NEAR-REAL TIME FIRE SURVEILLANCE USING HIMAWARI-8

Chathura H. Wickramasinghe[1], Simon Jones[1], Karin Reinke[1], Luke Wallace[1]

[1] School of Science, RMIT University, VIC

NEW ALGORITHM, AHI-FSA (AHI FIRE SURVEILLANCE ALGORITHM) IS INTRODUCED TO MAP FIRE LINE AT 500M SPATIAL RESOLUTIONS EVERY 10 MINUTES. THE ALGORITHM UTILIZES THREE DIFFERENT SPATIAL RESOLUTIONS PROVIDED BY THE MIR, NIR AND RED CHANNELS TO DETECT THE FIRE FRONT AT 500M RESOLUTION. INITIAL RESULTS SHOWS THE ALGORITHM CAN BE EFFECTIVELY USED FOR WILDFIRE SURVEILLANCE.

Himawari-8 is a new geo-stationary weather satellite launched in October 2015 by Japan Meteorological Agency (JMA). On board is the AHI (Advance Himawari Imager) 16 channel mutli-spectral sensor with a 500 m RED channel,1 km GREEN, BLUE and NIR(Near Infrared) channels. The remaining 12 channels are in the MIR(Middle Infrared) and TIR (thermal infrared) region ranging from 1.6-13.3μm with 2km spatial resolution. In terms of coverage AHI can capture entire hemisphere image every 10 minutes covering the entire East Asia region

ALGORITHM

The algorithm models differs in the MIR, NIR and the RED channels radiance/reflectance between non-fire and fire day images. Three difference threshold conditions are applied to the three bands, improving the spatial resolution from 2km to 500m.

- MIR difference based contextual threshold condition us used to detect thermal changes at 2km.
- NIR difference slope based threshold is used to track changes in vegetation cover. This will detect the burning and non burning pixels at 1km resolution.
- RED channel is used to detect edge between smoke and non-smoke with in the burned/burning NIR pixel.

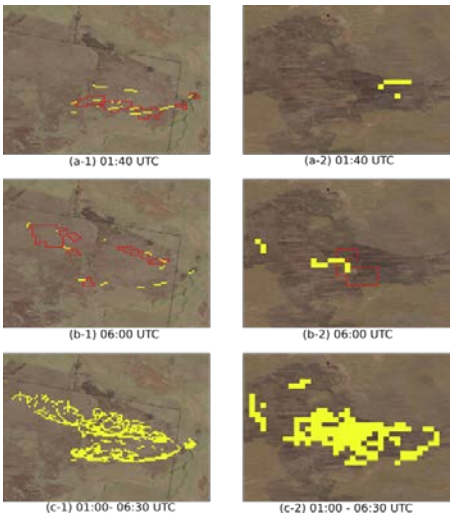

Figure 1: shows results from Fitzroy Crossing fire (on the left-1) and Broome fire (on the right-2) on 10th September in Western Australia. Landsat-8 burned scare image is used as background. Algorithm results are shown in yellow. MODIS thermal anomalies pixels as boundary line in yellow. Images (a-1) and (a-2) shows at 01:40 UTC. Images (b-1) and (b-2) shows snapshot at 06:00 UTC. The last row (c-1) and (c-2) shows composite image computed using every 10 minutes fire line hotpots results from 01:40 to 06:00 UTC.

CONCLUSION

Overall the algorithm performed well during the case study, over scrub and grass land fires. Continuously detecting the fire front at 500m, throughout the three case study fires. The muli-resolution approach adopted in the algorithm has proven to be highly effective in developing AHI into a wildfire surveillance sensor. It can prove valuable information for fire fighters, such as speed and direction of the fire every 10 minutes. Sudden changes in fire direction can be monitored and warning can be given to fire fighters on the ground, which could potential save lives of fire fighters. Finally compared with MODIS thermal anomalies products the algorithm proved great improvement overall , in terms of spatial/temporal resolution.

END USER STATEMENT

Identifying hotspots is a high priority for operational fire response. Currently information from the fire ground and from airborne information gathering is dependent on weather conditions as well as accessibility, so often situational intelligence can be limited under extreme conditions. MODIS hotspots are only available 12 hourly, so more frequent satellite information would enable better tracking of bushfires and allow planners more accurate and timely information to plan their response strategies, especially in remote locations or under extreme conditions where other forms of situational intelligence is not available.

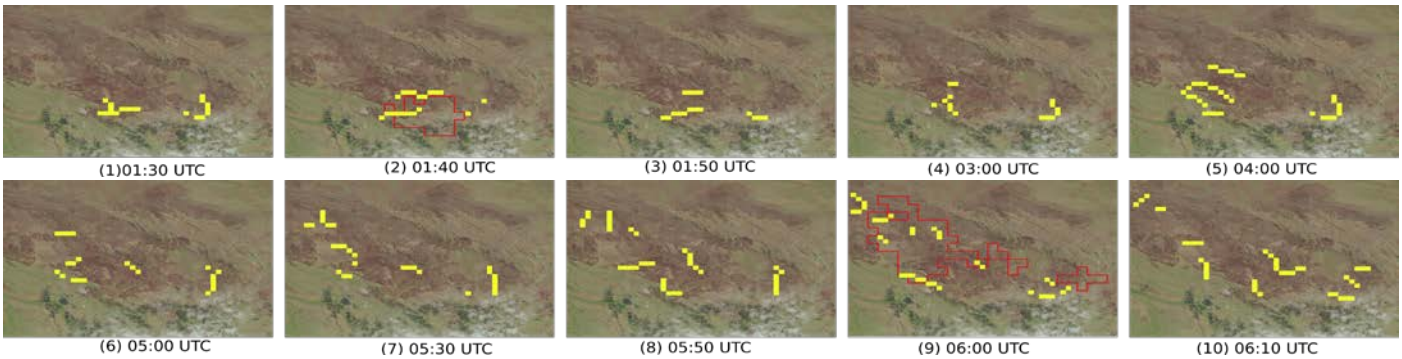

Figure 2 shows time sequence of fire line hotspots results from the algorithm on 10th of September 2015 in Camballin, Western Australia. The background image is Landsat-8 post fire image acquired on 24th September. Algorithm results are in yellow and the MODIS thermal active fire products as pixel boundary in red.