



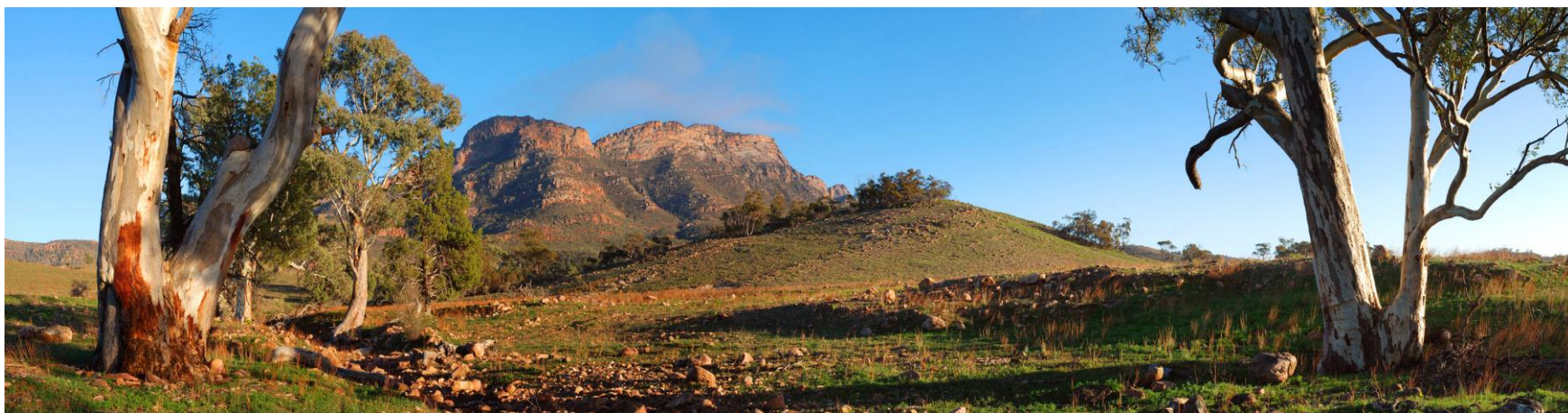
Australian Government
Geoscience Australia



Geoscience Australia Report: Activities Supporting Calibration and Validation for EO

Medhavy Thankappan

Director, Earth Observation Science, National Earth Observation Group



Geoscience Australia

- Agency in Federal Government Resources, Energy and Tourism portfolio
- Provides geoscientific information enabling government / community to make informed decisions about:

- resources
- environment
- community safety

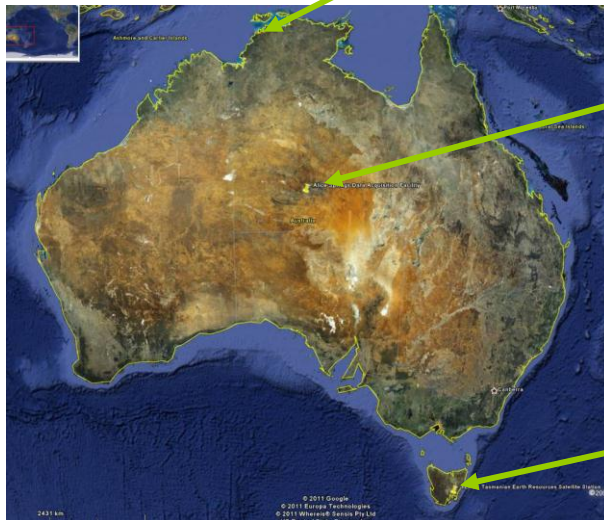


National Earth Observation Group

- National remote sensing capability
- Advice on use of EO data in national programs
- Provide data / information on land, oceans and hazards
- Manage EO data from international partners / commercial sources

EO Data Acquisition Facilities

1. New Antenna being installed in Darwin
2. Data Acquisition Facility at Alice Springs
3. Tasmanian Earth Resources Satellite Station (TERSS) Facility at Hobart



EO Archive at GA: Time Series Observations

*MODIS – daily
from 2000*



Jun 22, 2008

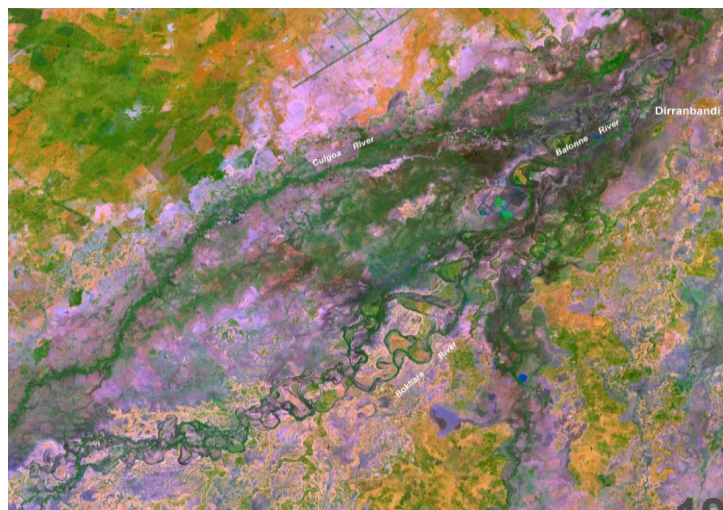


Jun 26, 2008

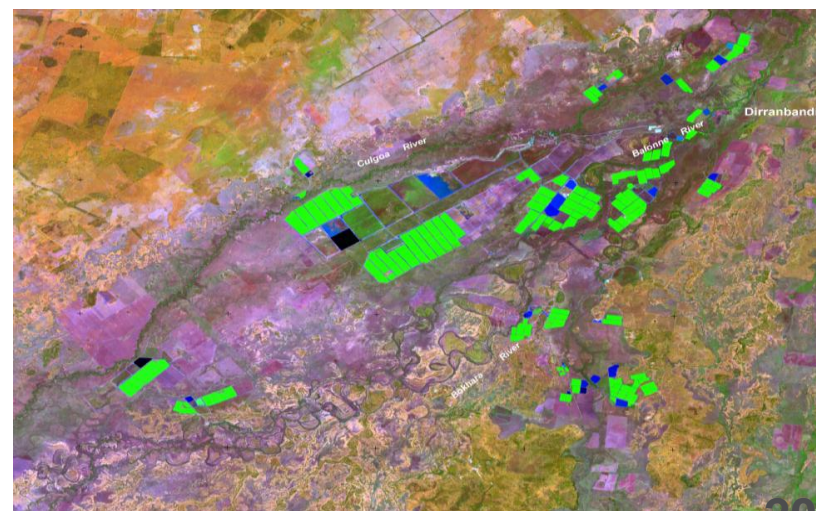
..... Nov 26, 2008



Landsat – fortnightly for 3 decades



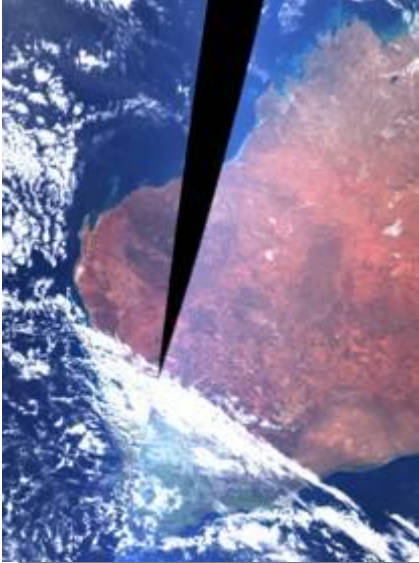
1988



2005

EO Data Correction

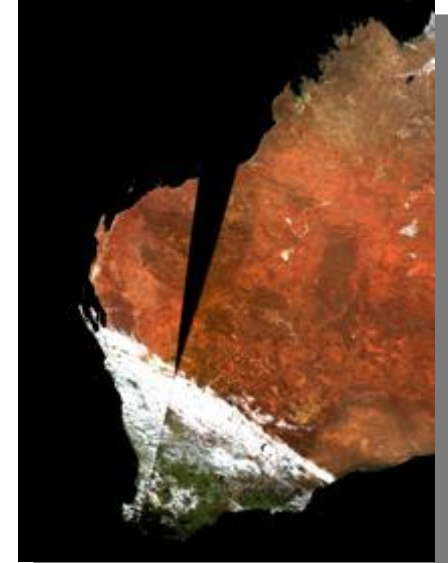
Top-Of-Atmosphere-Reflectance



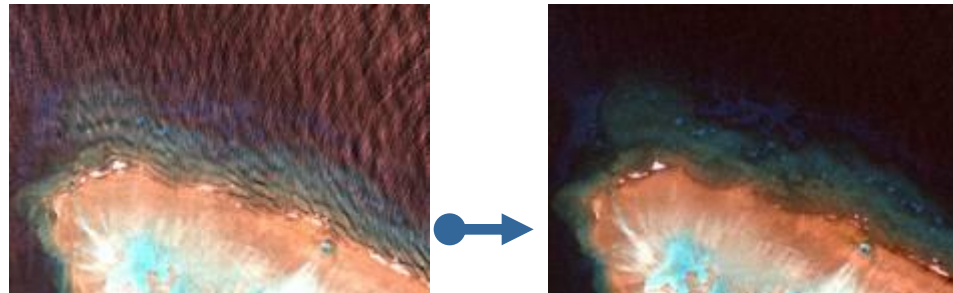
Bottom-Of-Atmosphere-Reflectance



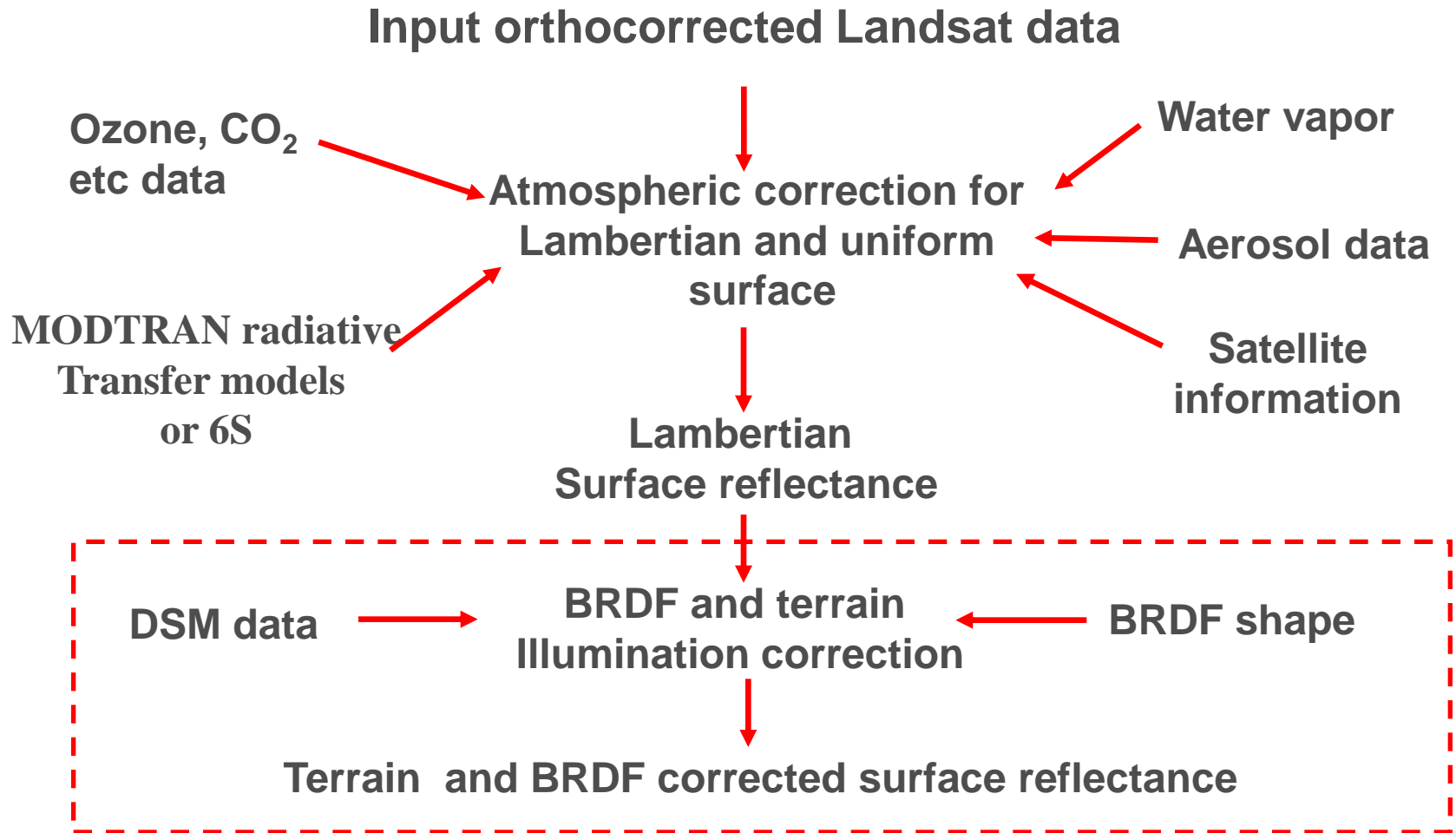
NADIR-Bottom-Of-Atmosphere-Reflectance



Sun glint correction



Atmosphere, Illumination and Terrain Correction



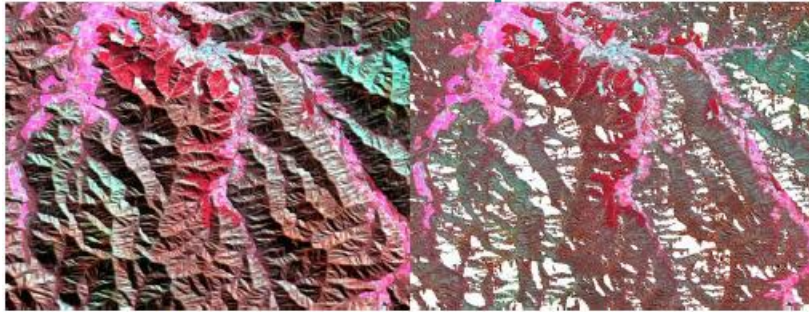
Li, F. et al. (2010) An Evaluation of the Use of Atmospheric and BRDF correction to Standardize Landsat Data

Li, F. et al. (2012) A physics-based atmospheric and BRDF correction for Landsat data over mountainous terrain

Terrain Illumination Correction

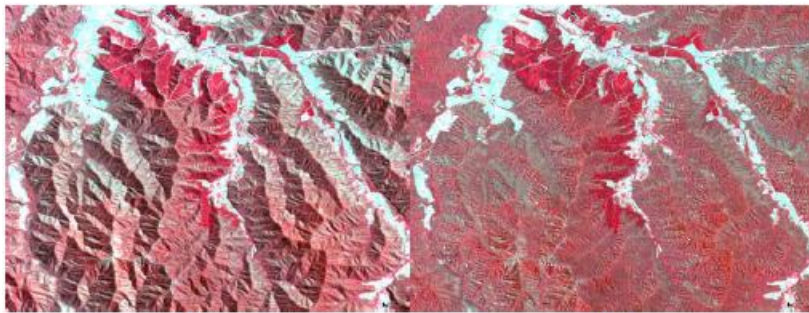
Li, F. et al. (2012) RSE A physics-based atmospheric and BRDF correction for Landsat data over mountainous terrain

Victorian Alps



(a)

(b)



(c)

(d)



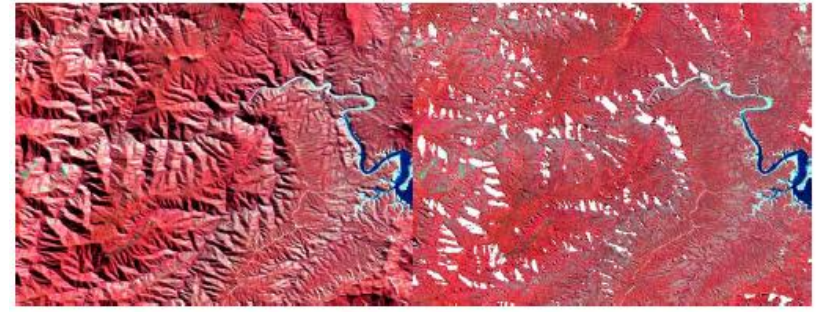
(e)

(f)

Uncorrected

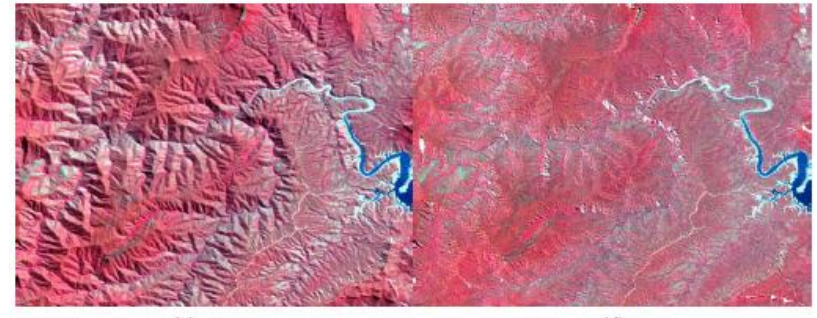
Corrected

Blue Mountains



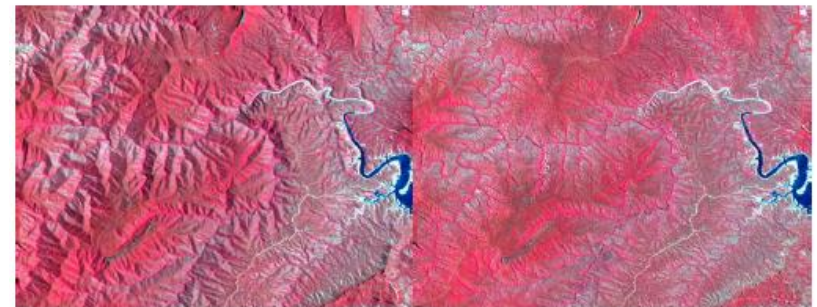
(a)

(b)



(c)

(d)



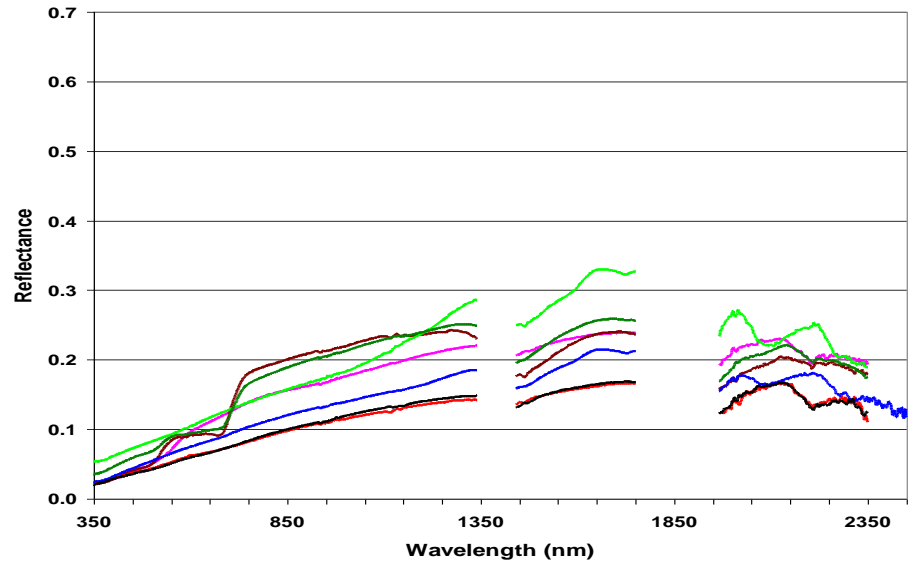
(e)

(f)

Uncorrected

Corrected

Field Measurements - June 2008

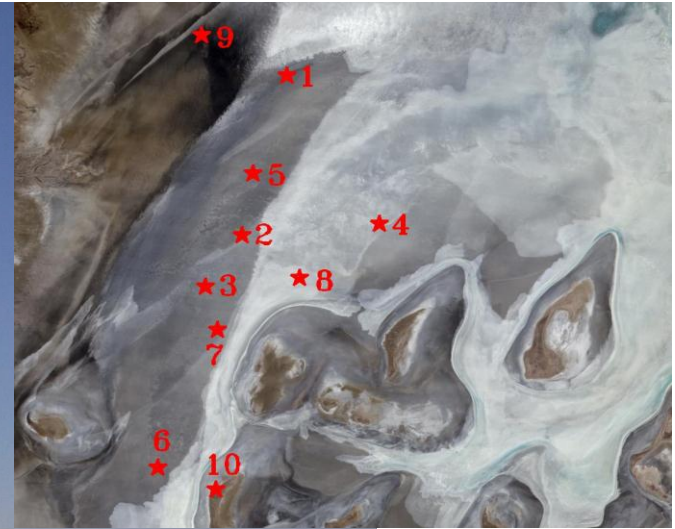


Gwydir - Northern New South Wales, bare soil and vegetation

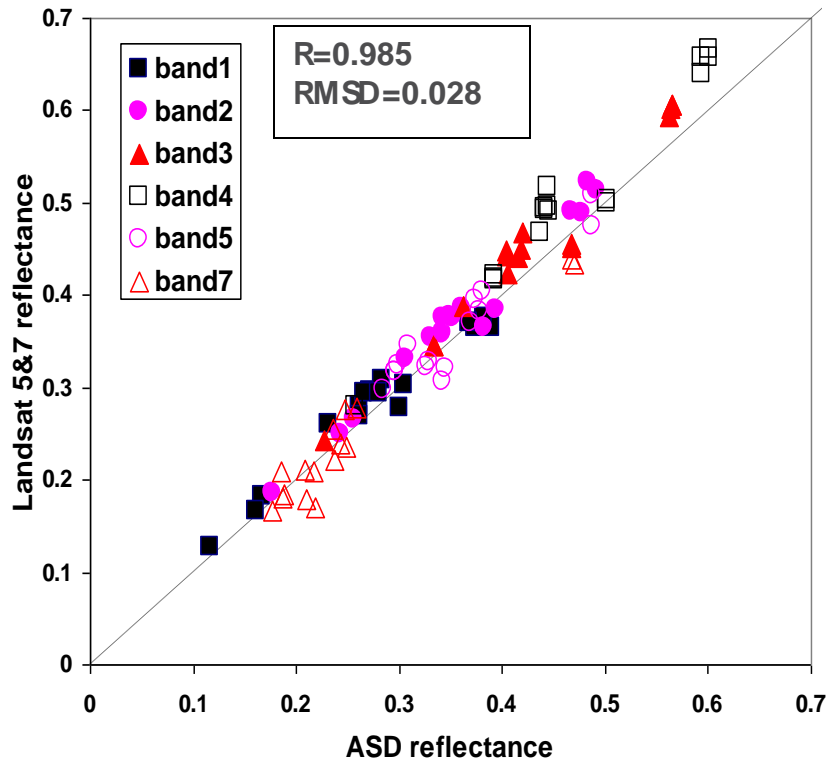
Calibration / Validation Campaign - February 2009



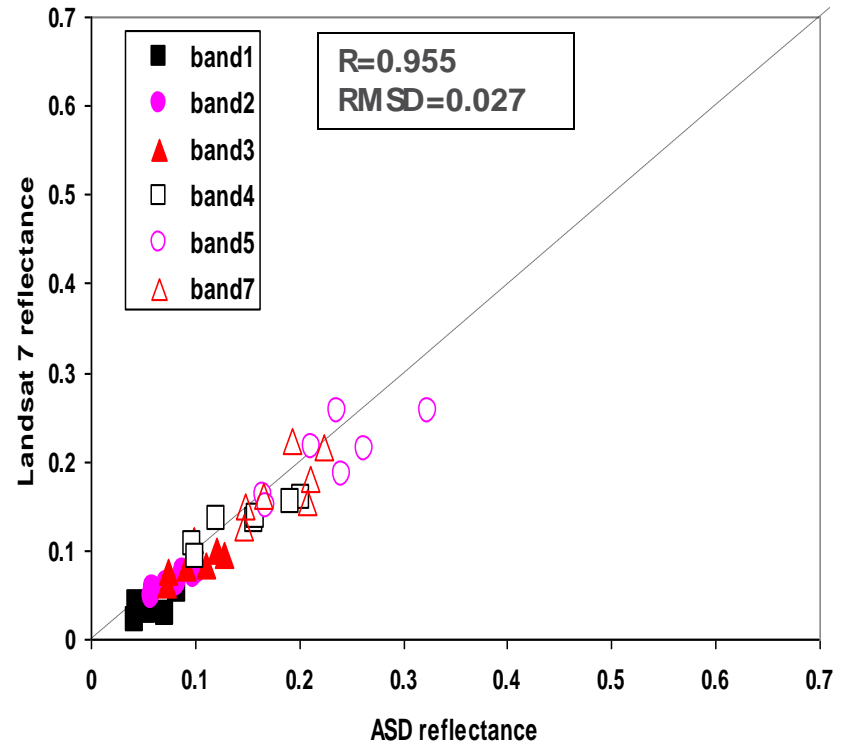
Lake Frome, South Australia, dry salt lake



Validation Using Field Data



Lake Frome, SA



Gwydir, NSW

National Field Spectrometer Loan Service

FieldSpec® Handheld Pro (325-1075nm)

HH Full Sky Irradiance Cosine Receptor

7.5 Deg HH FOV Lens Fore optic

Two instruments available to Australian researchers for field data collection; loan conditional on sharing of the field data

Currently there is no single repository for collected data; efforts are underway to address this

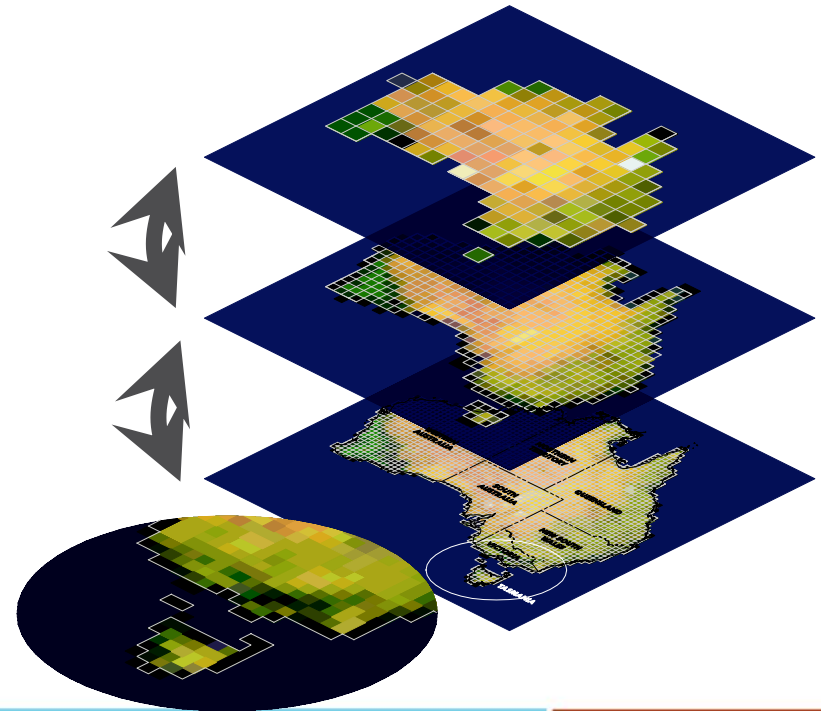


Unlocking the Landsat Archive (ULA)

\$3.5M project funded through the Australian Space Research Program

Represents a fundamental shift from on-demand processing of raw scene-based Landsat data to the automated generation of standardised, well calibrated, products at the national scale

	Lockheed Martin Australia
	Geoscience Australia
	Victorian Partnership for Advanced Computing
	National Computational Infrastructure – Australian National University
	Cooperative Research Centre for Spatial Information



Key Elements of ULA

Online storage and delivery of 10 years of Landsat data (2000 – 2010)

Input: Level 1T from the USGS Landsat Product Generation System

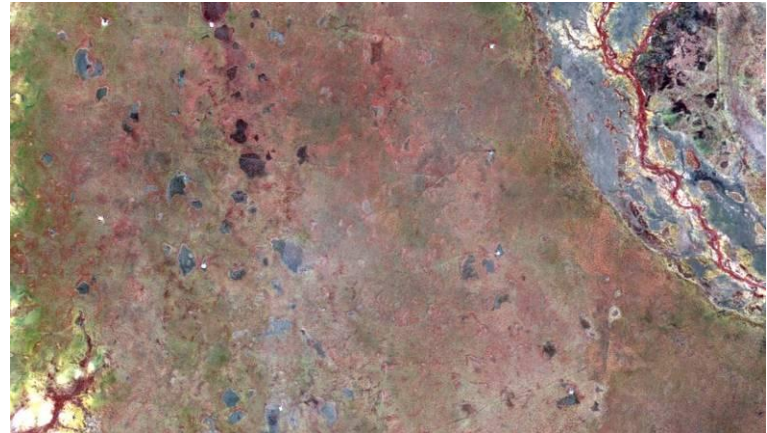
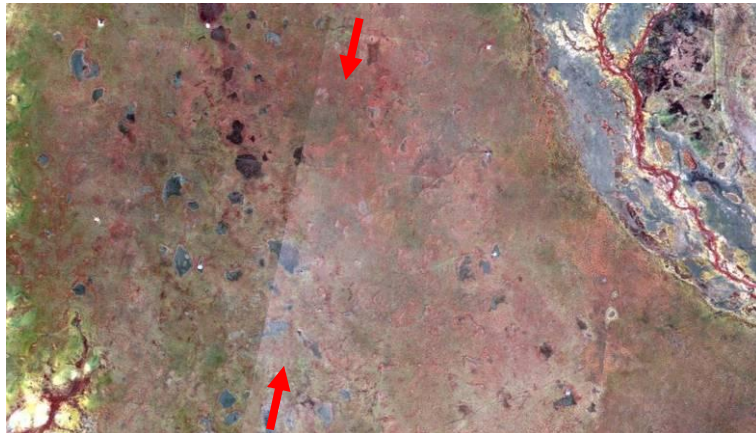
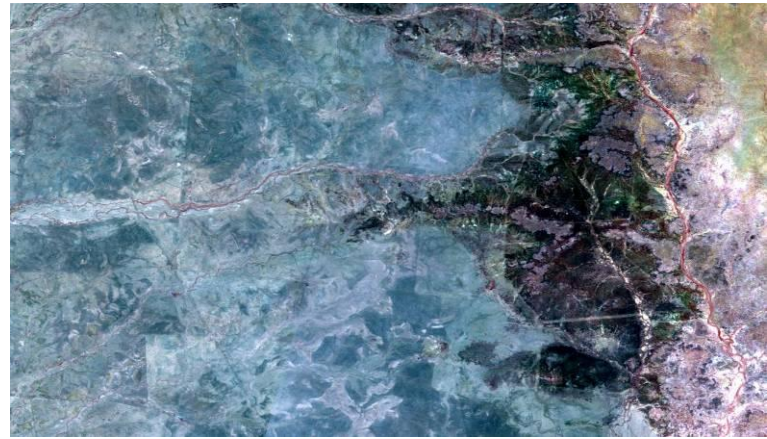
Outputs: Nadir BRDF Adjusted Reflectance (NBAR); Pixel Quality; Fractional Cover (green, brown, bare); Land Cover

National Nested Grid - a sensor agnostic system for time-series analysis; key piece of eResearch infrastructure



A month's worth of Landsat data processed through the ULA workflow - Surface Reflectance (NBAR) and Pixel Quality

ULA : Surface Reflectance

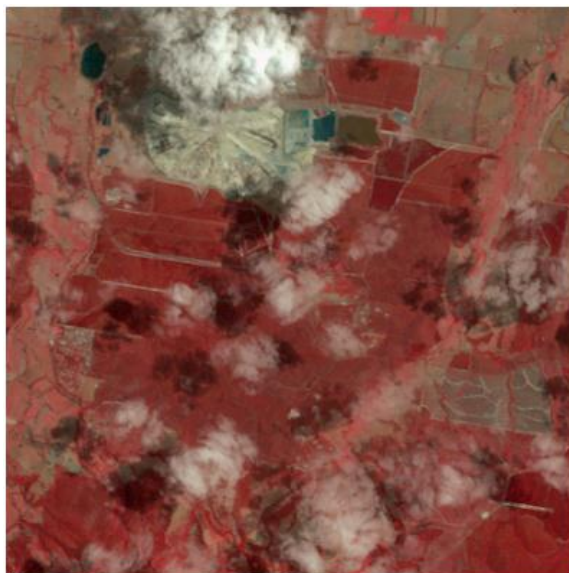
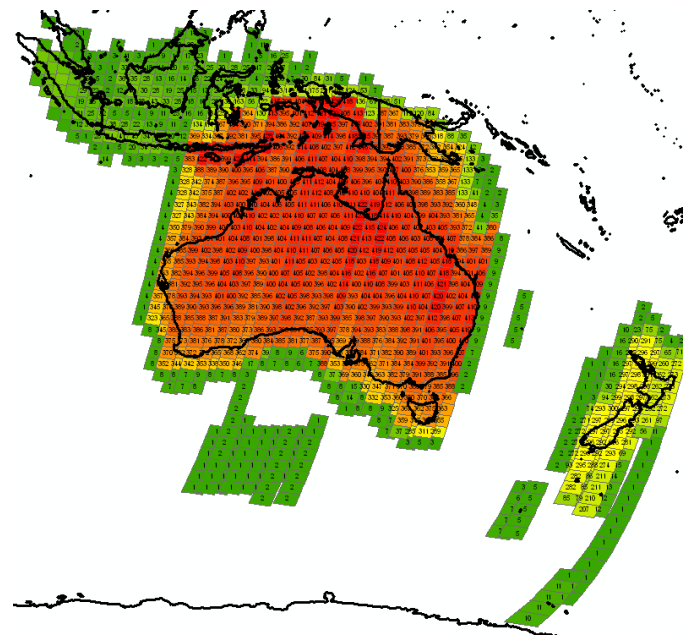


Before correction

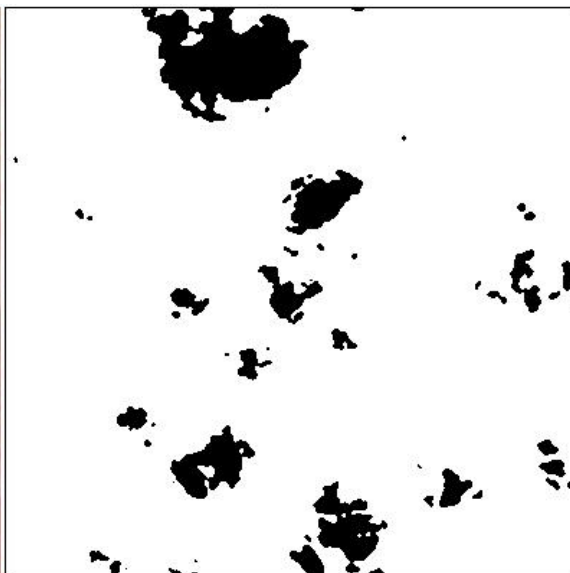
After atmospheric and BRDF (NBAR) correction

ULA : Pixel Quality

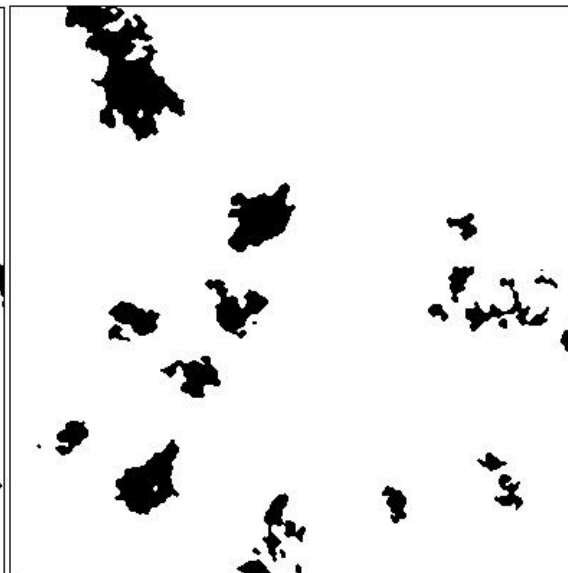
Saturation and Null values
Pixel contiguity (through spectral domain)
Cloud
Cloud Shadow
Topographic Shadow
Land/Sea discrimination



Landsat false colour (RGB = 4/3/2)



Cloud mask

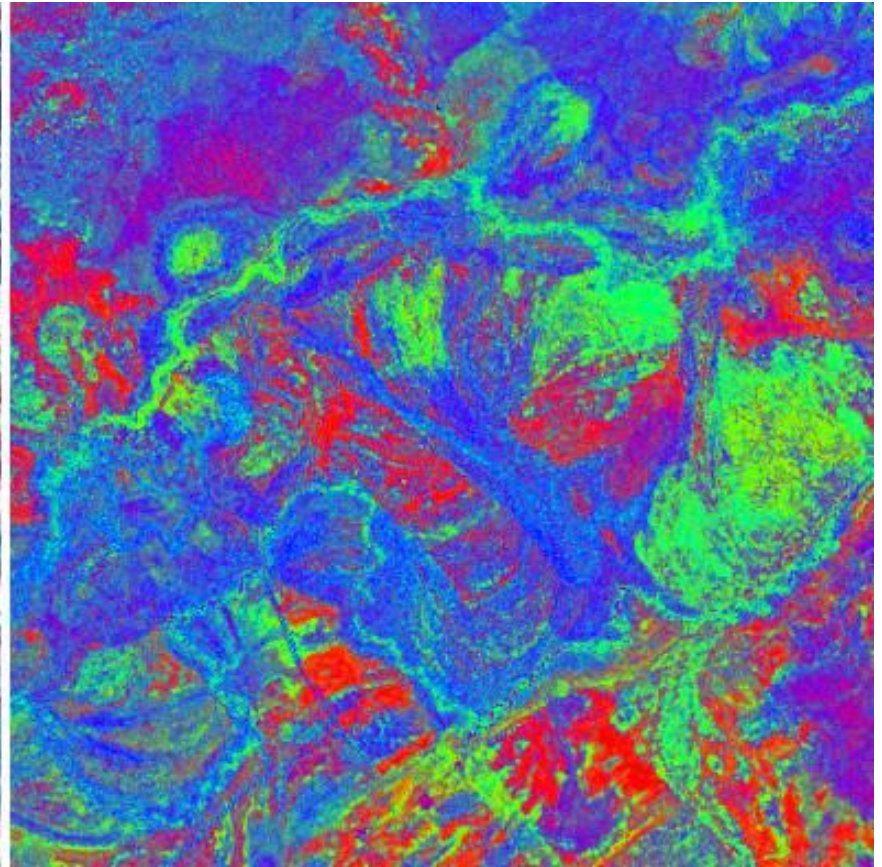


Cloud shadow mask

ULA : Fractional Cover



Landsat False colour (RGB = 4/3/2)



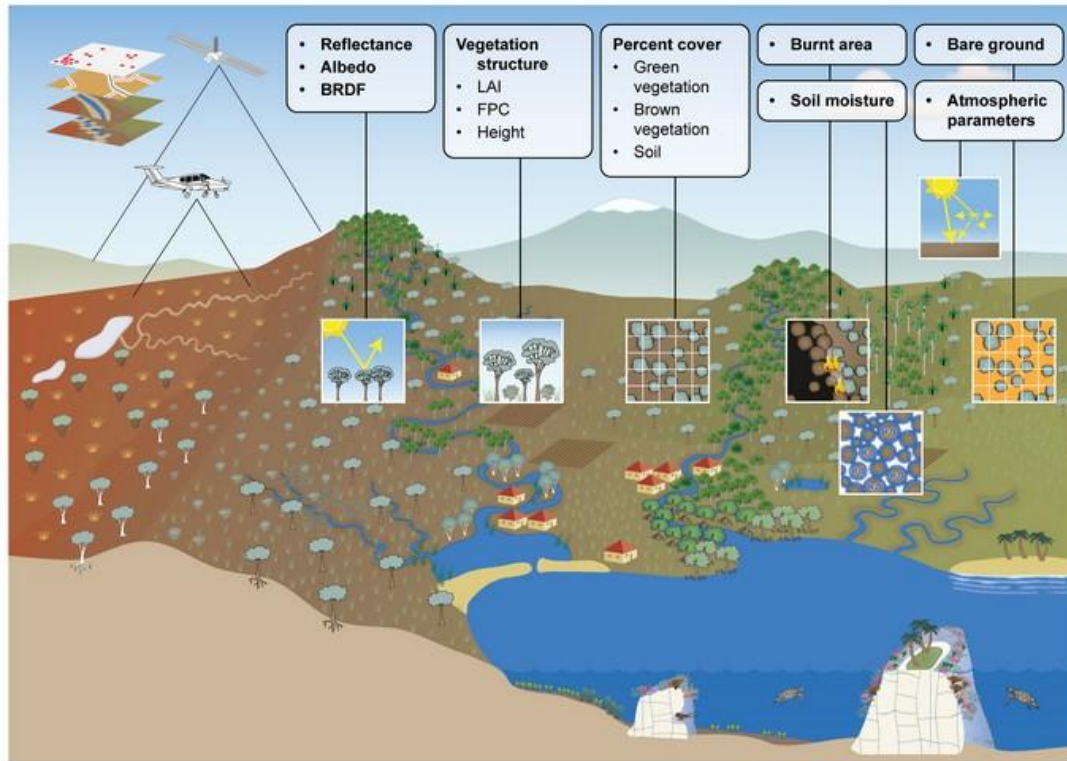
Fractional cover

Red: Bare ground

Green: Photosynthetic vegetation

Blue: Non-Photosynthetic vegetation

Terrestrial Ecosystem Research Network (TERN)



National expert network - provides RS time-series data, and EO based biophysical products to Australian ecosystem scientists

The AusCover Facility enables integration of data across disciplines

Supports calibration and validation activities at continental scale

Physical implementation of the AusCover Data facility will provide standardised, calibrated and validated biophysical data products, delivered via a 24/7 Distributed Data Archive and Access Capability (DAAC)

Driving Adoption of Best Practice

Comparative evaluation of EO data correction methodologies through TERN AusCover

Good Practice Technical Handbook

Field Measurement of Fractional Cover

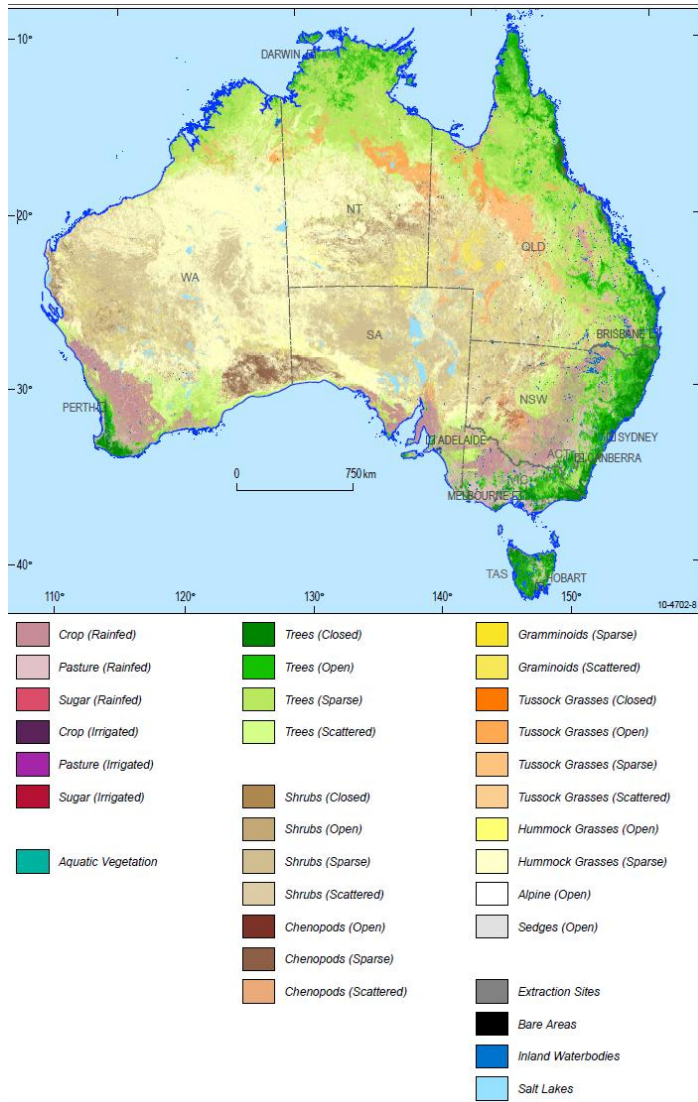
National Satellite Calibration Working Group

ASD FieldSpec Handheld Cookbook



	BAND											
	1		2		3		4		5		7	
	MEAN	SD	MEAN	SD	MEAN	SD	MEAN	SD	MEAN	SD	MEAN	SD
CSIRO	0.013	0.007	0.016	0.010	0.016	0.006	0.019	0.007	0.023	0.009	0.022	0.012
GA	0.009	0.005	0.009	0.005	0.013	0.006	0.016	0.007	0.022	0.011	0.020	0.011
JRSRP	0.007	0.005	0.009	0.005	0.013	0.006	0.015	0.006	0.020	0.010	0.021	0.011

National Land Cover Dataset– ISO Standard



First national LC dataset based on time-series observations (250m, 8-years, standard classes)

Validation with field data from +25,000 locations

Released in Nov 2011, free to download; annual updates are planned

Web page: <http://www.ga.gov.au/earth-observation/landcover.html>

National Land Cover: Mapping to Monitoring

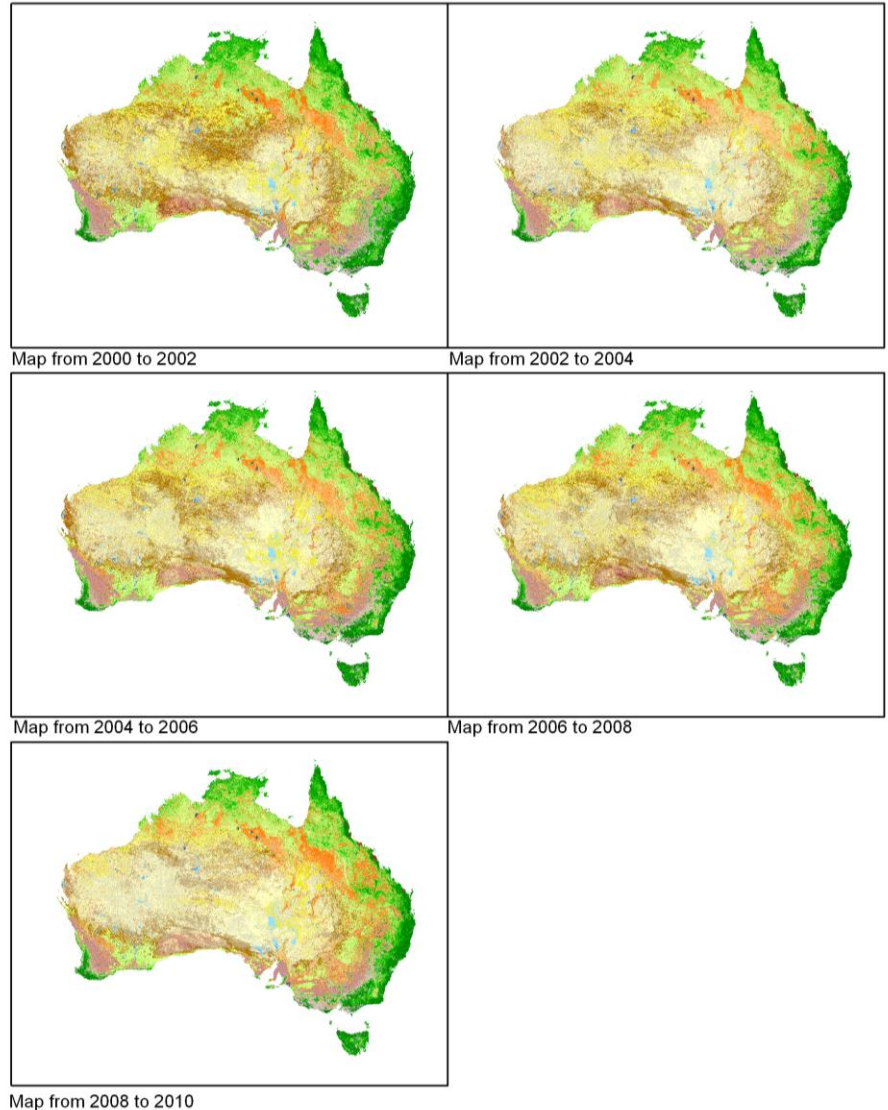
National Land Cover Dataset
Version 2- currently beta testing

Validation is fundamental
to the accuracy and useability of
the LC product

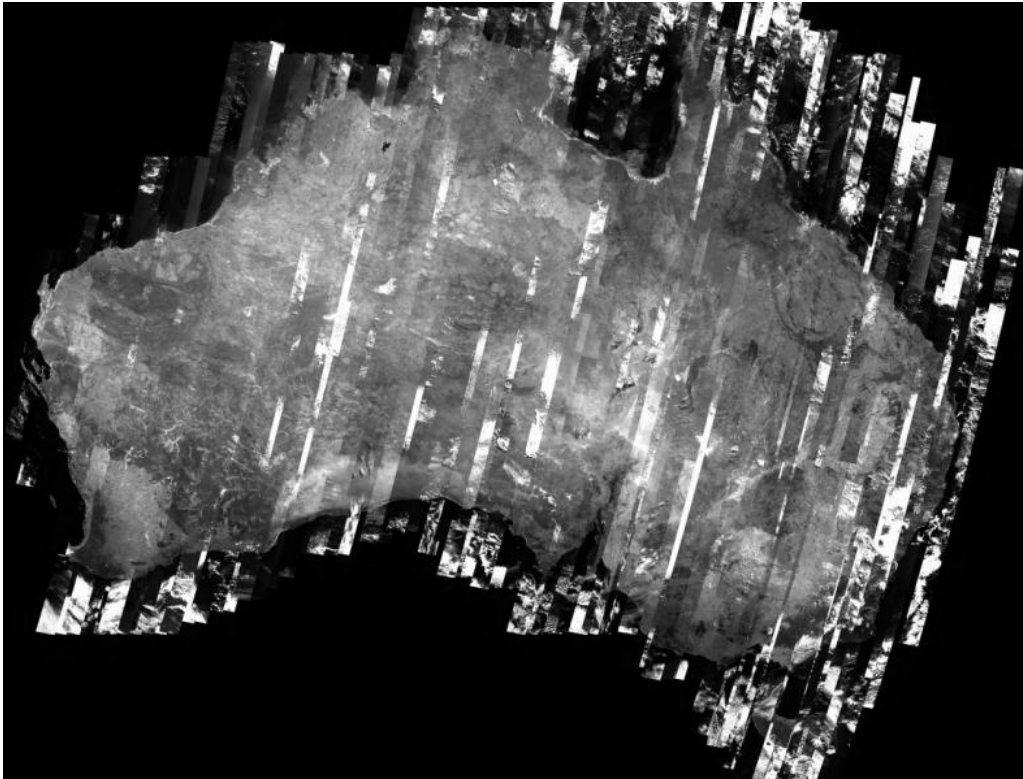
Progressively move to 25m
monitoring of land cover (e.g.,
water, urban, forest...)

GEO land cover task and global
land cover using Landsat are of
interest

Collaboration on global LC
mapping efforts will be essential
to ensure local relevance



Australian Geographic Reference Image (AGRI)



National mosaic product

Spatially accurate reference image (2.5 metre resolution 5 m accuracy) across Australia

9560 PRISM images from the ALOS satellite used

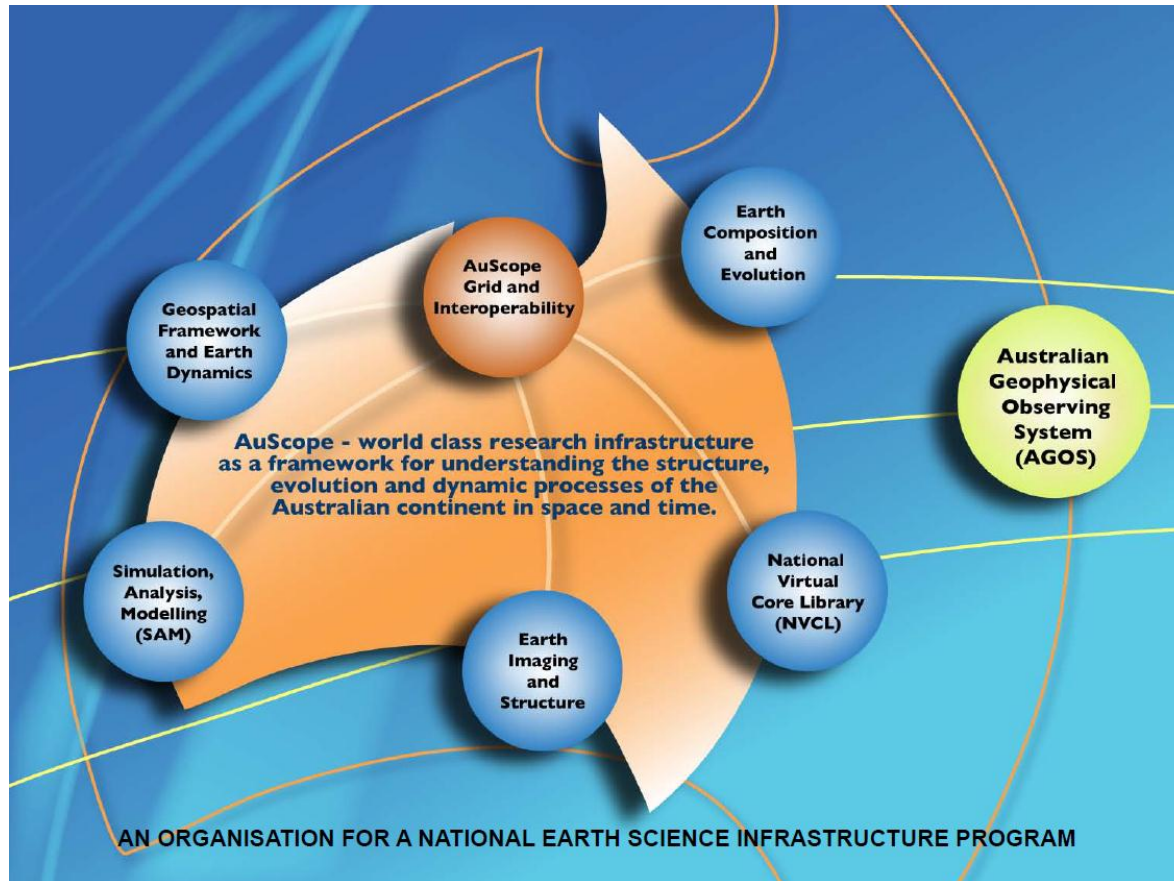
Next generation GCPs to rectify new image data

Sample data provided to USGS Cal / Val team for GLS2010 accuracy assessment over Australia

Technical Report: http://www.ga.gov.au/image_cache/GA20164.pdf

Australian Geophysical Observing System (AGOS)

Australian Government investment of \$23 million in a new Australian Geophysical Observing System (AGOS)



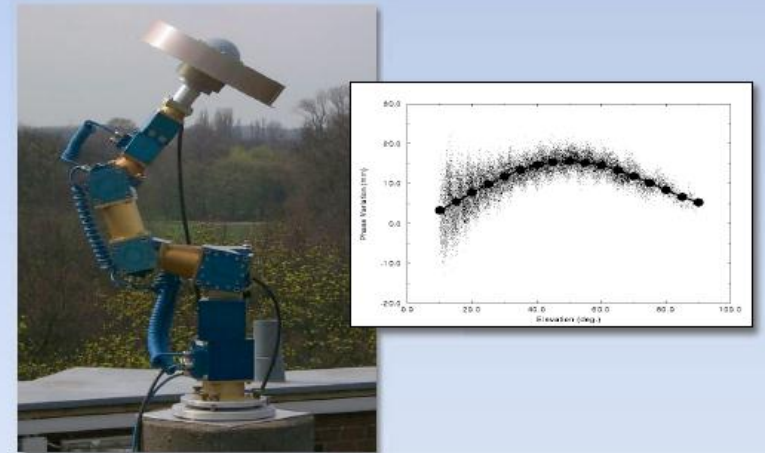
Objective: Increase understanding of the Earth's crust by delivering capabilities in data acquisition, management, modelling and simulation

Geospatial Components of AGOS

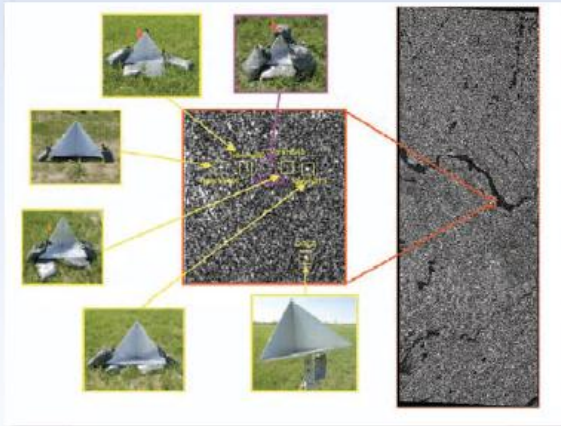
Continuously operating
GNSS stations



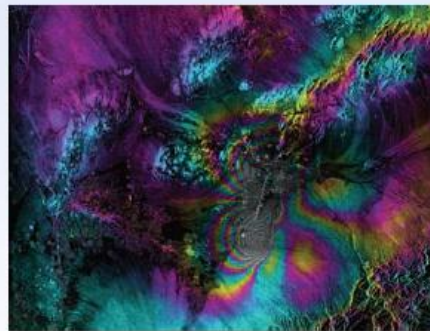
A Robotic antenna-calibration system



Design, construction and
installation of the radar reflectors



A remote sensing
data portal

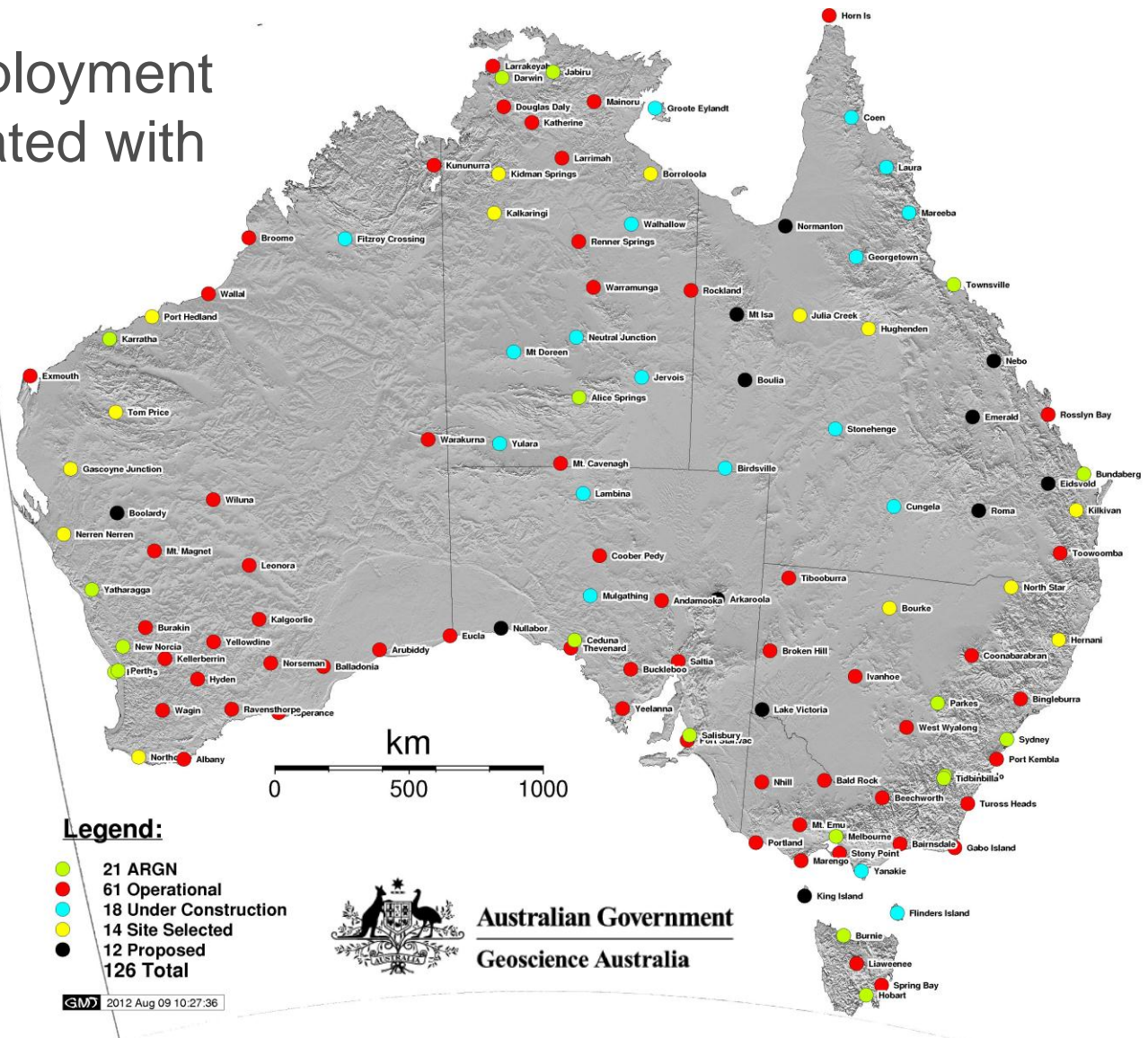


A deployable GNSS
instrumentation pool



Australian Regional GPS Network

~ 200 CRs for deployment
in the field co-located with
GNSS stations



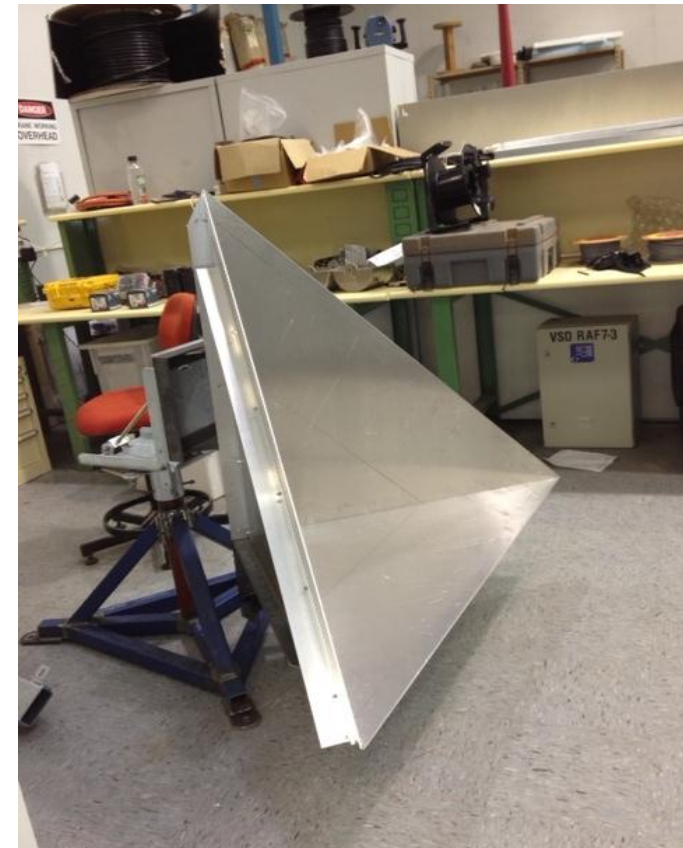
AGOS : SAR Corner Reflector Array

Study to determine CR specifications and orientation strategy;
Signal to Clutter Ratio effect on reflector characteristics;
requirements based on accuracy for displacement monitoring
and radiometric calibration

Reliable means to perform radiometric,
geometric, and impulse response
measurements of satellite-based SAR

Advantages of low maintenance and
low cost compared to active devices
such as transponders

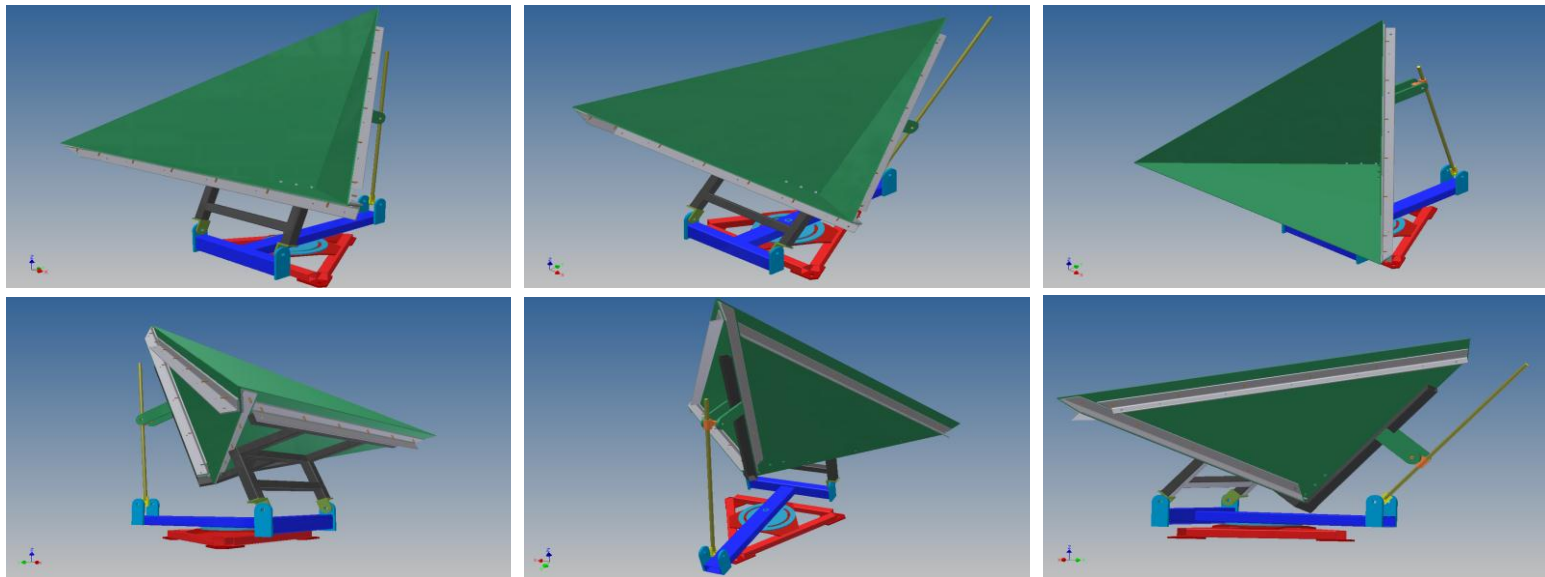
Significant infrastructure for calibration
of SAR (X & C)



Corner Reflector Design and Deployment

CRs are being designed at Geoscience Australia and will be manufactured by private industry; characterisation of RCS will be done prior to field deployment

Orientation strategy involves sensor orbits, imaging characteristics, and target locations; opportunity for SAR operators to influence location of CRs



Australian Space Policy Developments

The Department of Industry,
Innovation, Science, Research and
Tertiary Education is to develop a
National Space Policy
(www.space.gov.au)



Geoscience Australia and Bureau of Meteorology leading
development of a national EO Strategic Infrastructure Plan
(EO-SIP)

EO-SIP will inform the National Space Policy; has no funding
identified at this time

Calibration/Validation is an important component of the plan;
engagement with this group will be key



Australian Government
Geoscience Australia



Questions

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