



# Geoscience Australia Report on Cal/Val Activities

Medhavy Thankappan

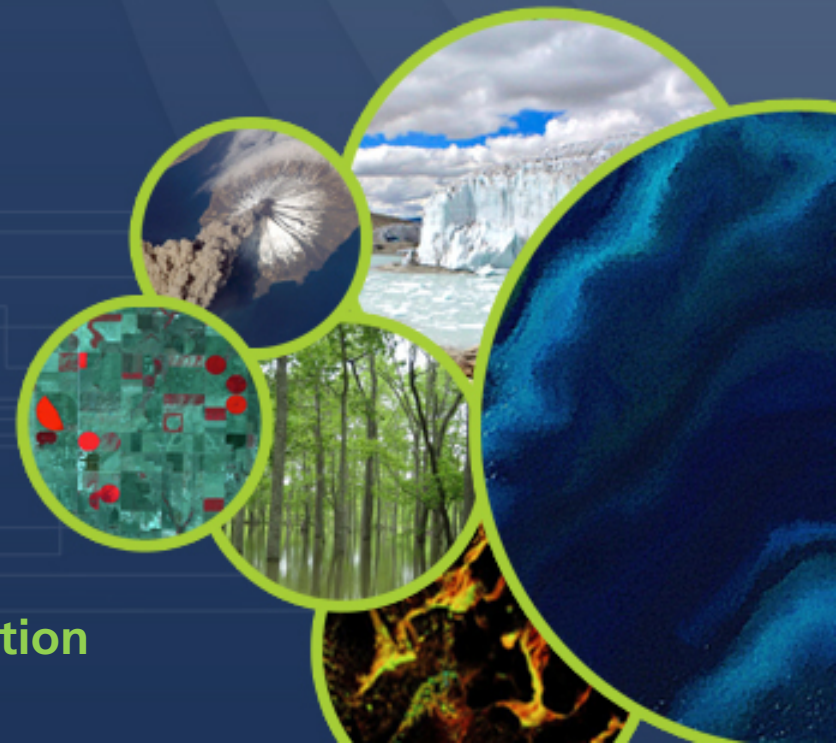
Geoscience Australia

Agency Report I

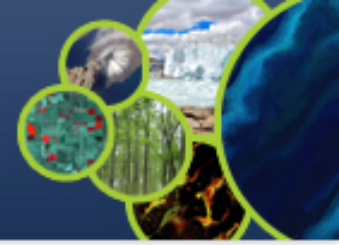
WGCV Plenary # 39

Berlin

May 6 - 8, 2015

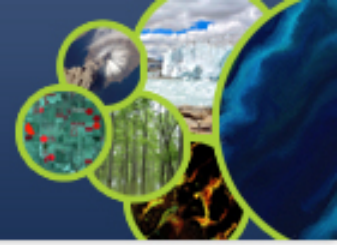


**Working Group on Calibration and Validation**



## Outline

1. Calibration / validation at Geoscience Australia
  - Corner reflector infrastructure for SAR calibration (*for information*)
  - Terrain illumination correction (*for information / discussion*)
  - WorldDEM™ evaluation notes (*for information*)
2. Australian calibration / validation initiatives
  - National spectroscopy database (*for information*)
  - Altimetry (*for information*)
  - SMAPex campaign (*for information*)
3. Other activities
  - Australian Geoscience Data Cube (*for information*)
  - Water Observations from Space (*for information*)
4. International collaboration
  - ESA/USGS/NASA (*for information*)



## Geoscience Australia



**SECURING  
AUSTRALIA'S  
WATER  
RESOURCES**

**MANAGING  
AUSTRALIA'S  
MARINE  
JURISDICTIONS**

**PROVIDING  
FUNDAMENTAL  
GEOGRAPHIC  
INFORMATION**

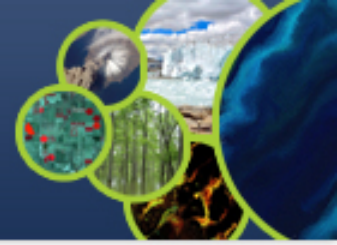
**MAINTAINING  
GEOSCIENCE  
KNOWLEDGE  
AND CAPABILITY**

**BUILDING  
AUSTRALIA'S  
RESOURCE  
WEALTH**

**ENSURING  
AUSTRALIA'S  
COMMUNITY  
SAFETY**

**Earth observation at GA is focussed on improving the frequency, reliability, quality and impact of Earth observations for Australia**

**Working Group on Calibration and Validation**



## Corner Reflectors for SAR Calibration

- The Australian Geophysical Observing System includes Corner Reflector (CR) infrastructure for calibrating SAR sensors
- The Defence Science and Technology Organisation's Radar Ground Reflection Range in South Australia used to characterise CRs
- Field testing involved data acquisition by the TerraSAR-X, COSMO-SkyMed, RADARSAT-2 and RISAT-1 missions over a 6-month period
- A network of 40 CRs has been permanently installed in Queensland



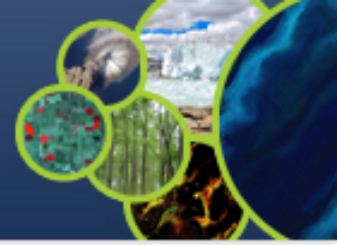
Record 2015/03 | GeoCat 82751

### The Design of Radar Corner Reflectors for the Australian Geophysical Observing System

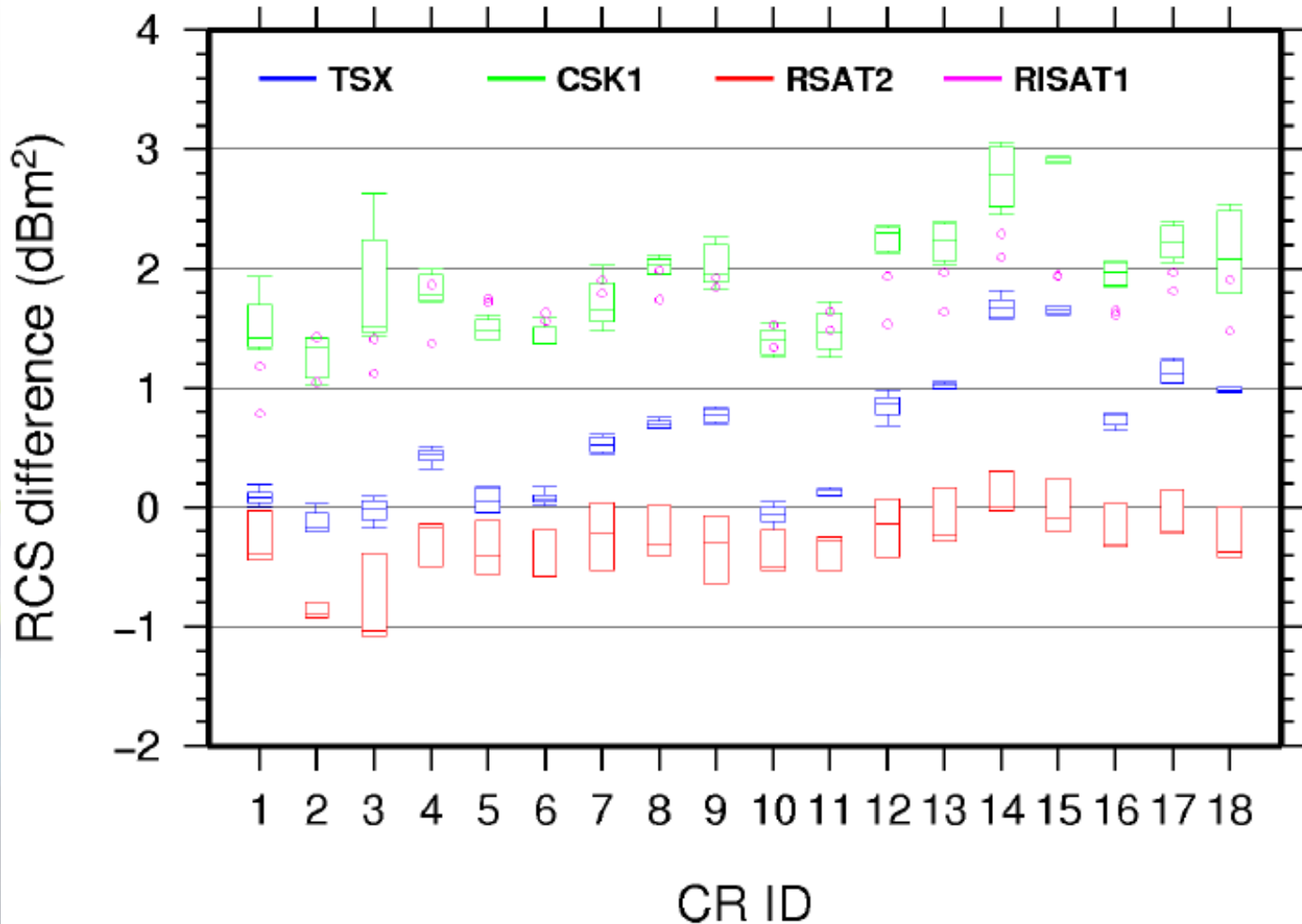
A single design suitable for InSAR deformation monitoring and SAR calibration at multiple microwave frequency bands

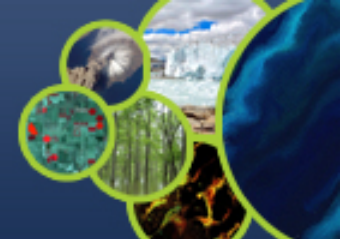
Garthwaite, M. C., Nancarrow, S., Hislop, A., Thankappan, M., Dawson, J. H., Lawrie, S.

APPLYING GEOSCIENCE TO AUSTRALIA'S MOST IMPORTANT CHALLENGES [www.ga.gov.au](http://www.ga.gov.au)

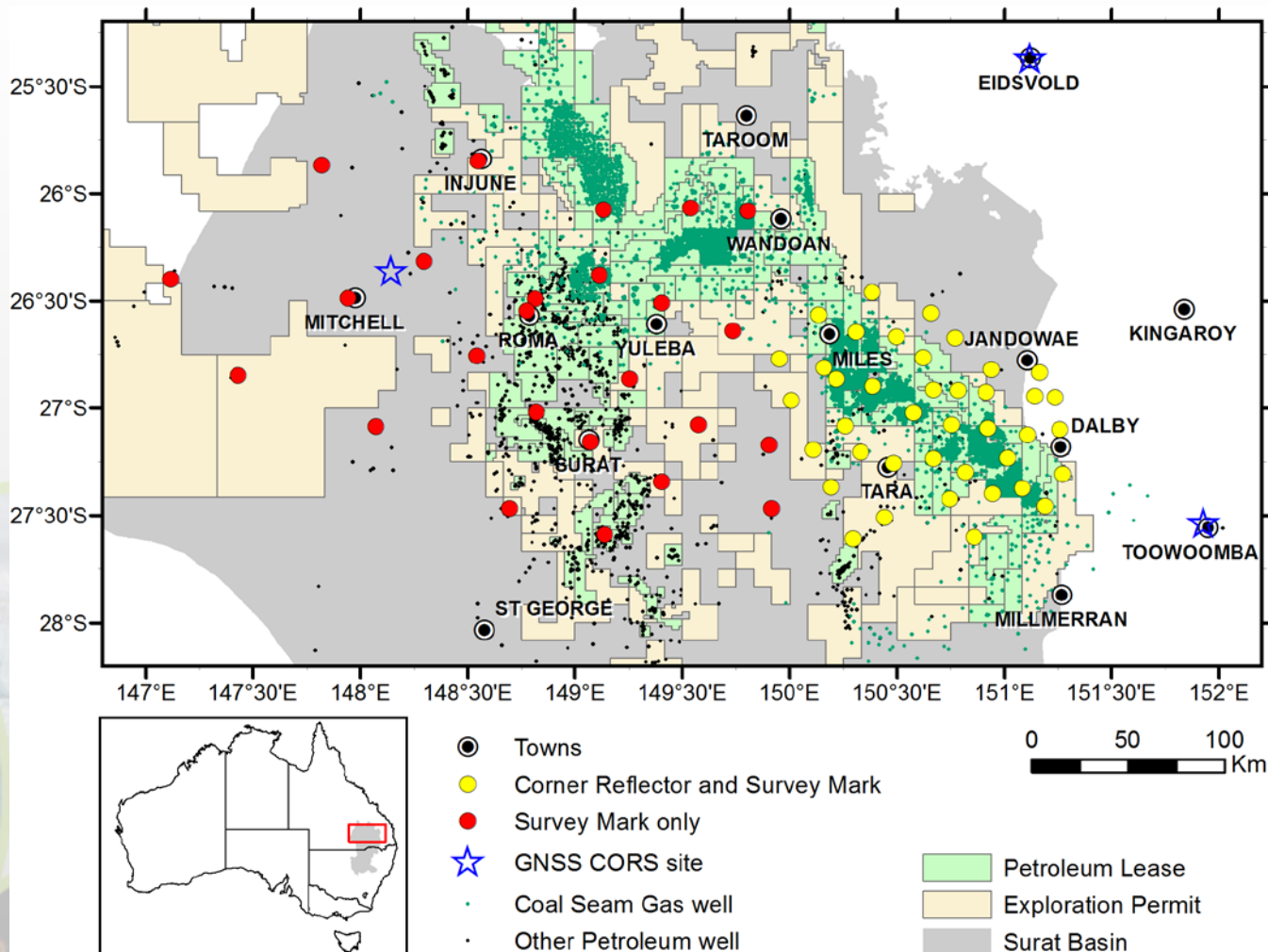


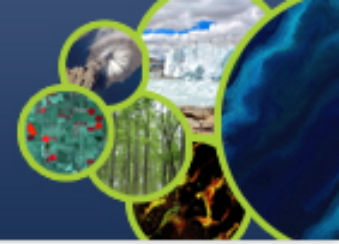
## Corner Reflectors: Field Performance Testing





## Permanent Location of Corner Reflectors

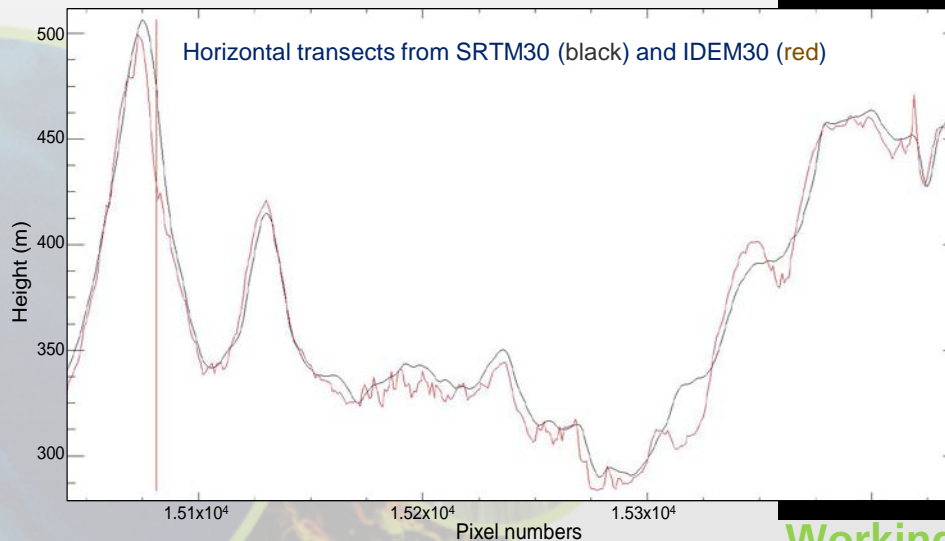
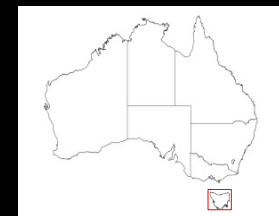
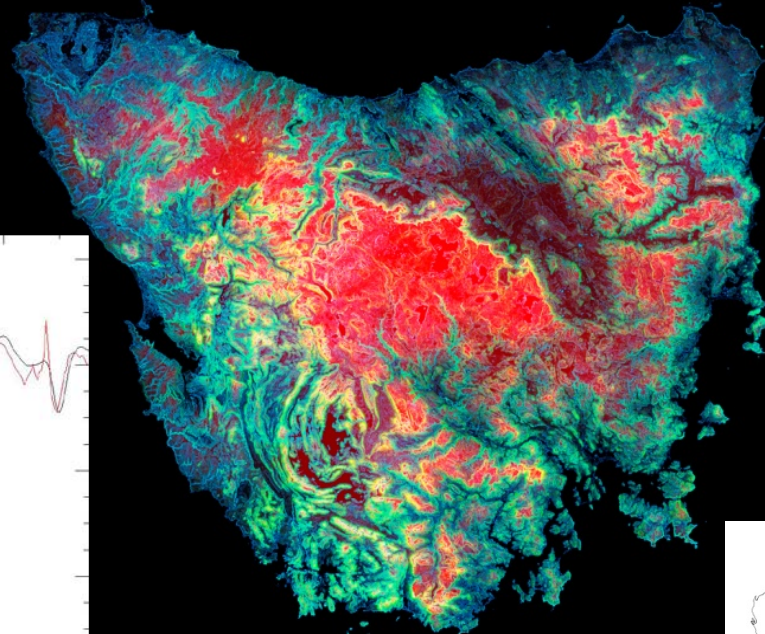


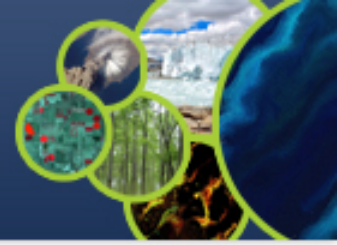


## Terrain Illumination Correction with TanDEM-X IDEM

- IDEM 12 / 30m data used for terrain illumination correction of Landsat and compared to correction with SRTM
- Filter bank analysis done
- Results show IDEM 12 / 30m data resolve finer details of terrain shading than the SRTM based DEM

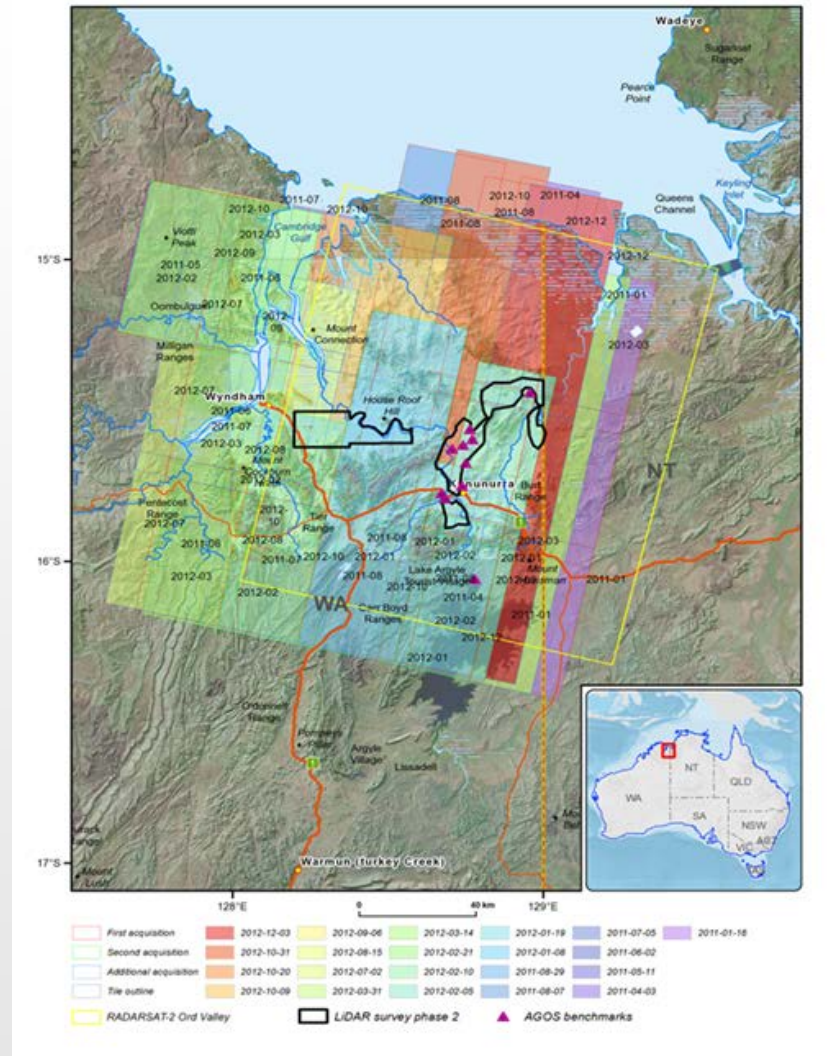
Terrain altitude, slope and curvature based on IDEM30 data and SRTM30 data in the areas where IDEM data was not available, and water areas masked



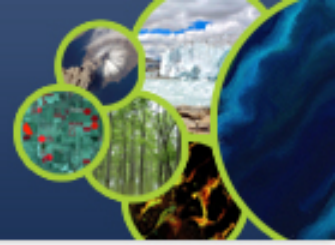


## Notes on WorldDEM™ Evaluation

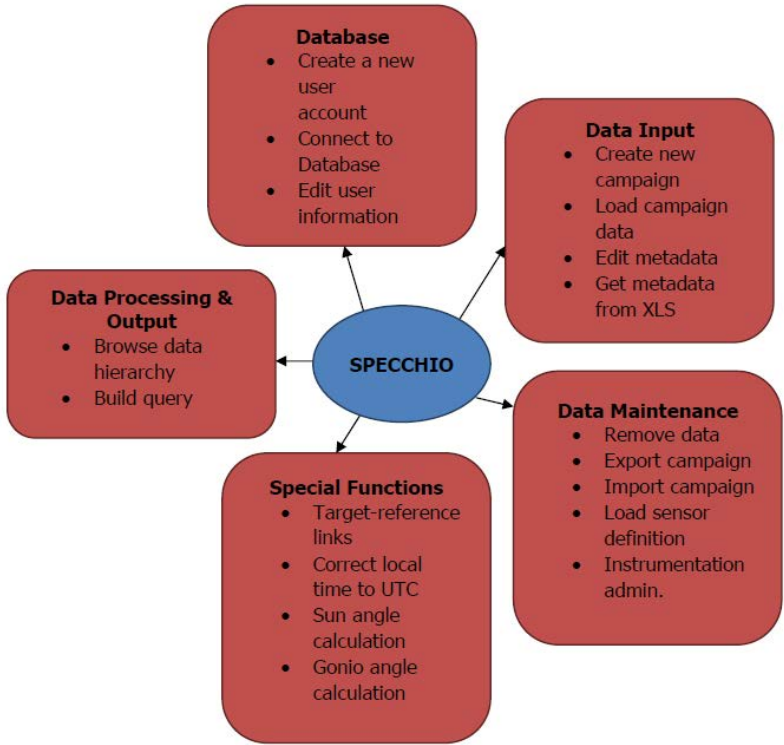
- Evaluation of WorldDEM™ product over Ord valley, Australia with LIDAR reference data
- Issues around temporal span of data used for DEM generation
- Landscape dynamics and spatial coverage issues
- Lack of detail on filtering/smoothing approaches used and vegetation removal for bare surface model





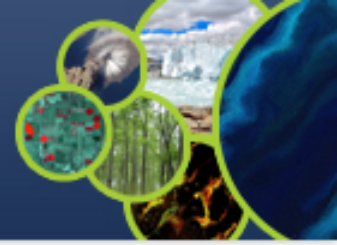


## National Spectroscopy Database



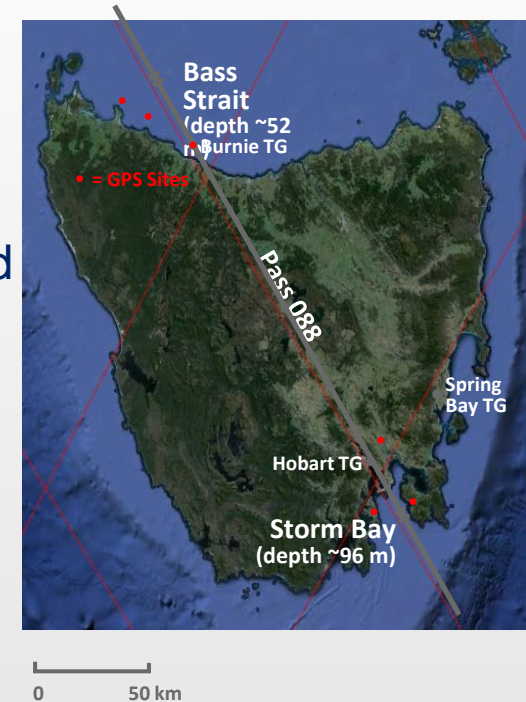
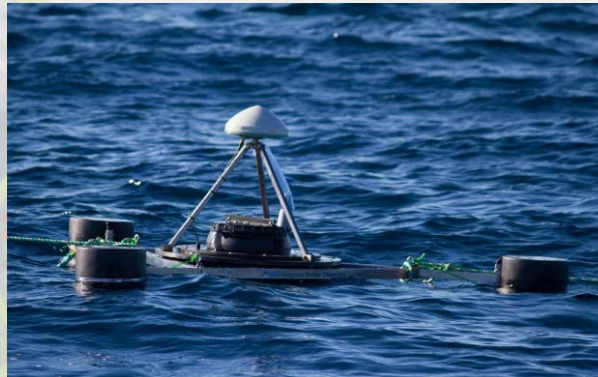
- Development of the Aus-SPECCHIO spectroscopy database was led by University of Wollongong (UoW), with funding from the Australian National Data Service
- Supports calibration and validation in Australia; seen as a useful national resource
- Discussion to migrate Aus-SPECCHIO from UoW for GA stewardship
- Long-term management plan is aligned with GA's role as the custodian of national EO datasets

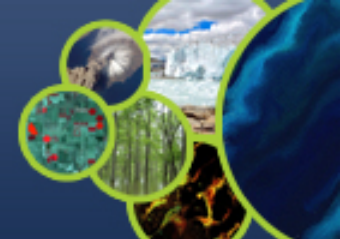




## Altimetry Cal / Val in Australia

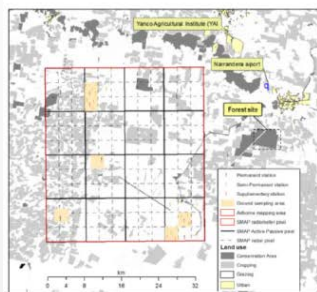
- Australia hosts 1 of the 3 primary calibration / validation sites for altimetry (sea surface height) - the sole site in the Southern Hemisphere. Bass Strait has been contributing since the launch of TOPEX/Poseidon in 1992
- Primary role is the cycle-by-cycle comparison of altimeter vs in situ sea level on the NASA/CNES/NOAA/EUMETSAT “Jason” ground track.
- Aim is to validate the sea level climate record
- Recently expanding to facilitate validation of Sentinel-3A and 3B in Bass Strait. Funded through the Integrated Marine Observing System (IMOS)





## SMAP Experiments (SMAPEX)

- The Soil Moisture Active Passive Experiment (SMAPEX) will develop algorithms / techniques to estimate near-surface soil moisture from the SMAP mission, and validate brightness temperature observations and soil moisture products
- The SMAPEX 4 campaign is currently underway; Geoscience Australia is participating



### SMAPEX-1: 5-10 July 2010



### SMAPEX-2: 4-8 December 2010



### SMAPEX-3: 5-23 September 2011



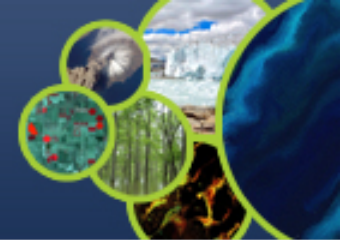
- Downscaling of radiometer observations using radar data.
- Radiometer retrieval using radar-derived parameters.
- Development of an Australian cal/val site for SMAP.
- Testing of radar retrieval algorithms.



MONASH University

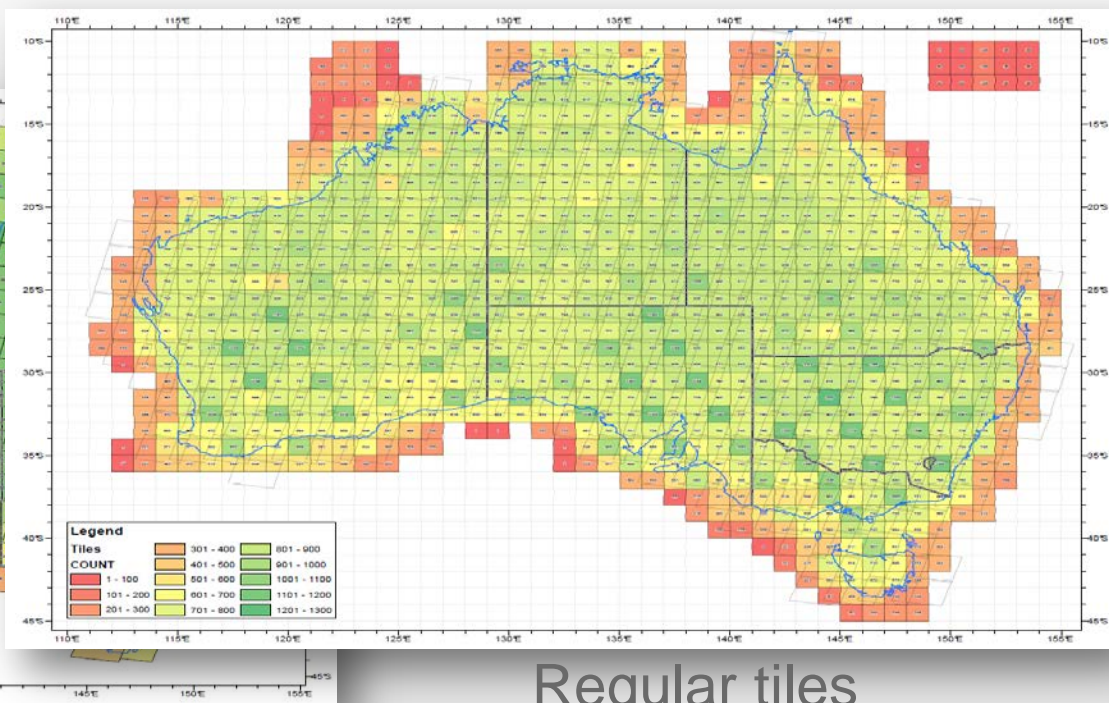
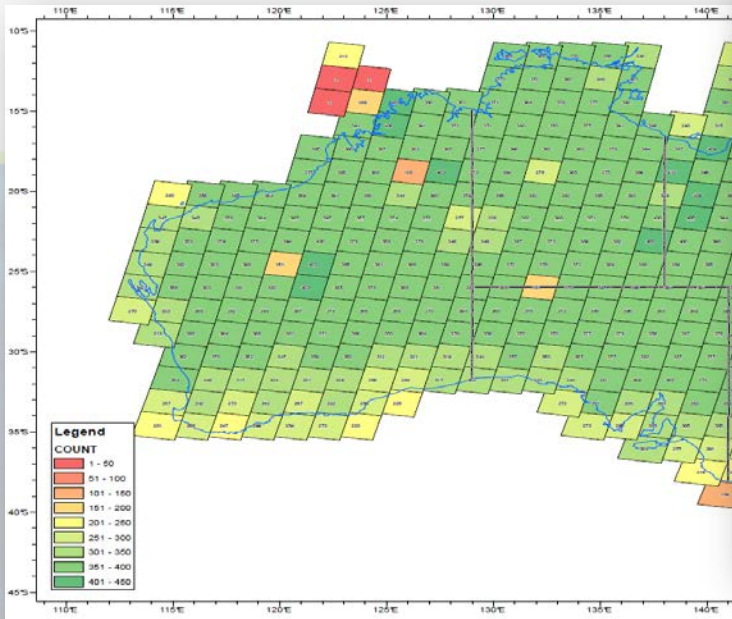


SMAPex 4 Campaign: 30 April to 23 May 2015  
particular objective of the fourth experiment is to acquire airborne microwave observations and ground sampling data concurrent with the overflight of the Soil Moisture Active Passive (SMAP) satellite for the purpose of calibration and validation of the SMAP products.



## Australian Geoscience Data Cube

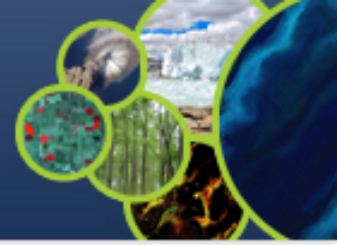
- New framework for deep time-series, continent-scale analysis of EO data, using high performance data / high performance computing
- Supports access to consistent, comparable, defensible 'Analysis Ready Data'
- Model brings '*user to the data*' rather than '*data to the user*'
- Initiative led by GA with a call for international cooperation



Regular tiles

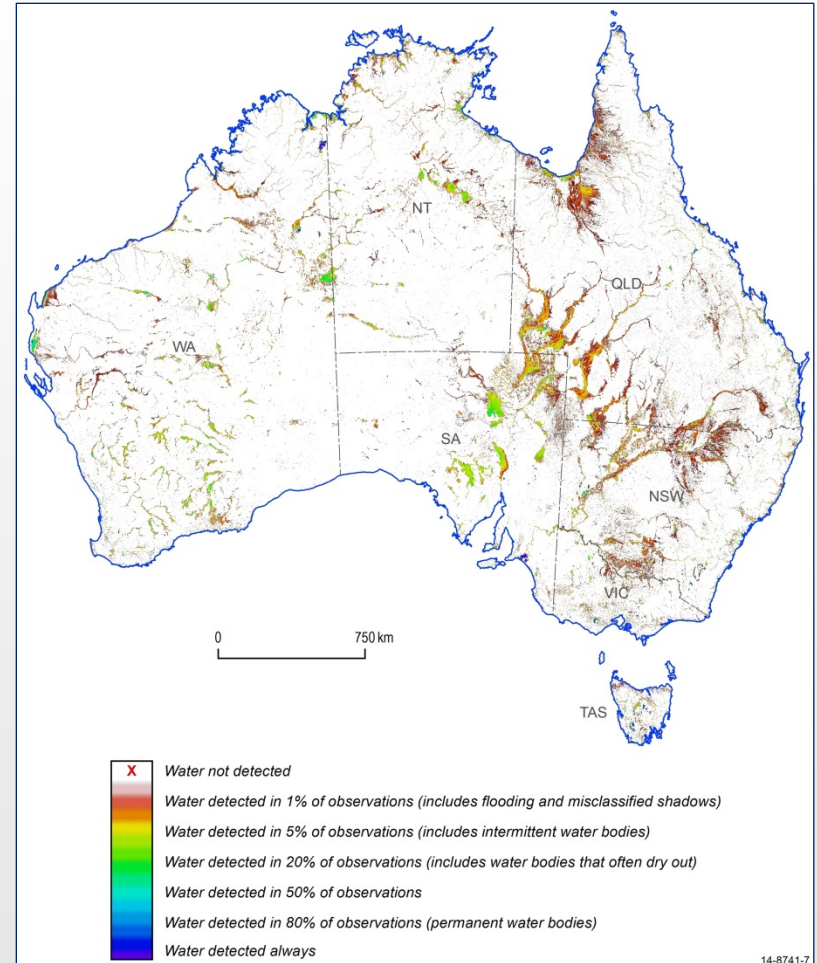
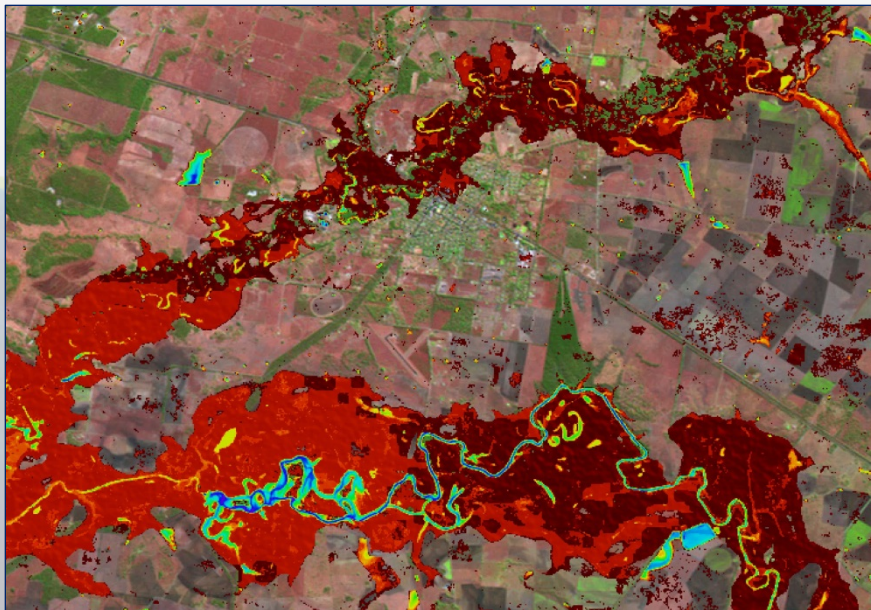
Images – collection units

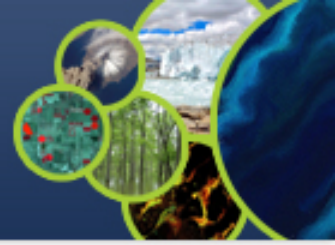
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## Water Observations from Space (WOfS)

- Satellite based water observations over 27 years, in a grid of 25m by 25m cells covering Australia; enabled by the AGDC
- WOfS is available through an online viewer at: [www.ga.gov.au/wofs](http://www.ga.gov.au/wofs) and as WMS from: <http://eos.ga.gov.au/geoserver>

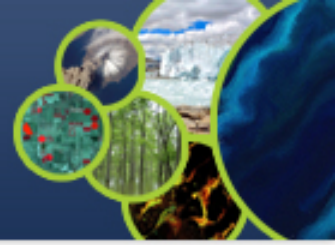




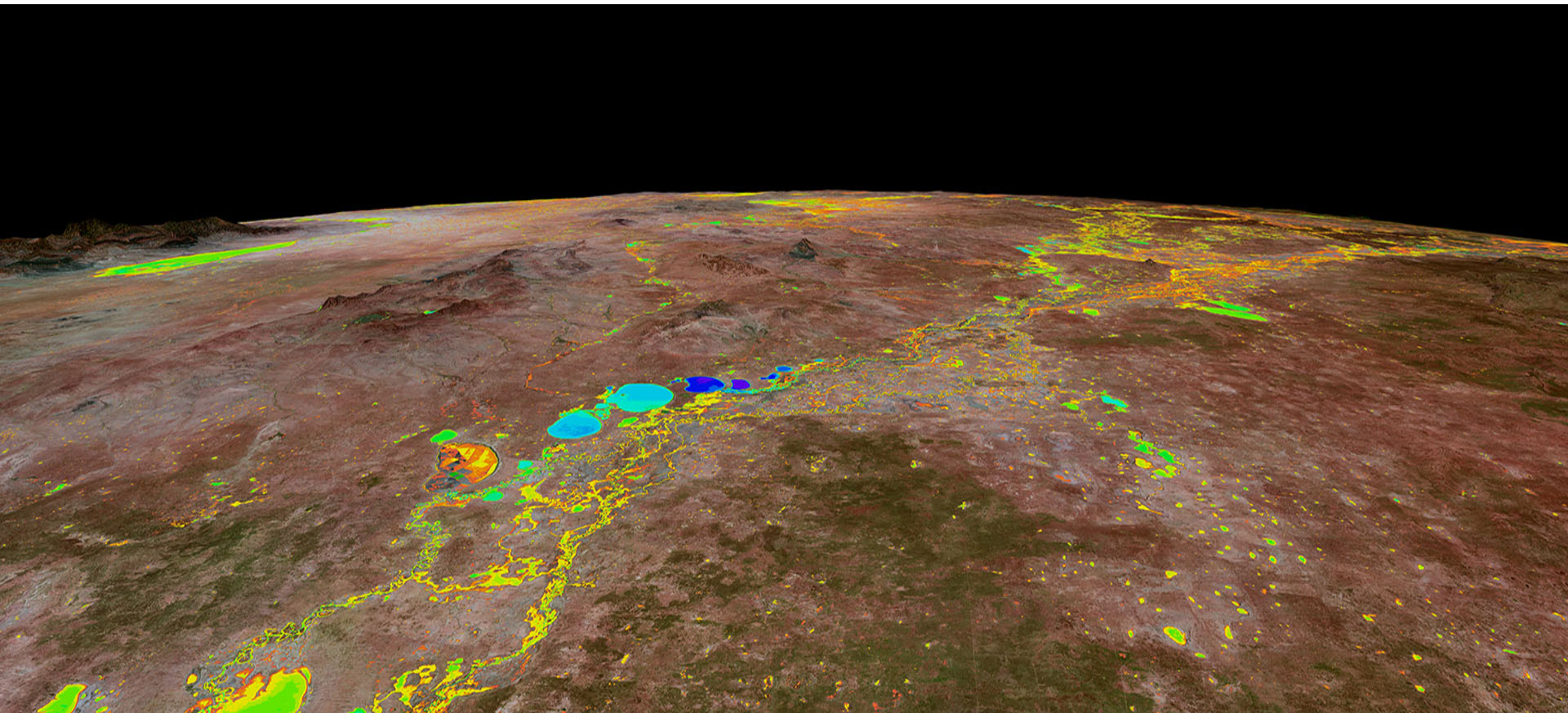
## International collaboration

- European Space Agency
  - GA staff at ESA EO for collaboration on Sentinels
  - GA support for hosting ESA Spectrometers
- United States Geological Survey / NASA
  - GA on the Landsat Science Team
  - Collaboration around the Australian Geoscience Data Cube
- GA + CSIRO collaborating with the CEOS SEO on 'KenyaCube' for GFOI
- GA interested in WGCV cross-cutting themes:
  - Atmospheric correction
  - Cloud, shadow masking
  - BRDF correction
  - Terrain illumination correction





## Questions



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