HighFire Risk: Weather anomalies in the high-country II Subsidence Inversions

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Introduction

Observations have revealed that fire weather in the high-country can be significantly different to that experienced at lowland sites. Moreover, these differences can often result in higher fire danger levels in the high-country than what is experienced at lowland sites. Of particular note are frequent (~ 1 in 7 days) and significant high-country dew point depressions. Some of these dew point anomalies are due to subsidence inversions, which can fall to levels where they impact upon the high-country. Such phenomena have serious implications for fire crew safety and any suppression activity being conducted in their vicinity.

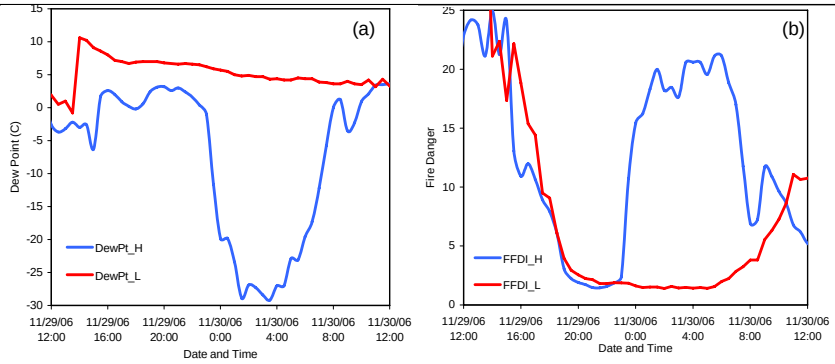

Figure 1. *(a) Dew point at Mt Ginini (blue) and Canberra (red). A strong anomaly is evident between 00:00 and 04:00 on 30/11/06, (b) corresponding forest fire danger at Mt Ginini (blue) and Canberra (red).*

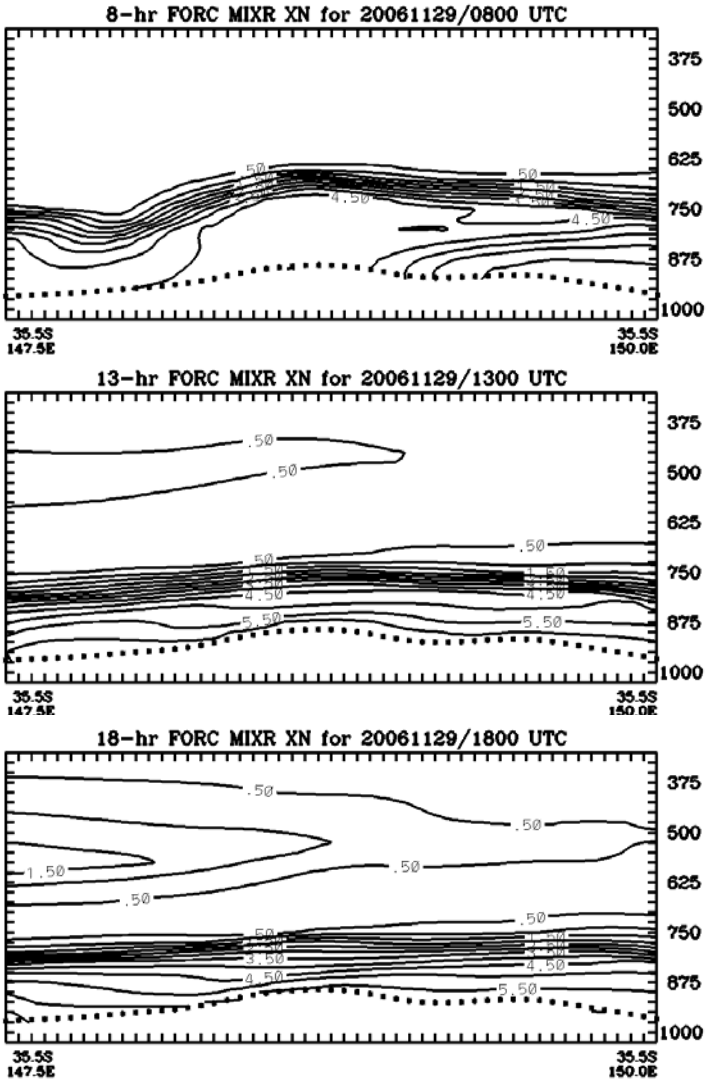

Figure 2. *Meso-LAPS vertical cross-sections of mixing ratio showing a subsiding inversion that impacts the high-country. Local times are 18:00, 29/11/06 - 03:00, 30/11/06.*

A case study – 30/11/06 00:00-07:00

The Bureau of Meteorology's mesoscale numerical weather model Meso-LAPS was used to investigate a significant dew point depression event at Mt Ginini (1760 m) which was recorded in the early morning of the 30th of November 2006. Figure 1a depicts the event and shows that the dew point at Canberra (578 m) was steady at ~ 5°C. The corresponding relative humidity at Canberra was around 78% while at Mt Ginini the relative humidity was 4%. Figure 1b shows how the event affected local fire danger rating at Mt Ginini, when compared with Canberra. We have taken the drought factor to be 10. It is worth noting that during the event, which began in the middle of the night, Mt Ginini experienced high fire danger ratings.

Figure 2 shows meso-LAPS mixing ratio profiles at five hour intervals. The sharp moisture gradient defines the inversion, which can be seen to drop towards the ground in the successive panels. In the bottom panel the inversion is at its lowest. At this level elevated parts of the ground protrude through the inversion and are exposed to the very dry air above it. As the inversion subsides the air temperature also rises due to compression. During this event a temperature rise of approximately 5°C occurred between 23:00, 29/11/06 and 03:00, 30/11/06 when temperatures would normally be expected to be falling. This temperature increase combines with the low atmospheric moisture to exacerbate fire danger levels.

Conclusions

The dew point depression event recorded at Mt Ginini in the early hours of the morning of the 30th of November 2006 was due to a subsidence inversion that allowed elevated parts of the landscape to be exposed to very dry air above the inversion. Warming due to compression and very low moisture levels resulted in high fire danger levels in the middle of the night. This type of event could seriously compromise fire crew safety and suppression activities, at a time when conditions would otherwise be expected to be mild.