MONASH University

Engineering

# Towards global water and energy balance monitoring using GCOM-W1 in the MDB

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# SHIZUKU (GCOM-W1)
# to Provide Geophysical Quantity Products

May 17, 2013 (JST)
Japan Aerospace Exploration Agency (JAXA)

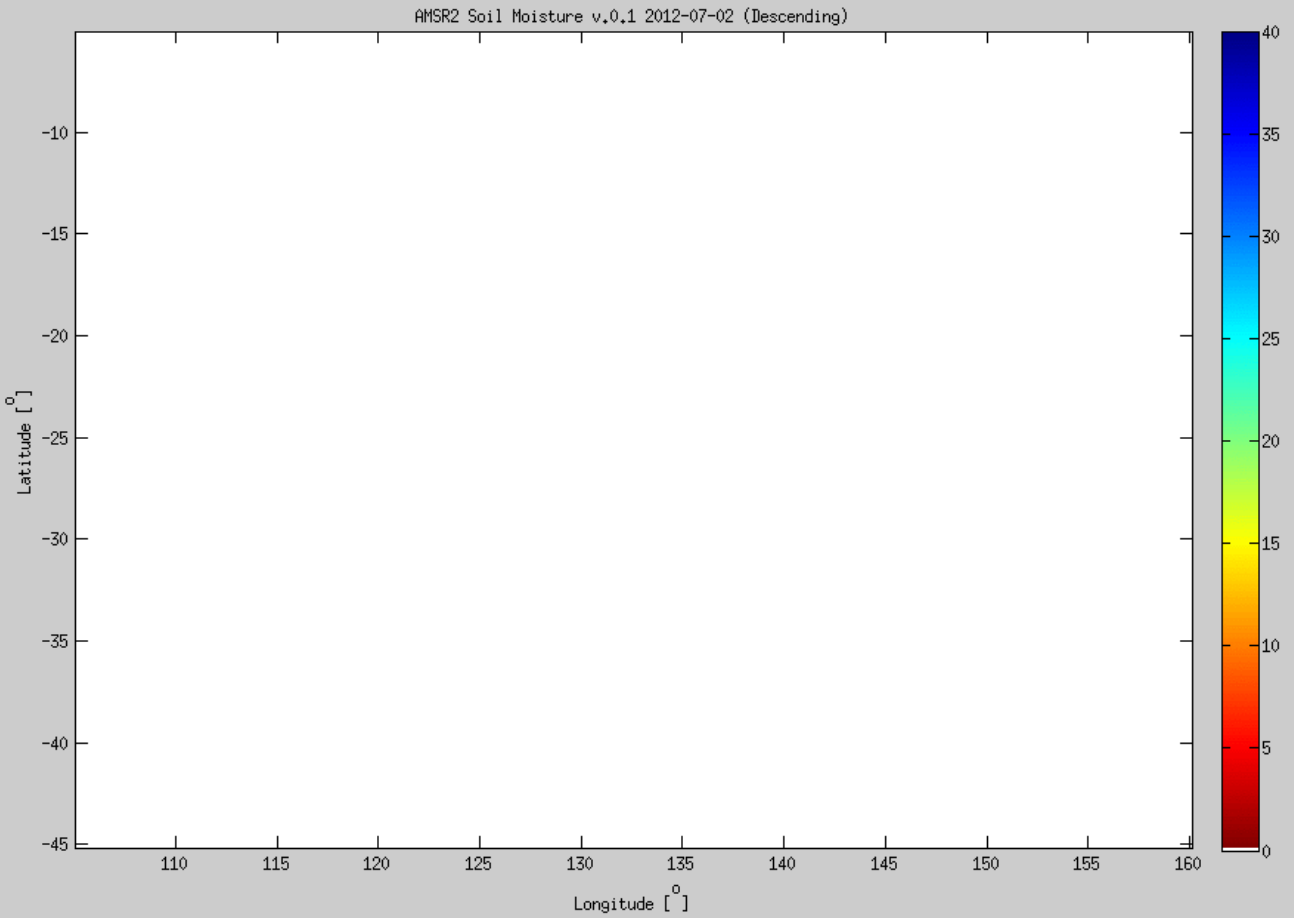
The Japan Aerospace Exploration Agency (JAXA) has started offering eight kinds of products whose physical quantity concerning water on the Earth, including precipitable water and sea surface temperature, is calculated based on the observation data acquired by the Advanced Microwave Scanning Radiometer 2 (AMSR2) aboard the Global Change Observation Mission 1st – Water "SHIZUKU" (GCOM-W1) after its initial calibration operation*1 was completed. The SHIZUKU was launched on May 18, 2012.
These products will contribute to capture environmental changes on a global scale such as worrisome decreasing ocean ice areas in the North Pole as well as the El Nino and La Nina Phenomena. The products can also be utilized for various fields including weather and precipitation forecasts for storms and downpours by global meteorological agencies such as the Japan Meteorological Agency and the National Oceanic and Atmospheric Administration (NOAA) of the U.S., compiling fishing and oceanographic conditions for efficiently finding fishing points by the Japan Fisheries Information Service Center, and enhancing measures against floods in Asian countries that engage in a cooperative project with the Asian Development Bank.

*1 Calibration operation: To improve accuracy, Earth physical quantity acquired through data obtained by the SHIZUKU, including precipitable water and ocean surface temperature, are compared with data acquired through other independent methods such as observations on the ground.

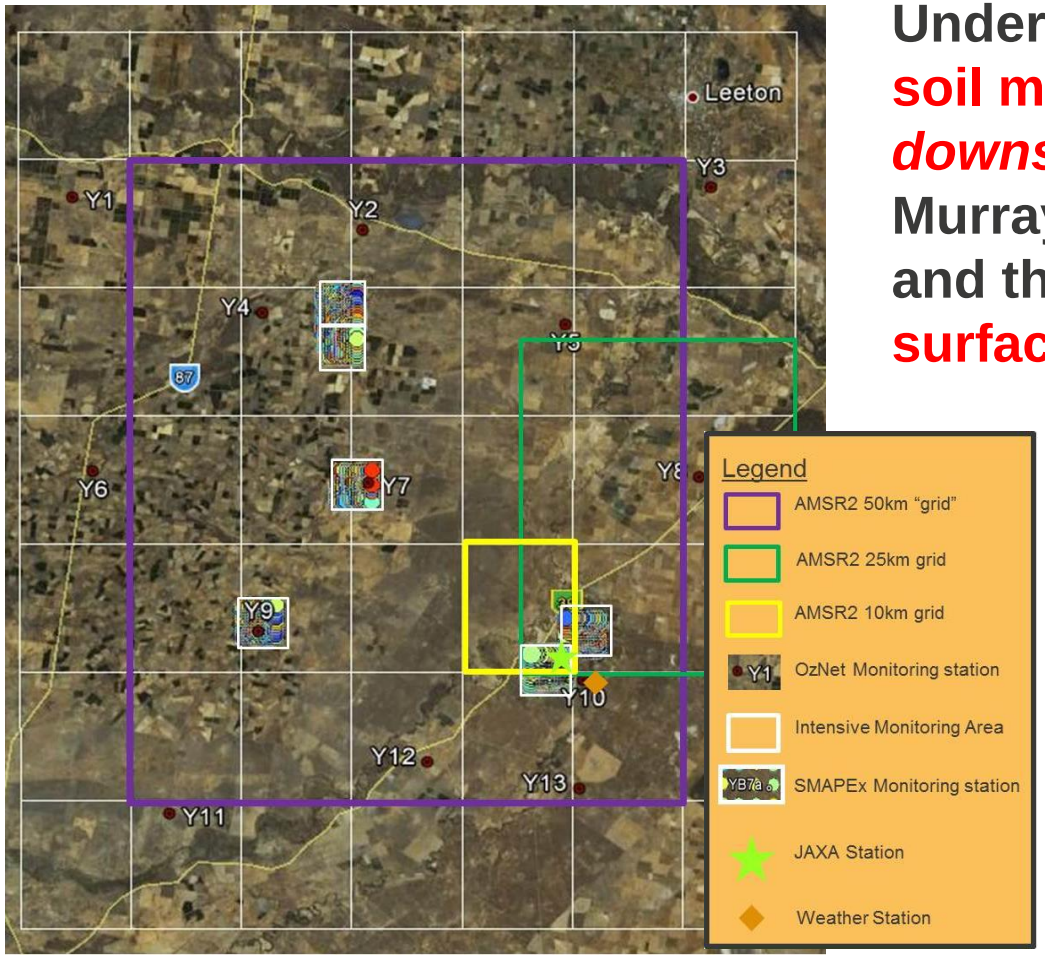
[How to receive data]
Please register at the following SHIZUKU data provision website:
https://gcom-w1.jaxa.jp
After registering, you can download brightness temperature products.

We began providing brightness temperature products on January 25, 2013 at the following website.
http://www.jaxa.jp/press/2013/01/20130125_shizuku_e.html

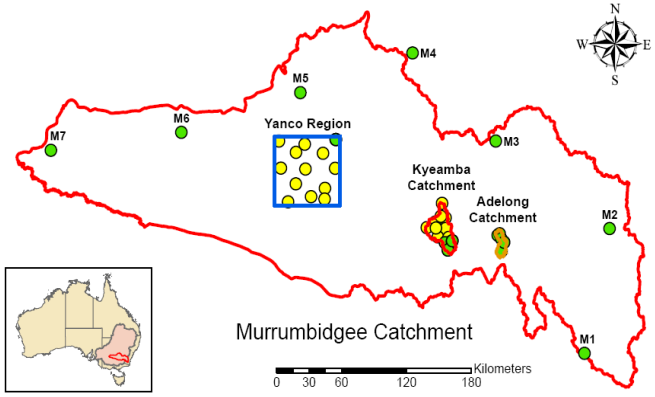
# AMSR2 Soil Moisture Product v0.1



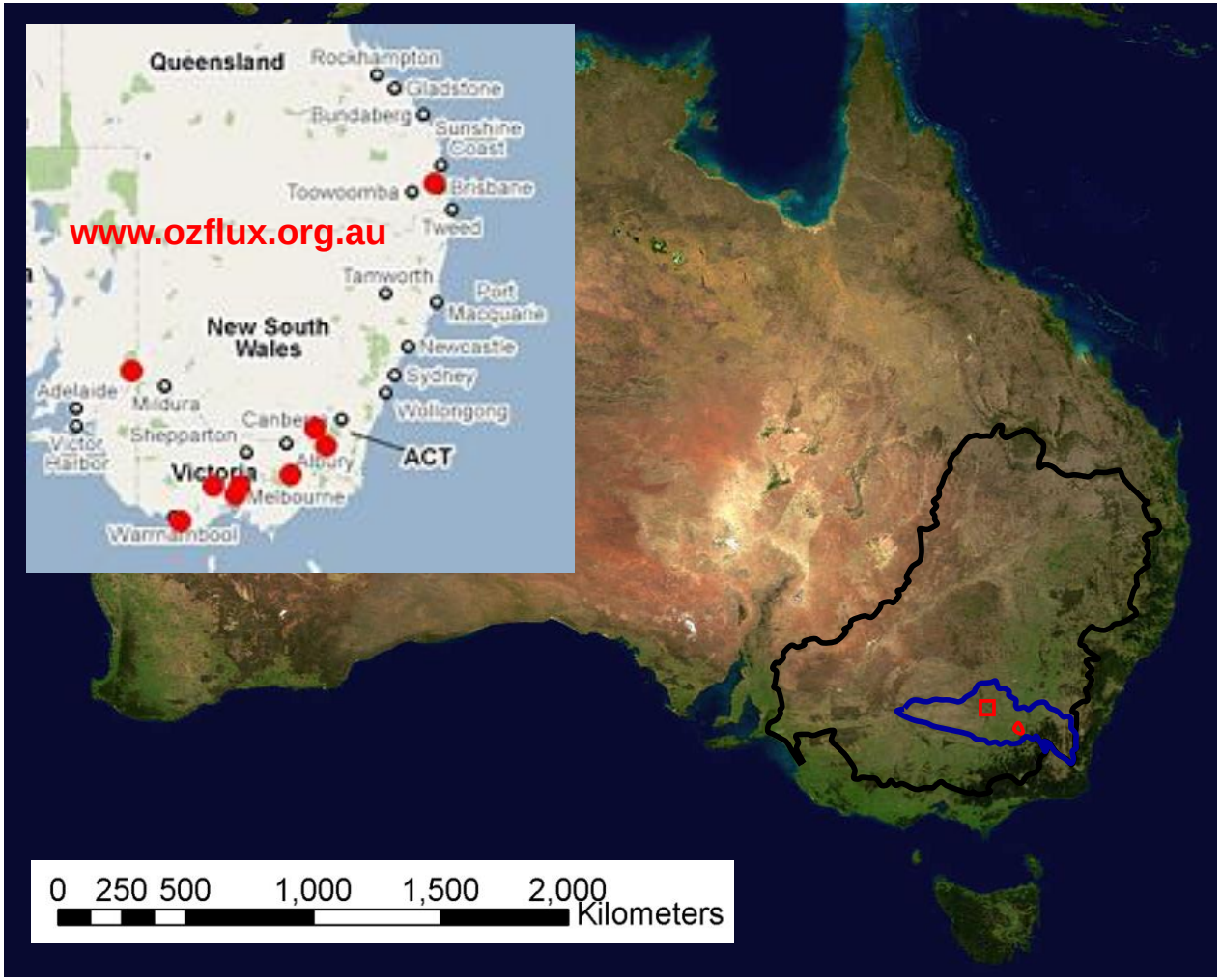
# Project Overview




**Undertake validation of AMSR2 soil moisture observations *and downscaled products* in the Murray Darling Basin of Australia, and their subsequent use in land surface data assimilation systems.**

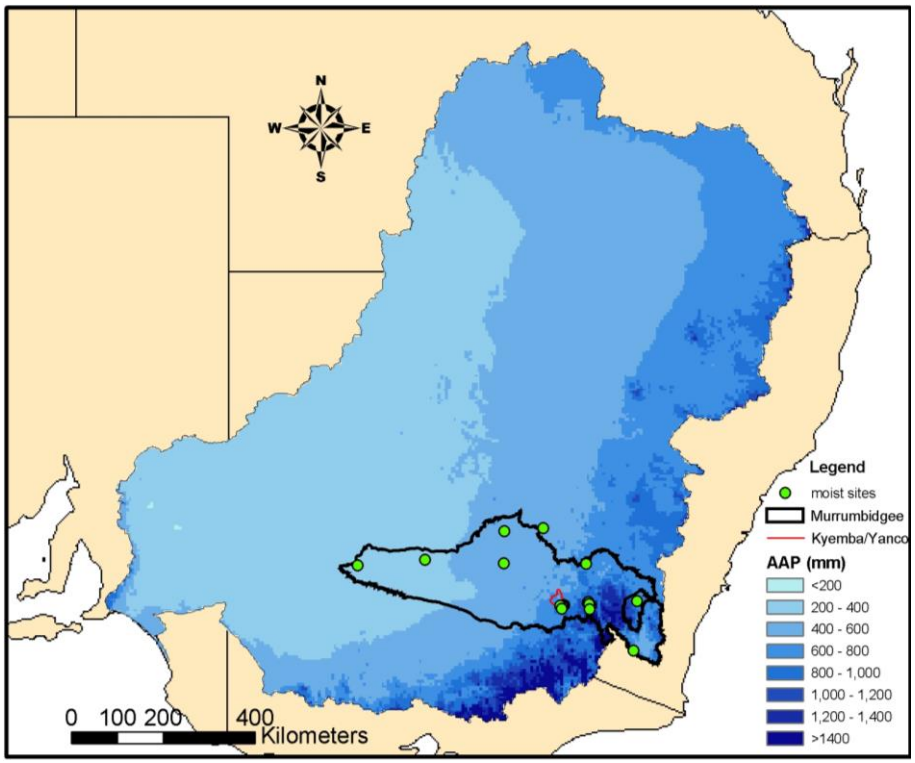


# The Murray Darling Basin

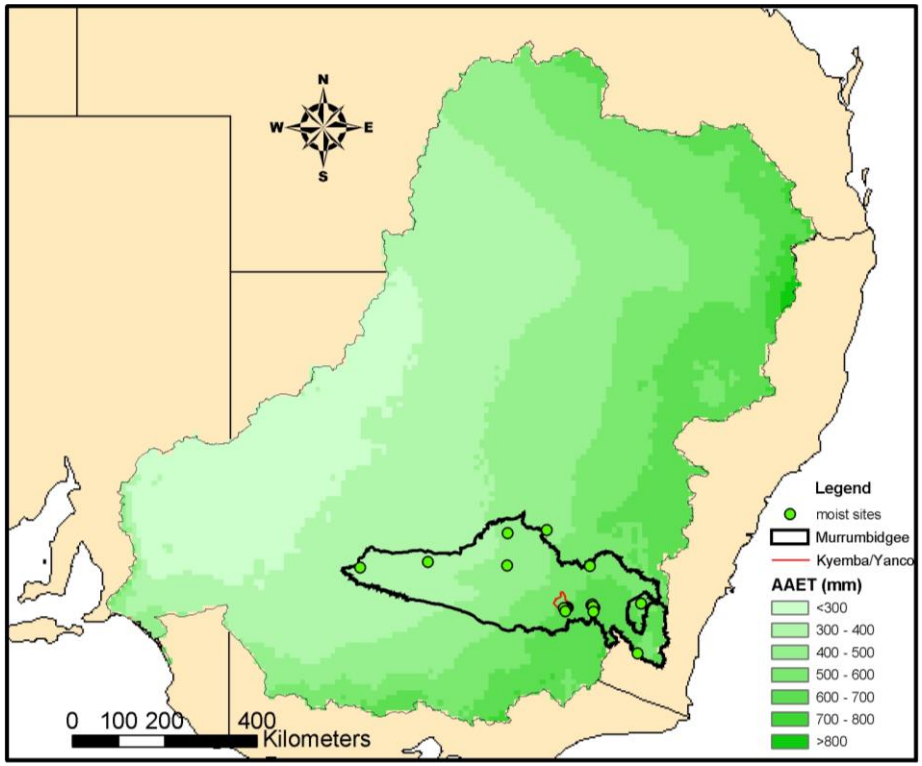


# Precipitation and Evapotranspiration

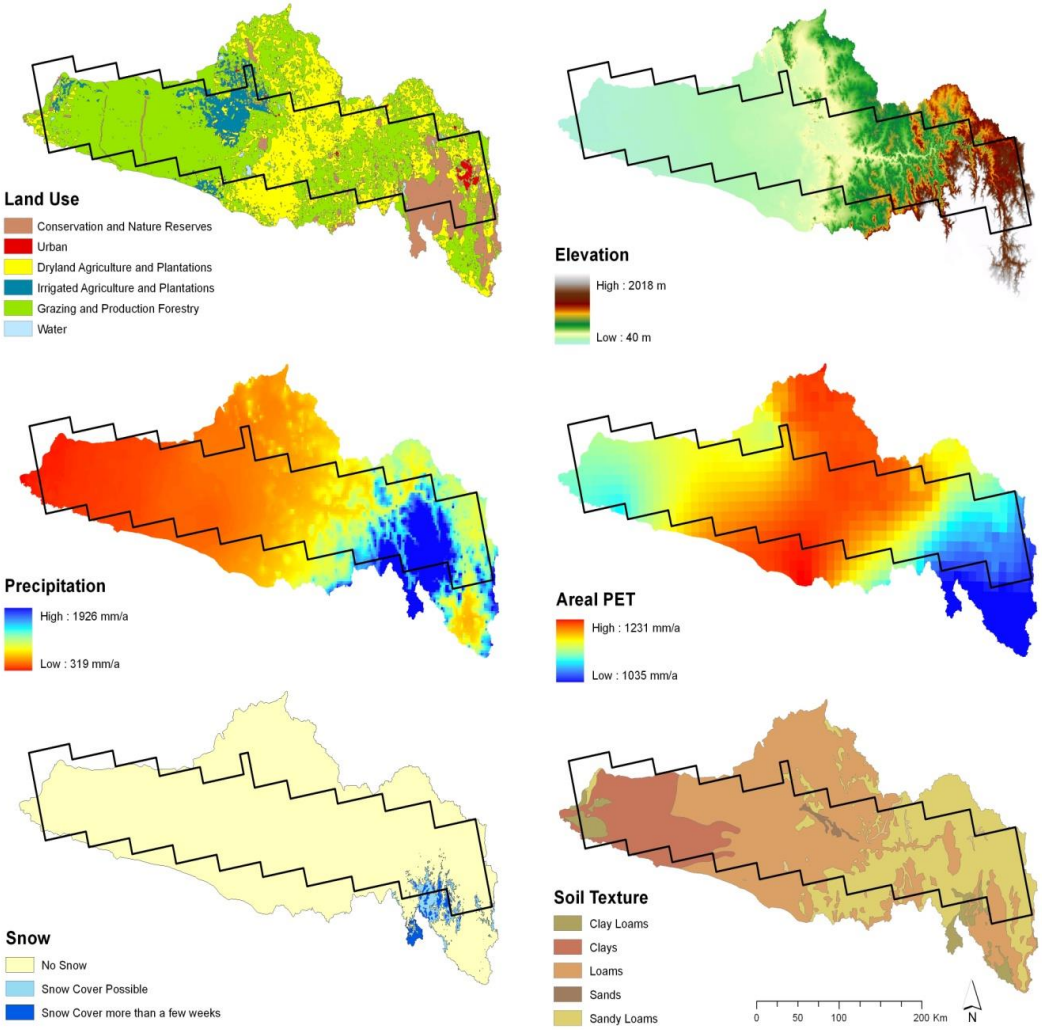
**Average Annual Precipitation (mm)**

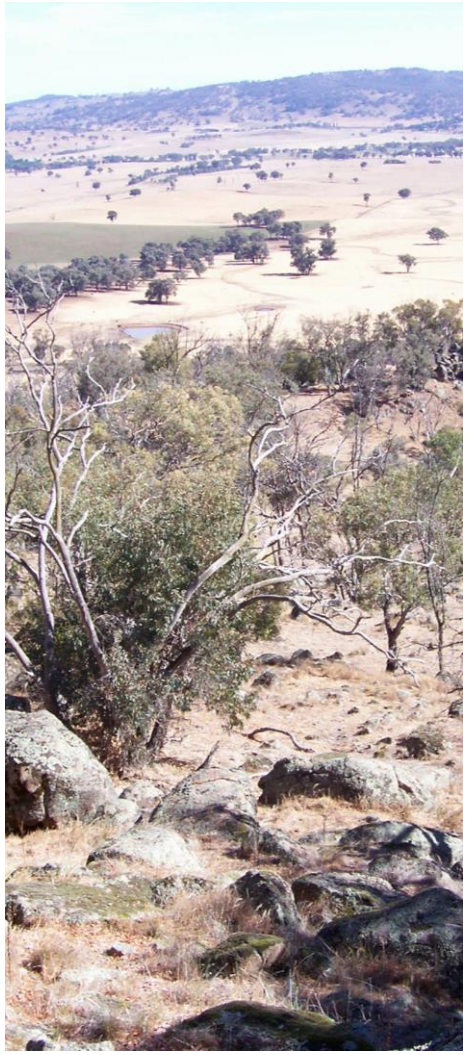



**Annual Actual Evapotranspiration (mm)**



# Catchment characteristics



# Specific Objectives

1. Install and maintain a flux validation tower in addition to soil moisture

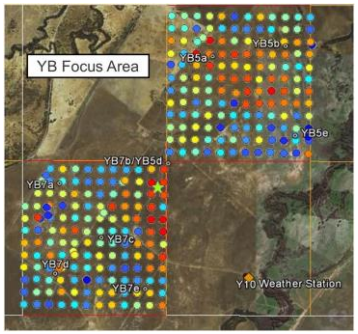
2. Validate AMSR2 soil moisture products
   - understanding the point-to-pixel scaling of the study site
   - comparison between time series station data and AMSR2
   - *comparison between model predictions and AMSR2*

3. Validate derived root-zone soil moisture AND land surface fluxes
   - official products
   - in-house studies

# Upscaling Plan for Validation of AMSR2

**1km resolution aircraft derived soil moisture**

(1) Validation of aircraft retrievals




**Intensive Sampling**

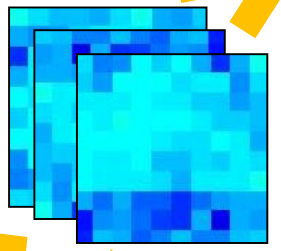
(2)

Validation of station representativeness

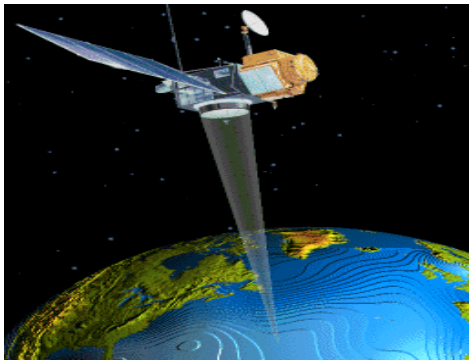
Validate Matched (5) Soil Moisture

(6) Identify long-term representative in-situ stations

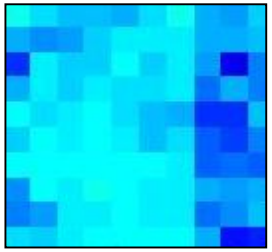
**CDF Matched JULES Soil Moisture time series**



(7) Validation of AMSR2



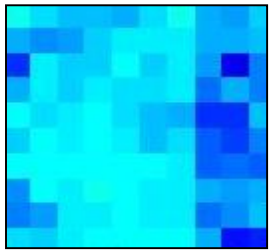
**AMSR2 Soil Moisture Product**



**JULES Simulation**

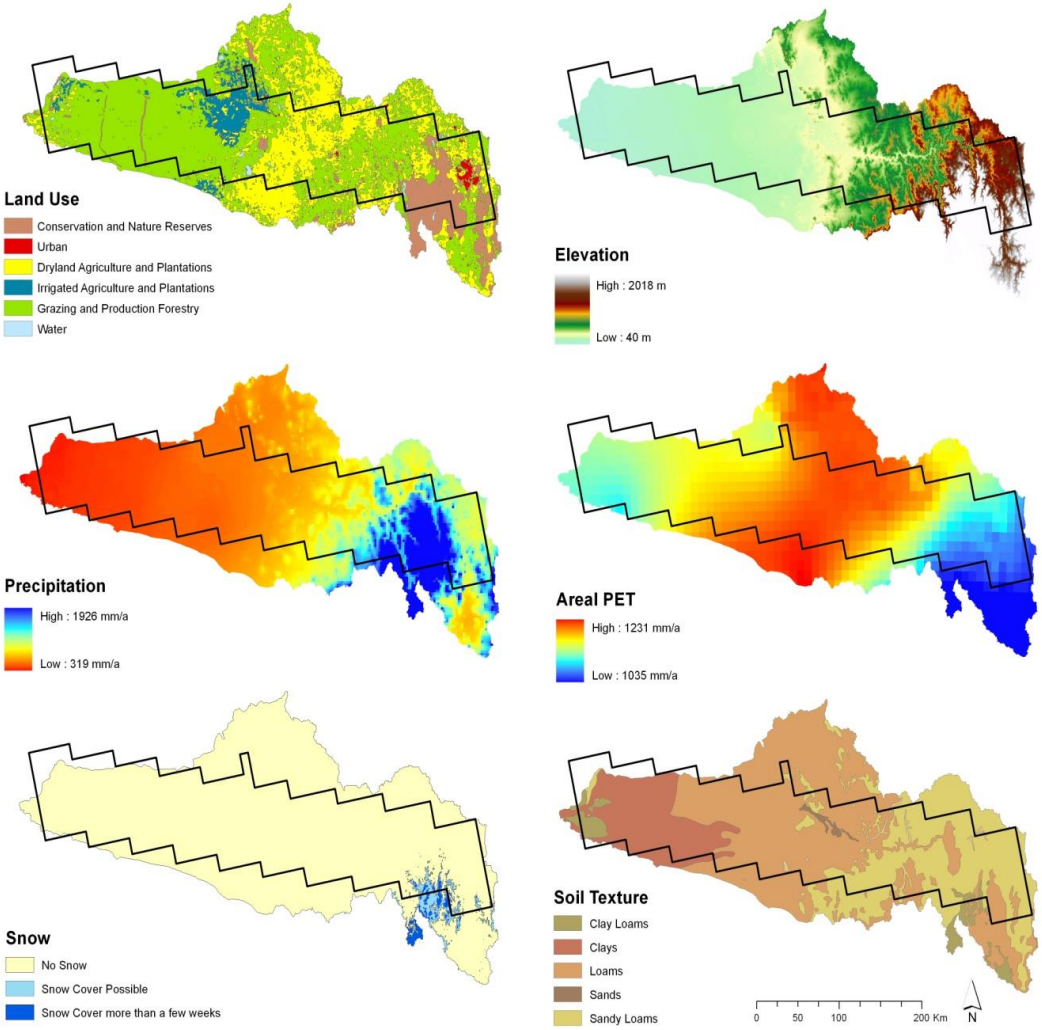
(3) CDF Matching

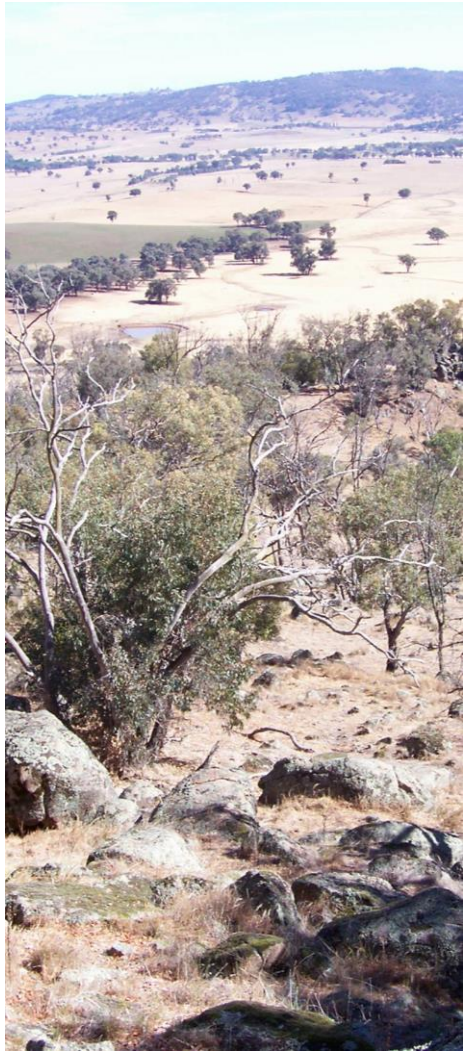
Matched JULES (4) Simulation



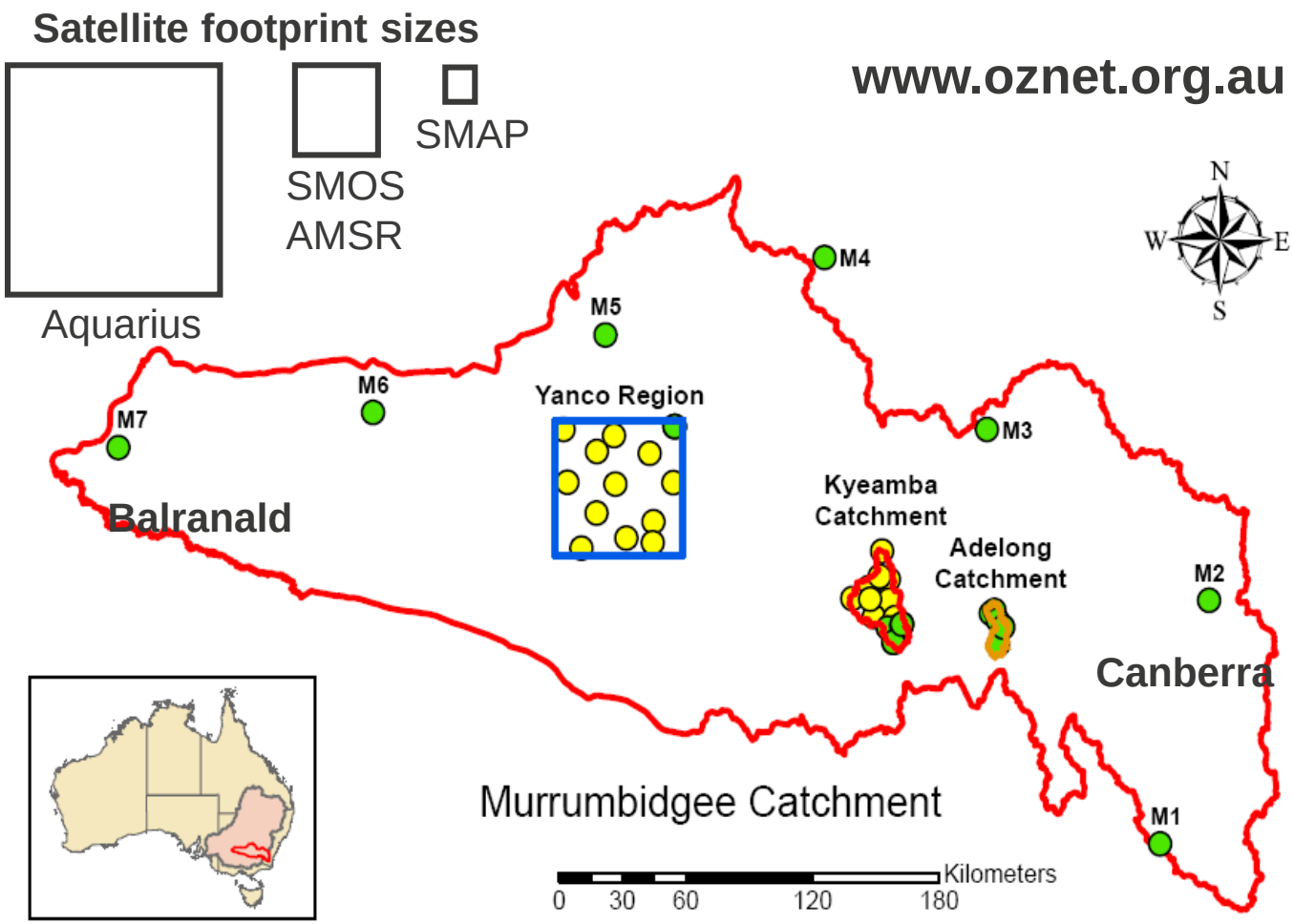
**JULES Simulation**

# Catchment characteristics



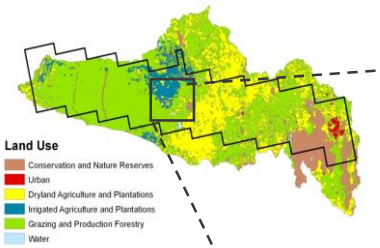



# A ground based soil moisture observatory



*Smith, Walker et al. (In Review) WRR*

# The SMAP test-bed (core validation site)

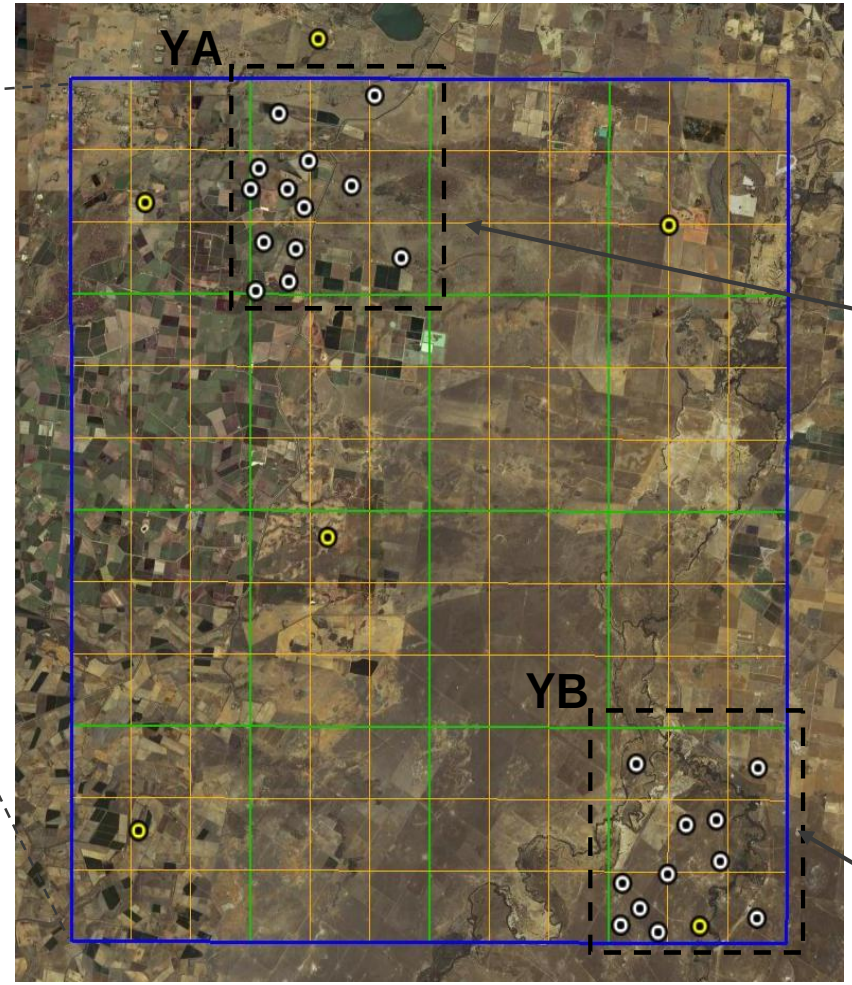



SM sites

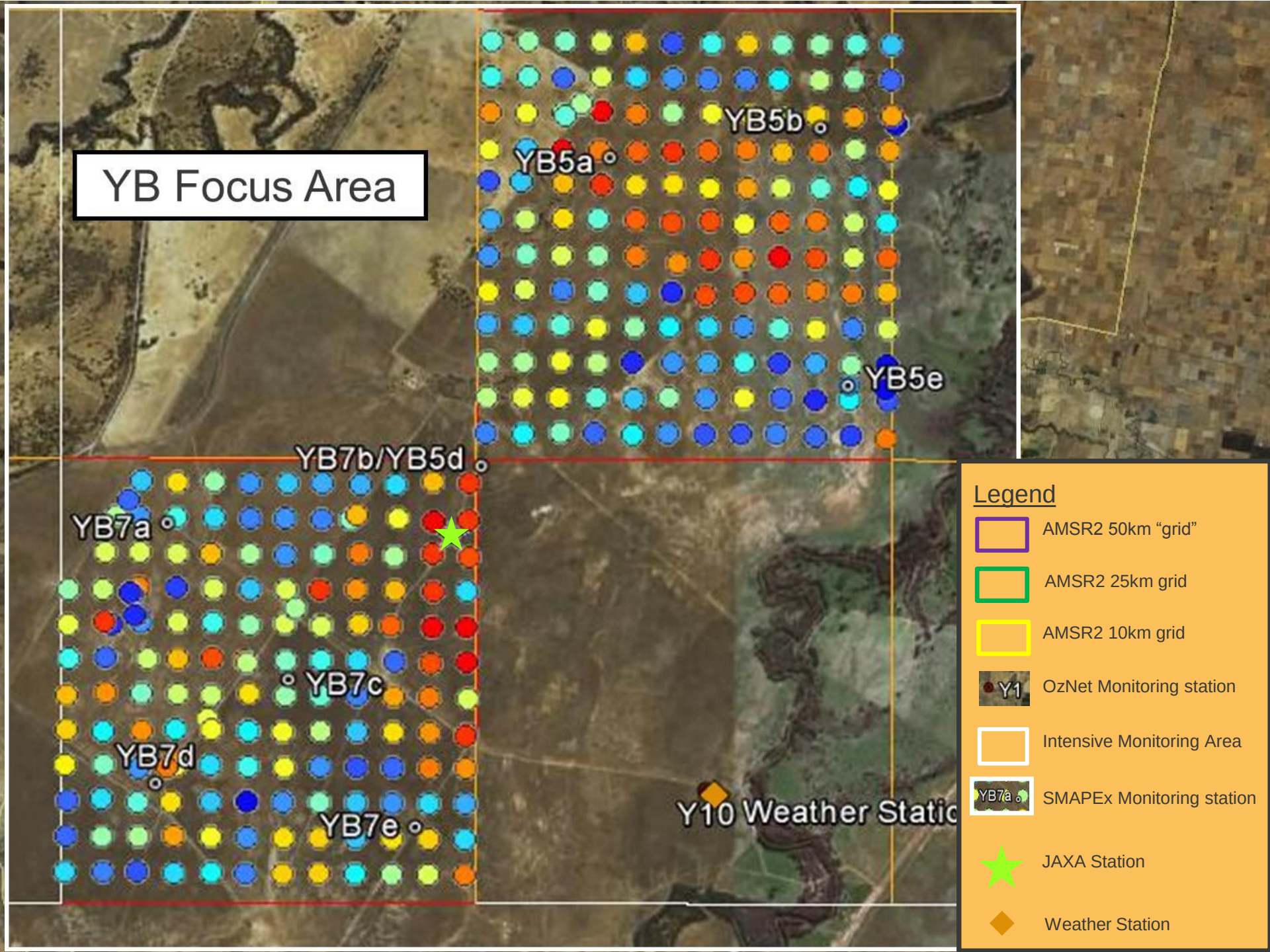
- 0-5cm
- 0-90cm only

SMAP grids

- L3_SM_40km
- L3_HiRes
- L3_AP_SM

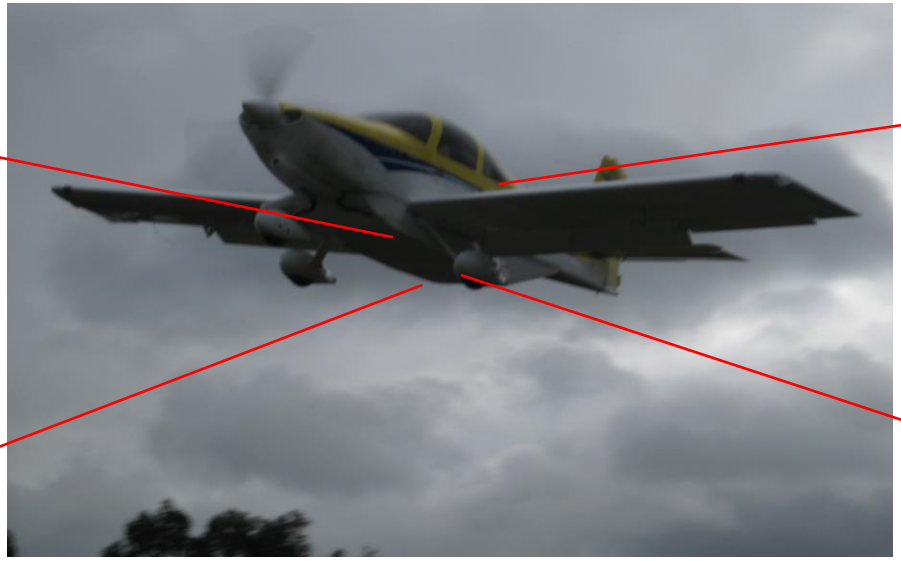



~40km


YB Focus Area
YB5b
YB5a
YB5e
YB7b/YB5d
YB7a
YB7c
YB7d
YB7e
Y10 Weather Statio
Legend
AMSR2 50km “grid”
AMSR2 25km grid
AMSR2 10km grid
Y1
OzNet Monitoring station
Intensive Monitoring Area
YB7a
SMAPEx Monitoring station
JAXA Station
Weather Station

# SMAP simulator

**L-band radiometer (PLMR)**



**6 x Vis/NIR/SWIR/TIR**

**L-band radar (PLIS)**

**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: 8 × 8 patch array

**PLIS: Polarimetric L-band Imaging SAR**

Frequency/bandwidth:1.26GHz/30MHz

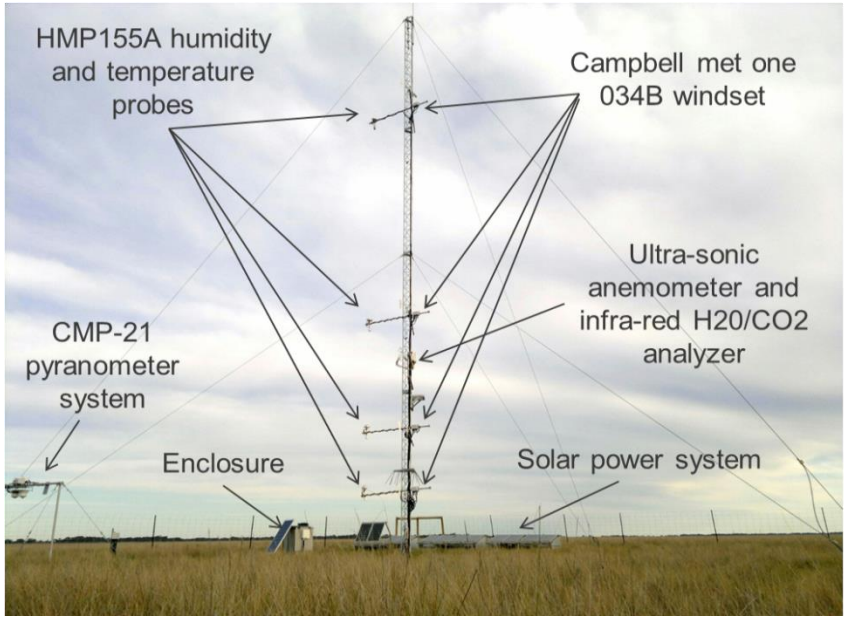
Polarisations: VV, VH, HV and HH

Resolution: ~10m

Inc. angles 15º -45º on both sides of aircraft

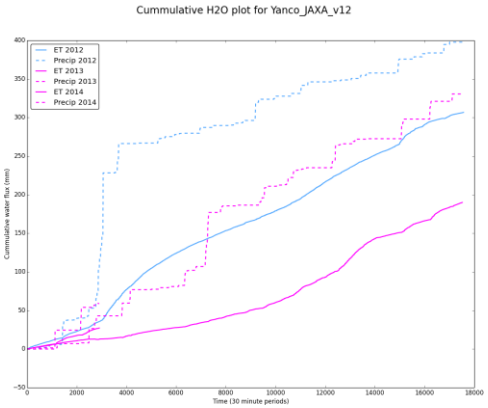
Antenna type: 2x2 patch array

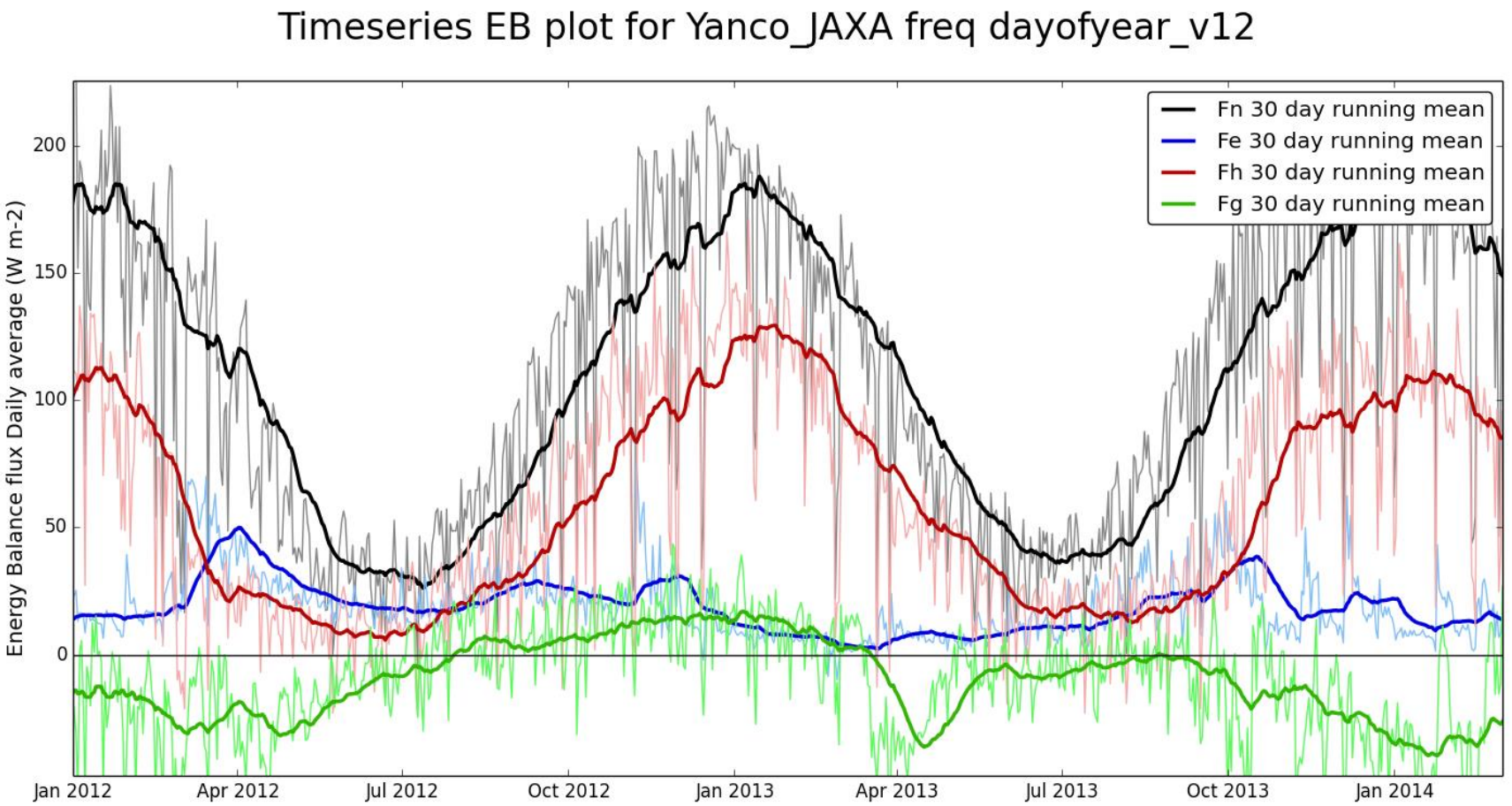
# 1. Install JAXA Flux Tower & Weather Stn

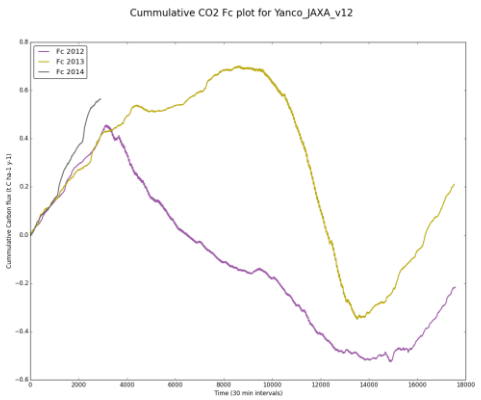


http://www.arts.monash.edu.au/ges/research/climate/jaxa/

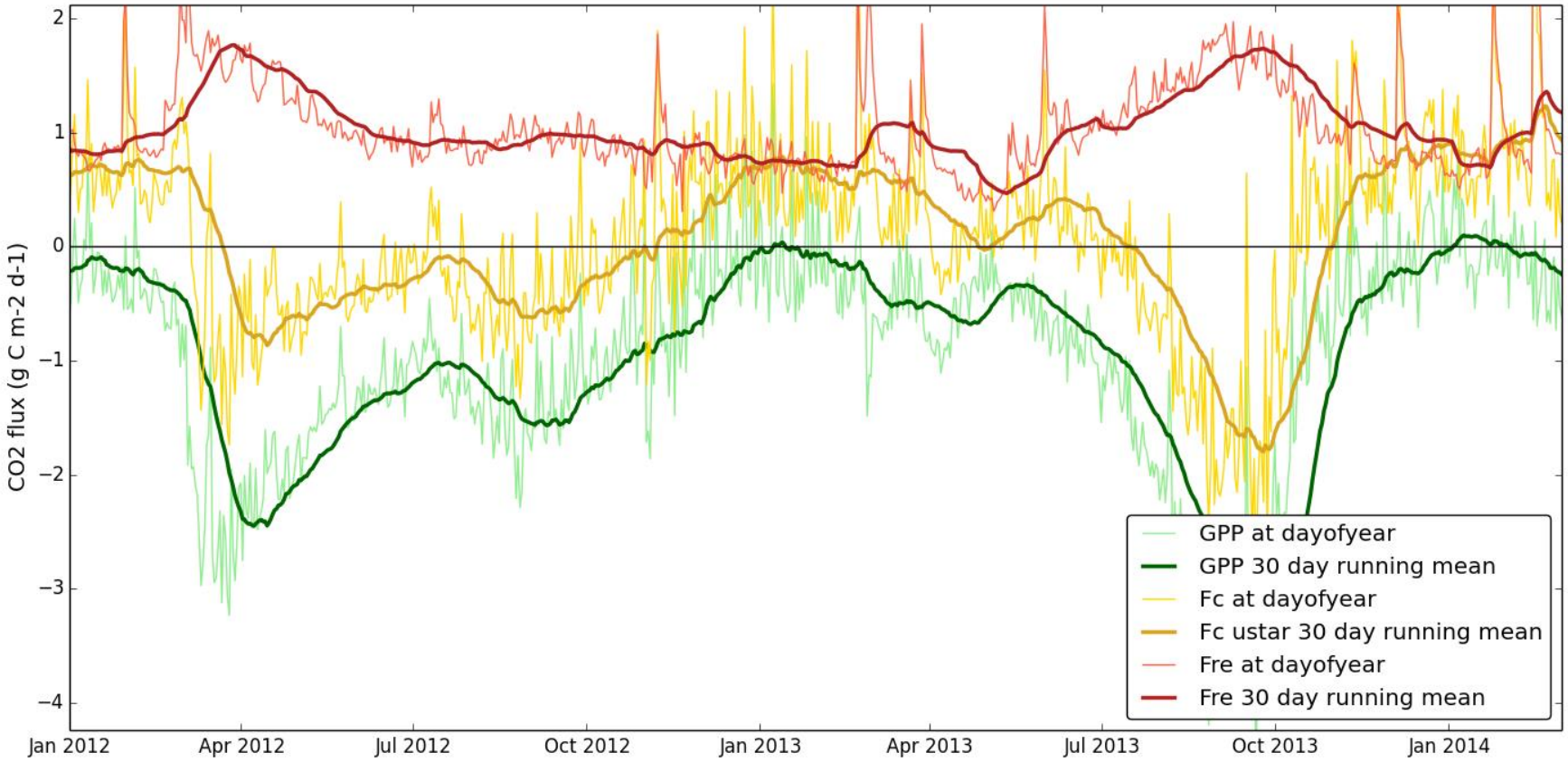
Operational since June 2012


Cummulative H2O plot for Yanco_JAXA_v12
ET 2012
Precip 2012
ET 2013
Precip 2013
ET 2014
Precip 2014
Cummulative water flux (mm)
Time (30 minute periods)

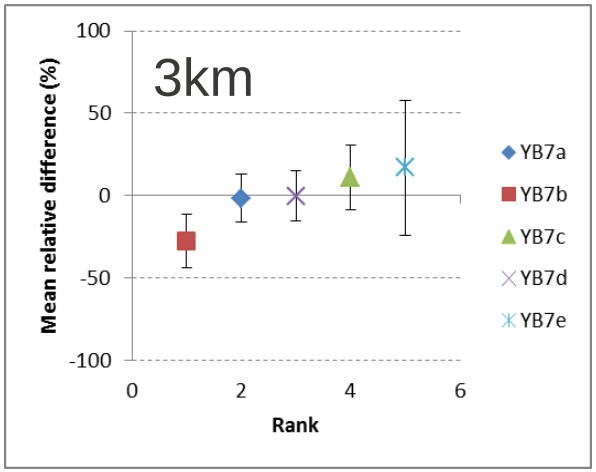

Timeseries EB plot for Yanco_JAXA freq dayofyear_v12
Fn 30 day running mean
Fe 30 day running mean
Fh 30 day running mean
Fg 30 day running mean
Energy Balance flux Daily average (W m-2)
200
150
100
50
0
Jan 2012
Apr 2012
Jul 2012
Oct 2012
Jan 2013
Apr 2013
Jul 2013
Oct 2013
Jan 2014

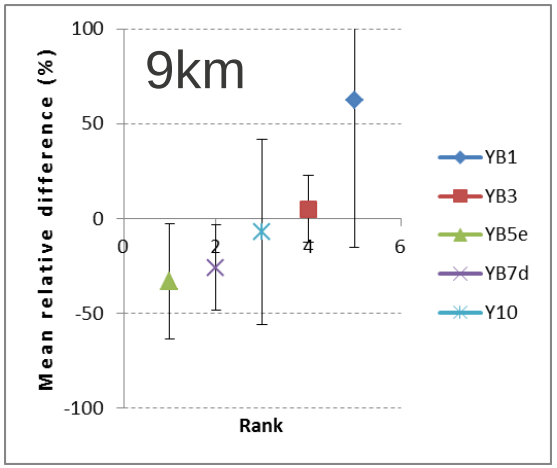


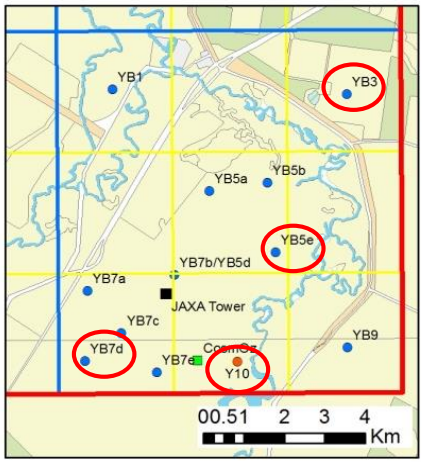

# Timeseries Carbon plot for Yanco_JAXA freq dayofyear_v12

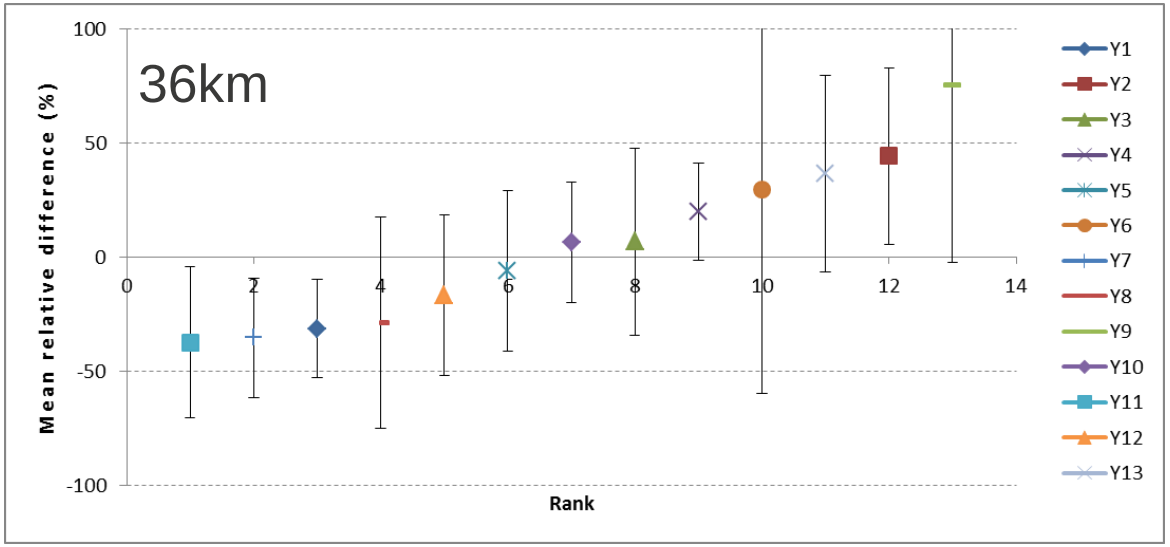


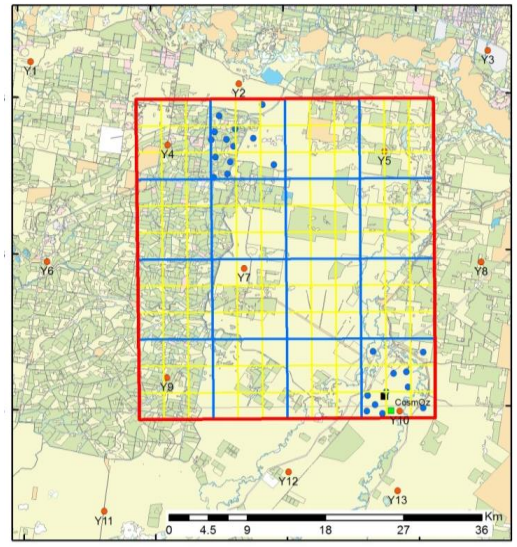
# 2. Understand the Point-to-Pixel Scaling



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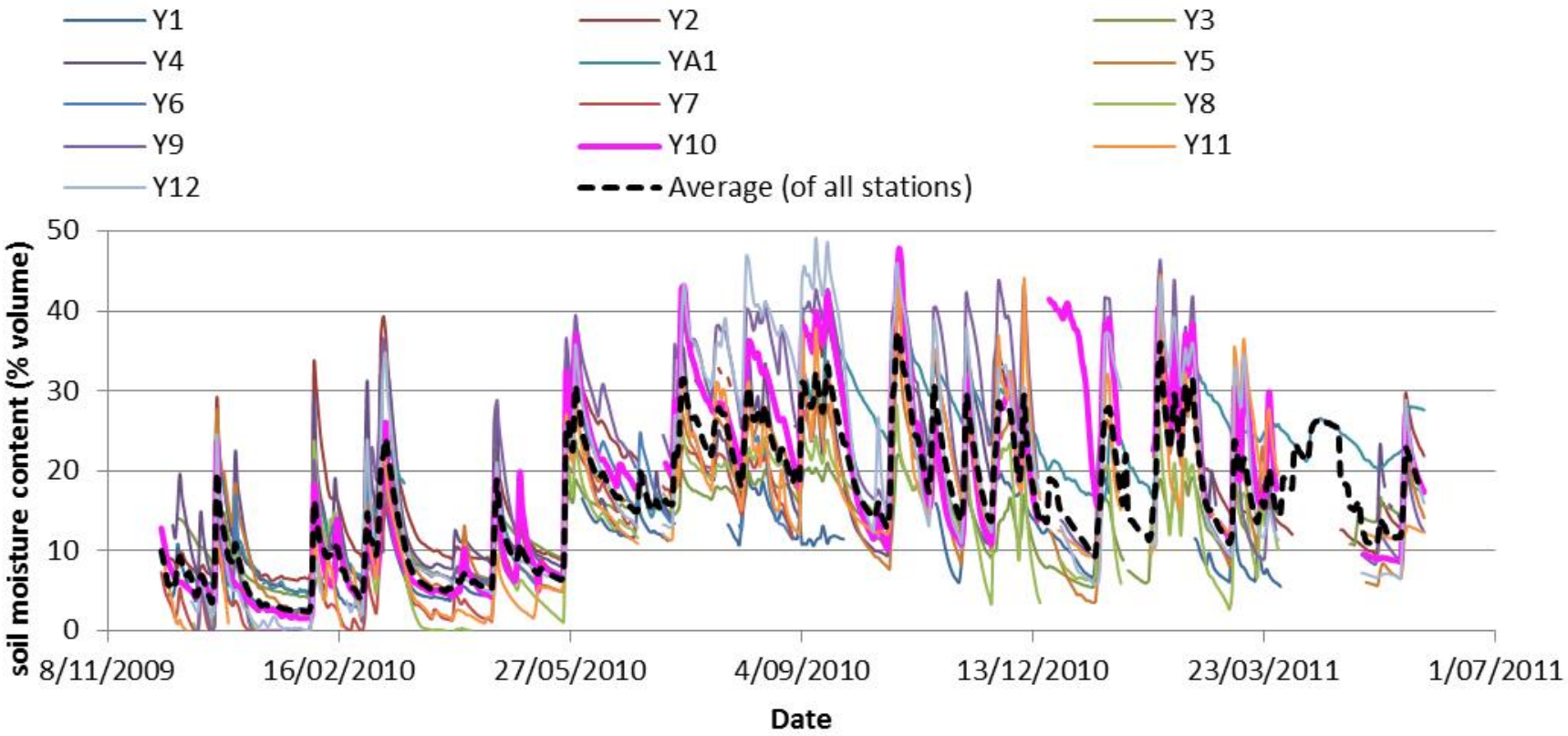
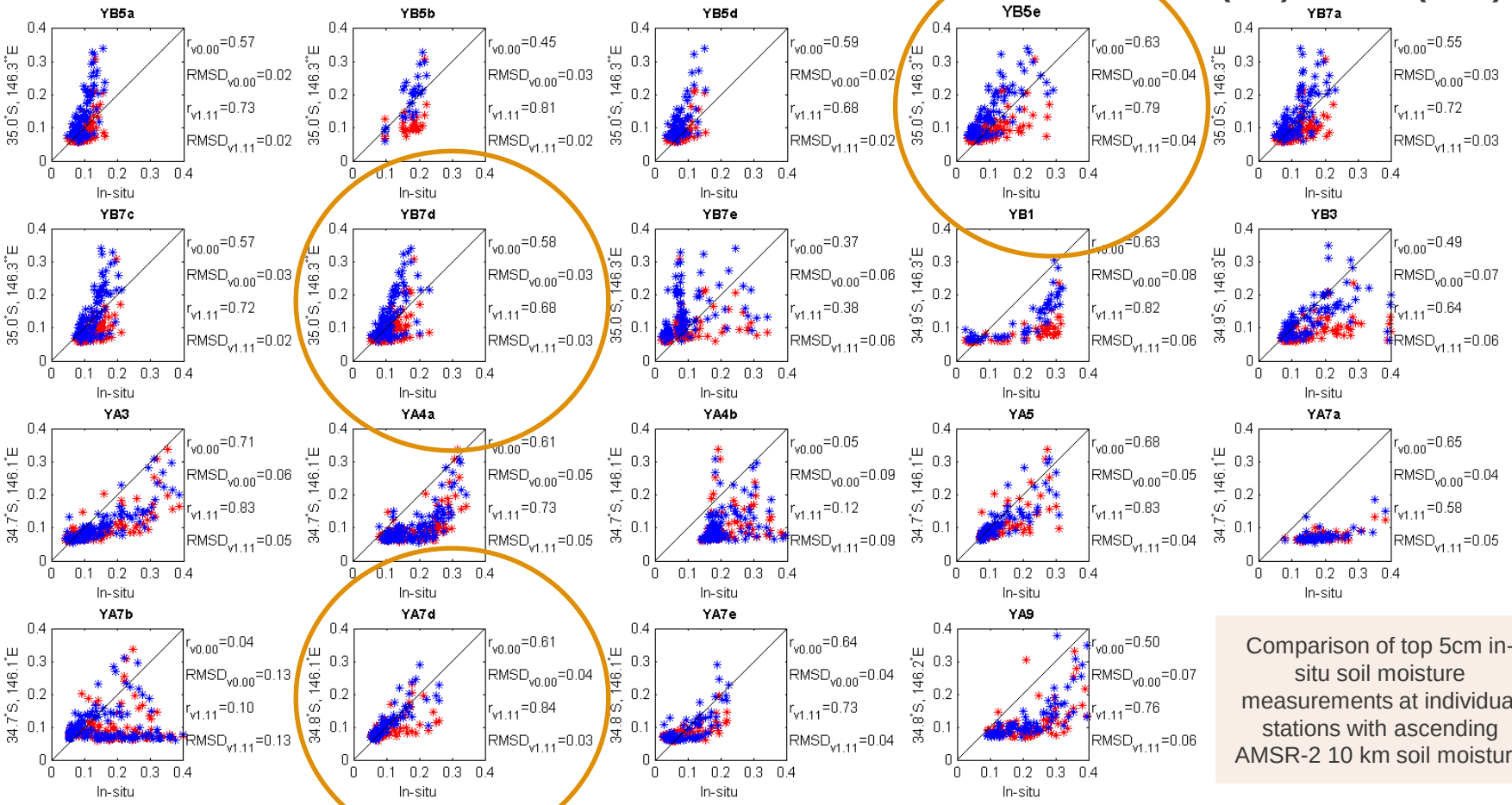



Disseldorp, D, Yee, M, Monerris, A and Walker, JP, 2013. Development of a SMAP satellite validation site using temporal stability analysis. *20th International Congress on Modelling and Simulation (MODSIM)*, Adelaide, Australia, 1-6 December, 2013.

# 2b. In-situ Comparison with AMSR2 SM

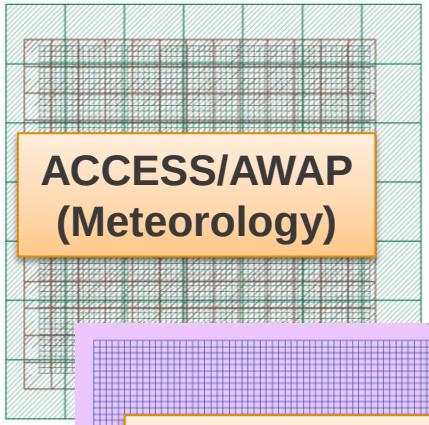
**AMSR2 2012 v0.0 (red) vs v1.1 (blue)**




Comparison of top 5cm in-situ soil moisture measurements at individual stations with ascending AMSR-2 10 km soil moisture

M. Yee, JP. Walker, G. Dumedah, A. Monerris and C. Rüdiger , 2013. Towards Land Surface Model validation from Using Satellite Retrieved Soil Moisture. 20th International Congress on Modelling and Simulation (MODSIM), Adelaide, Australia, 1-6 December, 2013.

# 2c. Model Comparison with AMSR2 SM

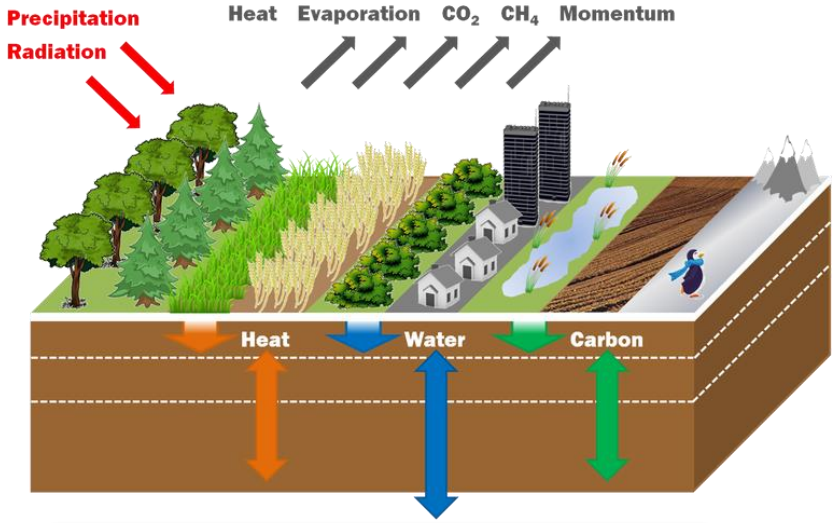


ACCESS/AWAP (Meteorology)

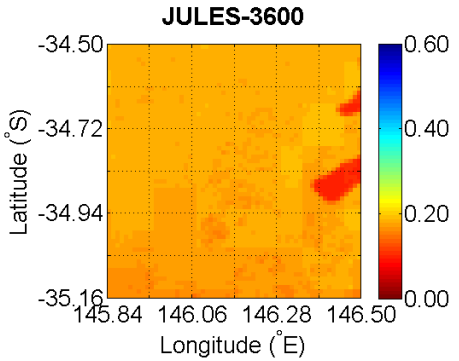
Digital Atlas of Australian Soils

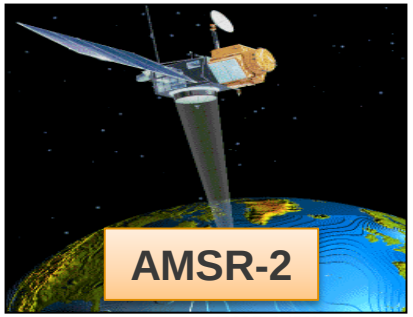
National Dynamic Land Cover

JULES LAND SURFACE MODEL

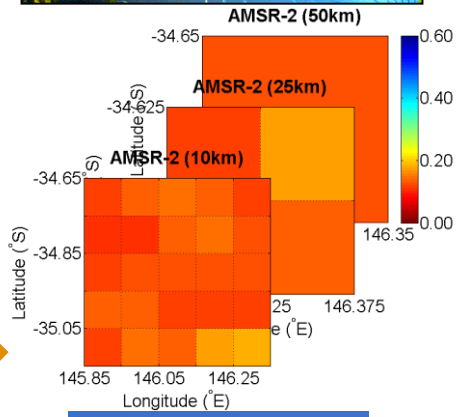



OUTPUT (Soil moisture)



AMSR-2

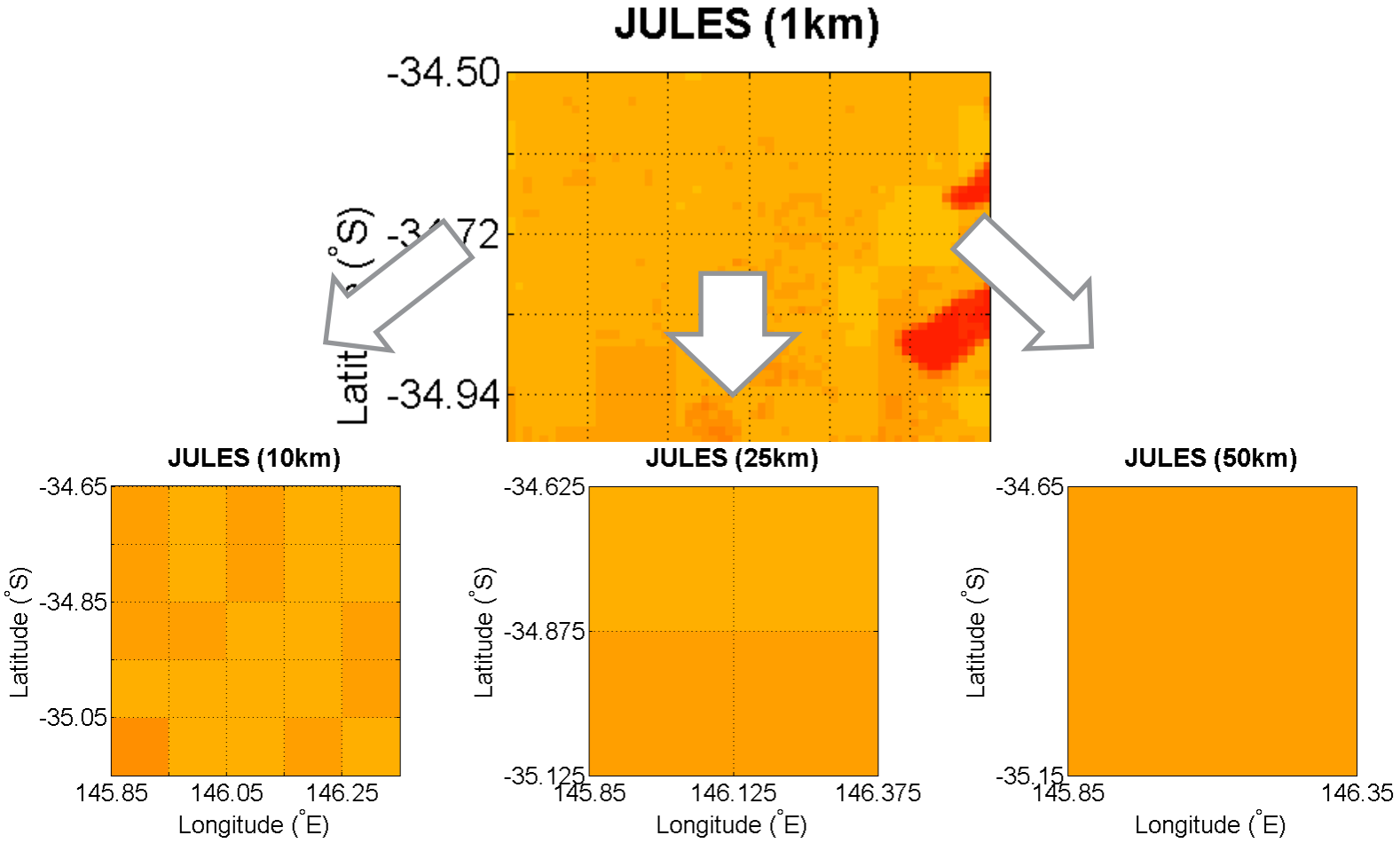


Soil Moisture Stations

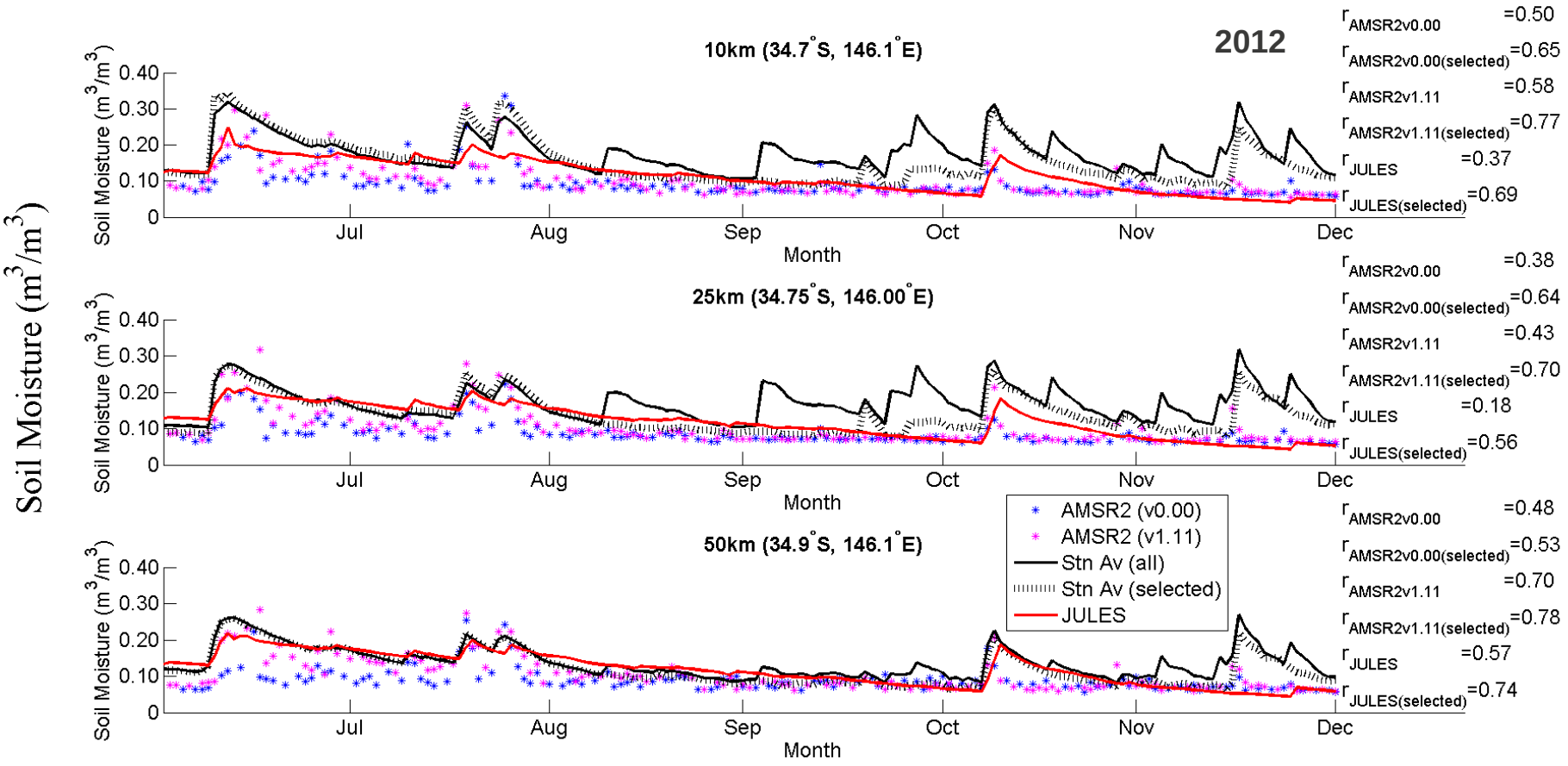
MONASH University

Towards global water and energy balance monitoring using GCOM-W1 in the Australian Murray Darling Basin

# 2c. Model Comparison with AMSR2 SM



# 2c. Model Comparison with AMSR2 SM




M. Yee, JP. Walker, G. Dumedah, A. Monerris and C. Rüdiger , 2013. Towards Land Surface Model validation from Using Satellite Retrieved Soil Moisture. 20th International Congress on Modelling and Simulation (MODSIM), Adelaide, Australia, 1-6 December, 2013.

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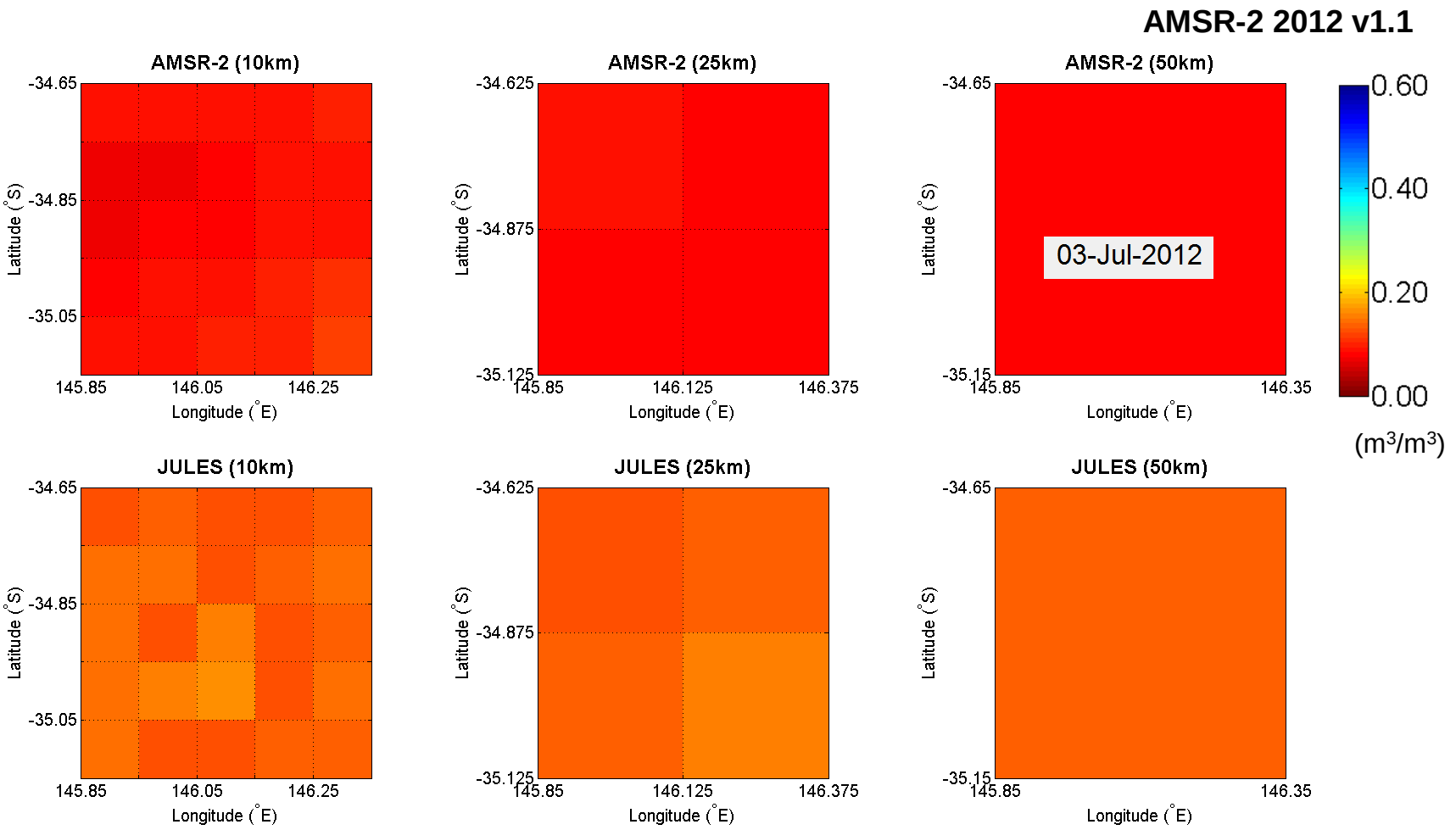

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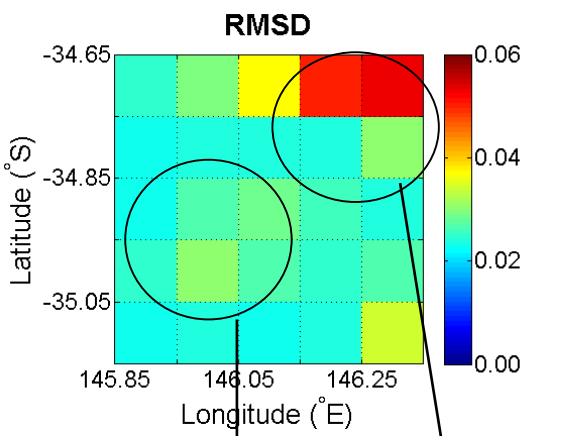
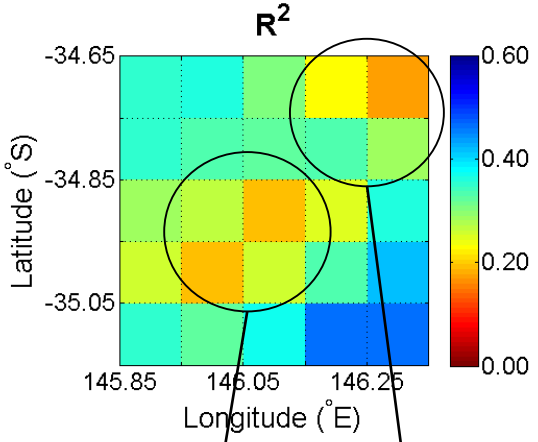
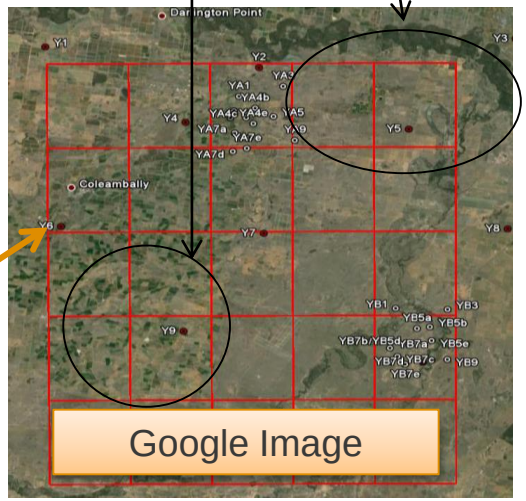
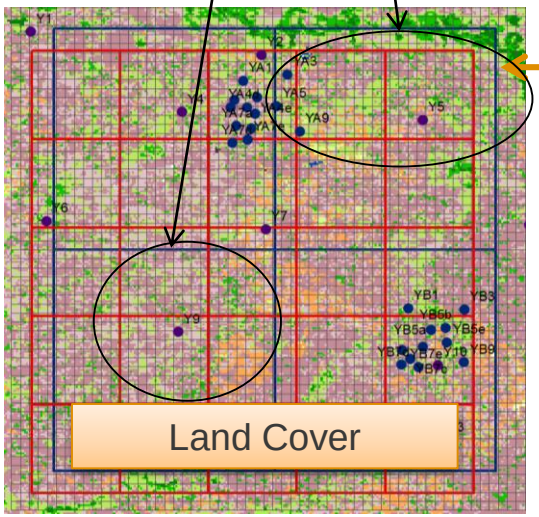


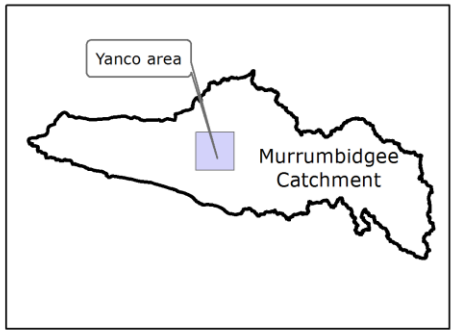



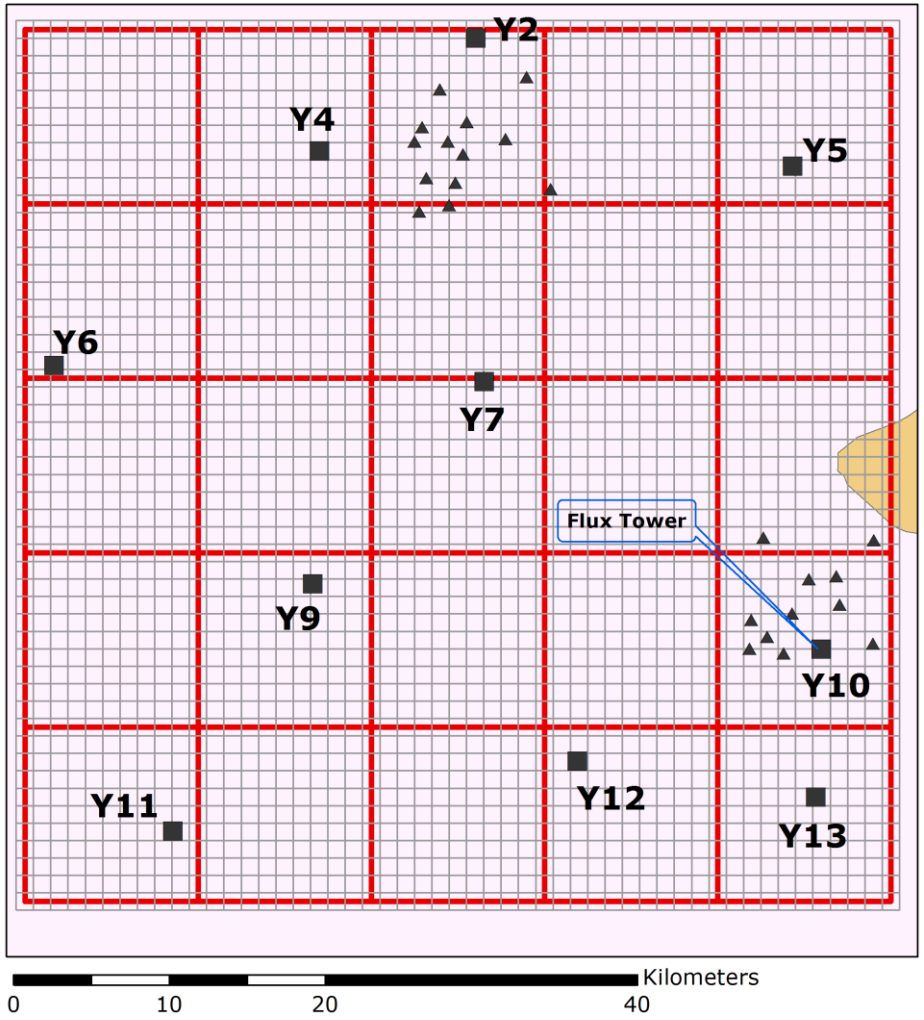




Irrigation/ Cropping Activities

Trees and water bodies

# 3. Validation of Derived SM and Fluxes




Legend

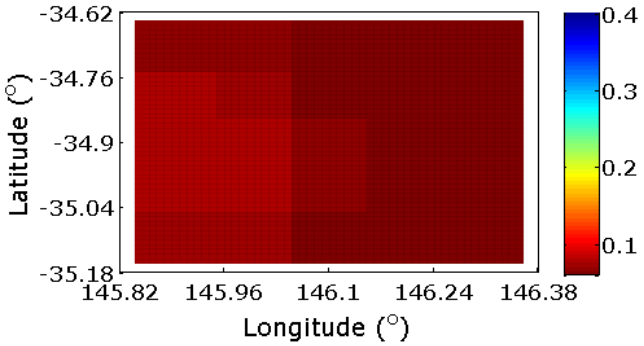
- SMAPEx stations
- OzNet stations
- MODIS 1km Grids
- 10km AMSR2 Grids

Surface Soil Texture

- Sand
- Sandy Loam
- Loam

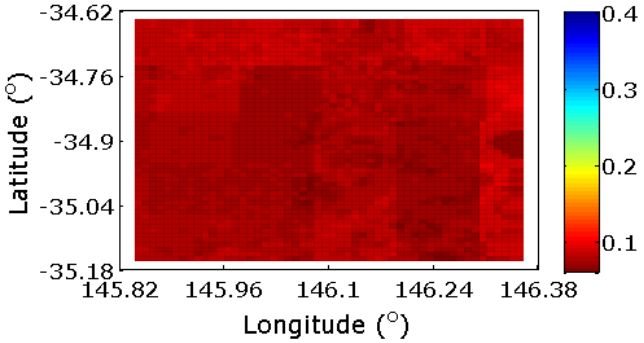
# 3. Validation of Derived SM and Fluxes

**AMSR2 – level 3**

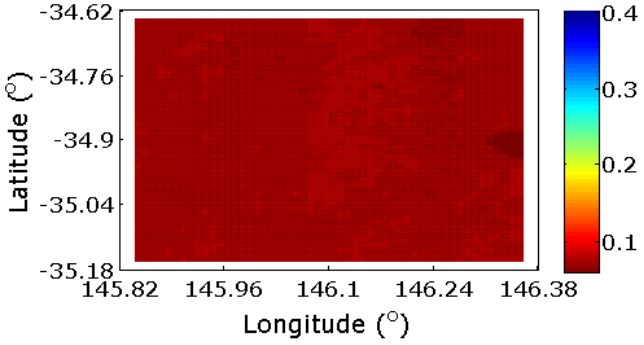



**Soil Moisture in the Yanco area on 23 July, 2012**

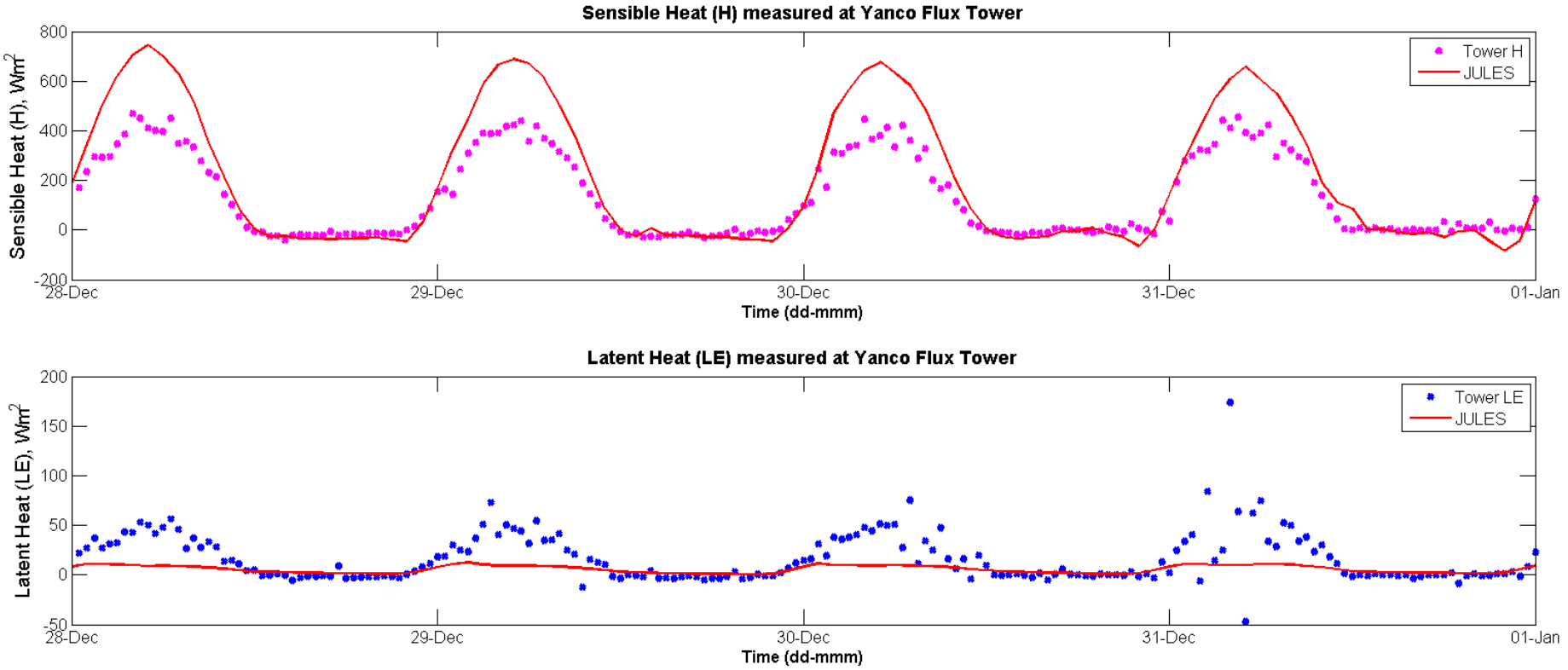
**Model estimate**




**Updated - EnKF**



# 3. Validation of Derived SM and Fluxes



# Future Work

- Develop/refine upscaling methodology
- Conduct AMSR2 validation for longer period/more diverse conditions as time progresses,
- Comparison/validation of downscaled products as made available
- Better understanding of model and its “biases”
- Assimilation of validated AMSR2 SM products into JULES to improve simulation of heat fluxes.