Modelling the fire weather of the Eyre Peninsula fire of January 2005

Robert Fawcett[1,2], William Thurston[1,2], Jeffrey Kepert[1,2] and Kevin Tory[1,2]

[1] The Centre for Australian Weather and Climate Research, Victoria

[2] Bushfire CRC, Victoria

Introduction: This poster describes high-resolution modelling of the weather across the Eyre Peninsula (South Australia) on 11 January 2005, using the Australian Community Climate and Earth-System Simulator (ACCESS). The atmospheric component of ACCESS is the UK Met Office Unified Model (version 7.5 is used in this study), initialised from 0000Z (10:30 am CDT) on 10 January 2005. An ERA-Interim initial condition is used.

A cascade of multiple nested models is employed, starting with a global model run, nesting down to a 3°×3° (approx. 300 km × 300 km) region (Figure 1). Two resolutions (0.0075° and 0.004°) are employed at the last nesting stage.

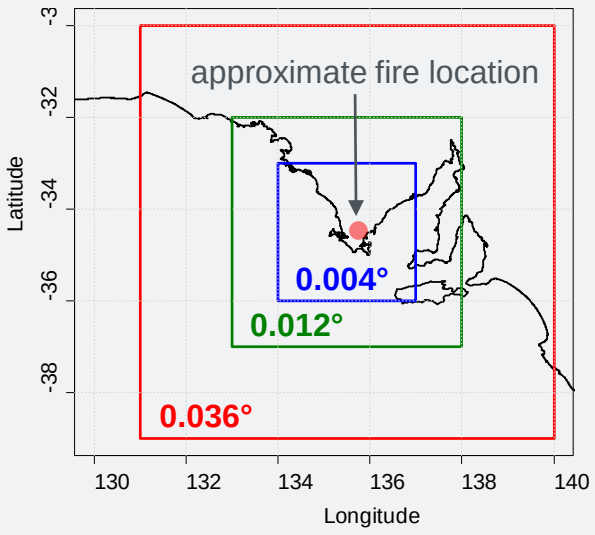

Figure 1: Model domains and resolutions (0.036°, 0.012° and 0.004°). The innermost domain is also modelled at 0.0075° resolution.

Model validation: The model data are compared against the available surface and upper air observational data, to see how well the modelling performs. Air temperatures and dewpoint temperatures are modelled well at inland sites across the model region, although the 10-metre wind speed underestimation typical of most models is evident. Comparisons against surface observations for one site, Ceduna AMO, are shown in Figure 2. Figure 3 shows a comparison of the observed and modelled location of the primary wind change between 11:00 and 14:00 CDT on 11 January 2005. The timing of the change is modelled to within 30 to 60 minutes of the observed change. Good agreement was found between the 0.036° model and radiosonde observations at Adelaide Airport (not shown).

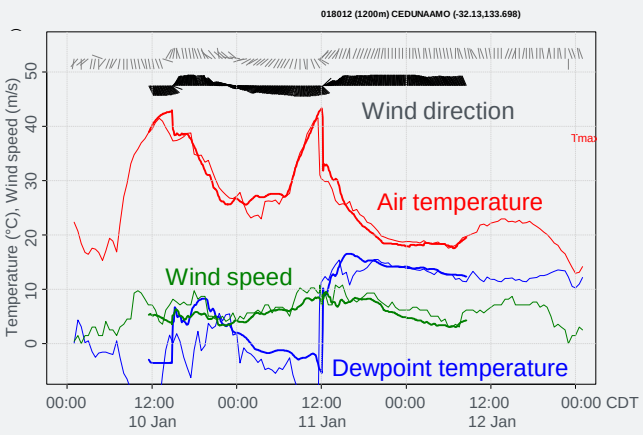

Figure 2: Near-surface (10-metre) wind and screen air/dewpoint temperature data for Ceduna AMO on 10 to 12 January 2005. Thick lines are five-minute model data from the 0.012°-resolution model run, thin lines are one-minute AWS data. Model data are from the gridpoint nearest the AWS location.

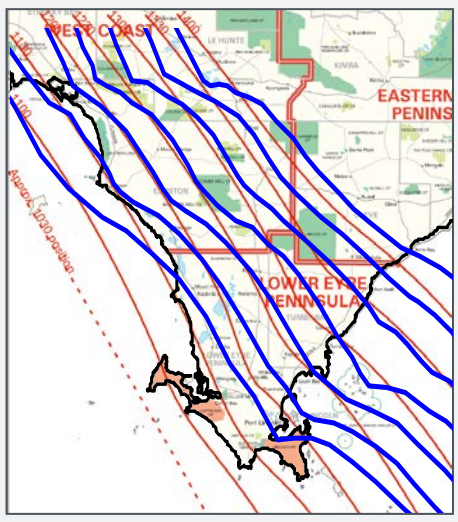

Figure 3: Analysed wind change isochrones (BoM 2005; red lines) and modelled (0.012° resolution; blue lines) for 11:00 to 14:00 CDT on 11 January 2005.

Discussion: The ability to suppress fires is highly dependent on a number of weather features. These include air temperature and humidity, wind strength and variability, atmospheric stability, and the strength and timing of wind changes. It is therefore important that these basic meteorological properties be well modelled.

The high-resolution simulations described in this poster are very successful in modelling the air and dewpoint temperatures. The timing of the primary wind change is generally within 30 to 60 minutes of the observed times, from a forecast initialised around 24 hours earlier.

Figure 4: MODIS satellite image at 1515 CDT on 11 January 2005, accessed from rapidfire.sci.gsfc.nasa.gov. The smoke plume from the fire is clearly visible. The red lines denote the extent of the fire.

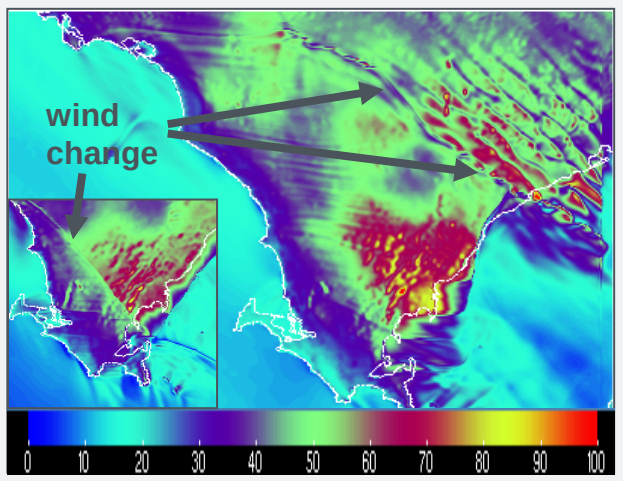

Figure 5: Notional instantaneous GFDI (Mark 5) values for 01:00 UTC (11:30 CDT; inset) and 03:30 UTC (14:00 CDT; main figure) on 11 January 2005, assuming a 100% degree of curing and a fuel load of 5 tonnes/hectare (0.0075°-resolution simulation).

Near the fire location (Figure 4), the notional instantaneous grassland fire danger index (GFDI; Noble *et al*. 1980) shows high values both ahead of and behind the wind change (Figure 5). Figure 5 also shows indications of boundary-layer rolls ahead of the wind change, something also seen in simulations of the Black Saturday (7 February 2009) fire weather.

References:

Bureau of Meteorology 2005: Meteorological report on the Wangary and Black Tuesday fires: Lower Eyre Peninsula, 10-11 January 2005.

Noble I R *et al*. 1980: McArthur's fire-danger meters expressed as equations. Australian Journal of Ecology **5** 201-203.

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