bushfire&natural HAZARDSCRC

Cloudy with a chance of fire

Chermelle Engel[1], Chathura H. Wickramasinghe[1], Luke Wallace[1], Bryan Hally[1], Simon Jones[1], Karin Reinke[1]

[1] School of Science, RMIT University, VIC

Recent advances in remote sensing have led to geostationary satellite data being available over Australia every 10 minutes. For frequent and accurate detection of fires from geostationary satellite data, and their assessment, a high-quality satellite cloud mask for Australian environments is required.

FIRE DETECTION IN AUSTRALIA

Recent advances in Satellite technology have provided access to Geostationary Satellite observations (Himawari-8) with data available every 10-minutes over Australia. Given that channels of the satellite data are sensitive to fires, using the 10-minute satellite data to monitor fire activity over the entire Australian region would be an efficient way to provide information to fire-personnel and land managers.

CLOUD MASKS FOR FIRE DETECTION

Current satellite fire-detection algorithms require cloudy-pixels to be masked out prior to detection and mapping of fire. Inclusion of cloud-affected pixels can reduce the accuracy of fire-detection algorithms (false positives). And, exclusion of cloud-affected pixels can lead to fires being omitted.

For the initial implementation of a Himawari-8 cloud-mask, the work by fire-detection researchers (Xu et al., 2010) was used. A cloud mask over land from Visible, Mid-Infrared and Thermal-Infrared Satellite Channels, along with solar information to delineate between daytime and night-time areas was produced.

Comparison of Himawari and LandSat cloud mask tiles over Northern Australia during April/May/June 2016, showed the Himawari cloud mask suitable for use over northern Australia (Table 1, Fig. 1). However, when this Himawari cloud mask is used across Australia to estimate the minimum percent of missed detections due to the pixel being cloud-affected, there is a higher percentage of missed detections in southerly and central regions (Fig. 2) suggesting significant limitations of the algorithm. This is explained in the following sections.

Figure 1. Example LandSat (left, red) and Himawari (right, orange) cloud-mask comparison showing good spatial agreement

Figure 2. Percentage of VIIRS hotspots that are missed due to being covered by Himawari cloud.

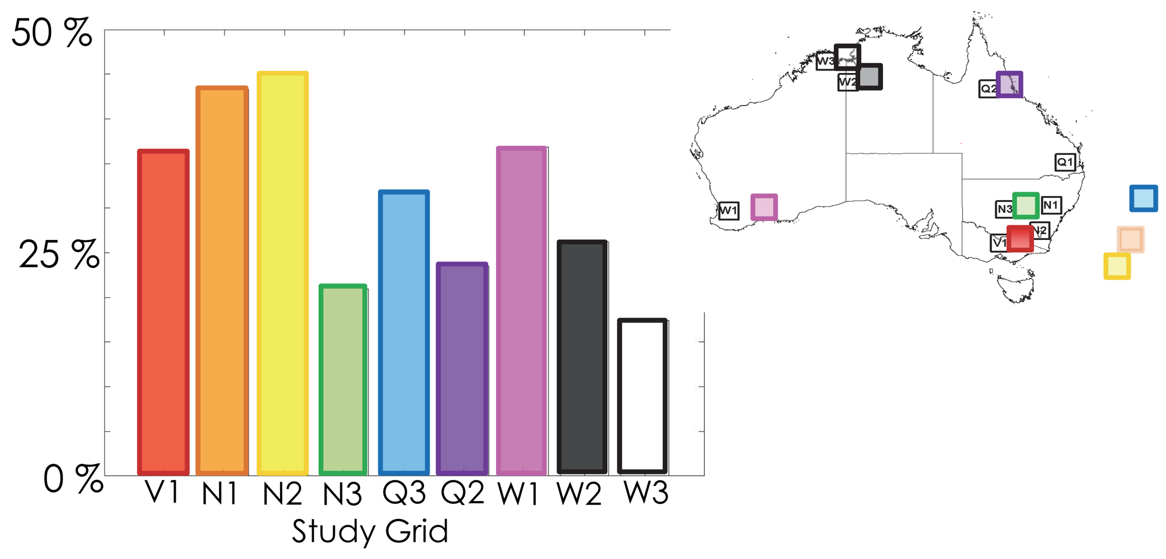


Table 1. Intercomparison of 577 LandSat/Himawari Cloud tiles from April/May/June 2016 over Northern Australia.

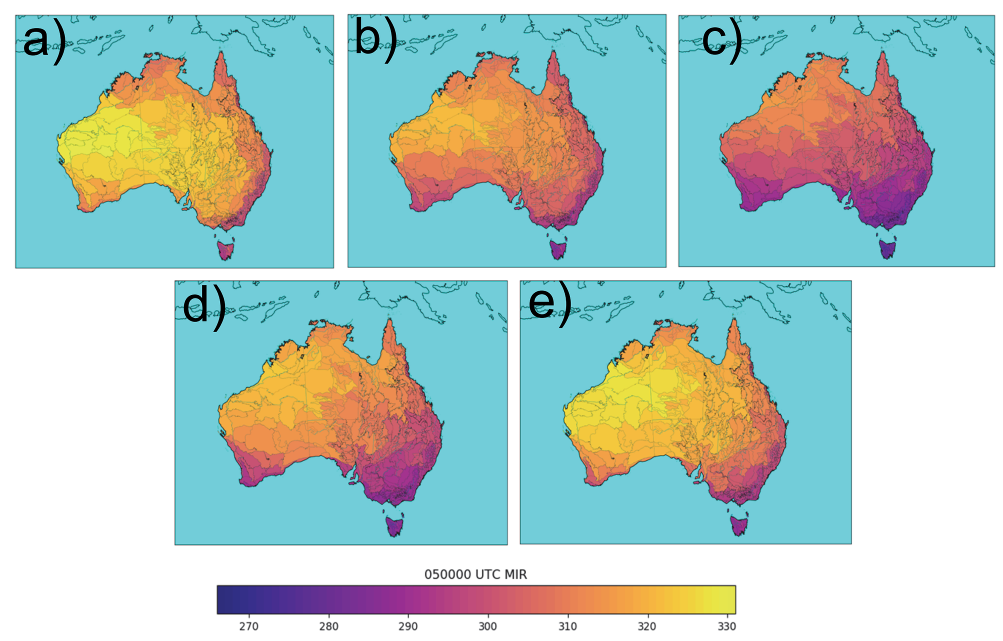
LandSat Threshold	10%			30%			50%		
Albedo Threshold	0.25	0.3	0.35	0.25	0.3	0.35	0.25	0.3	0.35
Accuracy	91	92	92	91	92	92	91	92	92
Bias score	91	92	92	91	92	92	91	92	92
POD score	86	84	84	90	88	88	92	90	90
False Alarm Ratio	11	8	8	15	11	11	19	14	14

DYNAMIC THRESHOLDS FOR AUSTRALIA

The work by Xu et al (2010) was optimised using data from the Brazilian Amazon (Schroeder et al, 2008). The Brazilian Amazon is a special region that is especially temperate. Australia, in contrast, has many different biogeophysical regions (Thackway and Cresswell, 1995; Environment Australia, 2000 that can vary a lot across seasons and times of day as shown in Fig. 3.

Our aim is to create a new Australia-specific cloud-mask that will use dynamic brightness value and albedo thresholds, to improve accuracy in fire detection using Himawari-8

Figure 3. Variation of most common MIR value at 0500 UTC by Season and IBRA biogeophysical region for (a-e): Summer, Autumn, Winter, Early Spring and Late Spring.



During phase one of the project, the RMIT team developed and demonstrated an improved early detection algorithm and methodology for use with Himawari-8 data. The recent work on developing a regionally-specific cloud mask aims to further improve the accuracy of this next-generation early fire detection system, as it moves towards further testing against historical datasets, prior to an initial live trial later in the project."

Dr Simon Heemstra, Manager Planning & Predictive Services, NSW Rural Fire Service

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