APPENDIX

This appendix serves a dual purpose. First it provides an explicit formulation for the temperature related corrections to the soil moisture measurements that were made during the fire (and included in Figure 5). Second, as with Kremens *et al*. (2010), it is also intended to inform the fire research community about issues that are often encountered when applying modern technology to fire-related measurements.

Time Domain Reflectometers (TDRs) are (by design and calibration procedures) sensitive to soil moisture, but they are also sensitive to temperature (e.g., Or and Wraith 1999, Wraith and Or 1999) because TDRs directly measure the dielectric permittivity of a moist soil (not the soil moisture itself) and the dielectric permittivity of water is temperature dependent (e.g., Wraith and Or 1999). Given the large changes in soil temperature during the slash-pile burn discussed in this study (see Massman *et al.* [2006] for the observed soil temperatures) it is necessary to investigate and correct for any potential temperature sensitivity that TDR measurements of soil moisture, θ_v, may have.

Subsequent to the burn discussed in the main text, a test was conducted to quantify the effect of temperature on the TDR measurements of soil water content. First, four TDR probes were placed in a 2 ft^3 container filled with dry glass beads. The container was placed inside a drying oven, and the temperature was increased from ambient to 105 °C. The temperature was measured at each TDR probe. The temperature coefficient (α = change in TDR signal as a function of temperature) was statistically significant, but very small at $0.7(10^{-4})$ m^3 m^{-3} $°C^{-1}$. Therefore, it is reasonable to assume that errors in the TDR reading due to the temperature effect on soil minerals, air, and the TDR probes themselves are minimal.

Second, the experiment was repeated with moist Manitou soil during which the volumetric soil moisture, $\theta_{v,0}$, was maintained at ≈0.12 m^3 m^{-3}. The temperature coefficient, α_0, was again statistically significant, but this time it was larger [$4.29(10^{-4})$ m^3 m^{-3} $°C^{-1}$] than for the glass bead experiment. This increase in the temperature coefficient is attributable solely to the presence of water. Therefore, as a first approximation, α is assumed to be a function of water content, θ_v, with $\alpha = 0$ when $\theta_v = 0$. After some trial and error, the following model was adopted:

$$\alpha = \sqrt{\frac{\theta_v}{\theta_{v,0}}}\alpha_0 \qquad (1)$$

With the final model for correcting the TDR probes given as

$$\theta_{v,measured} = \theta_v + \alpha T_s \qquad (2)$$

where T_s was the soil temperature [°C]. Combining these last two equations and solving for θ_v yields

$$\theta_v = \left(\frac{-\beta + \sqrt{\beta^2 + 4\theta_{v,measured}}}{2} \right)^2 \qquad (3)$$

where

$$\beta = \frac{\alpha_0 T_s}{\sqrt{\theta_{v,0}}} \qquad (4)$$

Finally, the data collected during the 2004 slash-pile burn was also used to test the TDR measurements for temperature dependence. Only data from heating between 20 °C and 100 °C were included in this test. The assumption here is that water content did not change significantly during this initial period of soil heating. For the center of the slash-pile at 0.05 m, $\alpha = 6.50(10^{-4})$ m^3 m^{-3} $°C^{-1}$ (statistically significant with $p < 0.0001$). For the center at 0.15 m, α was not significantly different from 0.0 ($p = 0.51$). For the edge of the slash-pile, at 0.05

m, $\alpha = 1.66(10^{-4})$ $m^3\,m^{-3}\,°C^{-1}$, and at 0.15 m, $\alpha = 2.99(10^{-4})$ $m^3\,m^{-3}\,°C^{-1}$ (both were significant with $p < 0.0005$). Averaging all four values yields $\alpha = 2.90(10^{-4})$ $m^3\,m^{-3}\,°C^{-1}$, which was not particularly significant with $p = 0.15$, but did yield a value similar to the (above) laboratory value of $4.29(10^{-4})$ $m^3\,m^{-3}\,°C^{-1}$ obtained subsequent to the burn. For these four *in situ* determinations of the TDRs temperature sensitivity, $\theta_{v,0}$ ranged from 0.14 $m^3\,m^{-3}$ to 0.22 $m^3\,m^{-3}$. In closing, we note that the method outlined in this appendix for correcting the soil moisture data for temperature effects is different than that developed by Or and Wraith (1999) because we found that their approach gave unreliable results for the Manitou soil.