PROGRAM B6.3

HighFire Risk: The thermal belt in Australia

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Introduction

Overseas research, fire training modules and even personal experiences suggest that the thermal belt may be a significant effect in and around Australia's high-country. The thermal belt is a zone, which typically occurs mid-slope in mountainous terrain, where temperature maxima, and corresponding FDI maxima, may occur overnight. This can impact on the effectiveness and safety of overnight suppression strategies and tactics. An illustration of the processes causing the thermal belt is given in figure 1.

Methods

Night-time thermal linescan imagery was analysed to show the variations in ground temperature across a rugged landscape covered in eucalypt forest. This spatial pattern was matched against the underlying terrain and the results were used to develop a sampling transect over the same area. The transect consisted of three locations, one on a ridge-top (1252 m), one mid-slope (1027 m) and one at the bottom of the main slope (781 m). On a suitable night, these locations were monitored using portable automatic weather stations.

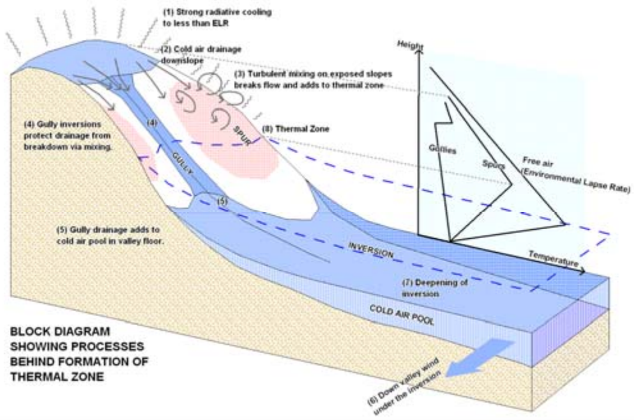

Figure 1. *Schematic showing how the thermal belt develops.*

Results

The three different landform elements showed distinctly different temperature and relative humidity trends, consistent with the findings of overseas research. The temperature and relative humidity time series can be seen in figures 2a and 2b, respectively. The data indicates a very clear set of processes at work.

- Radiative heat loss from the ground after sunset with associated cooling of air in contact with the ground, which becomes denser and commences a downslope flow at c. 1km/hr.
- Concentration of that flow into gullies, but with a time lag for commencement that increases with distance downstream.
- An eventual pooling of cold air in the lowest sinks in the landscape.
- On convex slopes, such as spur-lines, there is warming with height below the drainage inversion in the valley, and then cooling with height (at the ALR) above the inversion (see figure 3).
- The entire convex slope sequence is cooling with time.

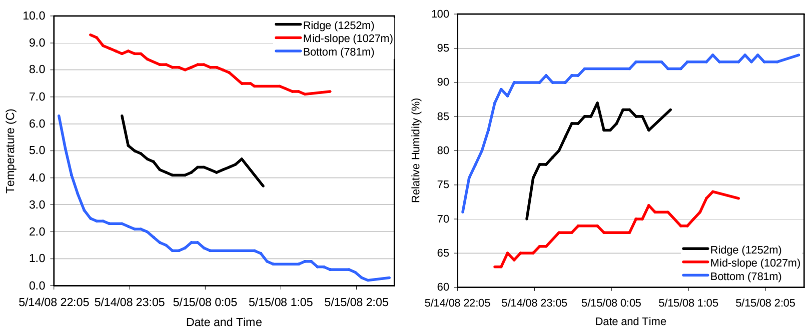

Figure 2. *(a) Temperature time series for the three locations, (b) Relative humidity time series.*

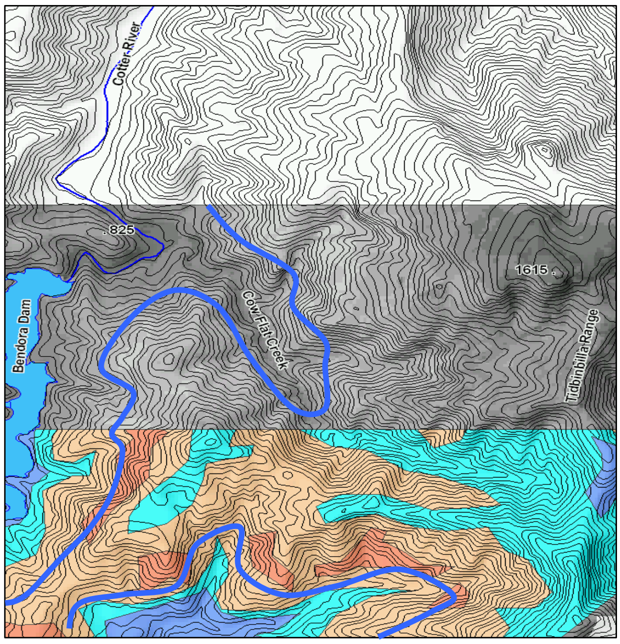

Figure 3. *Diagram showing (top) contours; (middle) thermal linescan, showing warm as light and cold as dark; (bottom) digitised contours of thermal ranges showing warm as orange and cold as blue. The blue line is the approx. inversion top.*

Conclusions

This study has confirmed the existence of a thermal belt in the Australian high-country with characteristics that are consistent with the findings of overseas research. The existence of a thermal belt implies that temperature relative humidity, and hence fire danger, can be quite variable at night across mountainous terrain, with the worst fire weather occurring on the mid-slopes just above the nocturnal inversion level. The thermal belt can be expected to form on clear nights when the winds are slight.

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