Post-K&C – First Report

Fusion of ALOS-2 and Spaceborne Lidar Observations for High Resolution Mapping of Degraded and Regenerating Forest Structure and Biomass in Australia

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Post-KC Science Team meeting #1
Tokyo, Japan, January 20-24, 2020
Project aim and drivers

• The aim of this research is enhanced mapping of degraded and regenerating forest structure and aboveground biomass in Australia through fusion of ALOS-2 PALSAR-2 image data with contemporaneous spaceborne lidar observations.

• JAXA ALOS-2 PALSAR-2 represent the only repeat global L-band SAR observations that are coincident with these new spaceborne lidar missions.
Project aim and drivers

• Project aims support coordination of biomass product calibration and validation activities in Australia
  - CEOS Land Product Validation Biomass Focus Area
  - Focus on SuperSites in use by the NASA GEDI, NASA/ISRO NISAR, ESA BIOMASS, and JAXA missions
  - Collaboration with ESA CCI+ Biomass Initiative (Cartus, Lucas)

• Project aims support *K&C thematic drivers*
  - Carbon cycle science – products are relevant to carbon data assimilation schemes, carbon offsets research and national reporting frameworks
  - Environmental Conservation – regional mapping at a scale relevant to land management, State Government vegetation management policy, and State of the Forests reporting
Australian Vertical Plant Profile Metrics (Phase 3 & 4)

Australian Vegetation Structural Formations (Phase 3 & 4)

Significantly improved detail, consistency and accuracy compared with existing mapping

http://dx.doi.org/10.4227/05/5703458340442
Internal matching of ALOS and ALOS-2 data to reduce spatial variations (both within and between swaths) of backscatter due to terrain and moisture.

Contact: Mark L. Williams (mark.williams@physics.org)
Internally matched ALOS-1 (left) and cross-matched ALOS-2 (right)

The cross-matching process places the two observation datasets (ALOS and ALOS-2) on a common footing to help in the subsequent estimation of changes in land cover and biomass. The combination of internal and cross-platform matching permits the use of generalized estimators for aboveground biomass.

Original data supplied by JAXA
Contact: Mark L. Williams (mark.williams@physics.org)
Use of basal area change as an indicator of regrowth in areas previously cleared, post-fire regeneration, plantings or growth in existing areas

- Allow tracking of areas of increasing woody vegetation across the State
- Feed into state-of-forest reporting

Location and frequency histogram of contemporary live tree basal area surveys (2014-2019).

(A) Casuarina and Maireana sp. (bluebush) in semi-arid woodlands of western NSW
(B) Mallee woodland in western NSW
(C) Mixed eucalypt/callitris forest in NW NSW
(D) Tall eucalypt forest in central tablelands

Contact: Anthea Mitchell (a.mitchell@unsw.edu.au)
JRSRP Assessment of Regrowth and Biomass for NSW

Live tree basal area (LTBA) estimates from ALOS (2009) and ALOS-2 (2016/17)

Change in LTBA obtained by differencing ALOS and ALOS-2 LTBA

Contact: Anthea Mitchell (a.mitchell@unsw.edu.au)
Post-K&C research objectives

1. Develop an approach for high resolution mapping of forest vertical structure and aboveground biomass for the 2019-2021 era using PALSAR-2 in combination with GEDI and ICESat-2

2. Quantify algorithm performance and the accuracy of demonstration products from (1) using updated reference data from TERN Landscapes supersites and the Australian Plant Biomass Library

3. Assess change in vertical canopy structure associated with degraded and regenerating forests using existing land cover change datasets

4. Evaluate the national (Australia-wide) implementation of (1) over the 2019-2021 era using JAXA L-band SAR, including the PALSAR-2 global mosaics
Study sites – TERN Landscapes SuperSites
Focus on regenerating and degraded forests at TERN SuperSites

Regrowth following clearing:
• Injune Landscape Collaborative Project

Fire disturbance:
• Calperum (January 2014)
• Warra (January 2019)
• Litchfield (May 2018)
• Tumbarumba (December 2019)
GEDI lidar aboveground biomass estimators

Filtering of the TERN Plant Biomass Library
(K&C-3/4)
GEDI and ICESat-2 observations (2019 – 2021)
Land observations

First data release
Start: 2019-04-18
Finish: 2019-06-12

ALOS
K&C Initiative
An international science collaboration led by JAXA
Land surface observations

First data release
Start: 2019-04-18
Finish: 2019-06-12
Land surface observations > 95% sensitivity

First data release
Start: 2019-04-18
Finish: 2019-06-12
JAXA 2018 PALSAR-2 Australian Mosaic

L-HH | L-HV | L-HH

Acquisition Date

2015-07-11
2016-05-23
2017-04-06
2018-02-17
2018-12-31
Deliverables and other output

1. Peer-reviewed publication on efficacy of GEDI and ICESat-2 for reducing uncertainty in L-band SAR mapping of aboveground biomass mapping in Australian forests and woodlands

2. Demonstration high spatial resolution height and aboveground biomass data products over TERN Landscapes SuperSites

3. Publication of open field/lidar data pairs through the NASA/ESA MAAP (Australian component under auspices of TERN and K&C)

4. Peer-reviewed publication and data product on 2019-2021 Australian vertical plant profile metrics and their changes across degraded (fire impacted) and regenerating forests

5. Non-peer-reviewed publications (e.g., post-K&C reports)
PALSAR/PALSAR-2 data access

Post-KC PALSAR/PALSAR-2 data requested:
- TERN SuperSites (fire impacts a priority)
- Cycles 137 to 139 (Oct – Nov 2019)

Post-KC PALSAR/PALSAR-2 data obtained:
- None

Data availability limitations:
- Post-fire over Eastern Australia sites (particularly NSW)
- No FBD scheduled in BOS Dec 2019 – Apr 2020 (Cycle 140 – 150)
- ALOS-2 “Super-Super site”?
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