FINDINGS

Real time wildfire detection trial using Himawari-8

Fire Surveillance and hazard mapping

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A real-time active fire hotspot detection algorithm was developed and trialed, with the active fire hotspots delivered in real-time to the NSW RFS. The trial demonstrated the timeliness and accuracy of the RMIT active fire hotspot method by comparison to MODIS overpasses and indicated possible areas for future research.

Introduction

Detecting active fires is critical for the protection of lives and property. While many tools exist for detecting active fires in the Australian landscape, new techniques providing enhanced temporal coverage and real time capability are needed. One option being explored is remotely sensed data from the Himawari-8 geostationary satellite. Himawari-8 provides remotely sensed observations over Australia every 10-minutes. In 2018, the RMIT team designed an algorithm to detect active fires in Australia using historical Himawari-8 data. This previous work created the desire for a similarly designed real-time algorithm.

Methods

A real-time RMIT Himawari-8 active fire algorithm was created and run over the whole of New South Wales and Victoria from 15th March 2019 to 23rd March 2020. Himawari-8 data was received in real-time from the Japan Meteorological Agency via the Bureau of Meteorology. Himawari-8 reflectance (0.64 µm, channel 3) , mid-infrared (3.9 µm, channel 7) and thermal infrared (10.7 µm, channel 13) were stratified according to Interim Biogeographical Regionalisation of Australia (IBRA) sub-regions and statistically compared with historical Himawari-8 data at the same time of day from the 4-weeks prior. Hotspots were determined using real-time data and delivered to the NSW RFS in real-time.

Results

Active-fire hotspots were to delivered to NSW RFS within two minutes of Himawari-8 data being received for processing. RMIT/Himawari-8 hotspots were compared against Fire Information for Resource Managements (FIRMS) MYD14 hotspots (table 1). RMIT/Himawari-8 hotspots had commission errors of 8% during the day (11% during the night). Omission errors were 51% during the day (37% during the night).

Discussion

This trial has demonstrated that RMIT/Himawari-8 NSW/VIC hotspots could be delivered in real-time to NSW RFS. Advanced discussions are underway to upscale this to all of Australia.

The MODIS Terra /Aqua satellite system has higher resolving power than the Himawari-8 satellite, and the difference in IFOV will impact on fire detection statistics. The omission errors of 51% (day) and 37% (night) probably result from fires below the resolving power of the Himawari-8 satellite. The 8% (day) and 11% (night) commission error may also reflect differences in the algorithms and/or the transient nature of fires. Our team is currently investigating ways to improve the RMIT/Himawari-8 algorithm and further investigate comparisons with the MYD14 collection.

Our team is also working on innovative ways to interrogate the reliability of RMIT/Himawari-8 hotspots outside the MYD14 overpasses times.

For more information, please email chermelle.engel@rmit.edu.au

Tables and figures
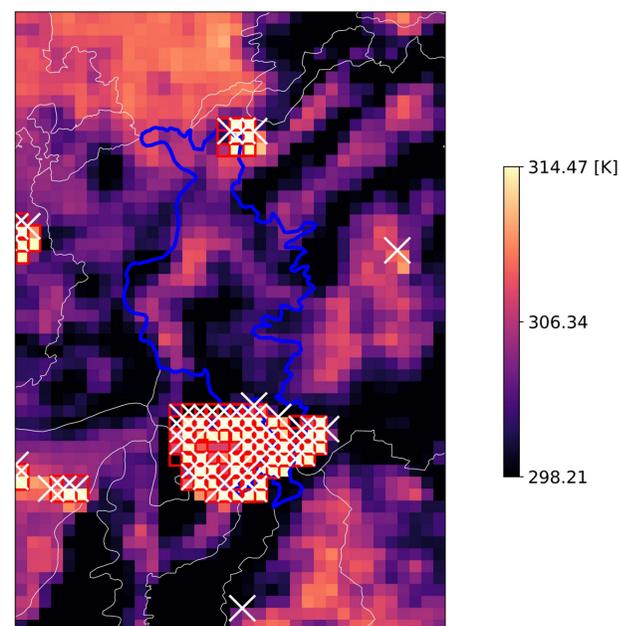
Above: Example Himawari-8 data (3.9 µm, channel 7) centered on NSW North Coast IBRA region NNC02 (outlined in thick blue line; other IBRA regions shown with thin white lines) for 4 UTC on 7th September 2019. Overlaid are RMIT/Himawari-8 (red squares) and MYD14(white crosses) active fire hotspots.

Description	MYD14 (DAY)	MYD14 (NIGHT)
Number of RMIT/Himawari-8 hotspots in the MYD14 reconstructed swath	6398	5132
Number of RMIT/Himawari-8 hotspots detected within 1 pixel of a MYD14 hotspot	5881	4546
Commission error for RMIT/Himawari-8 hotspots	8%	11%
Number of MYD14 hotspots (collated on the Himawari-8 grid)	14247	7496
Number of MYD14 hotspots (collated on the Himawari-8 grid) detected within 1 pixel of a RMIT hotspot	7003	4751
Omission error for RMIT/Himawari-8 hotspots	51%	37%

Table 1: MYD14 hotspots over NSW/VIC compared with RMIT/Himawari-8 hotspots from 15 Mar 2019 to 10 Jan 2020. MYD14 archival quality data was used for 15 Mar 2019 to 30 Sep 2019, and near real-time quality data for 01 Oct 2019 to 10 Jan 2020. MYD14 hotspots with pixel size less than 1.7km were kept and assigned to the nearest Himawari-8 pixel. Areas were defined using the MYD14 hotspots that fell on specific date/times. Hotspots that fell in the area (within +-10 minutes) were considered co-incident. Matches were defined as hotspots in one dataset that had at least one in the opposing dataset within +/- 1 pixel. Statistics were split into daytime and nighttime sets.