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EXTENDED ABSTRACT ONLY

The Waroona fire: extreme fire behaviour and simulations with a coupled fire-atmosphere model

Mika Peace [1,2], Jeffrey D Kepert [1,2], Harvey Ye [1]

[1] Bureau of Meteorology, [2] Bushfire and Natural Hazards CRC
Email: mika.peace@bom.gov.au

Abstract: The Waroona fire burnt over 68,000 ha and destroyed more than 160 homes in southwest Western Australia in January 2016. On the second evening of the fire, there were two fatalities when the fire made an unexpected run and produced a destructive ember storm over the town of Yarloop.

During the first two days of the fire, there were four episodes of extreme fire behaviour. Two separate pyrocumulonimbus events developed; both produced anomalously fast runs in the prevailing winds, with one pyrocumulonimbus igniting new fires downwind. The other pyrocumulonimbus event occurred at a time that is outside the normal diurnal timing of thunderstorms. Two evening ember storms occurred; the first impacted the town of Waroona and the second caused the devastation at Yarloop. The ember storms were driven by fire plumes interacting with local downslope winds; resulting in a turbulent horizontal transport mechanism for lofting and transport of numerous firebrands.

The processes that occurred at the Waroona fire were driven by three dimensional fire-atmosphere interactions. The detail of such processes can be examined using a coupled fire-atmosphere model.

The Australian Community Climate and Earth-System Simulator (ACCESS) Numerical Weather Prediction model has been coupled to a fire spread prediction model. The coupled model can be used to simulate large fires with full coupling to the atmosphere. The code has been developed and tested by Monash University (publications in preparation). The fire spread code is implemented by a level set solver and includes a number of fire spread formulae including McArthur, Rothermel and Vesta. SRTM topography is used and fuel maps can be included as available. The ACCESS model can be run at resolutions of hundreds of meters and the required resolution to resolve dynamic feedback processes will be explored as the project evolves.

This paper will describe key features of the extreme fire behaviour of the Waroona fire, introduce the coupled fire-atmosphere model ACCESS-Fire and report on progress simulating the Waroona event with the coupled model.

Figure 1. Pyrocumulonimbus above the Waroona fire. Image provided by Neil Bennet, Bureau of Meteorology.

Keywords: *Waroona fire, pyrocumulonimbus, ember storm, coupled fire-atmosphere model, ACCESS-Fire*