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FORECASTING FIRE ACTIVITY IN VICTORIA, USING ANTECEDENT CLIMATE VARIABLES AND ENSO INDICES

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INTRODUCTION

Climate variability alters precipitation and temperature patterns globally and presumably has an impact on regional fire regimes, yet relationships between climate variation and bushfire activity are poorly understood in many fire-prone regions. Such relationships might be used to forecast the potential fire risk for an upcoming season. This research reviews the preceding and coincident relationship between the El Niño Southern Oscillation (ENSO), and the climate and fire activity for the fire-prone state of Victoria, Australia.

DATA

- Fire Activity Data – DSE fire ignitions data were used to find fire season (Nov-Mar) total number of fires (TNF) and total area burned (TAB) for the whole of Victoria
- Climate Data – Australian Water Availability Project (AWAP) monthly total rainfall and mean maximum temperature (MaxT), minimum temperature (MinT), vapour pressure at 9am (VP09) and vapour pressure at 3pm (VP15) spatially averaged across the whole of Victoria, from the Bureau of Meteorology
- ENSO Indices – Southern Oscillation Index (SOI) from Bureau of Meteorology, and Sea Surface Temperatures (SST) from NWS Climate Prediction Center monthly SOI, NINO1+2, NINO3, NINO3.4, NINO4

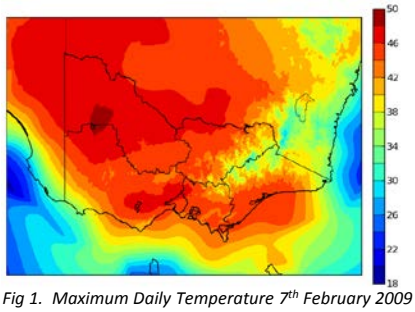

Fig 1. Maximum Daily Temperature 7th February 2009 (Data Source: AWAP, Bureau of Meteorology)

ANALYSIS

Linear correlations were computed between TAB and TNF with monthly and seasonal averages (three-monthly running average) of climate variables and ENSO indices. Both antecedent and concurrent relationships were explored.

RESULTS

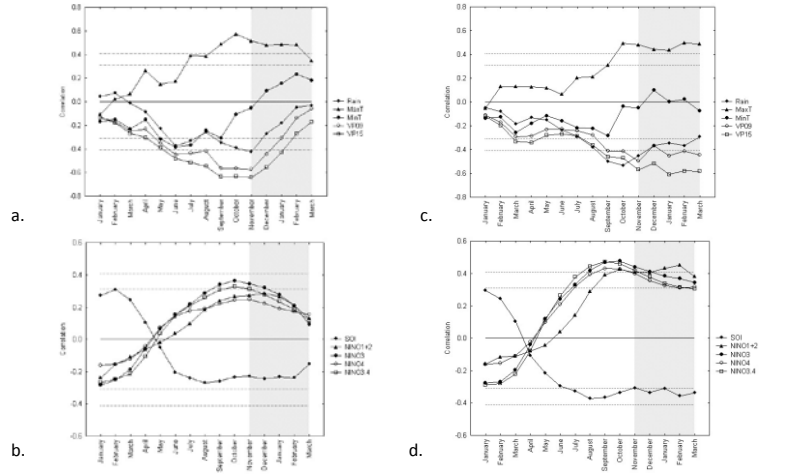

Fig 2. Correlation of (a) cube root of TAB (b) TNF, with three-month running average total rainfall, MaxT, MinT, VP09 and VP15 and correlation of (c) cube root of TAB and (d) TNF, with three-monthly running average SOI, NINO1+2, NINO3, NINO4 and NINO3.4. Months on x-axis indicate centre month of three-month average. Dashed horizontal lines indicate 1% and 5% statistical significance levels. The grey region represents the fire season (November to March). Number of samples (n) = 40 for the first 11 months on the horizontal axis and n = 39 for the last four months shown on the horizontal axis (December through March).

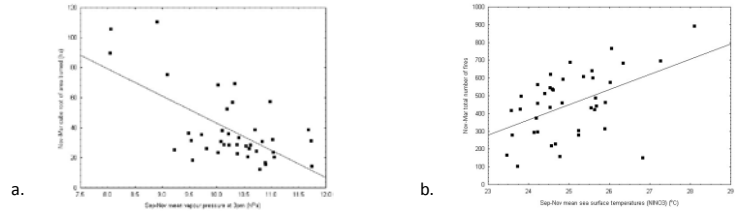

Fig 3. Scatter diagram of the (a) cube root of TAB with Sep-Nov VP15 and (b) TNF with NINO3 and linear line of best fit, n=40.

SUMMARY

This study has demonstrated that climate variables and, to a lesser extent, ENSO indices have the potential for predicting Victorian fire activity. Moderately strong relationships exist between fire activity and the antecedent climate variables and ENSO indices. The strongest relationships with fire activity in Victoria during the ensuing fire season, in order of strength are, VP15, VP09, MaxT, rainfall, SST, SOI and MinT. Therefore low rainfall totals, low vapour pressure averages and high maximum temperatures through the months of September to November tend to be followed by larger areas of burning and more fires in the subsequent fire season. This relationship is likely to exist because variations in shorter-term climate influence the fuel condition and availability. Employing these relationships as fire magnitude and extent forecasting tools warrants further investigation, to determine if they can be used to enhance the current qualitative bushfire seasonal forecasting used in Victoria.

End User Statement: *"This research is valuable because forecasting bushfire season activity is an important, but difficult part of preparedness planning. Better fire season predictions will improve our ability to establish appropriate levels of state critical resources such as aircraft and seasonal fire fighting crew. It will also improve our ability to inform communities, industries and other agencies so that they can make their own preparedness"* **Liam Fogarty (DEPI)**

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State Government Victoria