Project 1: Fuels3D

Project 2: Active Fires

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Fuels 3D

Challenge: Data collection technologies and methods for **repeatable, accurate** and **quantitative** measurement of fuel hazard

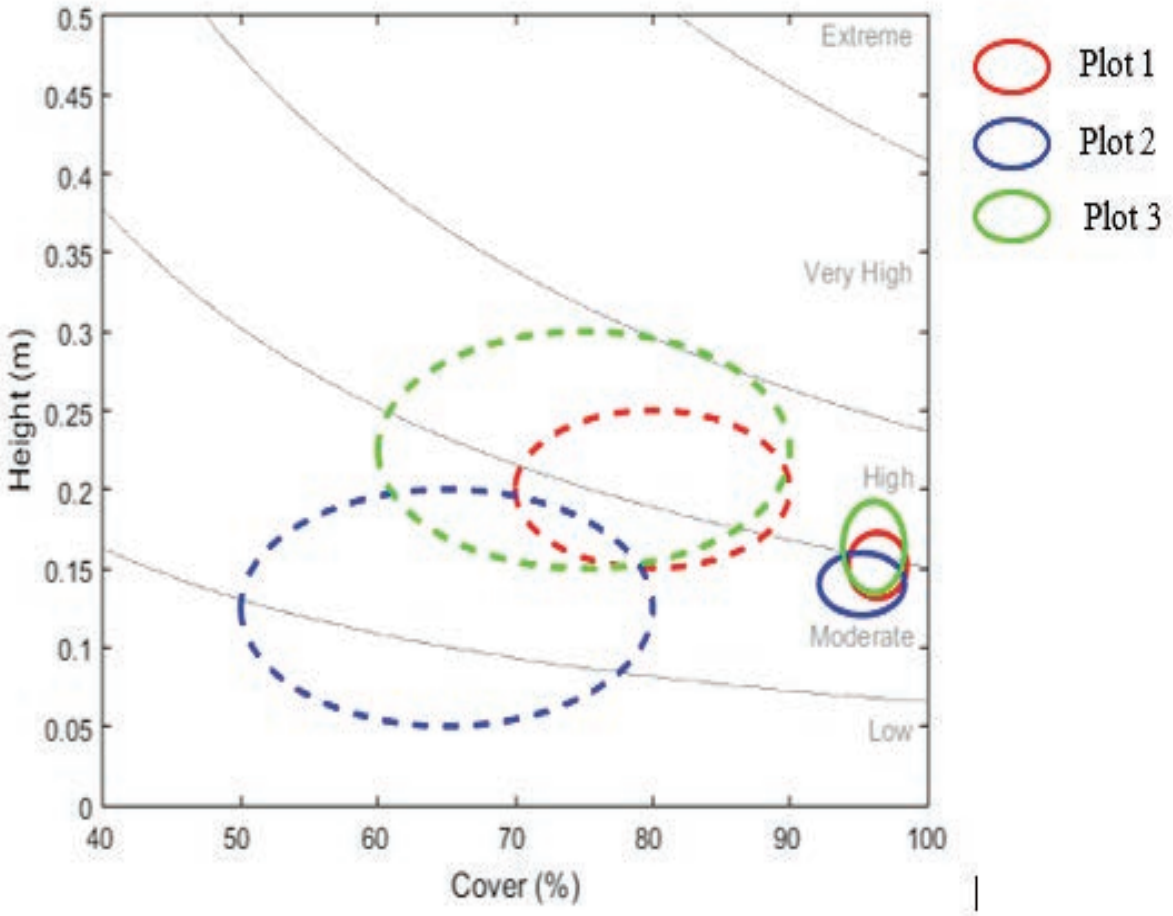
Opportunity: Investigate emerging terrestrial and aerial **remote sensing technologies**

Solutions: (i) **Sampling techniques and technologies** for repeatable and low-cost capture of the fuel environment (ii) **Point cloud data analytics** to derive fuel layers and quantitative hazard metrics from different sources.

Research Translation to Utilisation

How does it compare to visual assessments?

Evaluating **ease of use, precision and repeatability** of using low cost smart phone and camera options for **quantitative** fuel hazard assessments.



Research Translation to Utilisation

Data validation and accuracy assessment via examining point cloud volumes versus destructive samples.

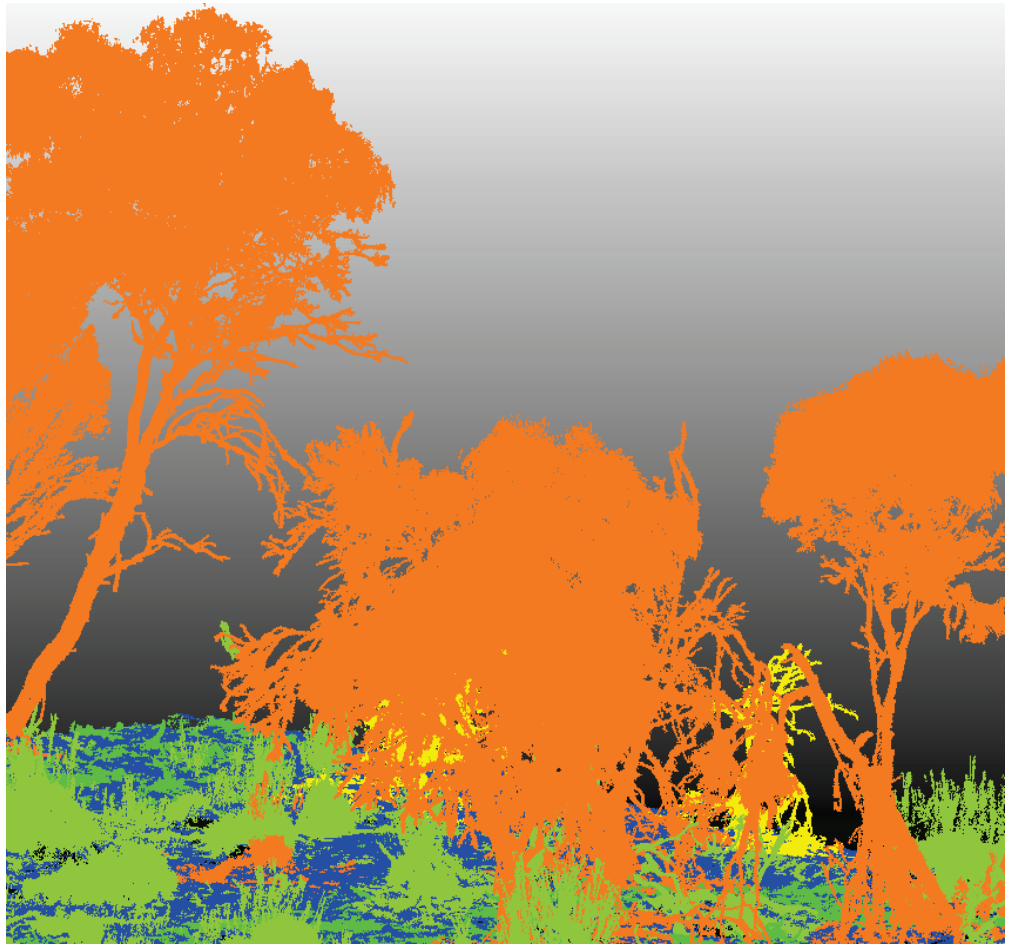
Inter-comparison with other point cloud sources (TLS, A-SfM and Airborne LiDAR)

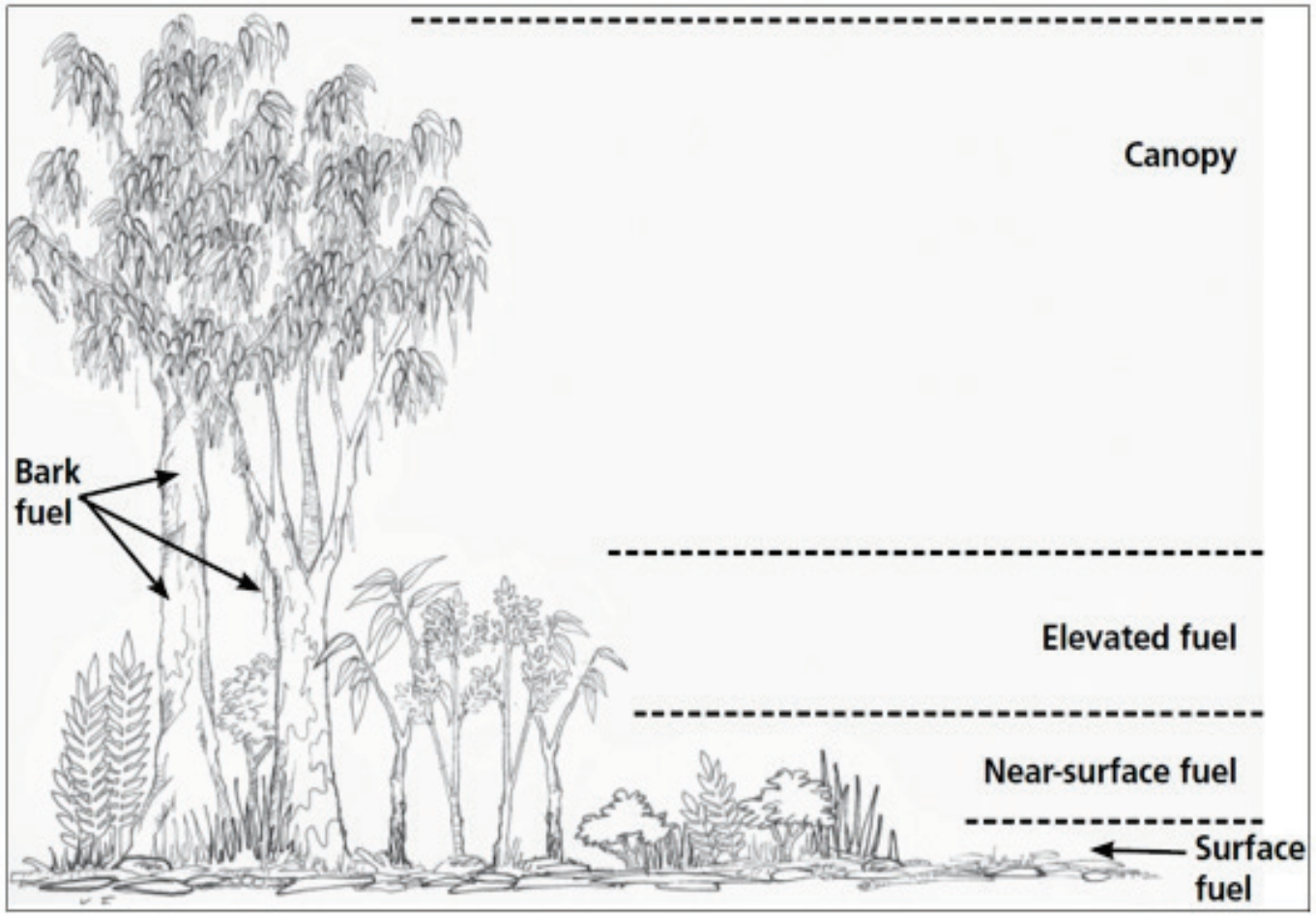
BUT how to assess **accuracy of 3D point clouds**?

Research Translation to Utilisation

What are the **environmental conditions** that impact on **performance**?

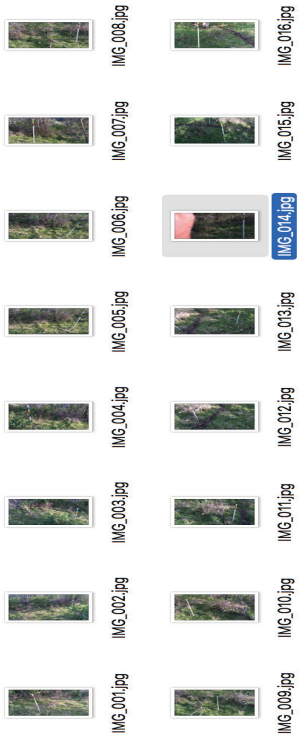
Research Translation to Utilisation

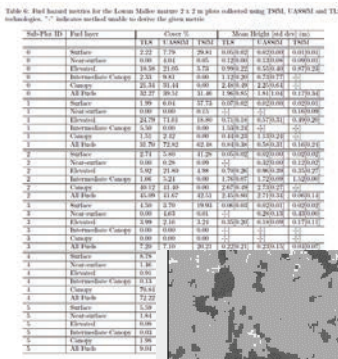


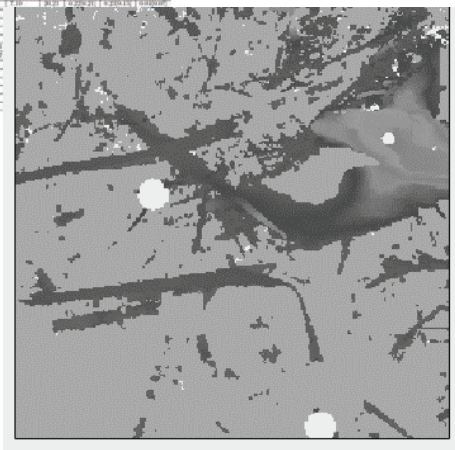


Solution Workflow

Field image capture → Image transfer → Image matching and scale → 3D point creation → Fuel layer extraction → Calculate fuel metrics and maps → Data transfer of metrics







Utilisation Next Steps

- End-user requirements capture (currently in progress) and consistency in defining fuel layers.
- Processing of data collected from previous utilization trials and return to end-users.
- Debugging and automation of end-to-end work flow and QA processes (level of human intervention?).

Summary of Achievements

Awards

- 2017 Victorian Spatial Excellence Award for Environment and Sustainability
- 2019 International Association of Wildland Fire PhD student scholarship

Research Outputs

- 8 peer-reviewed publications
- 3 manuscripts in review
- 1 PhD and 3 Masters completions
- 2 PhD students in progress

Utilisation Outputs

- Easy to use and cheap in-field sampling and image-taking method (quick guides)
- In-field scaling frame and automated extraction of scale (code)
- Point cloud processing and analytics to derive fuel layers, of various definitions, and metrics (code)

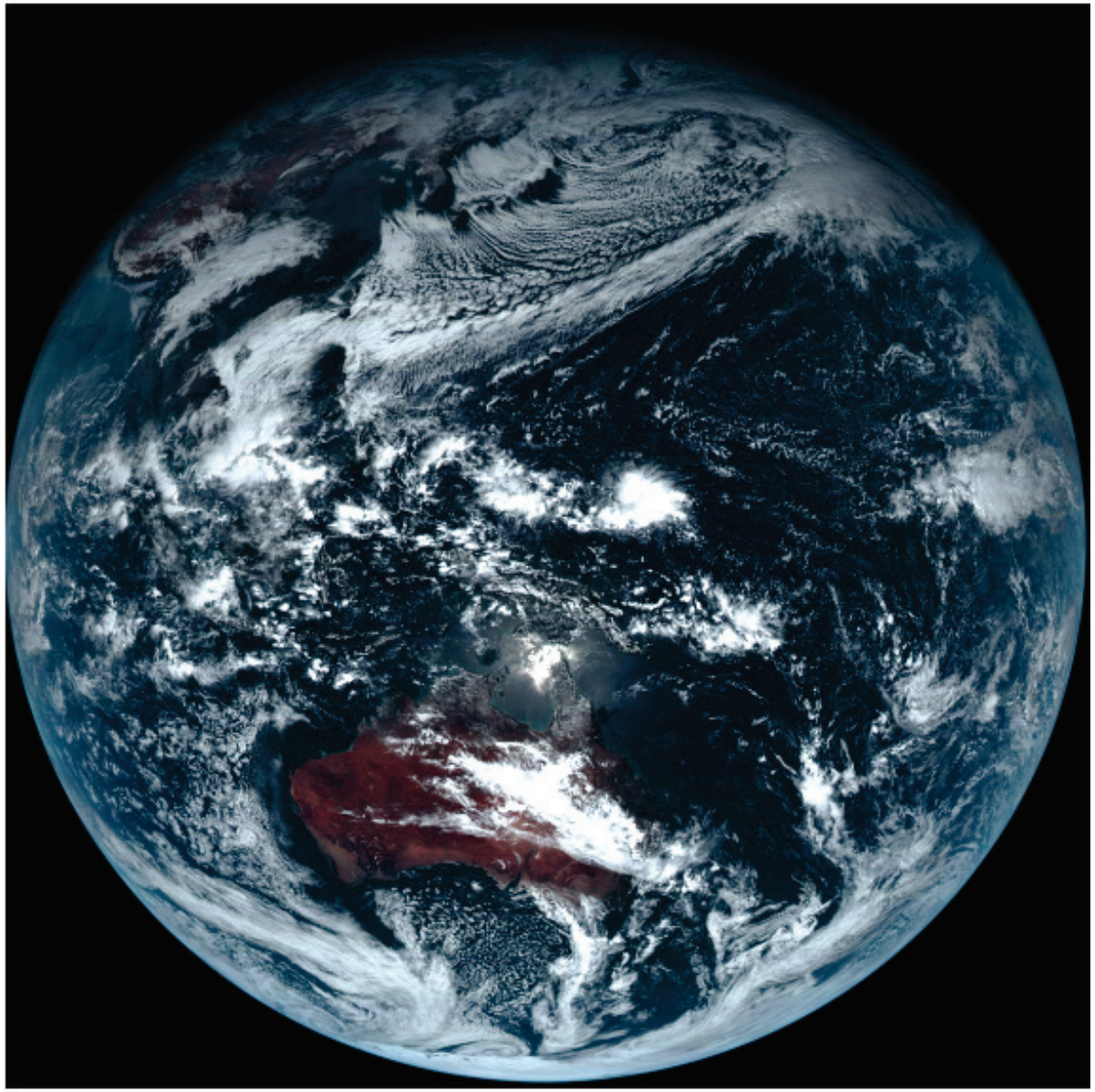
Active Fires

Challenge: **Continuous** and **timely** surveillance of active fire across the Australian continent; **old algorithms applied to new data**.

Opportunity: Launch of Himawari-8, providing **10 minute observations**.

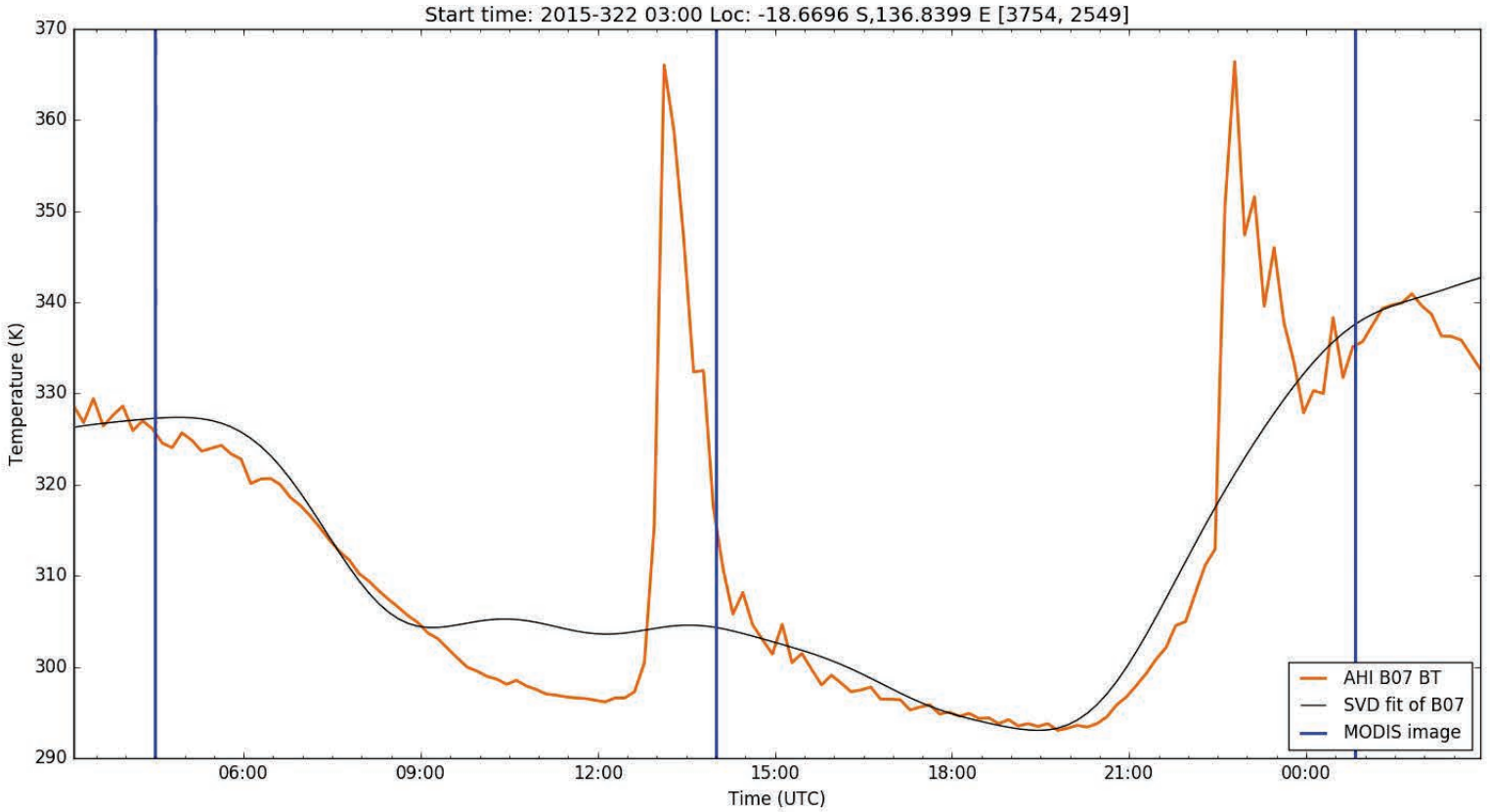
Solutions: (i) **new fire detection algorithms** customised to Australian conditions (ii) computational techniques to deliver **near-real-time (1-2 minutes)** implementation.

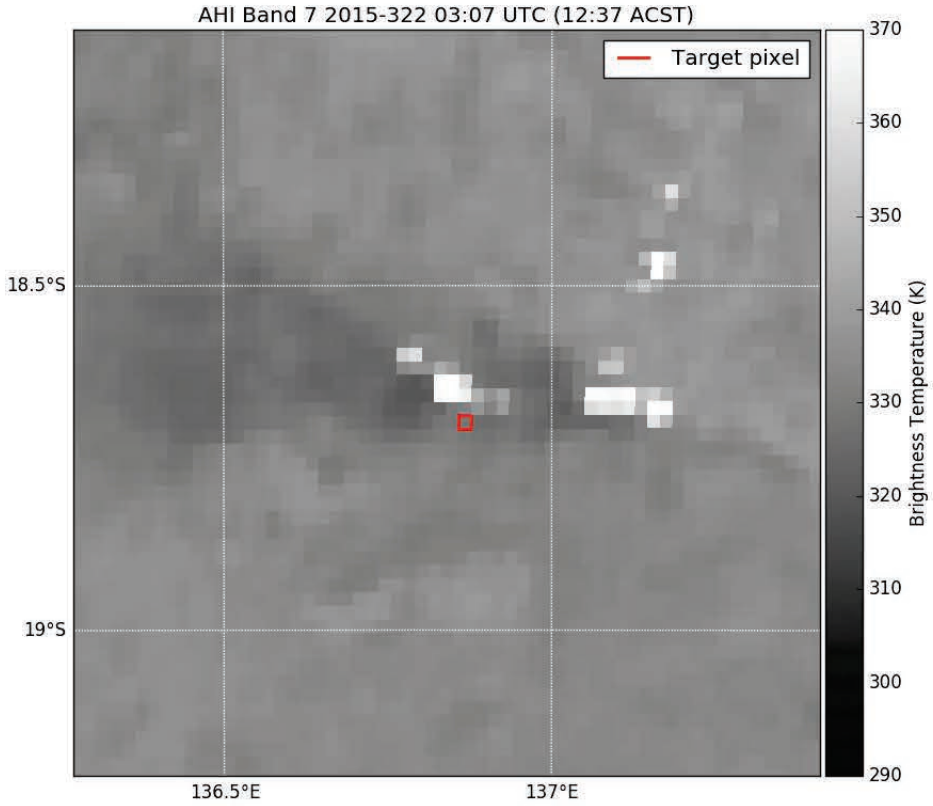
Himawari-8



Source: Japan Meteorological Agency website

Research Translation to Utilisation





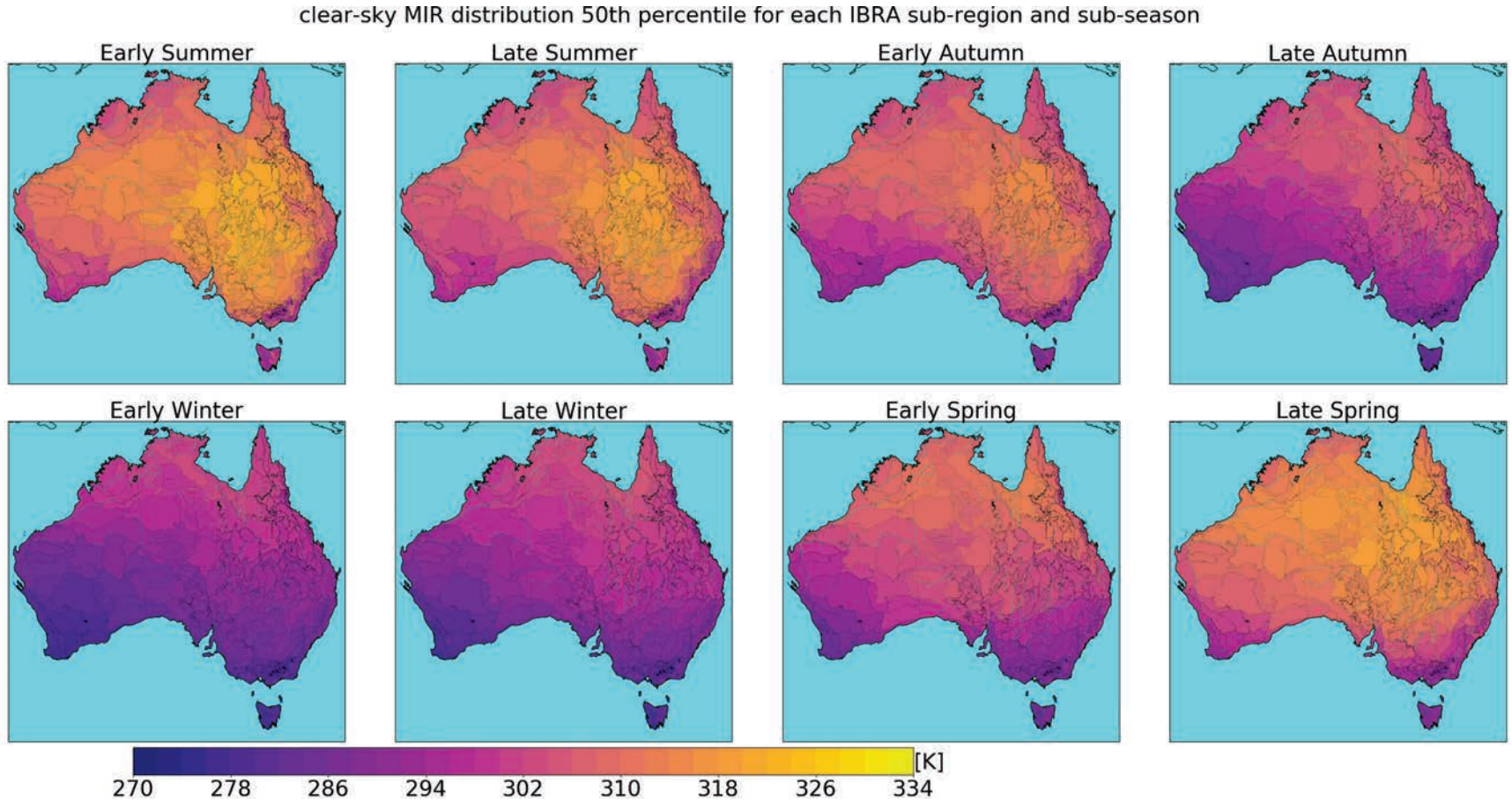
Research Translation to Utilisation

Surface temperatures vary with **time of day**, **season** and **geographical location**.

Algorithm varies based on rolling time windows, specific to time of day (ie every 10 minutes) and geographical region.

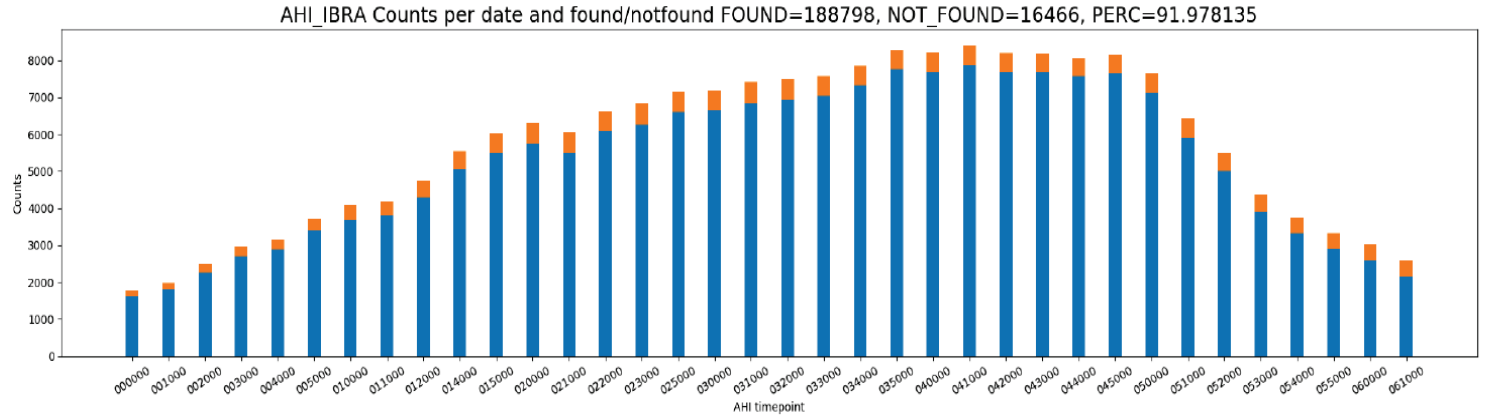
How to deal with **cloud**?

How can we do all of this **quickly**?

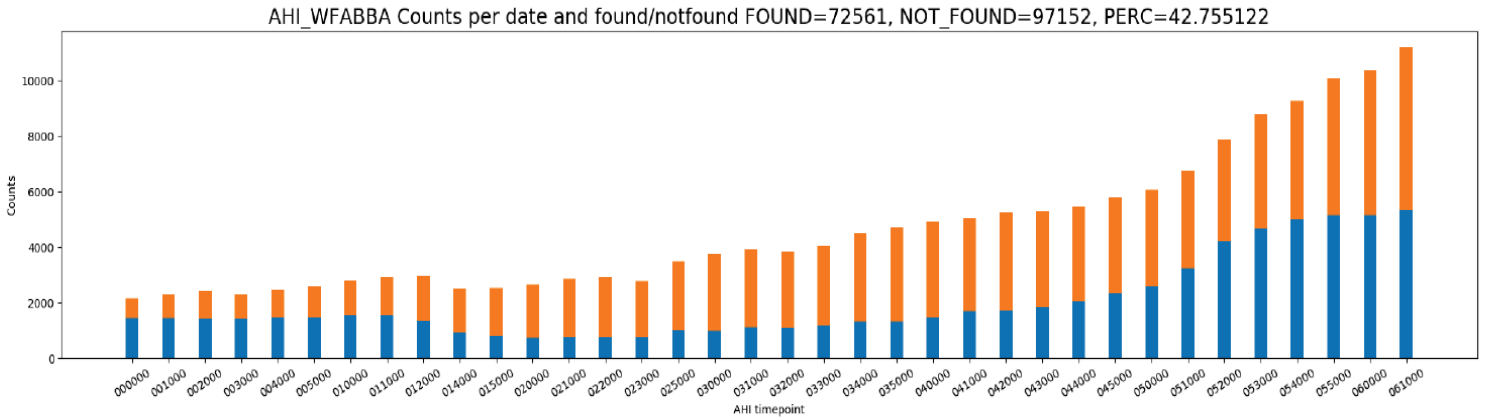


Research Translation to Utilisation

AHI-IBRA not in AHI-WFABBA compared to MODIS+VIIRS



AHI-WFABBA not in AHI-IBRA compared to MODIS+VIIRS

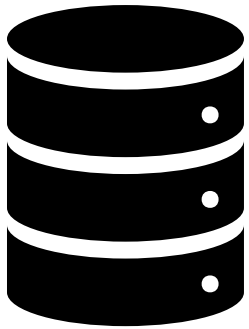


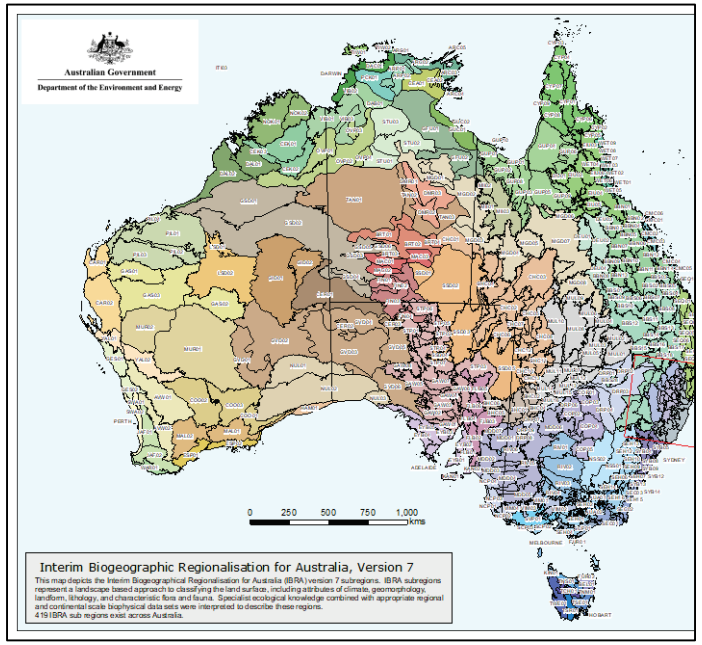
How well does the algorithm perform?

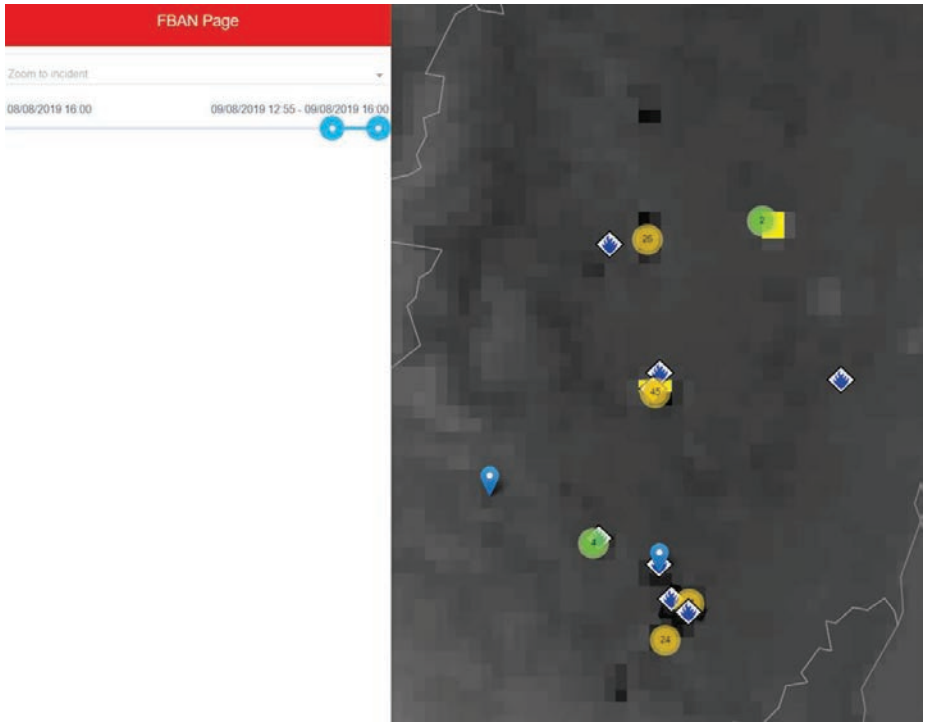
Challenges with validating geostationary satellite products with polar-orbiting satellite products.

Solution Workflow

Check for Himawari-8 data → Download bands 3. 7, 13 → Switch between day/night → Calculate albedo, MIR & TIR thresholds → Clear sky + raised MIR, TIR values → Format hotspots → Data transfer of hotspots







Utilisation Next Steps

- Chermelle presenting to FBAN webinar in November.
- Improve day/ night switch using solar angle information.
- Format hotspots for hotspots to be ingested into GA Sentinel program for NSW, Vic and ACT.
- Continue NSW RFS feed and conduct comparison between Himawari-8 hotspots and incident reports.
- Roll out hotspots for other states and territories as beta product.
- Delivery of code to host agency.

Summary of Achievements

Awards

- 2017 and 2018 Asian Conference of Remote Sensing best presentation award

Research Outputs

- 10 peer-reviewed publications
- 2 manuscripts in review
- 2 PhD and 1 Masters completions

Utilisation Outputs

- 3 new algorithms
- Python code to produce Himawari-8 cloud masks
- Python code to deliver hotspots in near-real-time without need for cloud-mask
- Implementation demonstration via NSW trial

Thank You

Fuels 3D Research Translation

RESEARCH

Problem

Lack reliability of field fuel hazard assessments = poor data quality and low information value.

Data collection devices such as LiDAR based technologies for quantifying fuel structure on the ground are expensive and sensitive to wind.

Fire behavior and fire spread models require quantifiable measures of fuel hazard elements.

Opportunities

Bring together off-the-shelf cameras with advances in computer vision / photogrammetry.

Adaptable to multi-platform + technology sources for point clouds.

Research Outputs

8 peer-reviewed journal publications, 2 new publications in review

VSEA (environment and sustainability) winner

3 PhD students

Solution

Complements existing fuel hazard assessments.

Uses off-the-shelf cameras.

Tool chain from images to 3D point cloud coupled with workflow for extracting fuel layers and calculating quantifiable surface and near-surface fuel structure metrics.

Benefits

Cheap, rapid, easy-to-use, repeatable.

Quantifiable metrics of fuel.

Adaptable to new research.

Utilisation Activities

Two end-user utilisation trials with end-users from across Australia.

In-field case studies across priority landscapes.

End-User Community

State land management, and emergency service agencies.

AFAC.

Local councils.

Fire behavior and fire spread modellers.

UTILISATION

What has been achieved?

Proof-of-concept and testing.
Accuracy assessment and technology comparison
Bespoke and novel algorithms for extracting fuel layers.
Solution workflow design - hardware and software.

What next?

Funding ceases December 2018 (*half project).
Seeking investment for continuation.

Active Fires Research Translation

RESEARCH

Problem

Consistent monitoring and timely detection of fire across the Australian continent.

Polar orbiting satellites have low re-visit frequencies meaning much of the continent is unobserved for most of the time.

Fire detection algorithms use spatial windows to identify hotspots, pixels can be vulnerable to cloud contamination leading to detection error.

Opportunities

Himawari-8 provides 10 minute observations across the entire Australian continent.

Research Outputs

10 peer-reviewed journal publications, 2 new publications in review

2 PhD students, 1 Masters student

Solution

Xxx

(note: 1 of 3 solutions developed in the project)

Benefits

Eliminates need for cloud mask.

Scaleable processing enabling NRT reporting.

Utilisation Activities

Planning near-real time trials

In-field case studies across priority landscapes.

End-User Community

Emergency services.

The Community.

UTILISATION

What has been achieved?

Three independent solutions for fire surveillance developed. Inter-comparison with MODIS, VIIRS and WF-ABB/AHI hotspots for all algorithms.

What next?

Utilisation trial and review commencing Feb 2019 with NSW Rural Fire Service.