Improving Fire Fighter Safety with RADAR Based Warnings

Research Fact Sheet

Forests, Fire and Regions Group invests in the *Integrated Forest Ecosystem Research Agreement* (IFER) with the University of Melbourne, which delivers critical science projects to support policy and operational practices. The core research themes of IFER include biodiversity, carbon, hazards, socio-economic, vulnerability and water. *Improving fire fighter safety with RADAR based warnings*, is a hazards supplementary project. The project commenced in March 2107 and was completed in June 2018.

The Project

Large wildfires can impact communities, resulting in significant damage to assets across the landscape. Consequently, fire management agencies commit significant resources to protect these communities and assets. Fire grounds can be inherently dangerous, due to factors such as erratic and/or rapid wildfire spread, strong winds and unexpected shifts in wind direction. These factors can create significant risks to the safety of fire-fighters in a bushfire context.

The Bureau of Meteorology (BOM) maintain several Radio Detecting and Ranging (RADAR) and Automatic Weather Station (AWS) sites across Australia. These sites cover most landscapes where there is the potential for dangerous conditions for fire fighters.

The *Improving fire fighter safety with RADAR based warnings* project will analyse the data from the RADAR and AWS network to explore the potential for these networks to:

- Observe patterns that indicate micro to lower meso-scale atmospheric perturbations such as storm cell development or other forms of convective winds that are a precursor to escalating fire behaviour or have the potential to change safety conditions for fire fighters.
- Detect the footprint within the atmosphere of erratic and/or rapid-fire spread resulting from strong wind changes, localised storm cells with the potential to cause downdrafts and the development of pyro-cumulus clouds.

The project will evaluate BOM radar and AWS data for use in the identification of micro to lower mesoscale atmospheric perturbations such as storm cell development or other forms of convective winds that are precursors to escalating fire behaviour or a change in safety conditions.

The project will also develop and evaluate prototype software for use in an operational setting to detect atmospheric changes relevant to an active fire ground and automatically inform relevant stake holders.

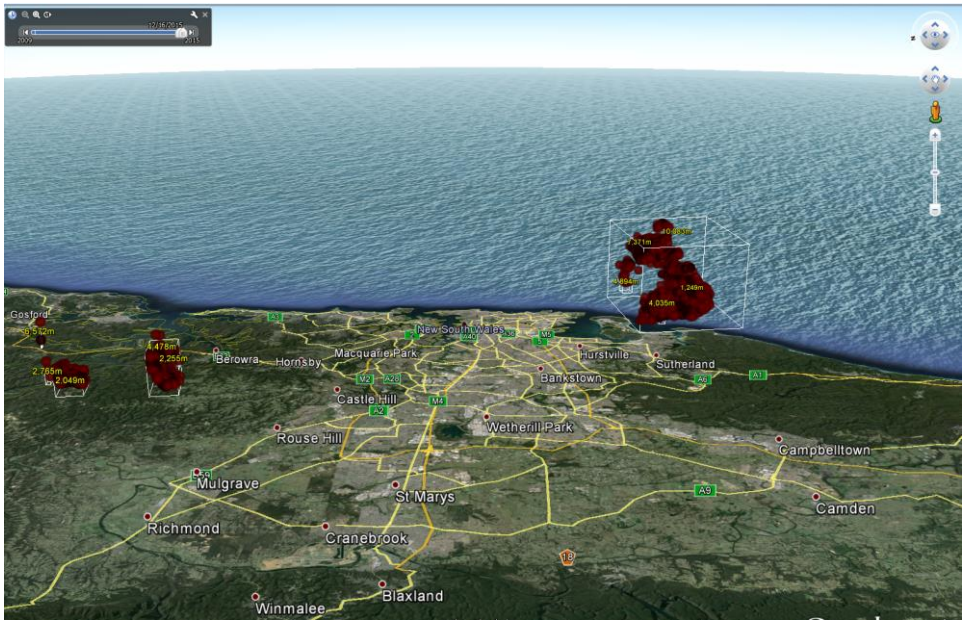

Figure 1: 3D radar depicting the destructive Kernell storm event in 2015.

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Project Outputs

The project will Provide DELWP with:

- a research paper outlining the ability of radar to predict conditions that are precursors to escalating fire behaviour or change safety conditions on the fire ground
- a prototype software that automatically detects micro to lower meso-scale atmospheric perturbations
- beta version of operational software that automatically senses change and alerts people on the fire ground and fire ground managers to be better forewarned and forearmed to respond.

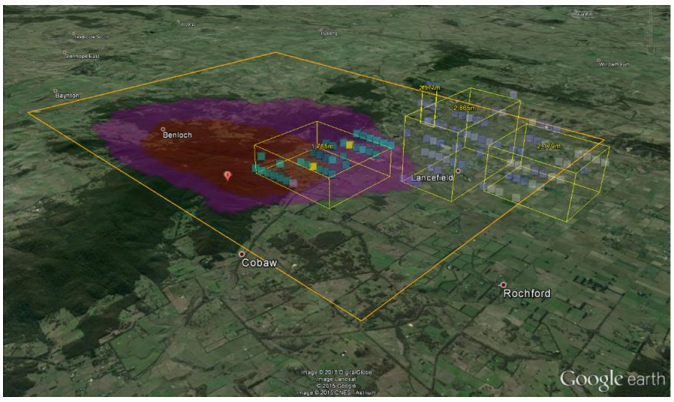

Figure 2: 3D radar signal detected over the Lancefield fire shown as coloured pixels with heights indicated on bounding boxes. Red/Purple area is the ensemble Phoenix RapidFire prediction used to define the sampling area.

Policy and Operational Implications

This project will assist DELWP in providing relevant, real-time weather and radar alerts to fire-fighters and the public in a bushfire context.

The Research Team

The project is being delivered by the Bushfire Behaviour and Management team within the School of Ecosystem and Forest Sciences at University of Melbourne.

The primary researchers are Mr Derek Chong, Dr Thomas Duff and Associate Professor Trent Penman.

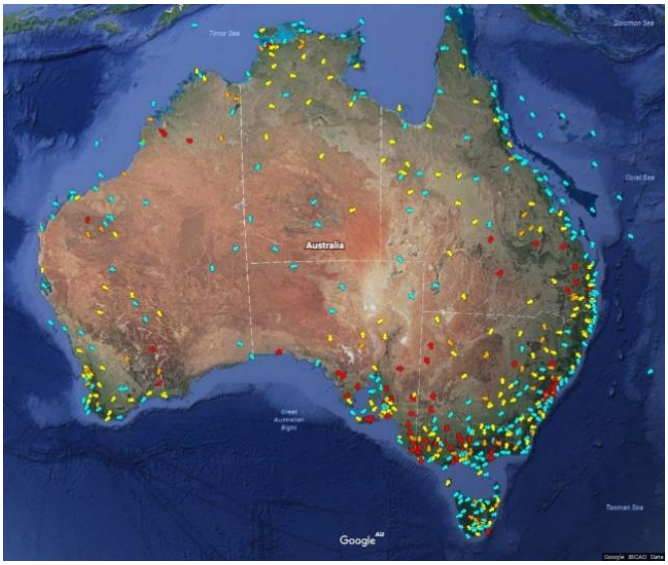

Figure 4: Real time 10-minute AWS observations with arrows indicating current wind direction and colour indicating the degree of change in wind direction over the last 30 minutes. Blue indicates little change, increasing with yellow, orange and red.

Project Status

The project is now complete.

A detailed analysis of radar data from seven well documented bushfires has been completed, which looked at possible links between a bushfires 3D radar footprint and fire growth.

A research paper has been published in the International Journal of Wildland Fire.

Work on AWS change tracking has started with backend data logging and archiving well under way. An initial visualisation product has been developed utilising Google Earth. Currently nation-wide 10-minute weather observations are being processed and archived.

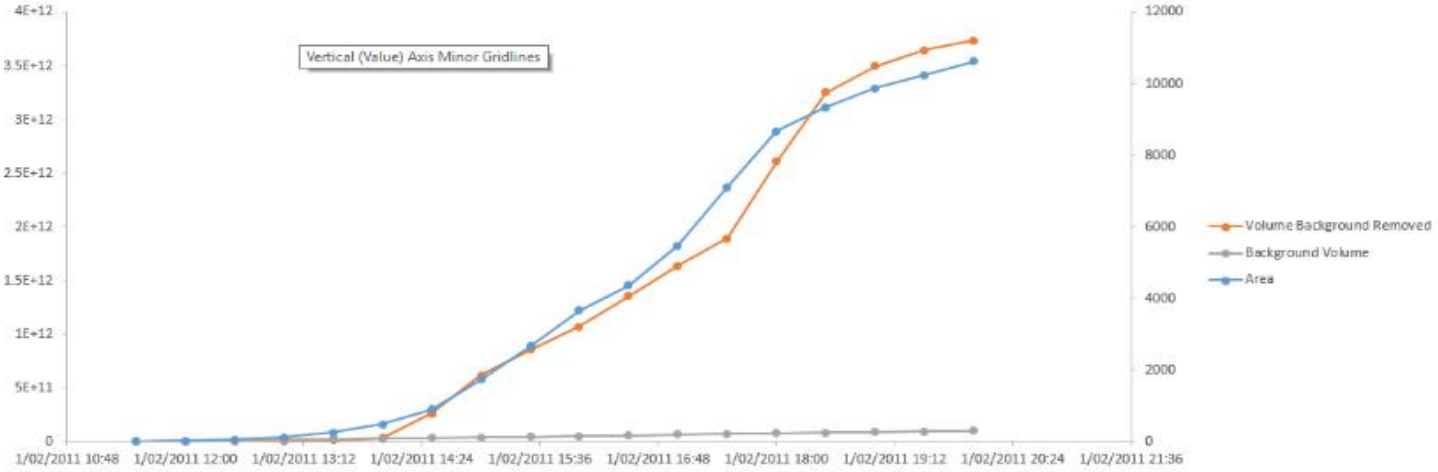

Figure 3: Graph showing a good match between change in fire area (blue) compared to plume volume (orange) observed in 3D radar for the Tostaree fire in 2011.