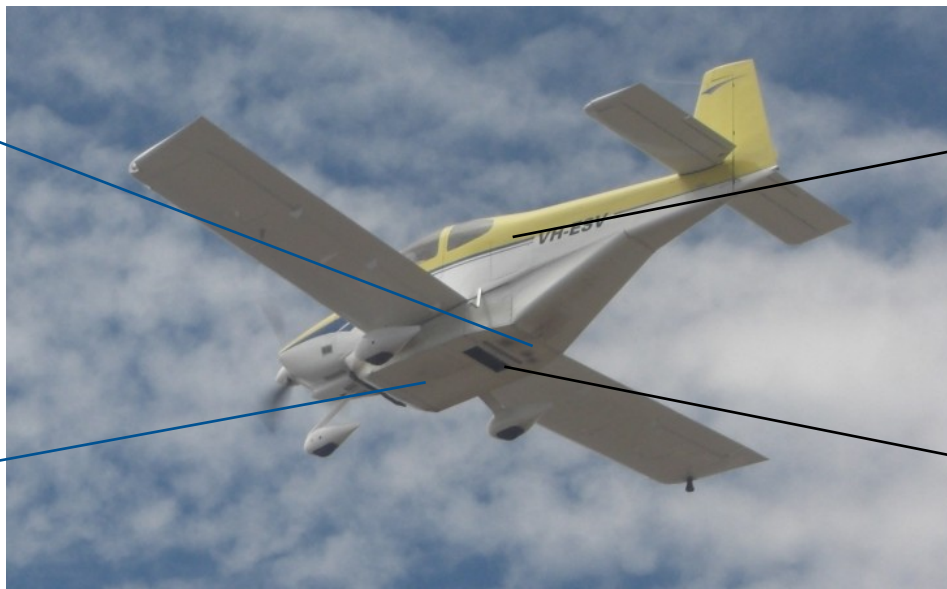


Polarimetric L-band Imaging SAR

L-band Radar



L-band Radiometer



6 x Vis/NIR/SWIR/TIR



PLMR:

Polarimetric L-band Multibeam Radiometer

Frequency/bandwidth: 1.413GHz/24MHz

Polarisations: V and H

Resolution: ~1km at 10,000ft flying height,

Incidence angles: +/- 7°, +/-21.5°, +/- 38.5° across track

Antenna type: 8x8 patch array

PLIS:

Polarimetric L-band Imaging SAR:

Frequency/bandwidth: 1.26GHz/30MHz

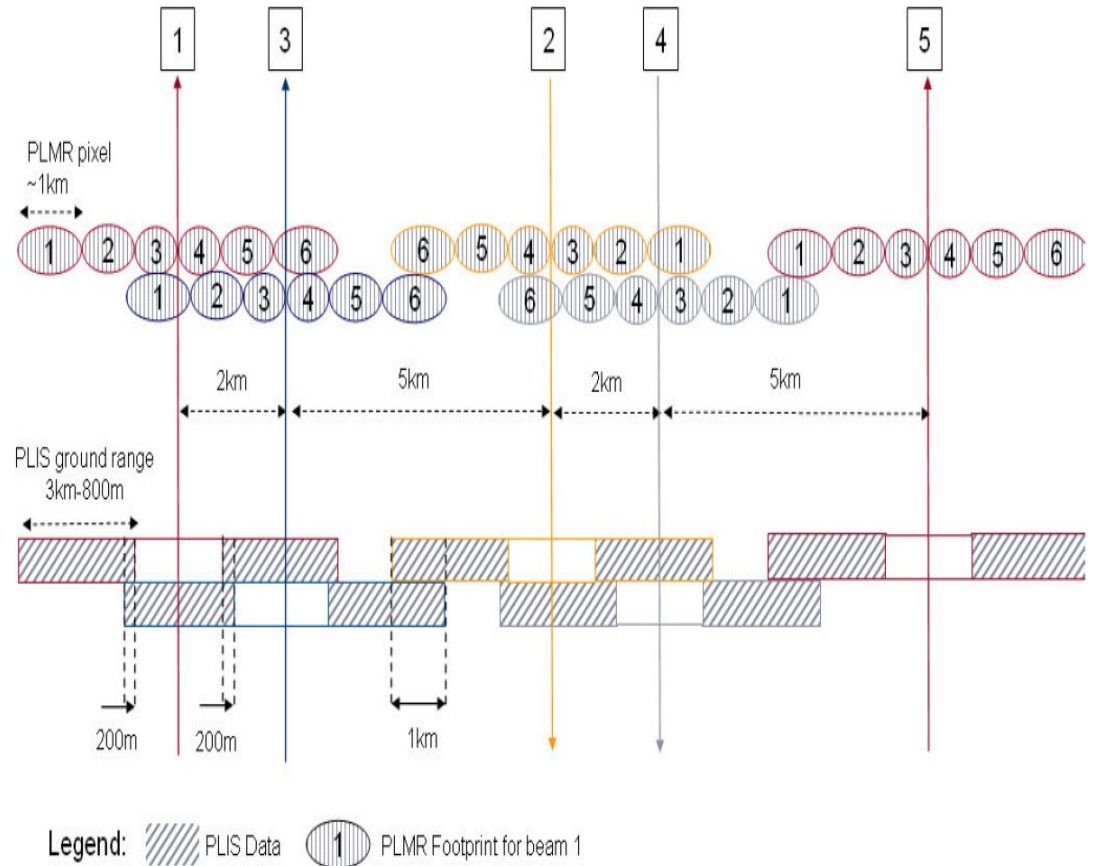
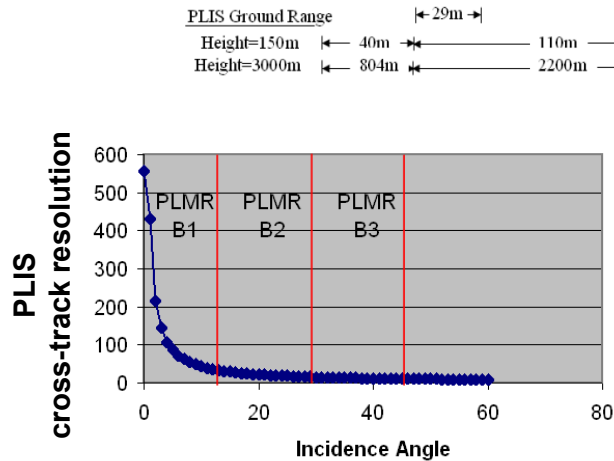
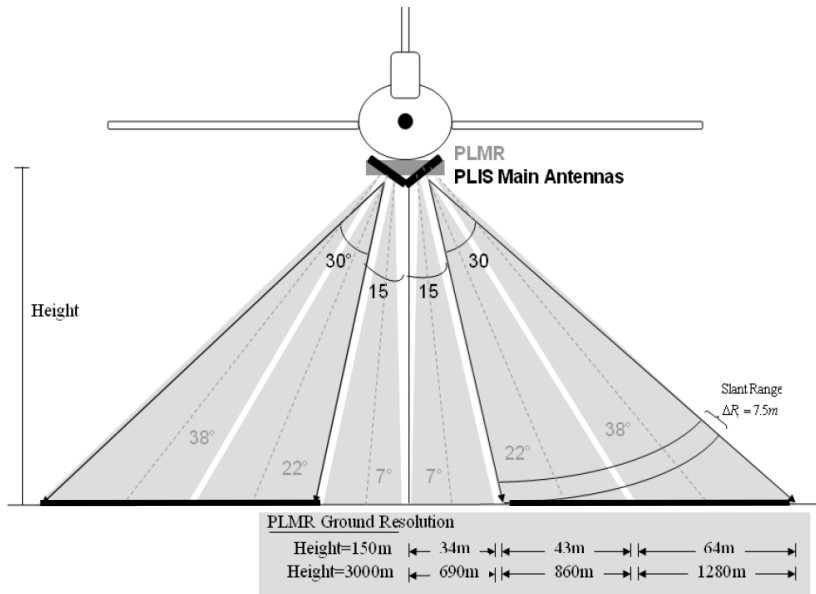
Polarisations: VV, VH, HV and HH

Resolution: ~10m

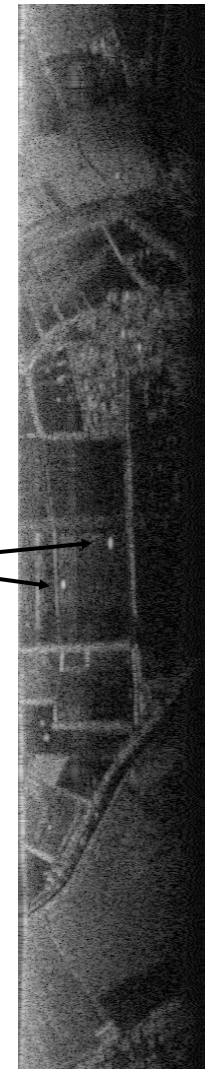
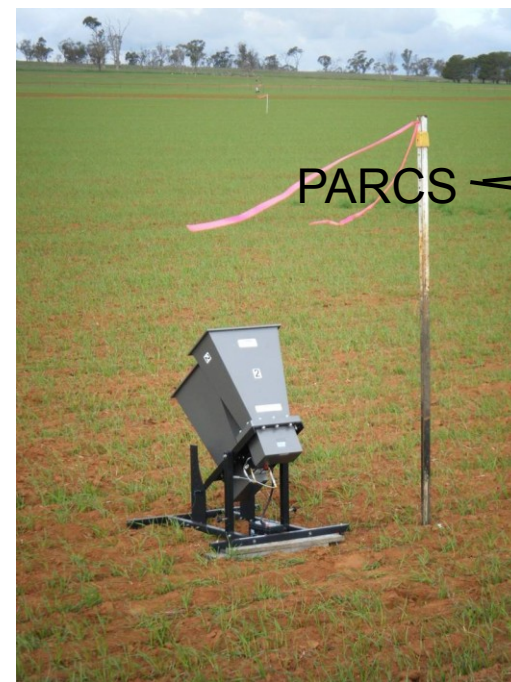
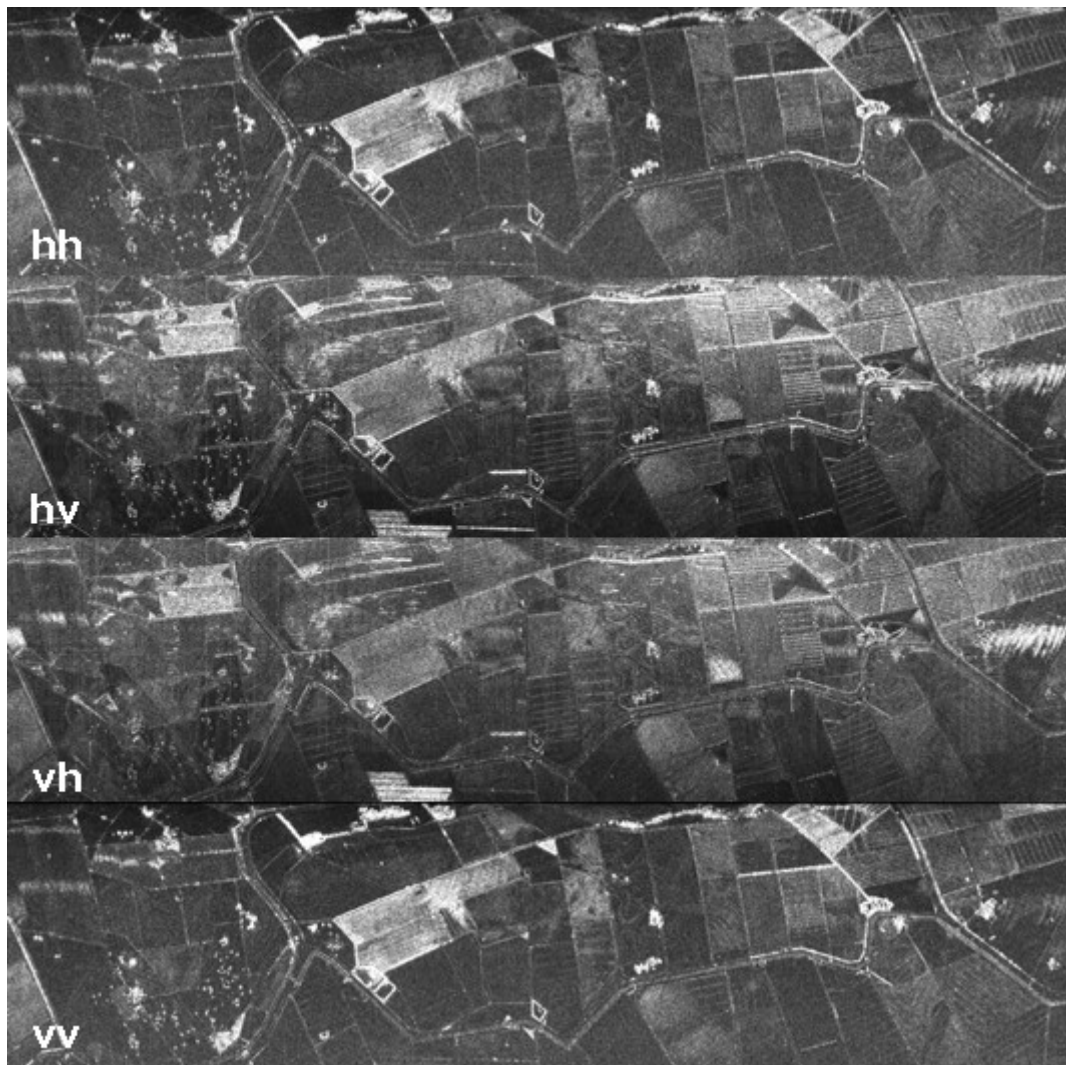
Incidence angles 15° -45° on both sides of aircraft

Antenna type: 2x2 patch array

Coverage



Radar data



Overview of activities

2004: PLMR
ARC-LIEF \$657k

2005: Lidar
ARC-LIEF \$338k

2008: PLIS
ARC-LIEF \$840k

2009: Hyperspectral
ARC-LIEF \$785k

Murrumbidgee OzNet Monitoring Network: 2001 onwards

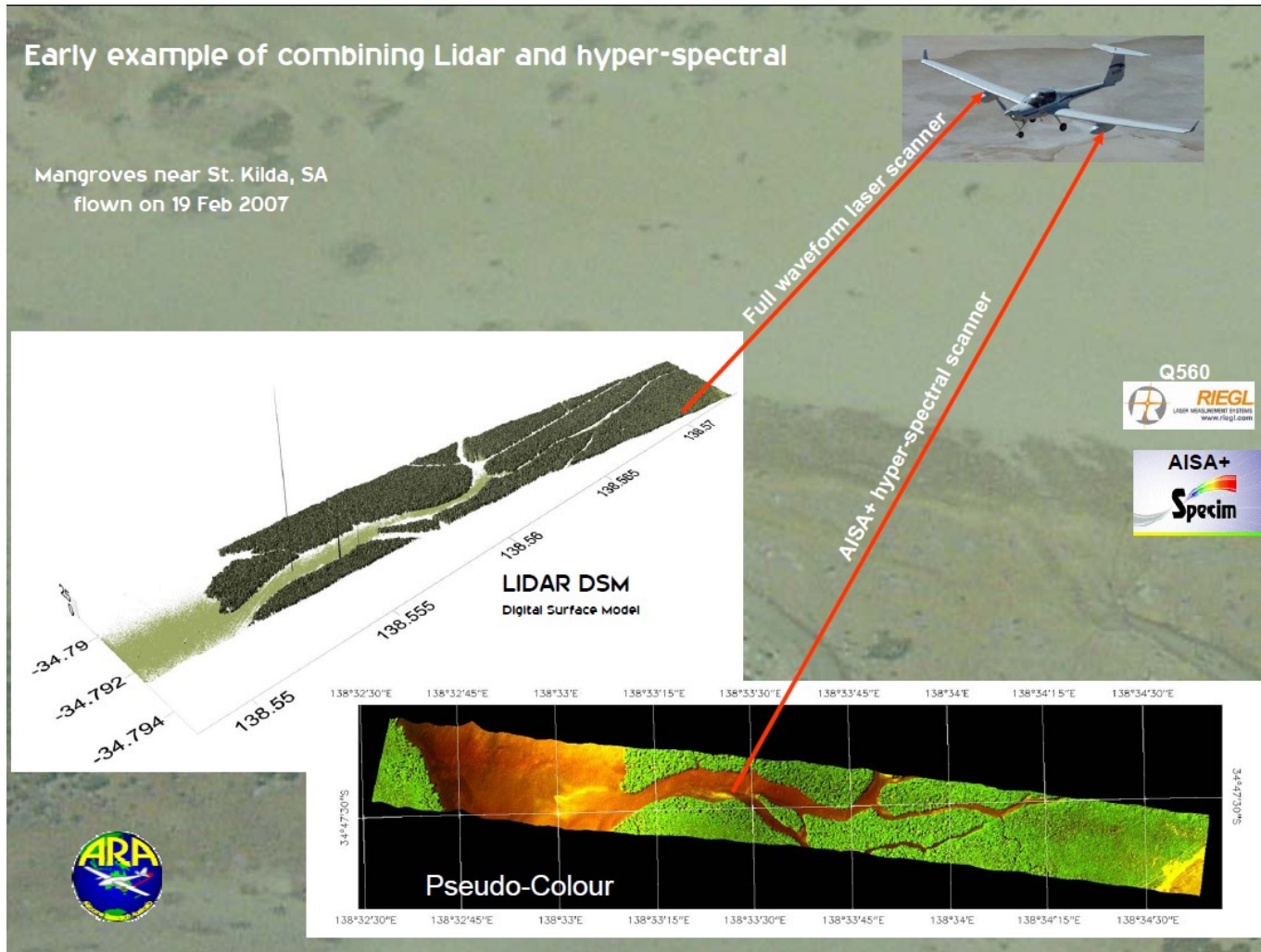
www.oznet.org.au
~\$500k+ investment

SMAP Testbed
2009 onwards

Time



Hyperspectral: AISA Eagle and Hawke (450 – 2500nm)



Overview of activities

2004: PLMR
ARC-LIEF \$657k

2005: Lidar
ARC-LIEF \$338k

2008: PLIS
ARC-LIEF \$840k

2009: Hyperspectral
ARC-LIEF \$785k

Murrumbidgee OzNet Monitoring Network: 2001 onwards

www.oznet.org.au
~\$500k+ investment

SMAP Testbed
2009 onwards

2003-2006: GRACE
ARC-DP \$277k

2002-2005: AMSR-E
ARC-DP \$235k

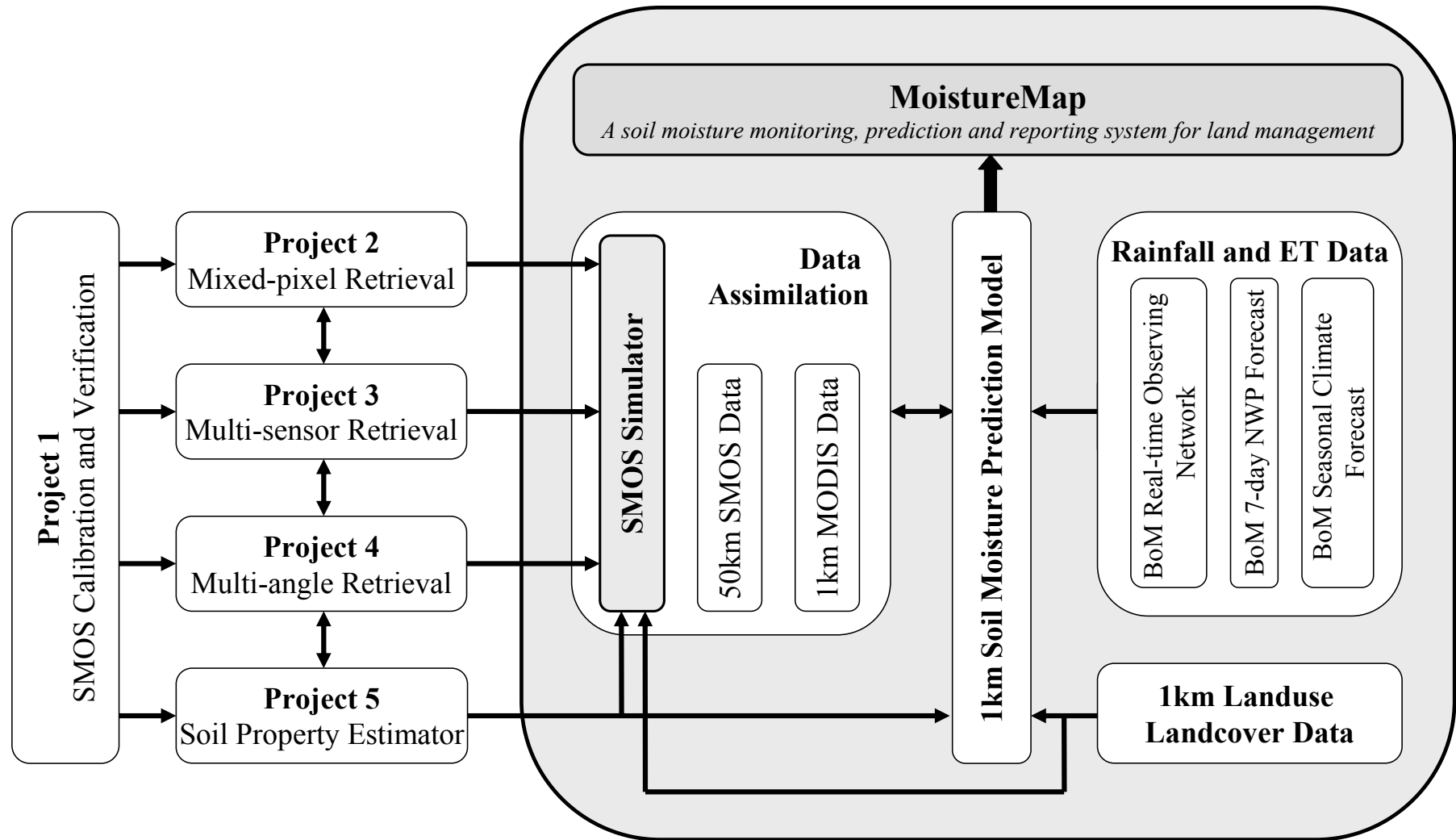
2005-2008: SMOS
ARC-DP \$667k

2008-2012: SMOS/MoistureMap
ARC-DP \$910k

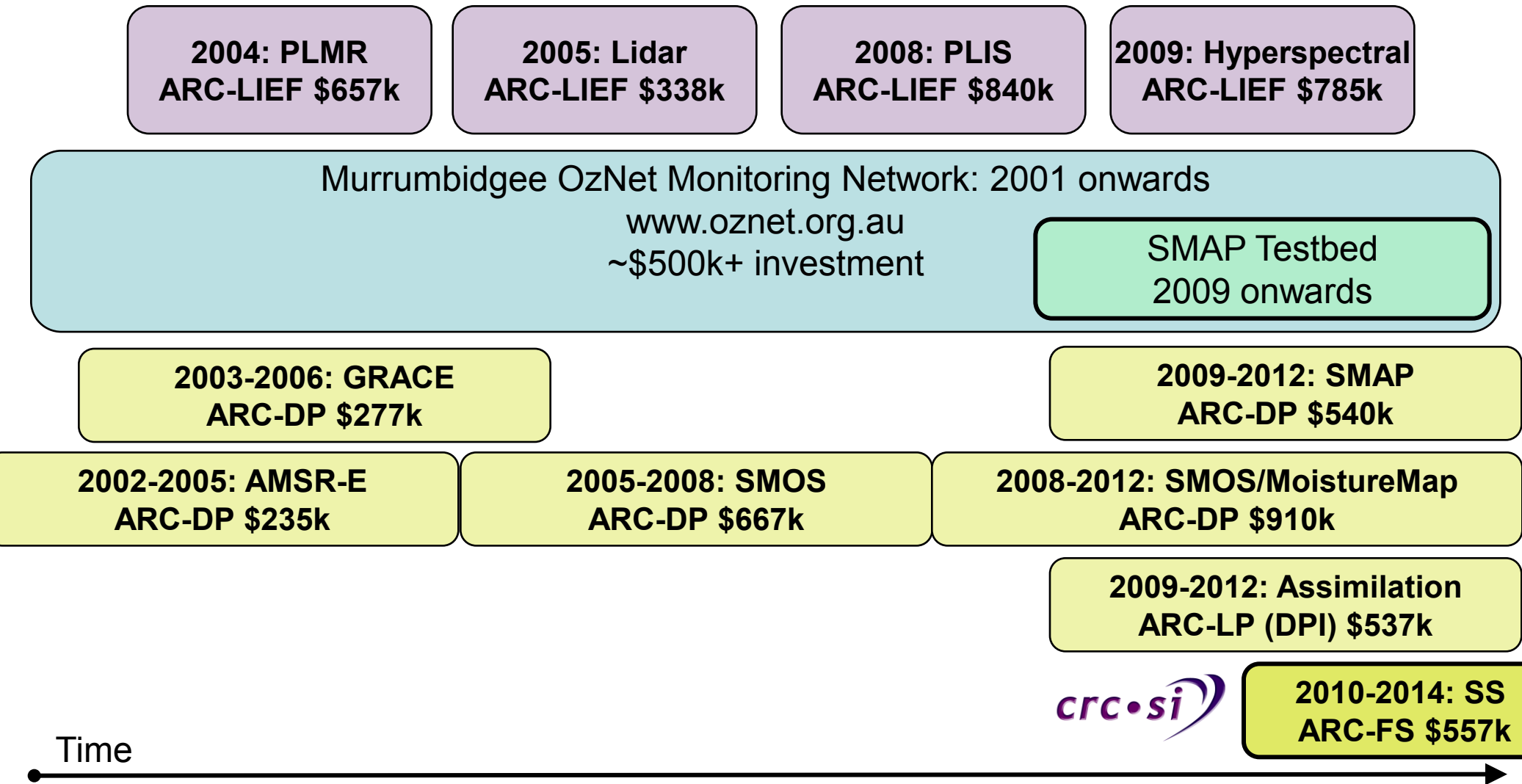
Time



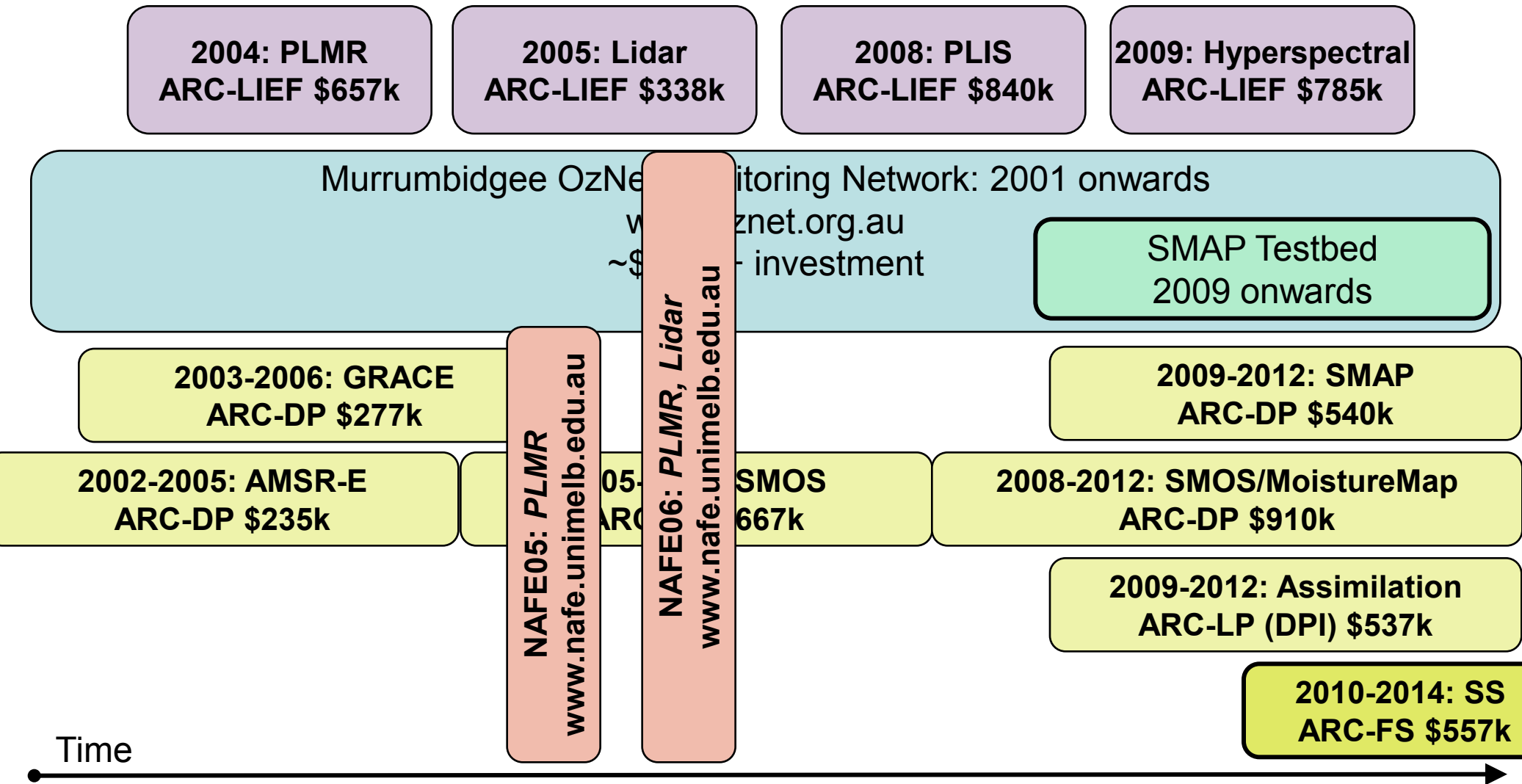
MoistureMap



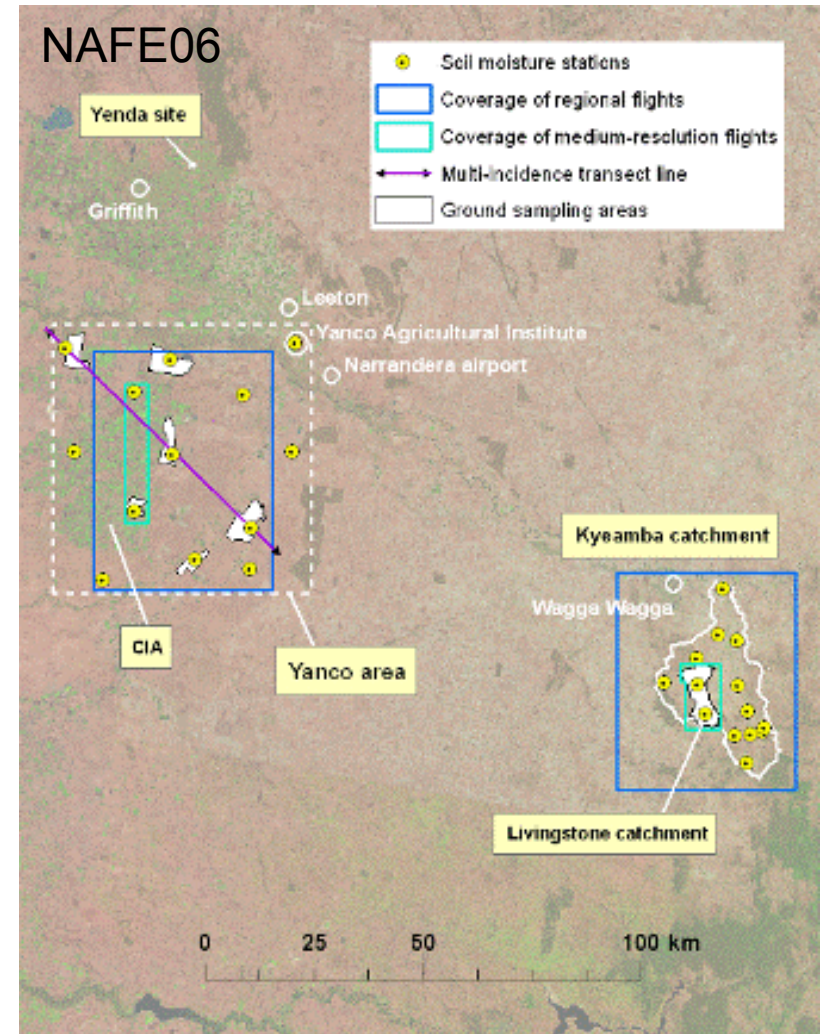
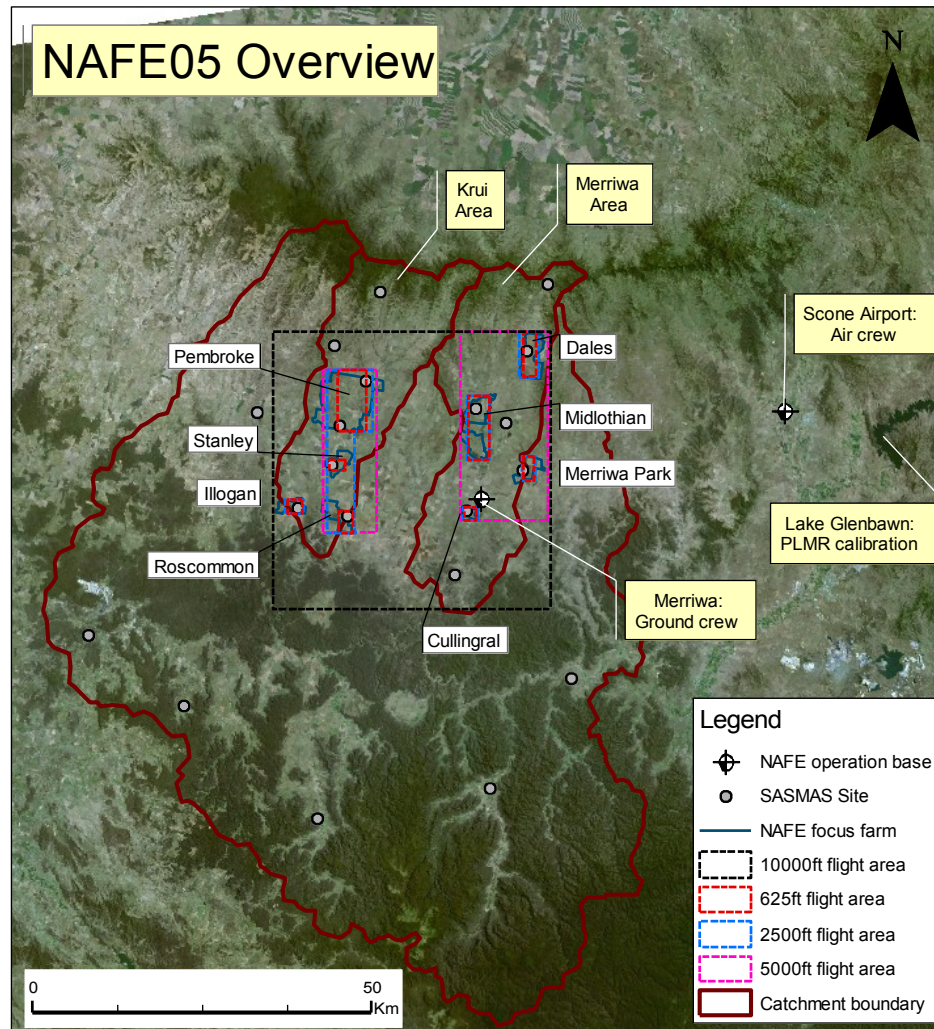
Overview of activities



Overview of activities



NAFE overview



NAFE: www.nafe.unimelb.edu.au

NAFE - Goulburn River Basin - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address <http://www.civenv.unimelb.edu.au/nafe/nafe05/index.html>

NAFE - Murrumbidgee Basin - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address <http://www.civenv.unimelb.edu.au/nafe/nafe06/index.html>

NAFE
National Airborne Field Experiment

Welcome to the NAFE Project
National Airborne Field Experiment

Satellite Data (Remote Sensing Data Access)

- AATSR
- AMSR-E
- ASAR
- PROBA/CHRIS
- MERIS
- MODIS

Aircraft Data

- PLMR data
- Thermal data
- NDVI data
- Digital Photo
- Water calibration

Ground Data

- Monitoring stations
- Regional sampling

NAFE'06 Overview [Experimental plan](#)

NAFE'06 was undertaken in the Murrumbidgee catchment during November 2006, with the objective to provide data for SMOS (Soil Moisture and Ocean Salinity) level soil moisture retrieval, downscaling and data assimilation. The study area included the 60 by 60km **Yanco area**, the 600 km² **Kyeamba catchment**, and the 26ha **Yenda site**.

A Polarimetric L-band Multibeam Radiometer (PLMR) and a Thermal Imager were flown at an altitude of 3000m AGL to provide 1km resolution passive microwave data (and 20m for Thermal Imager) across a 40x55 km² area in Yanco every 2-3 days and a 40x50km² area in Kyeamba once a week. This both simulated a SMOS pixel and provided the 1km soil moisture data required for downscale verification, allowing downscaling and near-surface soil moisture

National Airborne Field Experiment 2005

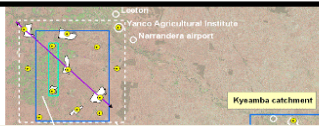
31 Oct – 25 Nov 2005

Jeffrey Walker and Rocco Panciera
University of Melbourne, Australia



Experiment Plan

October 2005



National Airborne Field Experiment 2006 (NAFE'06)

29 Oct – 20 Nov 2006

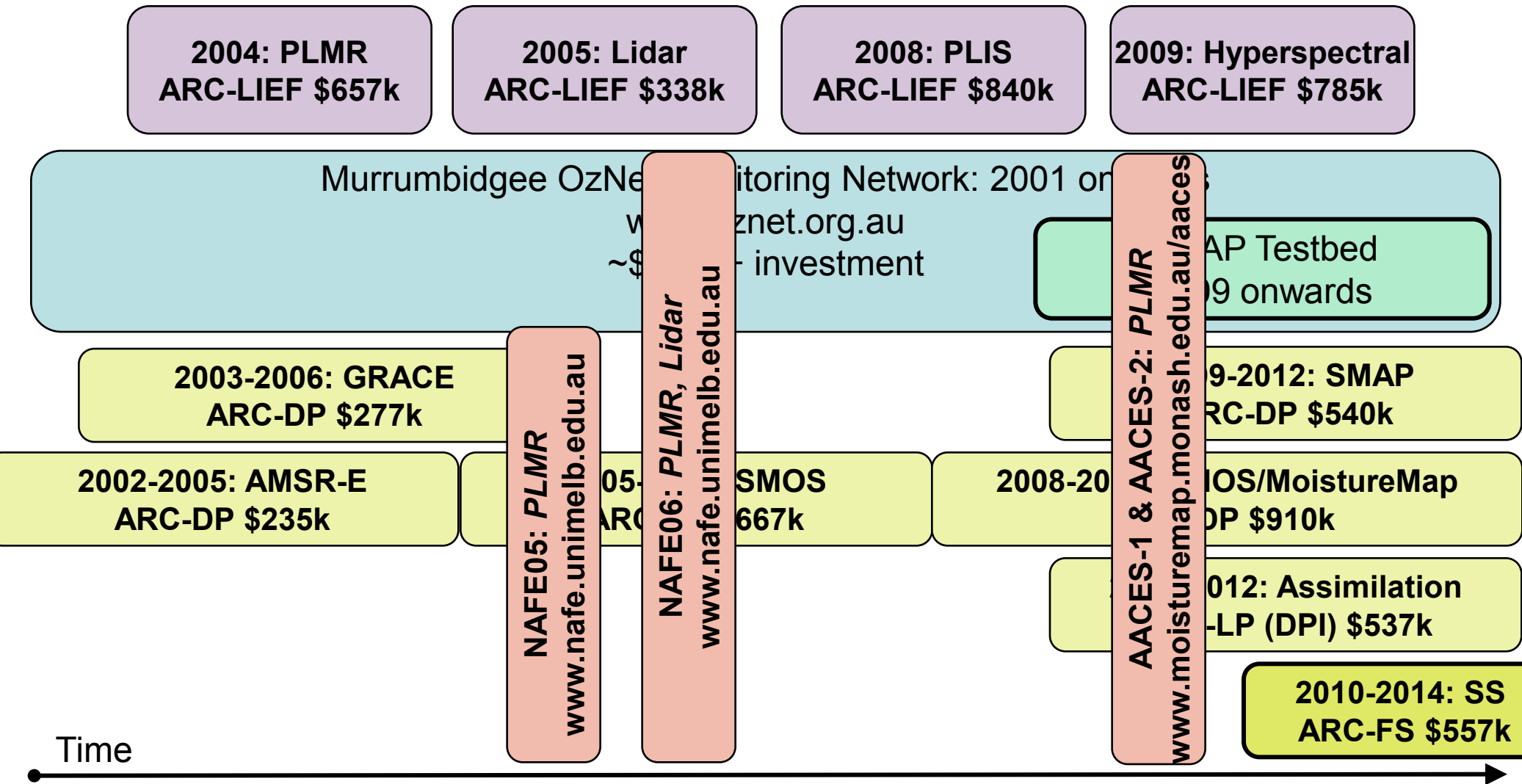
Jeffrey Walker, Olivier Merlin and Rocco Panciera
University of Melbourne, Australia



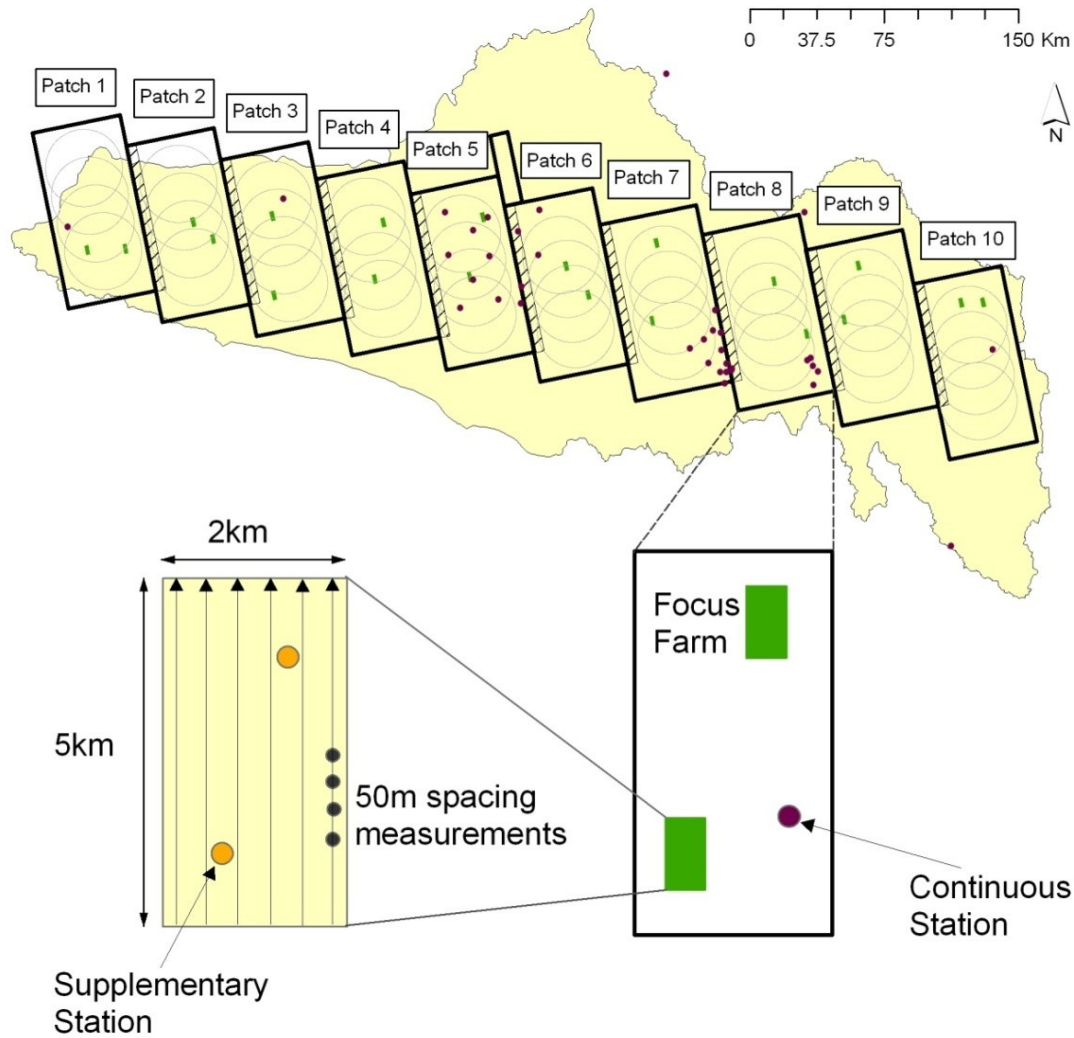
Experiment Plan

October 2006

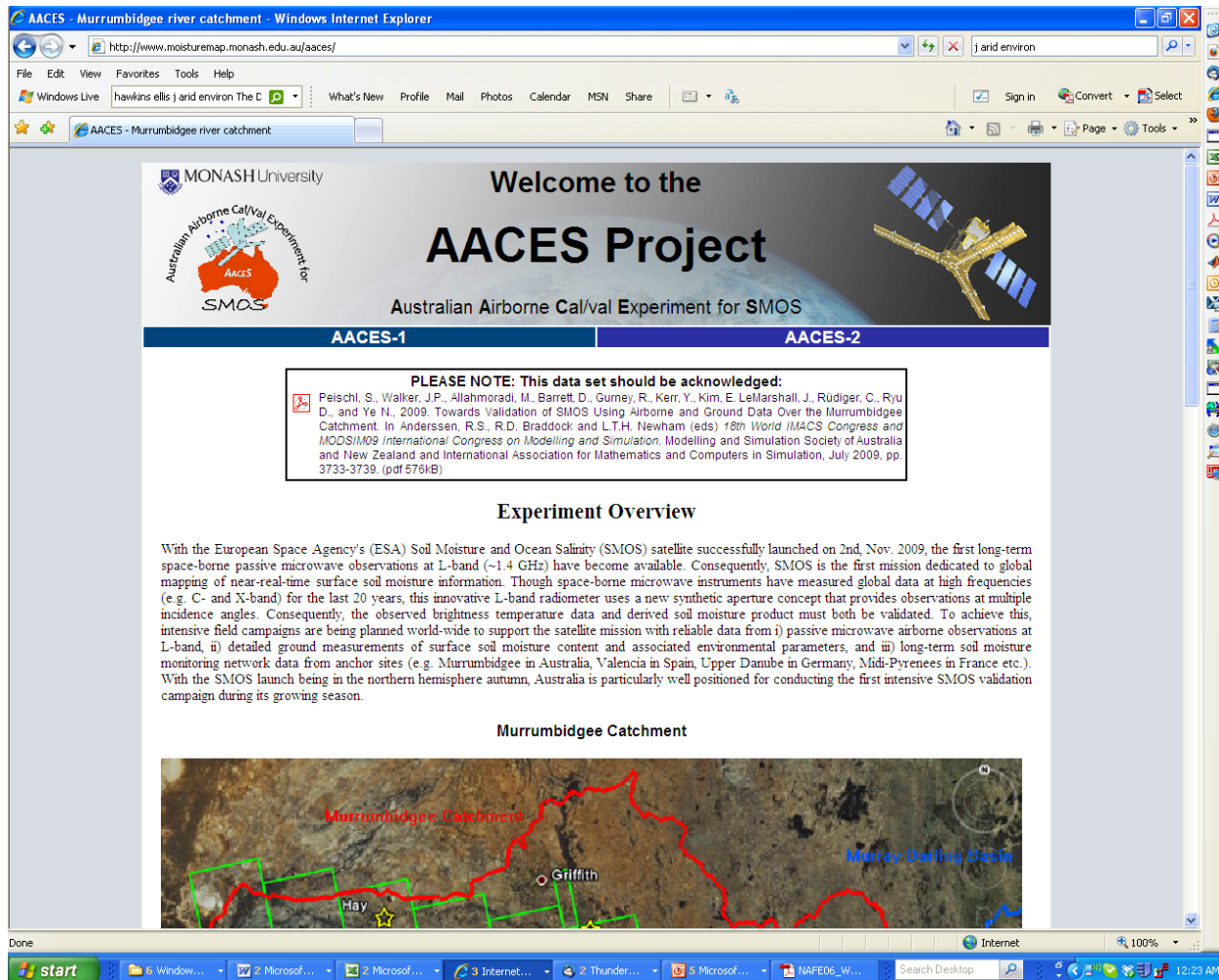
Overview of activities



The concept



AACES: www.moisturemap.monash.edu.au/aaces



Australian Airborne Cal/val Experiments for SMOS (AACES)

2010 - 2011

Jeffrey Walker, Christoph Rüdiger, Sandy Peischl, Ye Nan, Mahdi Allahmoradi, Dongryeol Ryu, Yann Kerr, Ed Kim, Robert Gurney, Damian Barrett, John Le Marshall

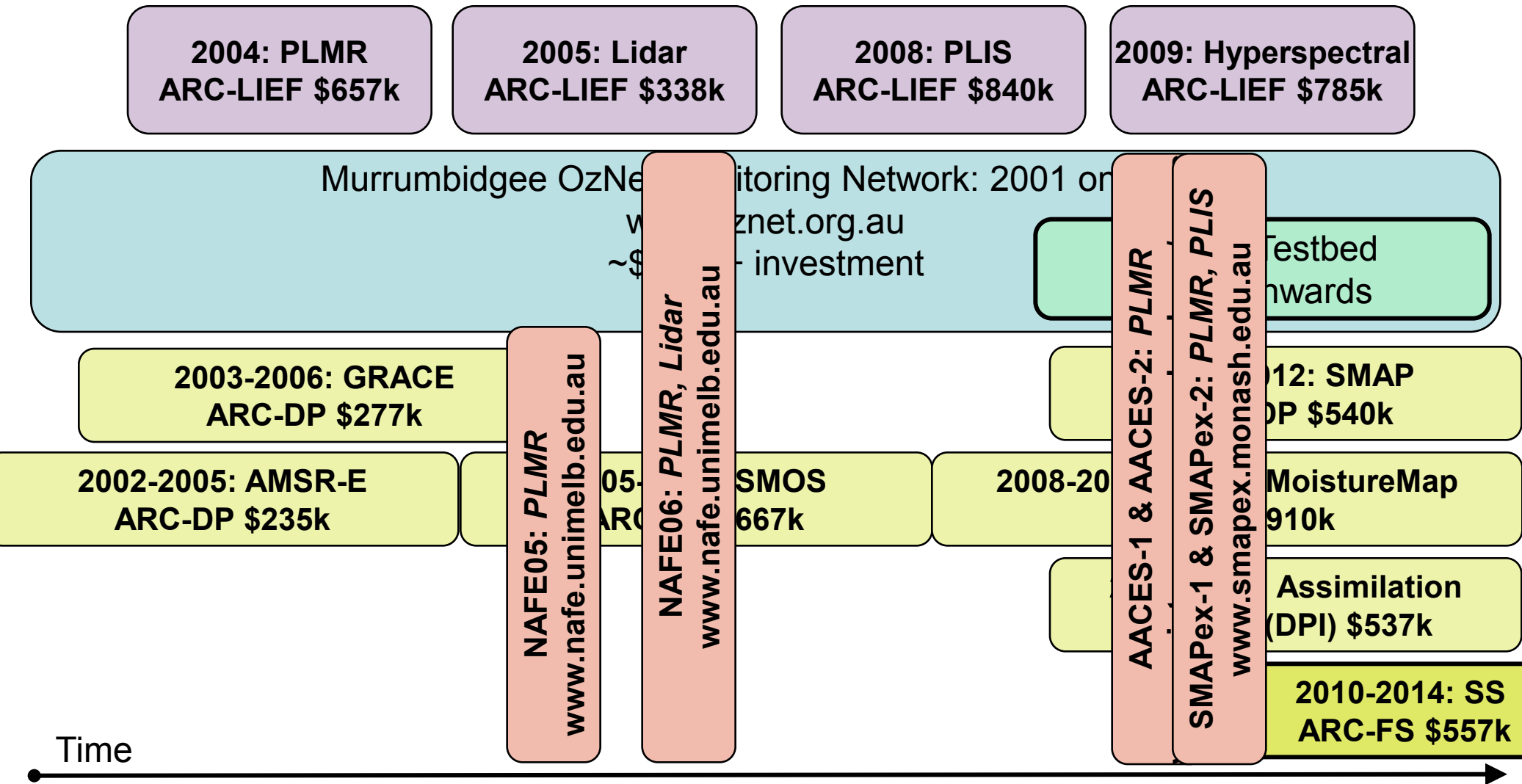
University of Melbourne, Australia



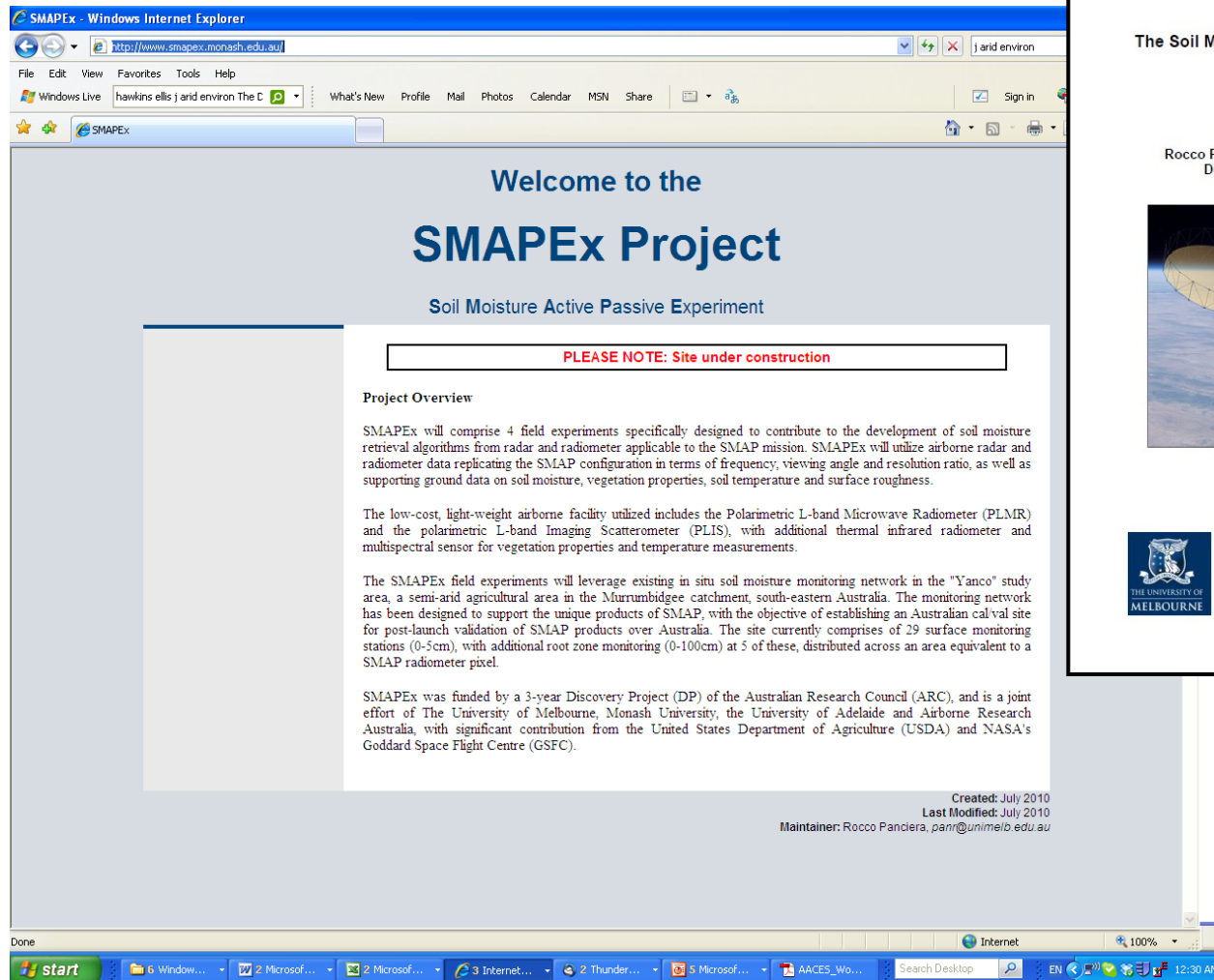
Experiment Plan

January 2010

Overview of activities



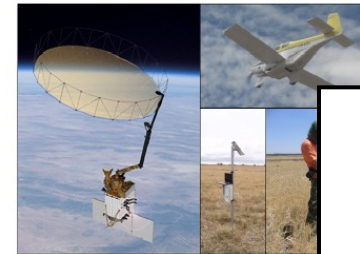
SMAPEX: www.smapex.monash.edu.au



The Soil Moisture Active Passive Experiments (SMAPEX)

2010-2011

Rocco Panciera, Jeffrey Walker, Dongryeol Ryu,
Douglas Gray and Thomas Jackson



Experiment Plan June 2010



MONASH University



Experiment Plan November 2010

Rocco Panciera, Jeffrey Walker, Dongryeol Ryu,
Douglas Gray and Thomas Jackson

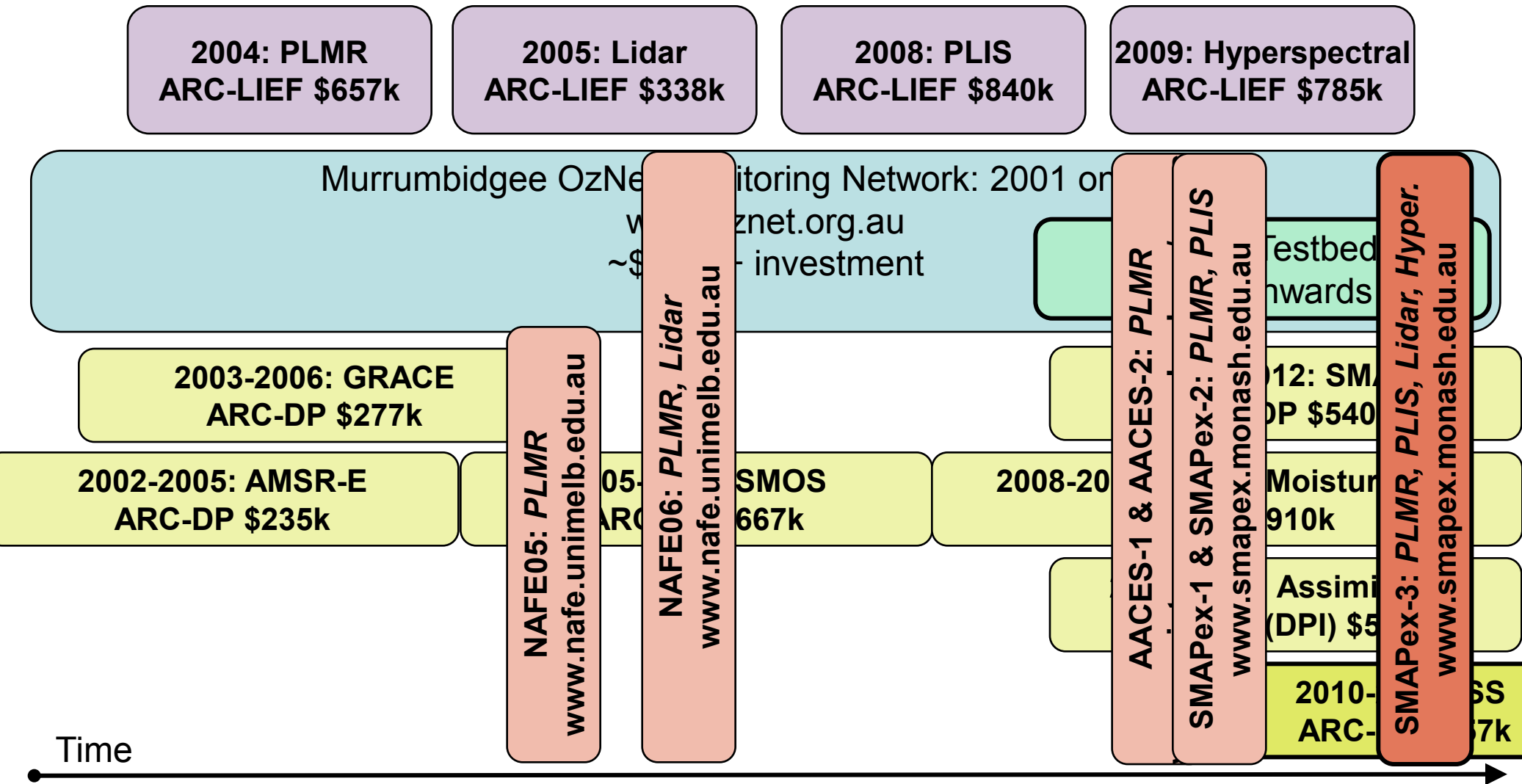


MONASH University





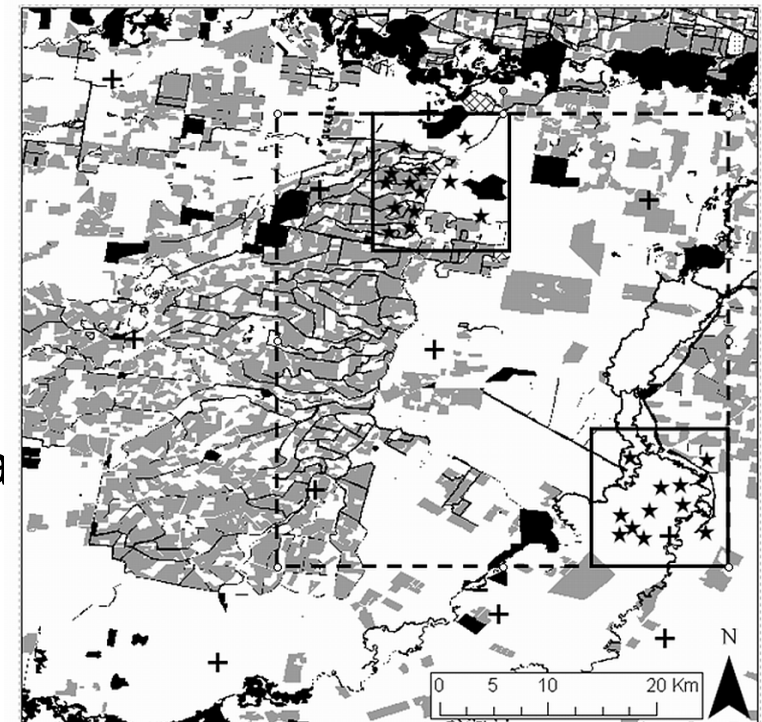
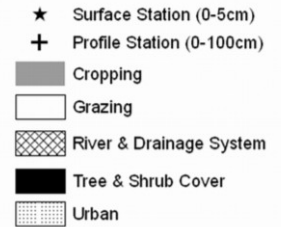
Overview of activities



SMAPEX-3

- Likely to be 3-weeks in Sept (TBC)
- Need to develop an experiment plan supplement outlining **ADDITIONAL** data requirements:

- PALSAR
- lidar flights
- hyperspectral flights
- ground roughness data
- ground-based hyperspectral data
- vegetation structural parameters, biomass etc (forest, crops and grass ...)
- additional soil moisture?
- etc





What in God's name is this freak talking about?

It's all bullshit and you know it...

Who's this guy again?

Please wake me up when he's done

I gotta do my nails tonite...

Maybe if I pretend I'm dead they won't ask me anything

Bla bla bla...and then bla and bla...and also B-L-A..