METEOROLOGY OF THE SAMPSON FLAT FIRE IN JANUARY 2015

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IN JANUARY 2015, THE SAMPSON FLAT BUSHFIRE BURNT IN THE ADELAIDE HILLS. IT WAS ACTIVE FOR 6 DAYS, BURNING 12,500 HA, 27 HOMES, NUMEROUS SHEDS AND 900 ANIMALS*. THIS STUDY FOCUSES ON THE METEOROLOGICAL CONDITIONS ON THE DAY OF IGNITION FRIDAY 2 JANUARY. THE MAJOR FIRE RUN OCCURRED THE FOLLOWING DAY.

* For more information refer BNHCRC project: Managing Animals in Disasters

INSTABILITY

Atmospheric instability on Friday 2nd was conducive to the development of pyro-convective cloud and spot fires. By mid afternoon a well-mixed layer extended to around 4.5 km. Pyro-convective clouds developed to a height of around 6 km. Strong winds in the low levels of the atmosphere helped spread spot fires.

WIND CHANGE

The wind structure around the Sampson Flat fire was complex, with a series of troughs and fronts that proved difficult to forecast during the event. A trough (Fig. 1) turned winds more southerly across the Adelaide plains in the evening on Friday 2nd. However winds quickly shifted northerly again ahead of a cold front which came through the area during the morning of Saturday 3rd.

HIGH-RESOLUTION MODELLING

- Operational ACCESS-C 4-km numerical weather prediction model and a research version run at 440-m grid spacing.
- The research model captured the timing of the trough on Friday well. Air temperature dropped rapidly and dew point temperature increased (Fig. 2).
- Fig. 3 shows the subtle interactions between wind and topography. This includes highly variable winds near the fire ground (white square) which are not evident in the coarser-resolution operational model (Fig. 4).
- Figs. 3 and 4 at 2130 CDT show the trough position over Adelaide and the surrounding area. Fig. 3 shows how the trough has been slowed down by the topography. Fig. 4 shows limited interaction as the trough has already passed the fire ground.

DISCUSSION

This fire posed many challenges to fire weather forecasters, due to the complexity of the weather pattern. Instability played a part in fire development with strong low-level winds facilitating spot-fire formation and the formation of pyro-convective cloud. High-resolution modelling would have assisted forecasters to understand and communicate the complexity of the winds across the fire ground. However there is currently no capability to run such a resolution operationally.

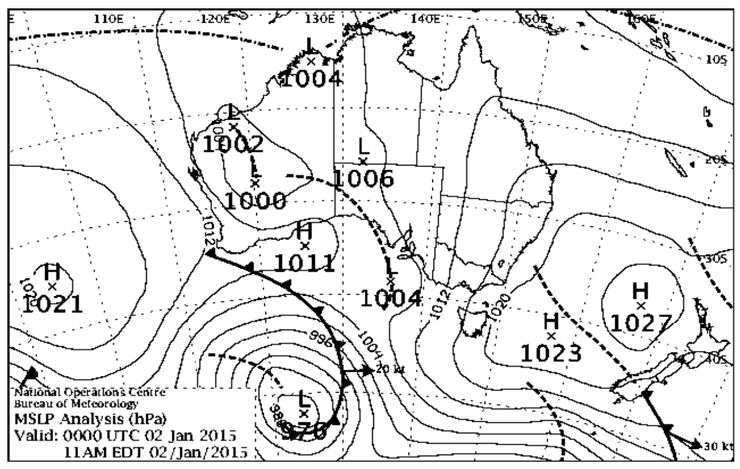

Fig. 1: Synoptic map for 1030 CDT (0000 UTC) on Friday 2. Pressures in hPa.

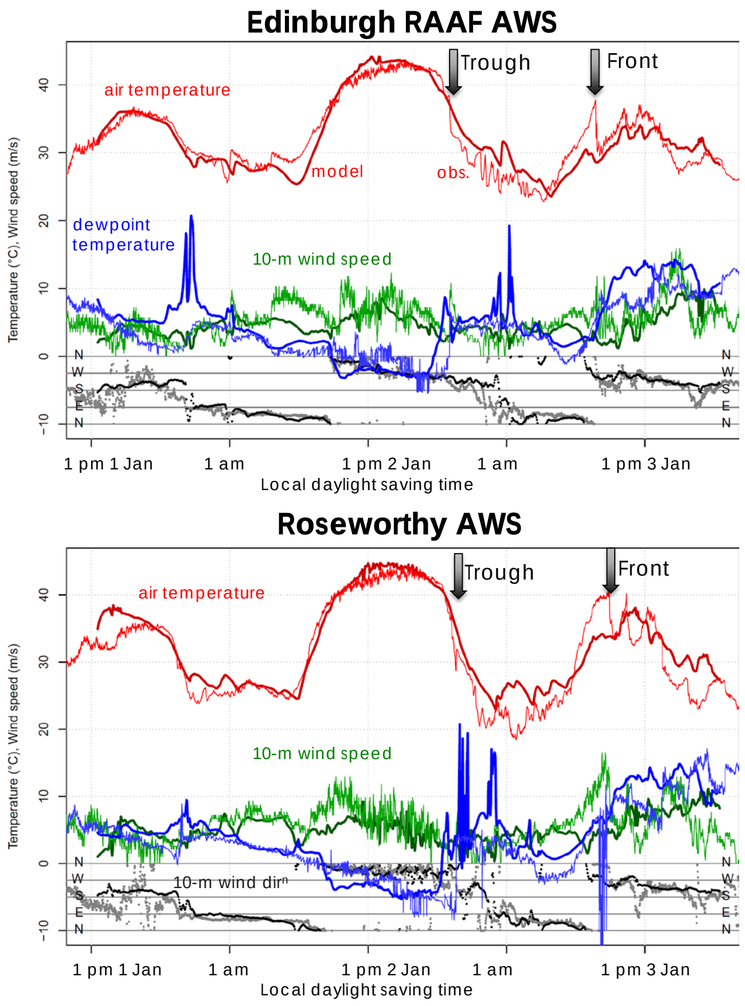

Fig. 2: Comparison of 440-m model and one-minute AWS observations at two sites near Sampson Flat. Times are in CDT. The observations are shown with thin lines, and the 440-m model with thick lines.

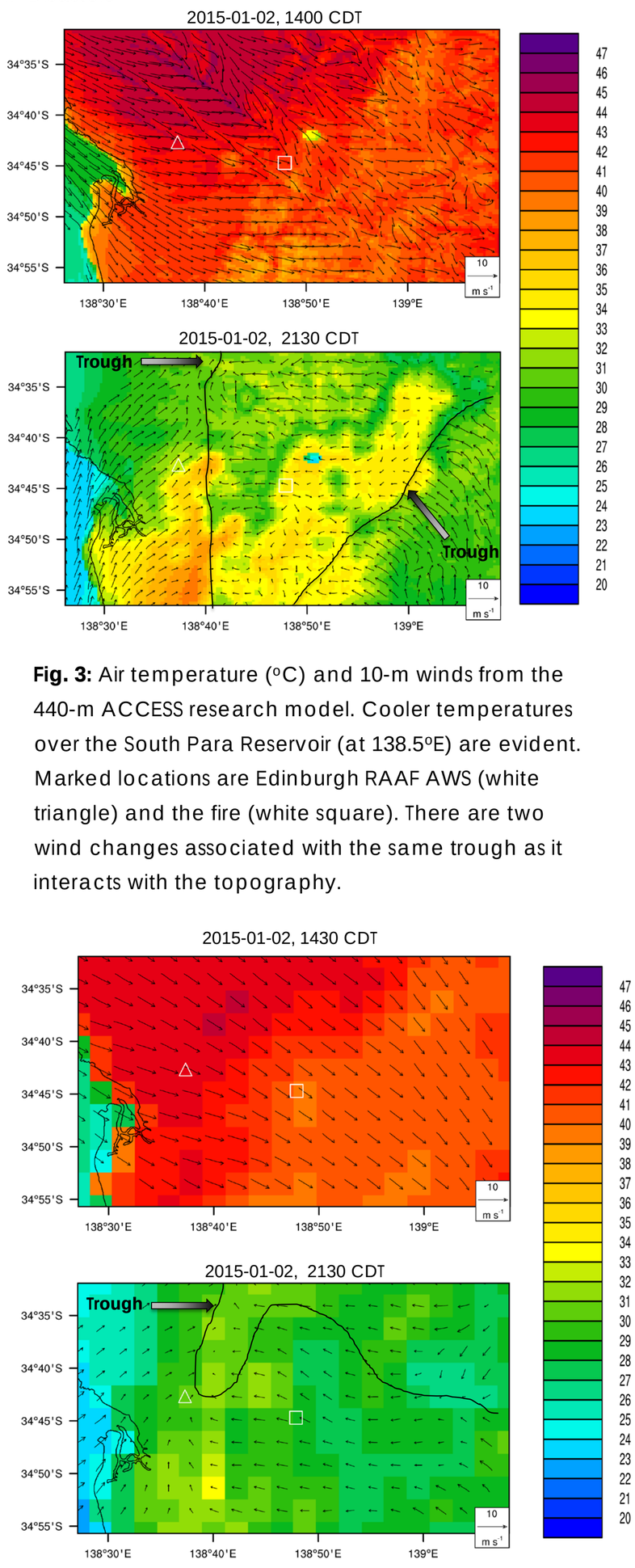

Fig. 3: Air temperature (ºC) and 10-m winds from the 440-m ACCESS research model. Cooler temperatures over the South Para Reservoir (at 138.5ºE) are evident. Marked locations are Edinburgh RAAF AWS (white triangle) and the fire (white square). There are two wind changes associated with the same trough as it interacts with the topography.

Fig. 4: Air temperature (ºC) and 10-m winds from the operational ACCESS-C with a 4-km grid spacing. The wind change structure at 2130 is very different from the 440-m ACCESS research model.

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