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# Fighting fire with satellite datasets

## *Satellite imagery aids emergency relief*


*David Hudson and Norman Mueller*

On the weekend of 7 February 2009 a series of large bushfires across Victoria resulted in Australia's most serious bushfire event which claimed 173 lives.

During the emergency, Geoscience Australia provided satellite-derived information to support the emergency response and recovery efforts. This support was through the Sentinel system (an online 'hotspot' detection system) and provision of satellite imagery and maps showing areas affected by bushfires.

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### Sentinel (online hotspot detection system)

The Sentinel online hotspot detection system was initially developed during the bushfires in New South Wales and the Australian Capital Territory in early 2002. Operation of the Sentinel system passed from CSIRO to Geoscience Australia in 2005. Sentinel's contribution to fire regime mapping was highlighted in the Council of Australian Governments' (COAG) National Inquiry on Bushfire Management, Prevention and Mitigation (COAG 2004, Recommendation 5.2).

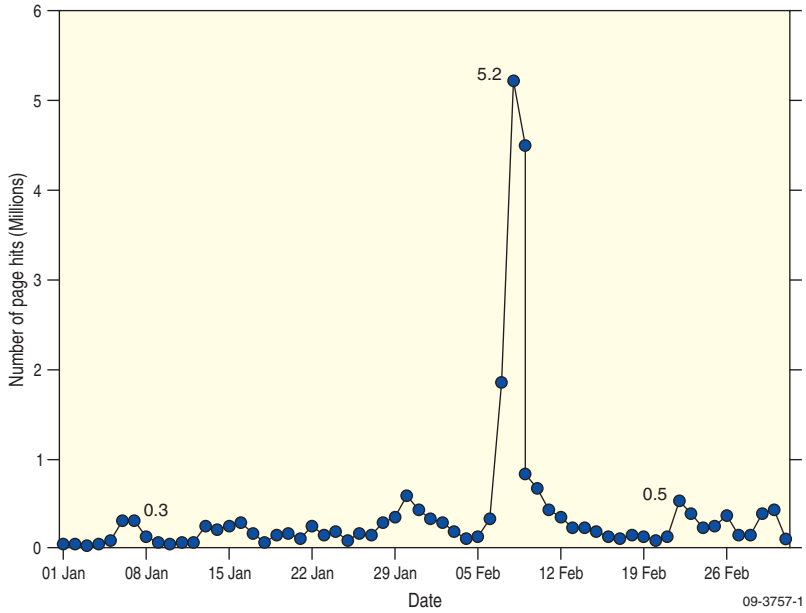


**Figure 1.** Levels of usage of the Sentinel website during January and February 2009.

Sentinel uses United States satellites with thermal infra-red sensors to detect hotspots which indicate bushfires. The satellites pass over Australia each morning and afternoon, observing the land surface and beaming that information to Geoscience Australia's ground station at Alice Springs. The information is analysed automatically by a computer to detect hotspots. Within an hour of the satellite overpass the hotspots appear on the internet site.

Record numbers of people accessed the Sentinel website during Victoria's catastrophic fires in February. Over 5.2 million hits were recorded on Sunday 8 February, and Geoscience Australia staff struggled to keep the system running. Figure 1 shows the levels of use experienced during

this period. The website's usage levels returned to normal by Wednesday 11 February, and full web mapping functionality was restored to the public later that week.

**Table 1.** Detailed breakdown of each of the acquired datasets and their source.

| Satellite, Sensor | Type | Scenes acquired | Resolution (m) | Acquired by |
|---|---|---|---|---|
| ALOS, AVNIR-2 | Optical | 18 | 10 | GA |
| ALOS, PALSAR | RADAR | 16 | 10-30 | Sentinel Asia |
| Terra, MODIS | Optical/ thermal | 24 | 250 | GA |
| Aqua, MODIS | Optical/ thermal | 21 | 250 | GA |
| Landsat 5, TM | Optical | 11 | 30 | GA |
| Landsat 7, ETM | Optical | 10 | 30 | GA |
| KOMPSAT-2, MS | Optical | 3 | 4 | KARI* |
| **Total** | | **103** | | |

*KARI: Korea Aerospace Research Institute

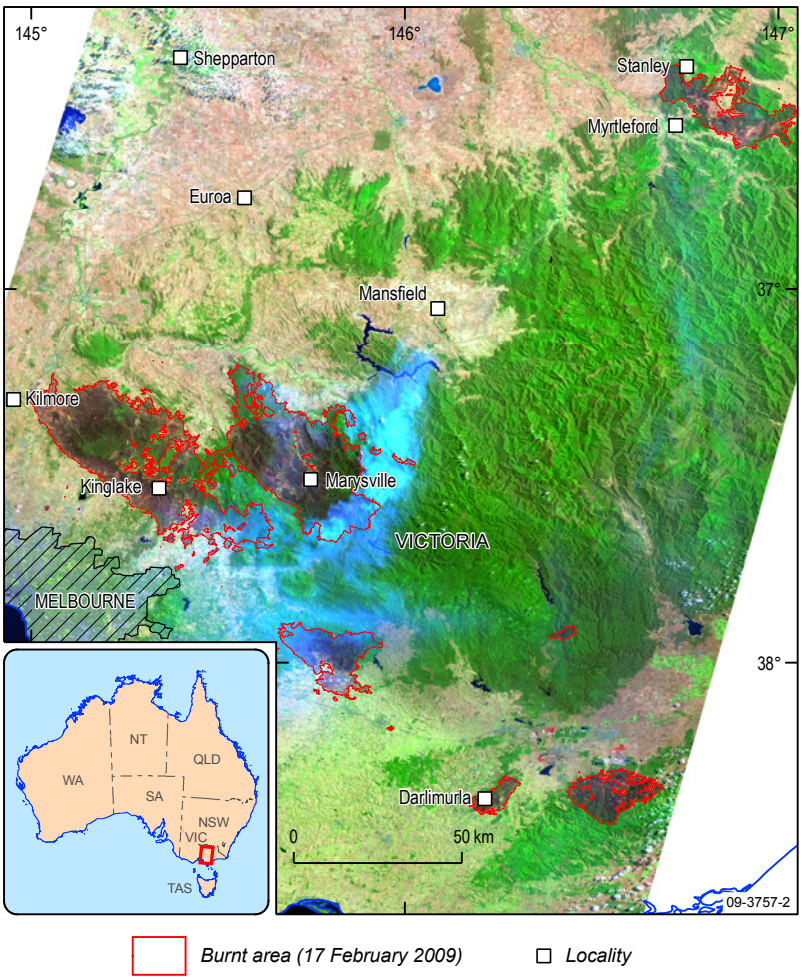


**Figure 2a.** Cloud-free image highlighting burnt areas (in red) and showing smoke rising from the Kinglake and Marysville fires.

## Satellite imagery and maps showing areas affected by bushfires

Between 7 February and 26 February, Geoscience Australia acquired 103 satellite scenes over the fire affected areas. Satellites operated by the United States, Korea and Japan all provided data (see table 1). China also provided satellite information products during the fires. Geoscience Australia's remote sensing scientists were able to analyse these images to produce some of the first maps showing the actual areas burnt. These maps and images were distributed to emergency managers, researchers and the media.

Thick smoke and cloud were common during the fires making it very difficult to gather complete satellite images. Although the fires began on 7 February, the first completely cloud-free image was not acquired until ten days later on 17 February by the Landsat-5 satellite. An image of the area of interest, which was cloud free, was highly processed to highlight burnt areas and show fire fronts (figure 2a).

As is common during an emergency, many requests for data of the affected area were received. Geoscience Australia worked with Emergency Management Australia's Incident Management Facility to distribute this data. Satellite imagery, burn extent information and Sentinel hotspot data were requested by power and water utilities, communications

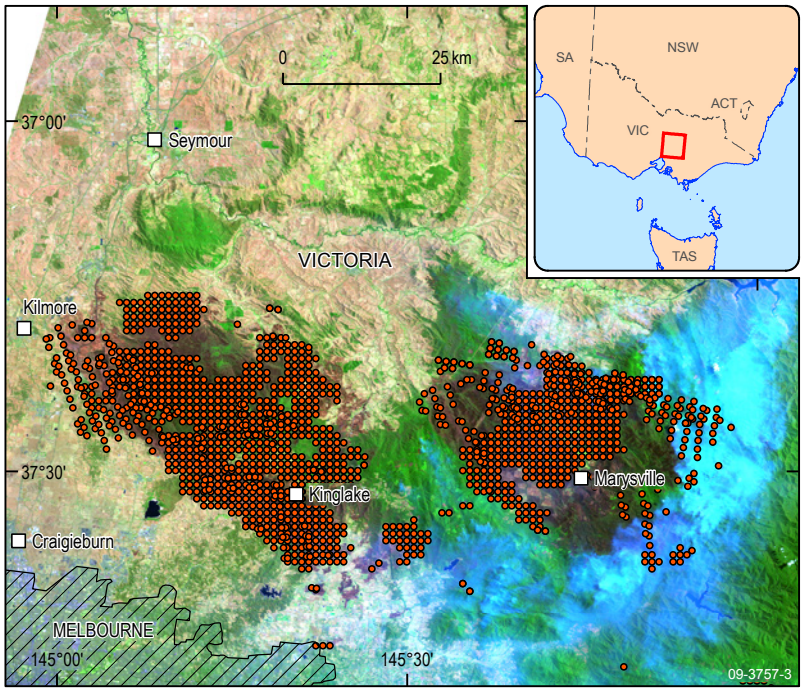


**Figure 2b.** Hotspot data from the Sentinel system (red square dots) overlaid on a satellite image of the Kinglake and Marysville fires.

companies, insurance providers, state and federal Government agencies involved in disaster mitigation and relief, as well as Australian and overseas research organisations.

## For more information

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## Related articles/websites

Sentinel online hotspot detection system
sentinel.ga.gov.au/acres/sentinel/index.shtml

Council of Australian Governments' (COAG) National Inquiry on Bushfire Management, Prevention and Mitigation
www.coagbushfireenquiry.gov.au/findings.htm