PROGRAM B6.3

HighFire Risk: A simple approach for assessing fuel moisture content and fire danger rating

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Introduction

The amount of moisture present in dead fine fuels is a key factor affecting fire potential and fire behaviour. Assessing fuel moisture content is therefore an important consideration in fire management practices, such as prescribed burning, where fire behaviour within certain thresholds is desired. The moisture content of fine fuels is also an integral component of fire danger rating schemes where it is combined with information on wind speed and drought effects. Models developed to describe fuel moisture content and fire danger rating are often expressed as complicated mathematical formulae involving temperature, relative humidity and wind speed. In the field these models are implemented as tables, which summarize the content of the mathematical formulae.

A simple approach

We have been investigating the utility of extremely simple indices in assessing fuel moisture content and fire danger rating. In particular we have considered the fuel moisture index *FMI* and the fire danger index *F**, which are defined as

$$FMI = 10 - 0.25(T - H) \qquad F^* = \frac{max(U_0, U)}{FMI}$$

Here T is air temperature (^{o}C) , H is relative humidity (%), U is the wind speed (km/h) and U_0 is a threshold wind speed to ensure nonzero fire danger rating even when wind speed is zero. Below we have assumed that U_0 = 1 km/h.

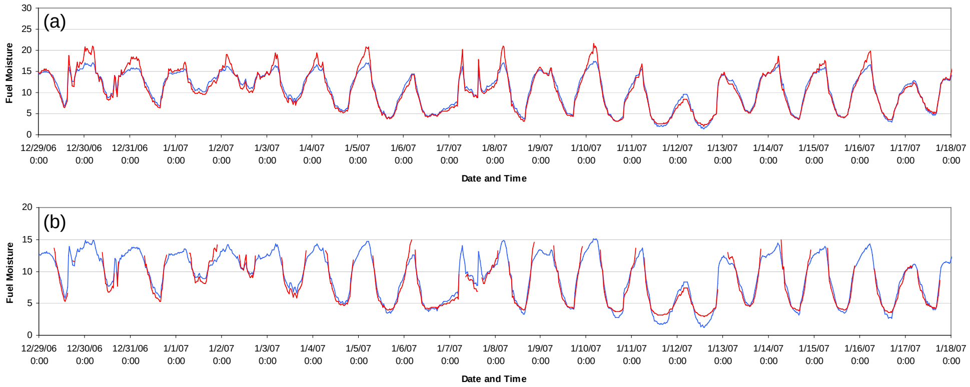

Figure 1*. Time series of FMI (blue) and model predictions of fuel moisture content (red). (a) Simard's model, (b) Viney's model*

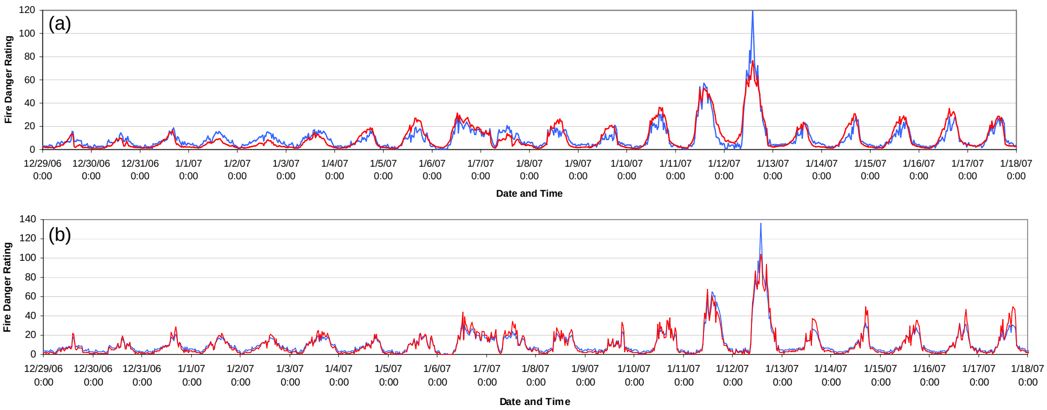

Figure 2*. Time series of F* (blue) and model predictions of fire danger rating (red). (a) McArthur's Forest Fire Danger Rating, (b) McArthur's Grassland Fire Danger Rating.*

Results

Figure 1 shows time series of *FMI* and predictions from models that feature in the literature. Figure 1a shows time series of predictions from Simard's model for wood shavings while figure 1b shows the same from Viney's model for eucalypt litter. The *FMI* has been scaled so that the mean of the time series are equal in each plot. The agreement is good (Correl. = 0.988, MAE = 0.58%, for Simard; Correl. = 0.999, MAE = 0.08%, for Viney).

Figure 2 shows time series of *F** with predictions from the McArthur Forest Fire Danger Index (figure 2a) and McArthur Grassland Fire Danger Index (figure 2b). *F** has been scaled so that its mean is the same as that for the other time series. The agreement is quite good (Correl. = 0.938, MAE = 2.83, for FFDI; Correl. = 0.976, MAE = 2.50, for GFDI). The biggest differences occur under very high and extreme fire danger conditions.

Conclusions

FMI and *F** have been shown to give results equivalent to those obtained from more sophisticated models but can be easily implemented in the field without the use of tables or circular slide rules.

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