International Journal of Wildland Fire **27**, 135–140

doi:10.1071/WF17107_AC

Supplementary material

A method for extensive spatiotemporal assessment of soil temperatures during an experimental fire using distributed temperature sensing in optical fibre

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Table 1. Weather conditions during the burn taken from Bureau of Meteorology Swanbourne weather station, 500 m directly west of the burn area

AWST, Australian Western Standard Time

Date	Time (hours AWST)	Wind direction	Wind speed (km h^{-1})	Temperature (°C)	Dewpoint (°C)	Relative humidity (%)
24-Apr-2016	2000	NW	11	21.1	20.8	99
24-Apr-2016	1930	NW	11	21.2	20.9	98
24-Apr-2016	1900	NNW	9	21.3	20.8	97
24-Apr-2016	1830	NNW	9	21.7	20	90
24-Apr-2016	1800	N	13	21.9	19.6	87
24-Apr-2016	1730	N	11	21.9	19.8	88
24-Apr-2016	1700	N	13	22.1	20.2	89
24-Apr-2016	1630	NNW	15	22.3	20	87
24-Apr-2016	1600	NNW	20	22.9	19.7	82
24-Apr-2016	1530	NNW	17	22.9	19.3	80
24-Apr-2016	1500	NW	17	23.9	20.6	82
24-Apr-2016	1430	NW	17	23.6	19.9	80
24-Apr-2016	1400	NW	15	24.2	20.1	78
24-Apr-2016	1330	NNW	19	22.9	18.2	75
24-Apr-2016	1300	NNW	19	23.5	17.9	71
24-Apr-2016	1230	NNW	22	23.3	16.6	66
24-Apr-2016	1200	NNW	20	24.3	15.5	58

Calibration equation

The calibration constants(C, γ(K) and(Δα)) are described more comprehensively in fundamental DTS papers such as Hausner *et al.* 2011, while here we are reporting the values we used in our DTS installation with justification of their origins. Temperature (T, K) at any particular position along the fibre (z) was estimated by using Eqn S1, which is outlined in Hausner *et al*. (2011).

$$T(z) = \frac{\gamma}{\ln \frac{P_S(z)}{P_{aS}(z)} + C - \Delta\alpha z} \tag{S1}$$

where γ (K) represents a shift in energy between a photon at the wavelength of the incident laser and the scattered Raman photon; $\Delta\alpha$ (m^{-1}) is the differential attenuation coefficient for the Raman Stokes and anti-Stokes wavelengths within the fibre; $P_S(z)$ and $P_{aS}(z)$ are the Stokes and anti-Stokes signals at position z along the fibre respectively; and C is a dimensionless calibration parameter that accounts for the incident laser and the distributed temperature sensing (DTS) instrument (Hausner *et al*. 2011). Temperature in Kelvin is converted to degrees Celsius.

Post-hoc calibration results

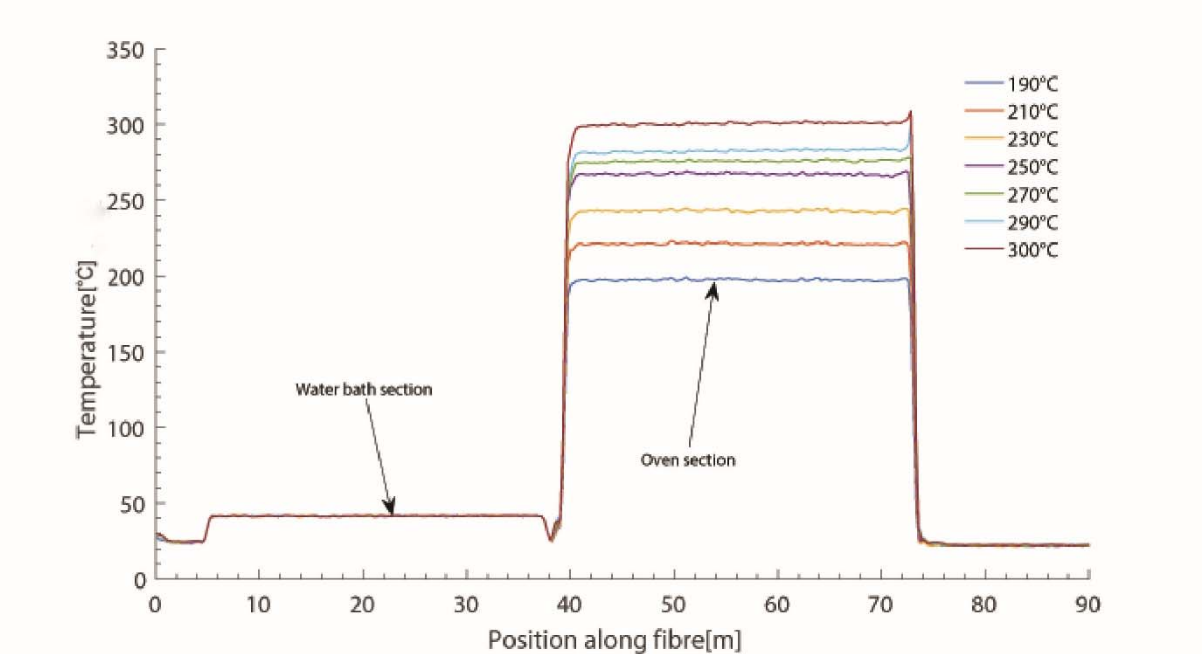

Fig. S1. Image of calibration procedure, using an oven and water bath and room temperature section. Water bath was set to 40°C whereas the oven was set to a range of temperatures between 190 and 300°C. The bath and oven were measured independently using k-type thermocouples. The range of temperatures were chosen to examine how the distributed temperature sensing (DTS) preformed at extremely high temperatures as well to test temperatures higher than those generated in the fire. This setup also allowed us to *post hoc* calibrate our field measurements by calculating the three independent calibration co-constants required, as set up by Hausner *et al*. (2011).

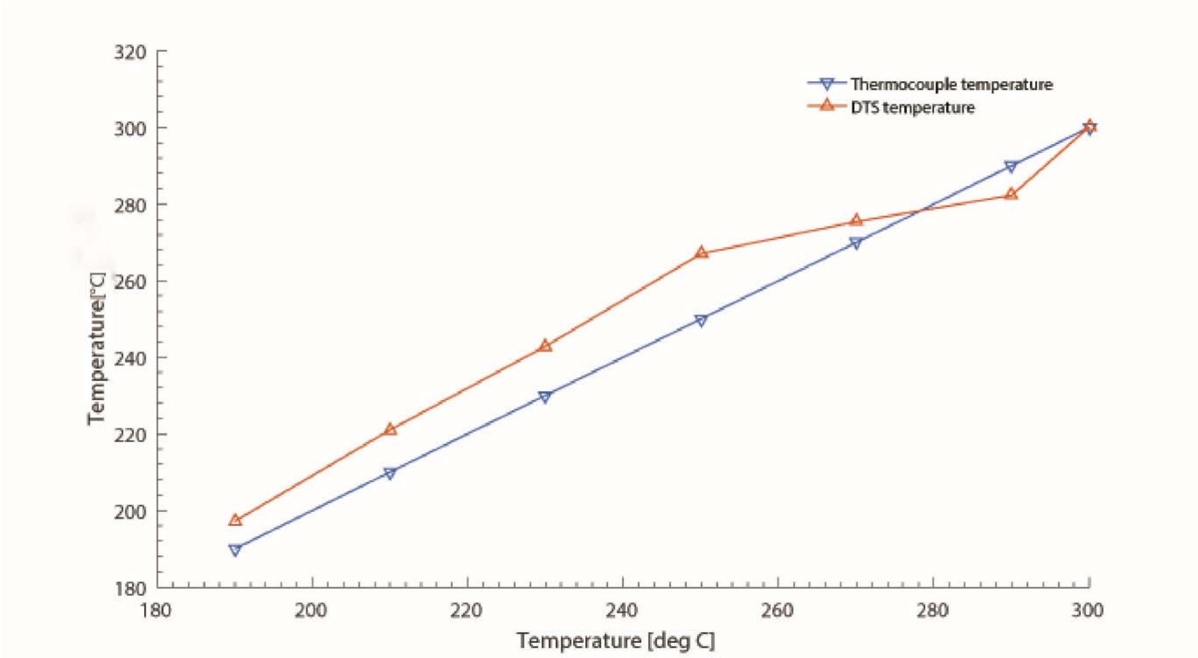

Fig. S2. The results from the oven calibration show an error of 6.8% at 250°C. Taking the mean temperature of the oven section and comparing it to the independent thermocouple allows for an estimation of temperature deviation. This shows that the largest error in temperature estimates occurs at 250°C, where distributed temperature sensing (DTS) temperatures over estimate temperature by 6.8%. This occurs as a function of the error in our *C* estimations, whereby changes of 0.1 in *C* greatly affect accuracy of temperature estimations at high temperatures.